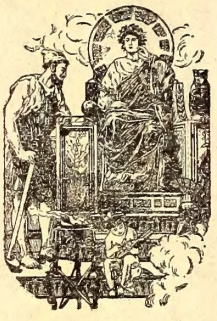
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Who Should Run the Road?

We submit for the edification and enlightenment of our readers this week an unique document which was prepared by the Amalgamated Association of Street Railway Employees of America, entitled a "Standard Form of Contract," between that organization and operating companies. The authenticity of this document cannot be questioned, as many street railway managers can testify, yet its contents are of such a startling character that at first glance it is hard to realize that their adoption could be seriously urged upon any employer. They are interesting at this time especially as an example of the unreasonable demands made on the part of labor unions, and an illustration of what the management of street railway companies have to contend with. No further explanation should be required by any fair-minded man after a perusal of these terms for the attitude of railway corporations in opposing "recognition of the union," which, in the case of a street railway company, would mean that the operation and management of the property would really be turned over to an irresponsible organization beholden to no one.

We believe that this document is without a parallel. Purporting to be a contract, yet in the entire seventeen sections into which it is divided the association assumes no responsibility, offers no consideration whatever in return for the concessions it would require of the company, and does not guarantee even that it will abide by the terms of the agreement in case they are accepted by the company, nor does it volunteer to hold the men to the proper performance of their duties. This is altogether too one-sided to be accepted by any business man, yet rejection of the terms here outlined have been followed in many instances by strikes, heavy financial loss to the operating companies, great inconvenience to the public and interruption to business, as well as the usual scenes of disorder, violence, intimidation and destruction of property which generally accompany acute labor troubles, and for which the union always disclaims responsibility.

A very bad feature of this plan is that it tends to destroy discipline among the employees and does not propose any method of maintaining order and providing suitable service. One of the very first provisions is that in case of the management rejecting the demands of the union, authority is given the officers of the association "to order the case to arbitration at once," thus inviting interminable controversy and practically refusing the employer any voice whatever in the direction of the property. The union does not even propose to recognize the right of the employer to discharge an employee without its sanction and consent, as it requires that a copy of the charges specified in writing shall be "furnished the secretary of the association within five days after the alleged offense is committed," at the same time it attempts to use the management in enforcing and increasing union control over the men. For instance, all motormen and conductors "must be turned in for initiation within sixty days after they are hired," and men in training must take out a "permit card from the association, paying the association the compensation of $1 for same." Again, when a member has been suspended from the union the company, upon receiving notice from the organization, "shall suspend said employee at once without pay until such time as the association shall request his reinstatement." In a word, the companies, whenever possible, are to be forced to build up an organization that is antagonistic to the interests of employers, arbitrary in its rule, and yet without any responsibility to the company or the community.

Pit Work in Car Shops

There has always been some controversy and variation in practice regarding pit work in car shops. There are those who believe that the less pit work the better for the quality of the work done, while others have arranged for the handling of motors and car wheels and the doing of all repairs as far as possible from the pit. The arguments in favor of the two methods are well known. If the motors are taken from the trucks into the pit the trucks can usually be left under the car bodies, and the same thing is generally true of wheel renewals. If the motors and other parts are to be worked at from above it necessitates removing the trucks from under the car bodies, whether the trucks are single or double. This theoretically involves some extra work; but those favoring the abandonment of pit work point to the fact that work done in the pit is sure to be inferior to that done from above with the trucks out in the open. It is not in accordance with human nature for a man to do his best work in a pit, which it is practically impossible to light, as well as the floor of a repair shop.

It is not to be expected that with a large amount of dirty apparatus over his head, ready to drop dust in his eyes, he will take pains to look up and see that all details are well attended to. At the present day in the larger shops and car houses probably the greater part of the repair work is done from the pit. In some of the smaller car houses, which are not as well equipped with pits and hydraulic jacks in the pits, more work has been done by taking the trucks from under the cars and working from above.

Just at the present time, however, there is to be noted the beginning of a tendency to abandon pit work. Two companies, very progressive as regards shop practice, have within the past year moved in the direction of abandoning pit work entirely, as far as new equipments are concerned. On old equipments, arranged to be handled from the pit, of course, such a move would be impossible; but the fact that the new equipments have been carefully designed to make the abandonment of pit work on them a possibility, is significant. The two companies referred to are the Milwaukee Electric Railway & Light Company and the St. Louis Transit Company. The former company even went so far as to insist on an entirely new design of motor, arranged so that it can be opened from above for inspection and can be lifted out of the trucks directly, with as much ease as the motors commonly in use to-day can be lowered directly away from the trucks. The latter company, although obtaining a new design of motor, has not gone as far in some particulars, and has retained some of the features of motors designed to be handled from below. In its new car shops, however, one division, which will be devoted to the repair of all the newer equipments, has been arranged without pits, and will be provided with motor-driven screw-jacks for lifting the car bodies, so that trucks can be quickly taken from under and worked at in the open.

Trolleys and Tunnels

The activity displayed by the promotors of tunnel projects to connect New York with the Jersey shore, and the establishment of direct trolley communication between New York and Philadelphia may be more than a mere coincidence, and some of those interested in these projects intimate that such is the case. Application has been made by the Hudson & Manhattan Railroad Company to the Rapid Transit Commission to build a single-track loop tunnel under Cortlandt Street, Church Street and Fulton Street, in New York, which is designed to be the continuation of a tunnel under the North River, beginning near Exchange Place, in Jersey City.

This is the second project of the kind that has been set on foot for trolley traffic, and its completion would be a great accommodation to New York business men who reside in the suburbs beyond the North River. The New York and New Jersey tunnel, promoted by the same interests which propose to invade the city at Cortlandt Street, is nearing completion. This tunnel is heading for Morton Street, and the company which is building it has planned a big terminal station on Christopher Street. It is reported that the company hopes to lay tracks in it in July of next year, and that when completed it is to be used by any railroad company that engages to run electric cars through it and pay for the privilege. It will anticipate the more ambitious Pennsylvania tunnel by about three years. The Union Terminal Company has planned a tunnel at Fourteenth Street, where the North River is narrowest, and is obtaining the consent of property owners along the route in Manhattan. President McAdoo stated at the hearing before the Rapid Transit Commission that the cost of the Cortlandt Street tunnel loop on the Manhattan side alone would be between $6,000,000 and $7,000,000, not including expenditure for real estate. It is, therefore, an undertaking of considerable magnitude, involving an outlay of probably $30,000,000.

In all plans of the New York-Philadelphia trolley projects it is proposed to secure entrance to both terminal cities by means of tunnels, that at the New York end crossing at some point under the North River, and that at the other extending between Camden and Philadelphia. This will give the project the advantage of much suburban patronage, provided passengers can be landed in the shopping district or at points easily accessible to the retail section. This feature of the project, however, seems to confirm the impression that no attempt will be made to operate at high speed between terminal cities. The possibility of the Pennsylvania system operating its Philadelphia section by electricity is confidently anticipated by many who are watching the development of that company's plans in connection with the Manhattan tunnel, although the executive officials and engineering staff have carefully refrained from encouraging this belief by any public utterances that would commit them to the electric system. It would not be at all surprising if electricity was adopted for the Philadelphia section, so that trains could be electrically operated from that city to New York by the time the Pennsylvania tunnel is completed; indeed, it will be a great disappointment if they are not.

The Troubles of Joint Ownership

Among the various electric interurban railways which have begun operation within the last year or two we call to mind one which is trying to live up to the distinction of being jointly owned and controlled by two different sets of individuals. It is a pleasure to record the evident financial success of the road, in spite of this burdensome condition, but it is far less agreeable to contemplate the evils which have arisen out of this modern attempt to discredit the old proverb that no man can serve two masters at one and the same time.

The road in question connects several populous towns with a busy manufacturing city, and runs largely upon a private right of way, or else at the side of highways, which permit operation at high speeds. The roadbed and track are of superior construction, and both rolling stock and power station machinery constitute examples of typically modern design. The power supply is direct current throughout, and the feeder system adequate for the schedules originally planned. Traffic growth, however, has been so great that the present line and car equipment is being pushed to the limit of its capacity, and things look as though the coming summer business of the line will call for the active utilization of everything on wheels which the road can muster into service.

All through the winter and early spring there were constant recriminations against the service by that one of the controlling organizations which was not identified with the actual operation of the road, and charges against poor equipment, low voltage, insufficient copper and general slackness in design and operation filled the air. From the first the men who were operating the railway realized that additional power supply and equipment was inevitable if the business of the system was to be properly handled, and they sought in every feasible way to impress the fact upon the balky contingent of owners who blocked progress by refusing to appropriate their share of funds for the purchase of the requisite apparatus. Finally, engineers, representing one set of owners, made exhaustive tests upon the road in the presence of similar experts representing the others, and absolutely determined the need of further facilities to

accommodate the business which was expected to double the road's traffic during the coming summer. The engineers of each party agreed that the need was imperative, and recommended its purchase to their respective principals.

The whole point of the matter was missed in the resulting decision. Several new and higher powered car equipments were ordered, the rolling stock purchased being easily enough to take care of the maximum traffic which the summer would be likely to throw upon the road's hands. But not a single cent was appropriated for additional power supply and distribution by the owning corporation which had been showering the complaints. The result can be imagined.

This example has been mentioned because it is an instance only of a large number of cases with which we are acquainted, where the absolute needs of a property have been sacrificed to the cheese-paring ideas of the directors, or where, if an appropriation has been made, it has been so small as to be about as effectual as an attempt to operate a car without a controller. It is pretty safe to say that if one of these same short-sighted directors had been consulting a physician about any bodily sickness, the medical man's advice would have been followed at least to the extent of taking two pills instead of one if the prescription called for a double dose. Certainly expert recommendations, such as the operating man can give, are of little use if they are not worth following, and we believe that boards of directors are often unduly conservative in placing reliance of this kind, rendered by experts in their employ, upon opinions rendered. In the case above cited one party in the road's control appreciated the need of more power and equipment; they were willing to make their part of the requisite appropriation, but the inability of the other side of the house to realize the situation, even when their own engineers advised extension of the power system, blue-penciled the progress requisition in heavy lines.

The Life of Street Railway Equipment

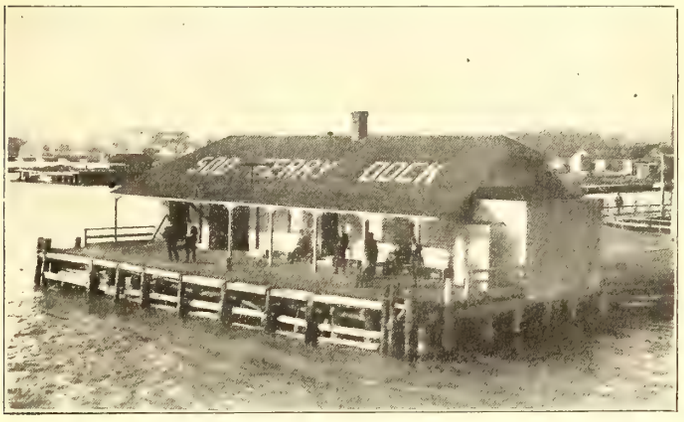
We wonder whether the noisy contingent of howlers that fills the air with demands for 3-cent fares ever contemplated the real conditions of street railway operation. During a somewhat lengthy street car ride the other day we were lured into a reminiscent vein of contemplation, and began to think over the successive changes that the road had undergone in the fifteen years of its existence. It is a considerable system, dealing with a large total population, and at the present time its equipment is well up to date and its operating department is conspicuously well handled. It has never experienced any grave vicissitudes and has been managed throughout its history in a conservative and judicious manner. In particular, it has been well engineered, and its apparatus has been well cared for and subject to no unusual depreciation. Here, if anywhere, is a good opportunity of judging fairly as to the reasonable expectation of life of the equipment, both as regards physical degeneration, and that still more important depreciation due to change in the art. Change in the art is a somewhat indefinite phrase, but it covers broadly a multitude of things which have to be done to keep the material and service of the road up to the requirements of economy and the demands of the patrons.

To begin with, we were riding in a modern double-truck car, equipped with air brakes and motors of the latest improved type. It is to our knowledge the fourth type of car which the road has operated in its really short life. Even now the change to this modern car is only just under way, but everybody realizes that the old cars must gradually go, and be replaced by such as the present one. The road began with some remodelled horse cars and some short cars intended for electric service. Nearly all of these have gone to swell the scrap heap, and the bodies are doing service as owl lunch carts, cobblers' shops and the like in remote nooks of the suburbs. On rare occasions one of the early electric cars gets on the road for a day or two, and the conductor is greeted with facetious allusions to Noah's ark, farm wagons and other supplanted means of transportation. Next came a regular single-truck car, magnificent for its time, but now passing into innocuous desuetude. A few of this second crop are still in service, dodged by passengers who are not in a hurry and generally regarded as rattle-traps. The trailers they once proudly towed have long since passed into the indefinite beyond—the limbo of things cast off. The third crop was of good double-truck modern cars, constituting the majority of those in service. The change to a still better type has started, and will doubtless continue, but the fact is that the system is fairly on the third set of cars in fifteen years with another in sight. Likewise, the motors have changed with the cars, and with few exceptions the motors now in use are the third type in the road's history. The change was not complete at any one time, and is not complete now, but the motors of a dozen years ago have wholly disappeared, those of a succeeding type are practically all gone, and recent acquisitions are improvements on even the third general form used. As to the rails over which we run there is a similar story to tell. The early strap rails and low light girders have disappeared, the succeeding girders of medium weight are nearly gone, and modern heavy girders have taken their place. The special work has been changed still oftener, and the bonding and other details of the track return have been changed with the rest of the track.

The power station has gone through a similar process of costly evolution. The little belt-driven generators of a dozen years ago were soon replaced by larger machines, then thought colossal, and these in turn by fine engine-driven generators. Even now, however, the steam turbine is looming up, and no one knows how long the present machines can economically be kept in service in view of the newcomer. The overhead construction has a similar history, and the long and short of the matter is that we have a system which, in fifteen years, is now well along in the third stage of its re-equipment, with the fourth beginning to appear as the last traces of the second are yet vanishing. Of course, these changes are not violent, nor have they fallen as a serious burden on any one year. They have been gradual, have been part of the general growth of the system, and with new equipment new lines have been initiated, but the fact of replacement remains. The old has gone, the new has come, and the cost of the change has been in the aggregate enormous. The actual total depreciation represented has been enormous, although the things discarded have not, as a rule, been fully worn out or wholly lost. But it is safe to say of any road, that ten years hence, even if not before, the equipment that is now new will be superseded, unless the steady march of improvement suddenly stops. To keep up with the times, to give the patrons of the road good service, and to keep the plant at the highest pitch of economy, constant improvements are necessary, and when summed up at the end of a decade the aggregate is startling. If people, generally, realized these responsibilities, which do not appear in the regular operating expenses, they would get an entirely new view of the working of a street railway system. Apparatus and equipment is improving yearly, and a street railway manager cannot let his present outfit wear out like an old shoe to its theoretical limit of existence.

TRANSPORTATION FACILITIES AT THE SOO

The street railway lines of the International Transit Company and the Trans-St. Mary's Traction Company are situated in Sault Ste. Marie, Mich., and Sault Ste. Marie, Ont. Each



RIVER TERMINAL OF CANADIAN RAILWAY AT FOOT OF BROCK STREET

place has a population of about 15,000, and is the center of a large water-power development, comprising the present capacity of 40,000 hp on the American side and 20,000 hp on the Canadian side, controlled by the Consolidated Lake Superior

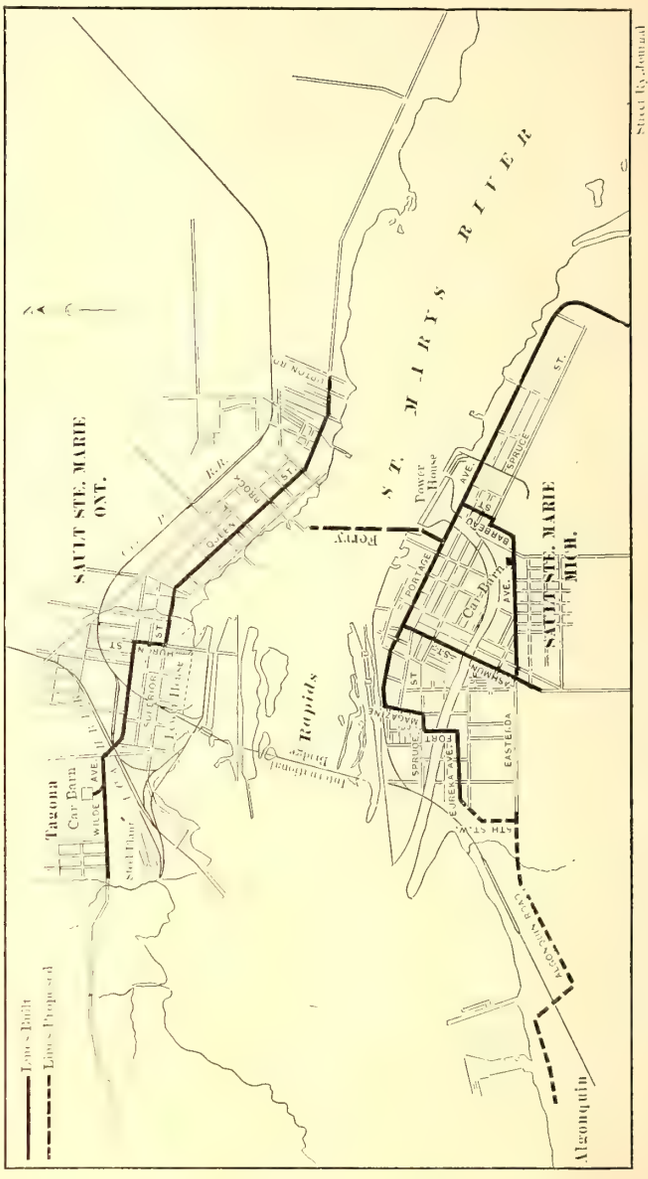


ONE OF THE STEAMERS PLYING BETWEEN RAILWAY TERMINAL DOCKS

Company, which established the local lines of electric railways and the ferry connecting the two cities.

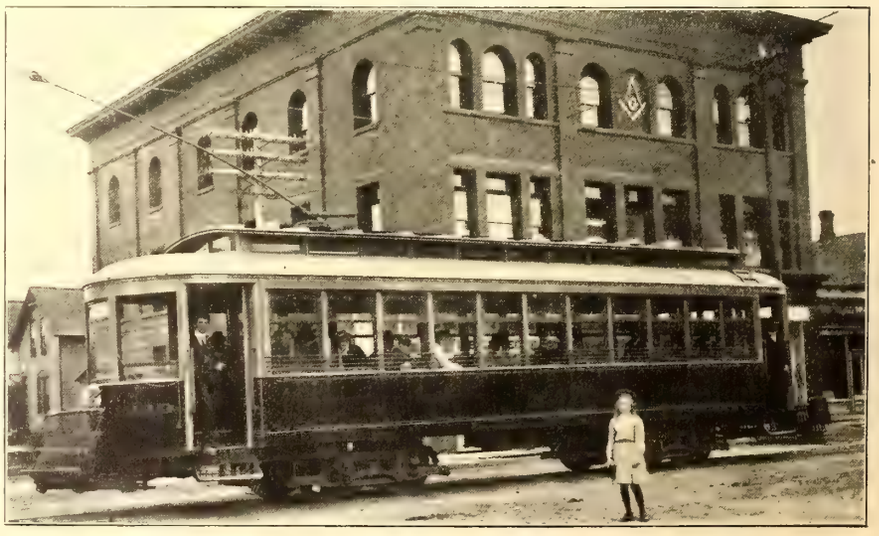
The industries of the community comprise those largely connected with the water-power companies, but in addition on the American side there are large lumber mills and tanneries. On the Canadian side there is a large steel plant, two blast furnaces, a rail mill, with a capacity of 600 tons a day, a sulphite pulp mill, with a capacity of 50 tons a day, as well as reduction works, alkali works, a large saw mill, with a capacity of 100,000 ft. a day, and a veneer mill, all located in the western part of the town.

The accompanying map shows the relative location of the several points in each city and the general plan of the transportation system. St. Mary's Falls separates the two towns, and is immediately below the International Bridge. The length of track on the electric railway system on the American side now comprises about 8 miles, including sidings, and



MAP OF TRANSPORTATION SYSTEM AT THE SOO

an extension of 1¼ miles is contemplated in the village of Algonquin, a short distance west of the main town. This place has a population of about 800. The present eastern



STANDARD PASSENGER CAR FOR CANADIAN SERVICE

terminus of the railway is at the ship yard known as "Pullar's," where a large paper mill has been started. At this end of the town is located the Country Club and baseball park, and it is also proposed to establish a race track, which will be an additional attraction. The line on this side runs mainly east and west, following the direction of the river, with a belt line running out Ashmun Street, which is the principal business throughfare, around the outskirts of the town and into the residential district. The car houses are located on Easterday Avenue on the belt line, south of the Power Canal, which runs through the center of the city.

The lines on the Canadian side comprise about 4 miles of track, and have for their western terminus the village of Tagona, where the steel works are located, and at the east end terminates at the Boat Club, in the residential district. The car houses are located at the western end of the line in the village of Tagona. On the American side the railway runs down to the river, and has terminals on the dock immediately west of the power house of the Michigan Lake Superior Power Company,



STANDARD PASSENGER CAR ON AMERICAN LINE

The route which the railway follows on both sides of the river is very interesting, especially for strangers and tourists, as it runs directly along the locks of the United States government on the American shore, giving an excellent idea of the extent and equipment of the canal, through which passes the greatest tonnage in the world.



POWER HOUSE AND RAILWAY TERMINAL DOCK ON AMERICAN SIDE

and communication across the river to Canada is maintained by a ferryboat giving a 20-minute service. This ferry is owned by the street railway company. The landing in Canada is at the foot of Brock Street, which is in the center of the business district.

The track is 80-lb. T-rail, A. S. C. E. section, with Bonanzo joints, four bolts to the joint. The turn outs have automatic spring switches, thus eliminating the necessity of turning switches, inasmuch as the traffic follows the switches throughout. The ties are spaced 2 ft. on centers, and are of cedar,

6 ins. x 8 ins. x 8 ft. All curves have tie-plates or braces. The track generally is located in macadam streets, and in all cases has at least 6 ins. of crushed stone ballast under the ties except where the track is laid on the side of a street in the outskirts, and then it is laid on gravel ballast. The special work on the American side was furnished by the Falk Company, of Milwaukee, and on the Canadian side by the Pennsylvania Steel Company for the car houses, but all other special work was manufactured by the company itself at the shops of the Algoma Iron Works.

The overhead work is constructed in a most substantial manner. The poles are all of native Michigan cedar, very straight, not less than 7½ ins. at the top, and all painted a dark bronze green with white tops, presenting a very neat and attractive appearance. The cross-span wire is ⅜-in. galvanized iron, and the pull-off wire ¼ in. The overhead fixtures were supplied by the Ohio Brass Company. On the Canadian side Detroit ears are used, and on the American side a heavy clinch ear is used. All the trolley wire is figure eight, while the feeder wire used is 300,000 circ. mil weather-proof copper wire.

The bonds used were supplied by the Mayer & Englund Company, of Philadelphia, and are known as the "foot bond," the terminals being secured to the base of the rail and the bond being of a horseshoe shape. The capacity of these bonds is equal to that of 0000 copper wire.

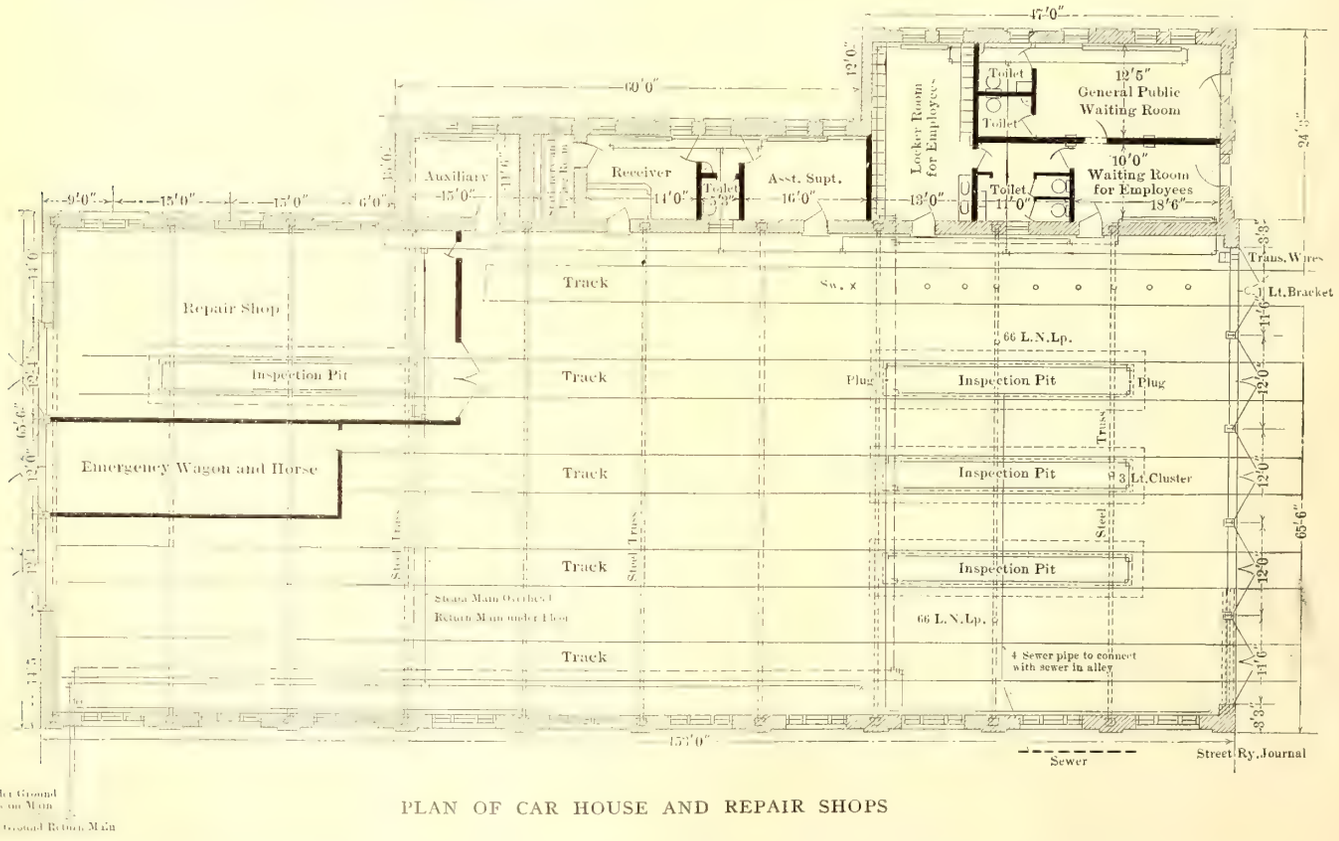
The car houses on each side of the river are of similar construction and size. The main building in each case is 65 ft. x 153 ft., with a large wing for offices. The repair shop is located in the barn proper. There are four inspection pits in the barn. The side walls are brick, the front stone, and the building has steel roof trusses with corrugated steel roofing. The interior of the building is finished in white, while the outside of the roofing is painted with dark green graphite paint. There is 3-in. pine flooring all over the building inside the car house proper. The machine shop is separated by corrugated steel partitions from the storage department.

All the cars used in this system are of the semi-convertible type, and were designed by G. W. Chance, the manager of the road. Those used on the American side, six in number, were built by the St. Louis Car Company. They are 32 ft. over all and will seat thirty-two to thirty-six people. There are four cross-seats on each side in the center of the car and in each end longitudinal seats. The cars have electric bells and Ohmer fare registers, and are all provided with type-"C" Providence fenders. The inside finishing of the car is in oak, while the outside is painted vermillion for the body color, and the upper part is given a citron shade. The electrical equipment consists of two No. 49 Westinghouse motors to each car, with two K-10 controllers and circuit breakers. The trucks are of the Dupont pattern, the wheels have 3-in. treads, ⅞-in. x 1⅛-in. flanges.

On the Canadian side the cars were built by the Ottawa Car



CAR HOUSE AND REPAIR SHOPS



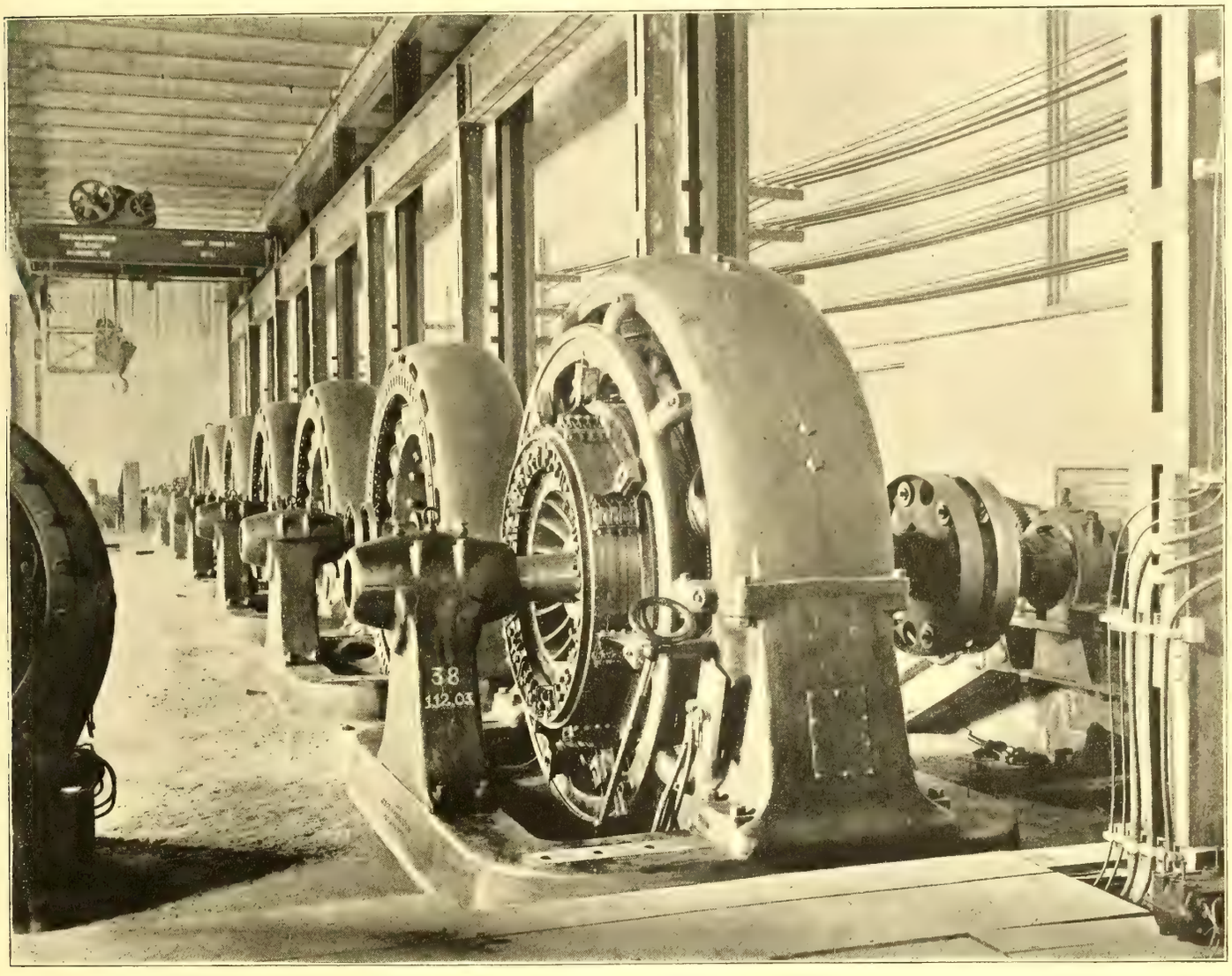
PLAN OF CAR HOUSE AND REPAIR SHOPS

Company. They are eight in number, 42 ft. over all, and are mounted on Brill No. 27-G trucks, equipped with four Canadian General Electric No. 67 motors and two K-6 controllers and circuit breakers. The cars have five cross seats on each side, made by Hale & Kilburn, of the walk-over pattern, covered with pantasote, and on each end the seats are longitudinal, covered with rattan. The Momentum Brake Company, of Toronto, supplied the brakes, which consist of two discs with wooden rubbing surfaces. A sheave and winding chain throws the brake on. The cars on the American line are equipped with the Sterling safety brakes. It is intended to add three large cars of the same pattern as those now in use on the Canadian side for the American line, and equip them with four Westinghouse No. 49 motors and K-6 controllers.

PLATFORM GATES FORBIDDEN IN KANSAS CITY

For several years the Metropolitan Street Railway Company, of Kansas City, had its electric cars equipped with what is commonly known as the Minneapolis gate, which is a platform gate controlled by the motorman and opened only at such times as the car is at a full stop. The latest form of these gates, embodying the same principles, was described and illustrated in the STREET RAILWAY JOURNAL, June 13, 1903. Last year an ordinance was passed in Kansas City, Mo., forbidding the use of gates of this type. This appears to be another one of the unexplainable proceedings of a body of city fathers. Usually the legislation is in the direction of increasing the safety of the public, or at least attempting to increase it. The City Council of Kansas City seems to have taken the other tack in forbidding the use of these gates. As to the practical effect of abolishing the gates the figures on step accidents in March, 1902, when the cars were equipped with gates, as compared with March, 1903, when the cars were not so equipped, tell the story.

W. A. Satterlee, assistant general manager, reports in 1903 ninety-seven accidents at the step, against none the year previous. Another month there were sixty-two step accidents as against none, and another month seventy-five as against none. This is counting the step accidents on cars formerly equipped with gates only. The cable cars have never had these gates. In Mr. Satterlee's opinion the worst feature of the whole business is that these step accidents, while they are not of the kind for which the company is justly liable, are, in reality, of a most troublesome and expensive kind.



NEW POWER PLANT AT AMERICAN SOO

The company owns two docks, one on each side of the river, each containing commodious buildings for ferry purposes. They also own two boats, each with a carrying capacity of about 1000 people. One boat at present is used for the regular ferry service and the other for excursion traffic.

On the American side the company takes power from the Michigan Lake Superior Power Company's plant, which was described in the STREET RAILWAY JOURNAL, Nov. 8, 1902. Stanley generators, furnishing current at 600 volts, are driven by water-wheels of special design, which are regulated by Lombard governors. Views of the power plant are presented.

On the Canadian side the company takes power from the Lake Superior Power Company. Canadian General Electric generators furnishing current at 550 volts are driven by water-wheels equipped with Lombard governors.

THE ELECTRIFICATION OF BRITISH RAILWAYS

BY A BRITISH ENGINEER

The electrification of steam railways is a subject which is being much discussed at the present moment, and is attracting widespread attention. The chairmen and directors of English railway companies have of late frequently brought the matter under the notice of their shareholders, whilst some companies have even gone so far as to lay down experimental lines, as in the case of the North-Eastern Railway's lines at Newcastle, and the Lancashire & Yorkshire Railway's line from Liverpool to Southport.

There appears to be greater activity in this direction in Europe than in the United States. As is well known to all readers of the STREET RAILWAY JOURNAL, the Italian government has lately gone into the question, with the result that at the present time there are two important long lines working electrically in that country, i. e., the Lecco-Sondrio Railway, equipped on the Ganz system, and the Milan Ceresio line, which uses the standard, series-wound, continuous-current motors of tramway practice. This is all that has been done in this quarter up to the present, but there are several other important sections of the Italian railways, the adoption of electric traction upon which is receiving serious consideration, and considerable developments may be looked for in the near future.

The Swiss government has not as yet converted any of its lines, but a government commission has been appointed to thoroughly investigate the subject, and it is probable that electric traction will shortly be adopted on one or more of its main lines.

In Sweden the subject is also receiving close attention, though the situation there is somewhat different from that which exists in other countries. There are large water powers available and coal is expensive. The government is considering the operation of its railways by electricity, generated by water-power, and this more to reduce its working expenses by dispensing with the coal bill, which forms one of the heaviest items, than for any other reason. With this end in view the Swedish government has laid claim to the ownership of all the various waterfalls in that country which may be used for power production. The main object in its case is not so much to increase and improve the traffic, but to reduce the operating expenses as much as possible.

Germany has taken a different view and spent a considerable amount of time and money in investigating the problem of how fast it is possible to run electric motor cars. The results of these experiments on the military line from Berlin to Zossen, which, owing to the light construction of the permanent way, were not very conclusive, have been already set forth in these pages and need not be entered into here.

The problem in Great Britain has several features peculiar to itself, and though a careful study of the results obtained in other countries is most helpful and instructive, great care should be taken in applying these results to the solution of the problem in this country. Although there have been proposals to construct lines, to be operated at abnormally high speeds, and powers have been obtained to construct a railway of this description between Manchester and Liverpool, this phase of electric traction will not, in the opinion of the writer, play any very important part at present in the great problem now before the nation. What the future may bring forth is, of course, uncertain, but under the conditions which obtain at the present, there does not appear to be any very extensive field for lines of this description in Great Britain.

That the importance of the introduction of electric traction on railways is realized by our government is shown by the fact that Gerald Balfour, the president of the Board of Trade, has recently introduced into Parliament a bill which is expressly designed to remove obstacles and facilitate progress in this direction. This bill is intended to enable railway companies to dispense with the necessity of obtaining an act of Parliament authorizing them to use electricity, either for electric traction or other purposes, which, owing to the fact of their being statutory companies, they are at present obliged to do. They will, instead, merely have to satisfy the Board of Trade as to the feasibility and general utility of their propositions, which being accomplished, they will be enabled to proceed with the work straight away, without the tedious and expensive proceeding of going to Parliament.

This applies, as mentioned above, to the use of electricity for all purposes, and a large field will thus be opened in the employment of electric power for operating cranes and capstans in goods yards. Many railway companies will doubtless be only too glad to avail themselves of the chance thus afforded them, as is instanced by the fact that the London, Brighton & South Coast Railway Company and some others have already applied to Parliament for power to utilize electricity.

Gerald Balfour's bill provides that the Board of Trade may make orders authorizing a railway company to use electricity, either as a motive power or any other purpose; to construct and maintain generating stations; to make arrangements with any body corporate or other person for the supply to the company of electric power, or the supply to or use of the company of any electrical plant or equipment; to modify any working agreement, so far as the modification is agreed to between the parties thereto, and is consequential on the introduction or use of electric power; to subscribe to any electrical undertaking which will facilitate the supply of electricity to the company, and to issue new capital for any of the purposes of the act. An order made in accordance with the provisions of the bill is to have effect as if enacted by Parliament, and the boon which this would confer on the railway companies can easily be imagined.

The railways in the United Kingdom may be divided into four distinct classes or sections:

(1) Long-distance main lines, such as from London to Scotland, Wales, Cornwall, etc.

(2) Branch lines which are practically light railways, though not regarded as such.

(3) Interurban lines, upon many of which there is an abnormally heavy service, as in the districts around Bradford, Manchester, Liverpool, Middlesborough, Newcastle, Birmingham, Wolverhampton, Glasgow and many other neighborhoods.

(4) Suburban lines, pure and simple, radiating from and surrounding the large towns, which serve to convey the workman and the man of business to and from his home in the suburbs and his work in the city. To supply proper facilities for this class of passenger is a problem of peculiar difficulty. A serious attempt at its solution is being made in London at the present time by the Royal Commission which has been appointed by His Majesty's government to investigate and report upon this intricate subject.

Amongst the various matters which the Royal Commission has to investigate and report on is the question as to whether or not it is advisable to create a new and special tribunal, to obviate, at least as far as London is concerned, the present expensive, cumbrous and unsatisfactory methods of procedure.

Tramway franchises may be sought in two different ways. First, by putting the case before Light Railroad Commissioners, who, if there is no serious opposition, and particularly if existing steam railroad companies do not oppose, recommend the bill, which is then created by the Board of Trade. If there is any serious opposition application has to be made to Parliament, which can only be done once a year, and if the opposition is strong it may be a very expensive matter.

Secondly, the franchise could also be sought under the Tramways Act by going direct to Parliament, a method which has hitherto proved cumbrous and unsatisfactory.

It is urged by many that a special tribunal, similar to the Rapid Transit Commission in New York, should be created, which should not only have the right to grant concessions but also to investigate and to decide upon the best routes and to suggest new lines and impose working conditions upon existing lines, which would enable all the various electric railway and tramway systems to work together to the greatest advantage of the traveling public.

In considering the question of British railways we must deal with the question under the four heads as above. Taking them in the order in which they there appear, we will briefly discuss the possibilities and probabilities of the application of electric traction in each case.

The question of electric haulage on the main lines in the United Kingdom is one which has chiefly attracted the attention of those business men and engineers whose knowledge of the subject is more theoretical than practical. These latter have been responsible for a large number of papers which have been read before the various engineering societies, and in which certain systems have been suggested for operating main line trains electrically. Many of the suggestions have been tried in the past and proved failures, whilst others are impracticable schemes which have been invented by the authors of the papers.

There are many reasons for considering that the time for the adoption of electric traction on main lines has not yet come. From the point of view of speed alone the limit with steam locomotives has by no means been reached, and could, in all probability, be increased some 10 per cent to 20 per cent. The reason why this is not done is because no great advantage would be gained therefrom. The great bulk of long-distance passengers would not be prepared to pay the increased fares which higher speeds would entail, because in most cases the saving in time which would be effected would be of little or no value to them. If the journey from London to Glasgow, for instance, is taken by night, it makes little difference whether nine hours or seven hours are occupied. As regards the day journey, it takes practically the whole day, and an hour more or less would not make any appreciable difference to the majority of travelers. It has not been shown in actual practice that it is possible to run trains at the enormous average speed of 100 m. p. h., and if it were possible the capital and working expenses would be so great as to more than compensate for any prospective profits. It must not be forgotten that whereas on the Continent of Europe, in many places, water-power is abundant and coal expensive, in England it is just the reverse; water-power is practically non-existent and coal is moderately cheap.

With reference to small branch lines electric traction can undoubtedly be adopted with advantage where water-power is plentiful, or where the traffic is sufficient to warrant a considerable number of trains per day being operated. This has been done in several cases on the Continent, descriptions of which have appeared in the STREET RAILWAY JOURNAL from time to time. There does not appear to be any very extensive field for this class of traction in Great Britain, and it is more probable that motor cars propelled either by petrol or else by steam on the Gardiner-Serpollet system, would suit the case better.

In this connection it may be interesting to point out that several of our railway companies, including the Great Western, the London, Brighton & South Coast and the North-Eastern, have ideas that by means of self-contained motor cars, either driven by ordinary steam engines or by special steam engines of the Gardiner-Serpollet type, or by means of oil and petrol engines, or by combining the latter with electric motors and generators and batteries of accumulators, the introduction of electric traction may be postponed for a time, if not indefinitely. Up to the present moment, however, although the South-Western and North-Eastern have actually constructed such motor cars, the former using steam and the latter the combined oil and electric system, the results obtained have been far from encouraging.

The use of automobiles is not so new as some think. The Belgium government has for fifteen years been operating steam motor cars, which are known under the name of "Train-Tramways." The mistake which English railway companies would seem to have made lies in their attempting to put into service motor cars which will give as rapid acceleration and as high an average speed as that which is easily obtained in the case of electric traction. These attempts have so far proved unsuccessful. Similar experiments with accumulator cars have been carried out by the Nord Railway Company in France, and by an Italian railway company between Bologna and St. Felice, but the results there obtained have not been so encouraging as to cause this system to be generally adopted.

Both the Nord and the Paris-Lyons and Mediterranean Companies, in France, have ordered Serpollet steam cars, and are going to experiment with them, but no record of results are as yet available, and in fact, in one case at any rate, the experimental car has not yet even been delivered by the makers.

The last two of the four classes into which we divided railways, viz., interurban and suburban lines, are on quite a different footing to the main and branch lines, and it is agreed by all those who are in a position to judge, that there is a wide and extensive field in Great Britain for the application of electric traction on such lines, probably more so than in the United States or on the Continent of Europe.

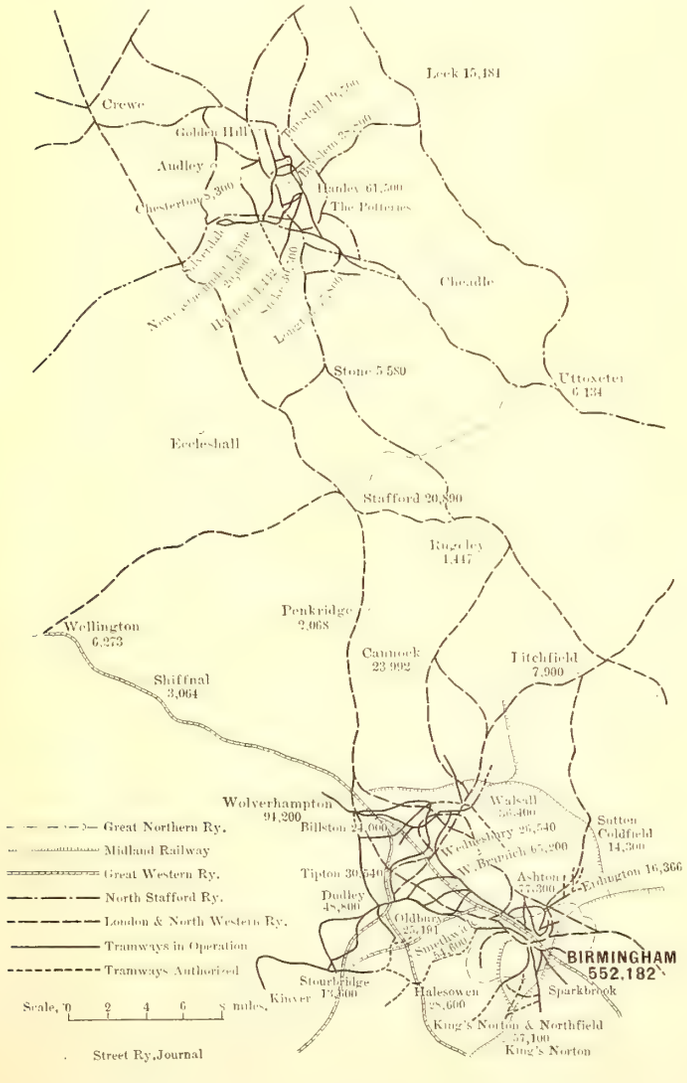
With regard to the suburban traffic in London much will depend upon the Royal Commission which is now investigating the subject. This body is entrusted with a great responsibility, as it has not merely to consider and sanction, or throw out the various proposals which have been made, but to consider the entire question of the transportation facilities in London as a whole, and arrange the schemes under consideration, so that they may work in with the existing lines. The report of this commission, when issued, may bring about some very important changes, and will, in all probability, force the railway companies to adopt a more progressive policy than most of them have done hitherto. Besides this they will probably consider the whole question and lay out recommended routes which have not yet been brought forward.

Till quite recently it has been more or less an unwritten rule for Parliament to refuse to grant franchises to tramways, light railways or other lines which could be shown to be in actual and sharp competition with existing railways, provided the latter were considered by Parliament to be capable of affording sufficient facilities to the districts through which they ran. The result has been that many of the railway companies have taken advantage of this, and being thus freed from competition have not troubled to give a proper service, such as would have been forced from them by the existence of a rival line. This is particularly the case with the Southern lines in or near London, serving some of the most desirable residential districts, and in all probability the action of the Royal Commission with respect to these will have most far reaching effects.

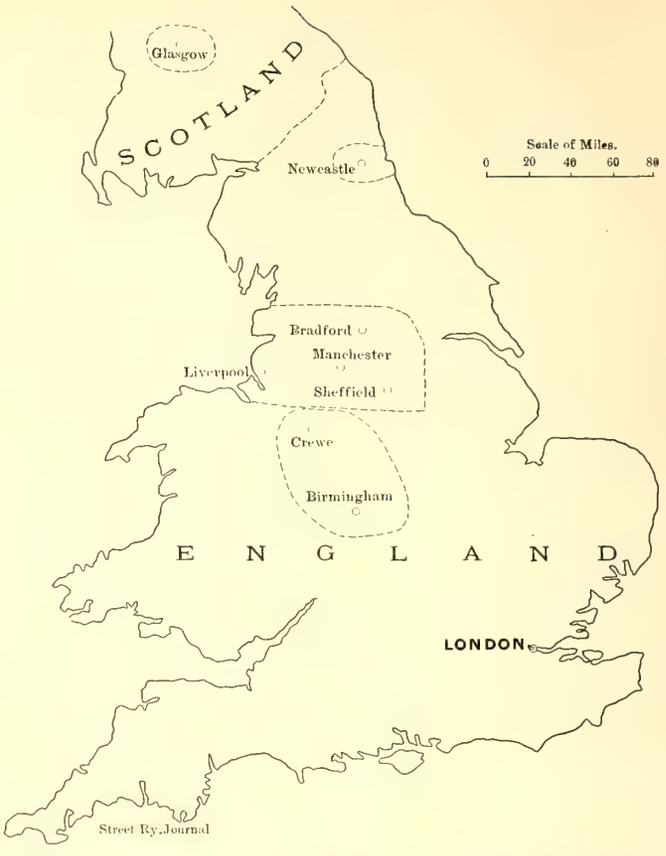
There is no doubt that the English railway companies have been far too conservative in the past, though the reason for their inactivity is not far to seek, and unfortunately certain members of the electrical engineering profession have done their best to give them an excuse to still hang back, owing to the many impracticable schemes which have been suggested for electrically operating suburban lines.

The dispute over the electrification of the Inner Circle, which culminated in the now famous arbitration to decide which system should be used, is a case in point. When railways see such a great difference of opinion amongst some of the leading experts, one can scarcely wonder at their concluding that the

present is not a time for them to attempt to do anything. This is only an excuse, and doubtless if the will to progress were not lacking the way would not seem so difficult. Many of the railway companies do not want to make any drastic changes, and merely wish to appear progressive whilst in reality doing nothing. They are, in fact, lazy and do not feel inclined to take the trouble to make themselves acquainted with the new and changed condition of affairs, which would be a natural consequence of the introduction of electric traction. But this is not the only reason for their hanging back, and it must not be forgotten that the capitalization of our railways has a very important bearing on the subject; it is already so enormous that one can readily understand that the directors do not wish to increase it, and thus depreciate the value of their shares. Some idea of the state of affairs may be obtained from the fact that they are capitalized for, approximately, £30,000 per mile of single track, and that the net receipts represent only about 4 per cent of the total capitalization. In the past railway companies have not written off sufficient profits to amply cover depreciation and renewals; the writer is personally cognizant of cases where machinery purchased thirty years ago, and now practically obsolete, stands in the companies' books at an amount equal to the original purchase price. Thus the introduction of electric traction on a large scale is not at all welcome, since it would not only involve a considerable capital expenditure, but would also entail the writing off of large sums which represent on the books of the companies the value of large quantities of rolling stock, machinery and other material which would be rendered useless by this step. What this might mean can be gaged from the statement that the total capitalization of the railways in the United Kingdom is in the neighborhood of $7,000,000,000.



MAP SHOWING BIRMINGHAM AND POTTERIES TRAMWAY SYSTEM



MAP OF ENGLAND AND SOUTH SCOTLAND, SHOWING LOCATION OF LARGE SCALE TRAMWAY AND RAILWAY MAP

Besides being hampered by this enormous capitalization there are great difficulties to be faced in operating suburban traffic electrically, owing to the lack of terminal facilities to handle even the long-distance traffic. The extension of a terminus is an expensive operation; the London, Brighton & South Coast Railway Company is spending over a million sterling to improve its station and the approach to it at Victoria.

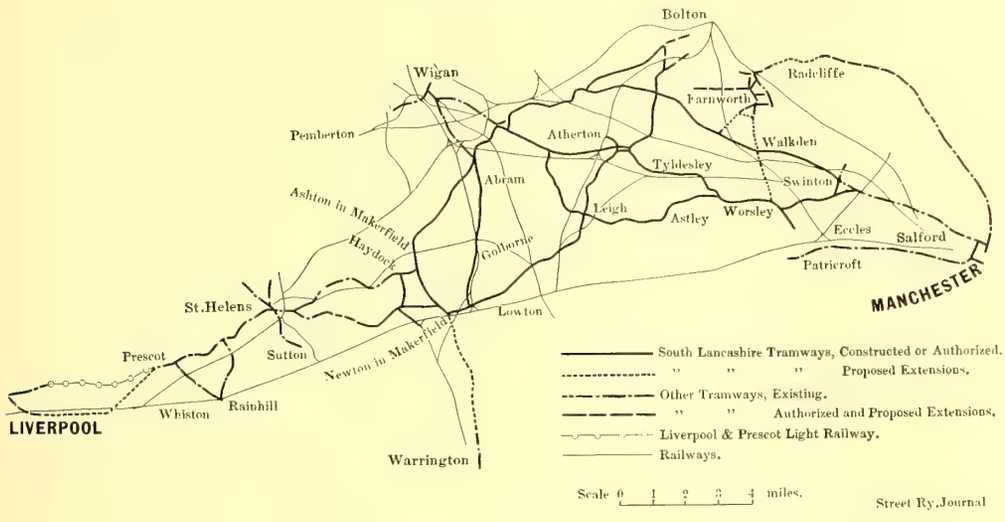
The question of suburban traffic in and around London is one of great interest, and much may be expected from the combination of tube, shallow tunnel, and surface railways which have been amalgamated by Mr. Yerkes, and which will most probably be in operation within the next two years. The chief importance of this system lies in the close connection which exists between the Metropolitan District Railway and many other railways, such as the Tilbury & Southend, the South-Western, the Great Western and the North-Western. The actual results of electric traction on the District Railway will doubtless go far towards persuading some of the companies to follow suit on portions of their own systems.

Other companies, such as the London, Brighton & South Coast Railway, are watching the progress of events, as is evident from their having appointed Philip Dawson, of Kincaid, Waller, Manville & Dawson, to act as their consulting engineer and advise them in this respect, so that doubtless they will not be slow to act when the time comes and will be fully prepared to meet any situation which may arise.

In the United States it is a very usual thing for suburban electric railways to run on their own right of way outside the towns, but on entering the towns to travel over the existing tramway tracks, and this method of procedure has met with considerable success. This, however, can scarcely be done in Great Britain, because the girder rails prescribed by the Board of Trade have such narrow grooves that wheels suitable for heavy suburban railway traffic cannot run on them. To this

must be added the fact that the maximum speed allowed in our cities is very low, and that even if this were not so the majority of the main thoroughfares are so narrow and tortuous that high speeds could not be attained even if they were sanctioned. These circumstances render it difficult, if not impossible, to build such lines as are to be found radiating from many of the large cities in America.

There is, however, an alternative method which might be adopted in the solution of the London and suburban traffic problem; that is to say, an arrangement by which the numerous suburban lines might be operated by high-speed electric cars or trains without involving the huge capital expenditure which would be entailed by an attempt to increase the terminal facilities of the existing railways. This might be effected by building special lines of tubes or subways which would come to the surface a few miles outside the town, and thus avoid the crowded and congested area near the center. When they come up to the surface they join up with the suburban lines.



SOUTH LANCASHIRE TRAMWAYS

It seems highly probable that if the railway companies do not show themselves to be ready and willing to initiate considerable reforms, not so much as regards lower and more uniform fares as in the direction of an accelerated and more frequent service, Parliament, under the advice of the Royal Commission, may be prepared to grant to other companies the right to do the necessary work, giving them powers to construct lines on the principle above, i. e., underground in crowded districts where terminal facilities on the surface cannot be obtained, and coming to the surface as soon as possible outside the town.

At present some of the prettiest and most desirable neighborhoods are either not served at all or only served very badly, and it is the rule, and not the exception, on the existing railways to get average speeds of less than 10 miles or 12 miles an hour, with stations from 1 mile to 2 miles apart. This deplorable state of affairs is beginning to be realized by the British public, whose eyes have largely been opened by the improvements of the tramways and tubes in London, and the promises which have been made by Mr. Yerkes as to what he is going to do.

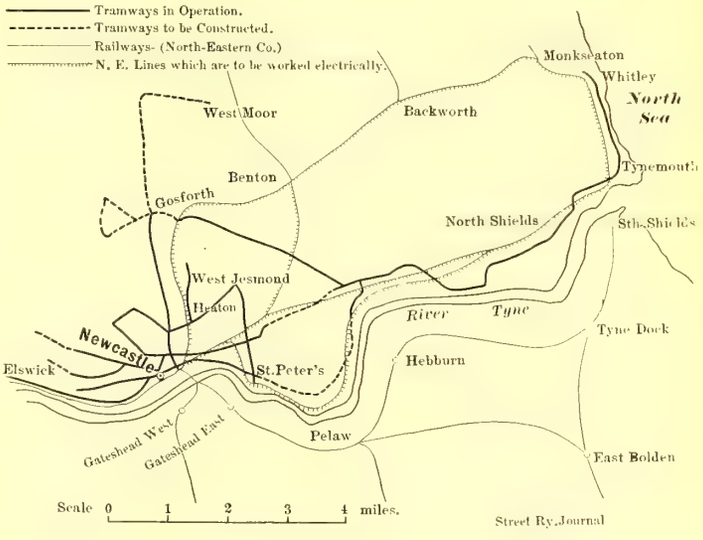
As already mentioned the whole question of London traffic is being very carefully investigated by the Royal Commission, and nothing fresh will be attempted until that body has made its report. The problem is exceedingly difficult and intricate, and is rendered more so by the fact that while the Commission is making its investigations Mr. Yerkes is building the tubes and other lines which have already been authorized, and any scheme of action which is drawn up will have to take these into account.

The situation in Great Britain, altogether, is surrounded by conditions peculiar to that country, and although much good may result from a careful study of what is and has been done in America and elsewhere, it should never be lost sight of that the problem is one which must be treated on its own merits if a successful solution is to be obtained.

London differs from most of the other large cities of Great Britain, in that the tramway systems in the latter are owned and operated by the municipalities, whereas, in London this is not the case at all; besides the London County Council there are several independent tramway, tube and underground railway companies.

Those who are interested in the subject of London traffic will, no doubt, have read the article which appeared in the last convention number of this paper (October, 1902,) which gave a very good idea of the existing network of railways owned by separate and divided interests. From this it will be seen that to operate all the existing tramways, railways and tubes, and make them work harmoniously together so as to best satisfy public requirements, is no light undertaking.

As already pointed out the railways, as a whole, are pretty well alive to the fact that if they do not change their ways the electric tramways which are springing up everywhere will seriously injure not only their suburban traffic but also the interurban traffic, especially in the densely crowded manufacturing districts which exist in various parts of the country. In fact, the competition of the tramways has already produced visible and tangible results. Under the auspices of Mr. Gibbs the North-Eastern Railway Company is at the present moment



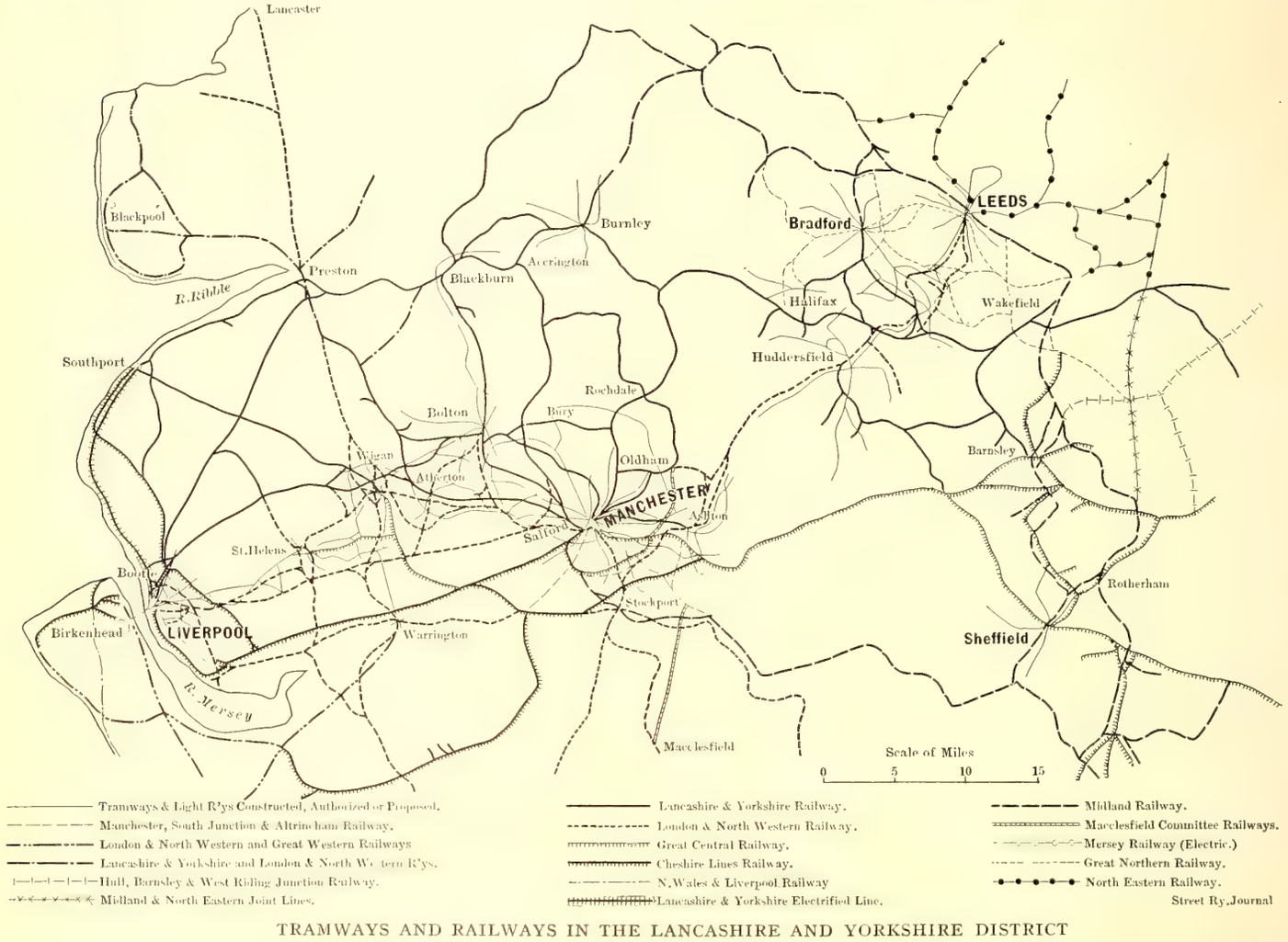
MAP OF TRAMWAYS AND RAILWAYS IN THE NEWCASTLE DISTRICT

equipping for electric traction the line which connects Newcastle and Tynemouth, this action being practically forced upon the company by the decrease in receipts caused by the tramways. A similar case is seen in the electrification of the railway between Liverpool and Southport, which is being carried out by the Lancashire & Yorkshire Railway, under Mr. Aspinall's supervision.

A very important tramway system, of which the first part has recently been completed, is that belonging to the South Lanca-

shire Tramways Company, which was designed and carried out by Kincaid, Waller, Manville & Dawson, the consulting engineers to the company. The accompanying map shows the extent of the system. At the present moment the company has powers to construct 115 miles of tramways, which, when completed, will interconnect Liverpool, St. Helens, Warrington, Salford, Manchester, Oldham, Rochdale, Bury, Accrington, Blackburn, Bolton and Wigan, and weld into one complete system the various tramways which radiate from the large towns in the above district. Taken altogether, it means a vast system of intercommunication comprising some 600 miles of journey. It is obvious that to reap the full benefit of this network of tramways which will shortly be in operation, the various companies must have running powers over each other's lines, and if any difficulty is experienced in making such arrangements it is most probable that the opposing bodies will be compelled by government to grant running powers for the public good, independent of their private wishes.

The exact arrangements that will be made as to the details of the system in this and similar cases, and the division of the receipts from the passengers, are impossible to foretell definitely, but the following is an outline of the probable course



TRAMWAYS AND RAILWAYS IN THE LANCASHIRE AND YORKSHIRE DISTRICT

route, and serving a population of over 5,000,000 souls. These tramways when complete will constitute a rival to the railway companies that the latter cannot ignore, and whose competition will soon make itself felt if the railways persist in their refusal to advance with the times. A glance at the map, which has been specially prepared for this article, will show what a strong position this network of tramways will hold.

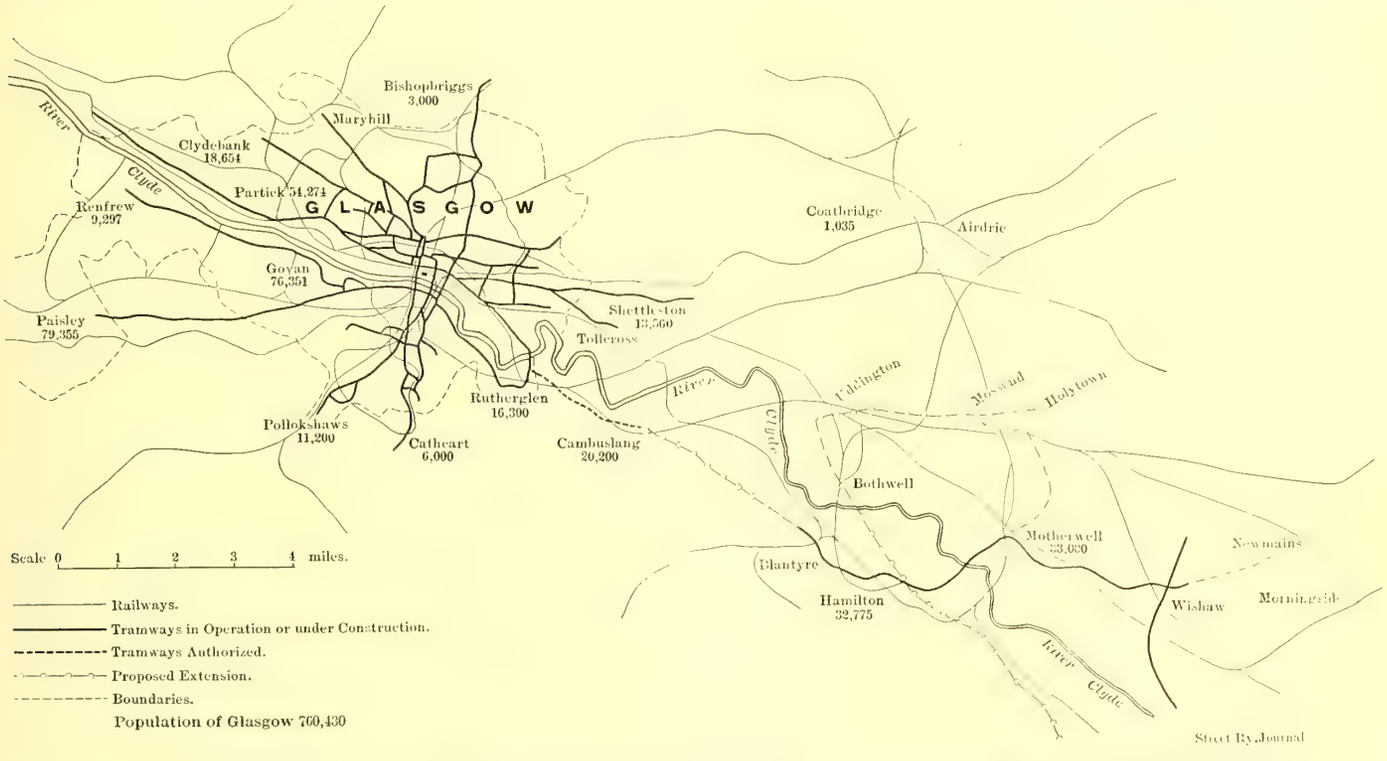
The map of Glasgow and its neighborhood is very interesting, as showing what could be done in that district, and what, in fact, will undoubtedly be carried out in the near future.

All the maps illustrating this article show very clearly how keen the competition of tramways with railways is becoming. This is especially evident in the case of the tramways in the South Lancashire and Yorkshire districts. As will be seen, when the various proposed extensions are completed, a very large and populous area will be covered with a continuous network of tramways, on which arrangements for through running will doubtless be made. Even in the present state of affairs it is possible to travel by tramcar right through from Liverpool Docks to Bolton, as was demonstrated practically on the occasion of the opening of the recently completed section of the South Lancashire tramway system by a car performing this of affairs: Each company or municipality will provide the electric power and the conductors and motormen for the cars that run over the lines owned by them, and will receive the fares of the passengers, but will pay a fixed rate per car-mile to the body who owns the cars for their use. To deal with through fares where passengers travel over lines of several different parties a clearing house would have to be used.

In the case of through routes and running powers in the London district it is very probable that some law will be passed giving compulsory running powers at specified rates to companies over each other's lines, also that to relieve Parliament from the burden of deciding such and other questions a special department will be formed. Such a proceeding would undoubtedly facilitate matters and generally tend toward reducing the useless waste of money and unnecessary delay which so constantly occurs in the present state of affairs.

The competition of tramways will not affect all railways in the same way and to the same extent. Thus, between Liverpool and Manchester, broadly speaking, there are two companies chiefly concerned, viz., the London & North-Western and the Cheshire lines, which, besides being subjected to outside competition, are rivals to each other; between Leeds and

America, and run high-speed cars on their own right of way, Bradford it is the Midland & Great Northern; between Huddersfield and Manchester it is the London & North-Western; the Lancashire & Yorkshire Railway are the lines chiefly concerned in the district around Bolton, Blackburn and Burnley. It seems pretty obvious that in the above and similar cases the various railways will be driven to electric traction to regain and retain their interurban traffic. In the event of their doing so they would undoubtedly be successful in securing this traffic, as by running on their own right of way they could use speeds quite out of the question for the tramways. The railways would then be in a very strong position, and even if the interurban tramways should develop, as has been the case in



MAP SHOWING GLASGOW CORPORATION, HAMILTON, MOTHERWELL AND WISHAW TRAMWAYS

Corporation Tramways, and Mr. Cottrell, the enterprising engineer of the railway, decided to use more powerful motors, and by obtaining more rapid acceleration increase the schedule speed of the trains, and thus be able to give a more rapid and frequent service. An entirely new equipment has been installed by Dick, Kerr & Company, which gives an acceleration of over 3 ft. per second per second, which is higher than any to be met with in regular practice in any other part of the world. This enables an average speed of about 19 miles an hour, to be obtained with stations approximately 700 yds. apart, including 10 seconds wait at the stations. This action on the part of the Liverpool Overhead Railway has converted into considerable profit what was formerly a weekly loss.

the railways being first in the field would not be seriously affected, as the tramways would not have any greater inducements to hold out to the traveling public, and, consequently, there would be no reason for any great amount of traffic to be diverted from the railways.

If the hands of the railways are forced in this way they will, doubtless, see the wisdom of dealing with their suburban lines in a similar manner, for they will find it harder to regain their old supremacy in this direction than in the other. A glance at the map will show how the tramways and railways radiating from Manchester parallel each other, and when one considers the peculiar advantages which tramways have in dealing with this class of traffic it will be realized how serious is the case of the railways.

The conclusion at which most engineers who have had experience have arrived is, that the time for the transformation of our long-distance main line railways is not yet come, and that the transformation, besides being beset with most serious difficulties, would result in very few advantages when completed. On the other hand, for the heavy traffic on suburban and interurban lines electric traction is peculiarly suitable; it has an enormous advantage from the very rapid acceleration which the use of electric motors renders possible, and the importance of this is well known to all who are at all conversant with the subject. The great value of rapid acceleration has been recently demonstrated in a most striking manner in the case of the Liverpool Overhead Railway. This railway was suffering considerably from the competition of the Liverpool

It is pretty generally predicted by those who are conversant with the subject that within the next five years or ten years almost all our railways will be operating their suburban traffic electrically. The next ten years or so will also doubtless see the electrification of those lines connecting populous manufacturing centers which are not a very great distance apart, and between which a large traffic already exists.

In many cases the electrification of the suburban lines may be pushed forward until they reach from 40 miles to 50 miles out, particularly where it is desired to develop pleasure traffic. Suggestions for a high-speed line of this sort between London and Brighton have often been made, but so far have always been thrown out of Parliament, owing to faulty plans and inadequate financial backing. While such a line does not at present seem to be particularly necessary, there is no doubt that the London, Brighton & South Coast Railway are quite alive to what is happening and are quite prepared to construct such a line should it be required.

It seems quite probable that, as stated above, owing to the great want of terminal facilities, separate franchises may be granted to connect the various business and residential centers in London to the outskirts. Electric tramways would serve the district within a radius of from 4 miles to 5 miles, and the electric railways would run the first few miles without stopping, until they had reached the boundary beyond which the tramways cannot be operated satisfactorily.

The maps of the district round Liverpool, Manchester, Bradford, Leeds, Sheffield, Birmingham and Wolverhampton shows

the enormous competition which the railways in that district will shortly have to face, and that the constitution of a few systems similar to the South Lancashire undertaking, but on a smaller scale, will suffice to cover this district with a complete network of electric tramways, which, unless the railways act promptly, would probably be followed by electric railways connecting the large centers and running over their own right of way.

TERMS OF A PROPOSED UNION CONTRACT

Following are the terms of a contract recently submitted to an operating company by the Amalgamated Association of Street Railway Employees of America, which had succeeded in organizing the company's motormen and conductors. Needless to say, the plan was rejected by the company, but as the terms demanded, and the form in which they were presented are identical with those adopted as the standard of the organization, they will be interesting generally to managers of other properties similarly situated:

Memorandum of agreement made and entered into this ..... day of ....., 19.., between the ..... Railway, party of the first part, and the Amalgamated Association of Street Railway Employees of America, Division No. ....., party of the second part.

Witnesseth, That in the operation of the lines of the party of the first part both parties mutually agree:

Section 1.—That the party of the first part, through the properly accredited officers, will treat with its employees through the Amalgamated Association of Street Railway Employees of America, Division No. ....., through their properly accredited officers and committees.

Section 2.—The properly accredited officers of the association shall have full power to adjust all differences that may arise between the parties hereto with the properly accredited officers of the company. All differences shall be submitted to the superintendent or manager of the company by the properly accredited officers of the association, and if they cannot agree the president, or in his absence the secretary of the company, shall be called to the conference. If, after such conference, there still remains a disagreement the properly accredited officers of the association shall have power to order the case to arbitration at once. The board of arbitrators shall consist of three disinterested persons, one of whom shall be chosen by each of the parties hereto. A third shall be chosen by the two first selected. The finding of the majority of the said board shall be binding on both parties hereto, the cost and expense of which shall be paid as follows: Each party to pay its own arbitrator and both parties shall jointly pay the third arbitrator.

Section 3.—That all business arising between the parties hereto shall be transacted directly by the properly accredited officers of the company, and the properly accredited officers of the association, respectively. Any member of this association under this agreement laid off, and after investigation found not guilty, shall be reinstated in his former position and paid for time lost.

Section 4.—That any member of this association by act or word interfering with or disturbing the course of negotiations between the properly accredited officers of the company and the association, respectively, upon any subject whatsoever, or interfering with or disturbing the service in any manner contrary to the conditions and spirit of this agreement shall, upon mutual satisfactory proof of the same, be dismissed from the service.

Section 5.—That all members of the association in the service of the company shall be entitled to free transportation over all lines owned or operated by the company. Said free transportation to consist of book tickets or annual card passes the same as now in use.

Section 6.—In all cases where the officers of the company charge a member of the association with any offense said charge shall be specified in writing and a copy of the same be furnished to the secretary of the association within five (5) days after the alleged offense is committed.

Section 7.—In case the association suspend a member who is an employee of the company for any violation of their laws or rules it shall request his suspension in writing, signed by the officers of the association. The officers of the company shall suspend said employee at once without pay until such time as the association shall request his reinstatement.

Section 8.—Any member of Division No. ...., elected or appointed to office in this Division or the International Association, shall, upon his retirement from said office, have his respective place in the company's employ again.

Section 9.—That all motormen and conductors shall be members of this association and must be turned in for initiation within sixty (60) days from the time they were hired. When men are put on to practice they shall take out a permit card from the association, paying the association the compensation of one dollar ($1.00) for same.

Section 10.—From eight (8) to ten and a half (10½) consecutive hours shall constitute a day's work on all regular passenger runs. All motormen and conductors shall receive one-half pay for all necessary dead-heading, and when men are called upon to do any work they shall be paid from the time they have been instructed to report, and must in all cases be paid from said time until they are relieved or their car in the car house. No order to report for duty shall be considered as less than one (1) hour of service. No regular man shall be required to do any extra work when an extra is available, and should he be able to secure substitute he shall be allowed to do so.

Section 11.—Motormen and conductors on regular cars that are derailed, disabled or delayed in any way shall be allowed to work the number of consecutive hours their run calls for, and if over-time is worked they shall be allowed pay for same at schedule rate.

Section 12.—All motormen and conductors shall have their respective places on their respective lines on the board in accordance with the time they were hired, it being understood that this is to have effect on all men hired in the future. The present list to remain as it is. Motormen and conductors to have the preference of regular passenger and freight runs according to said list.

Section 13.—That all cars running over any line owned, operated or managed by this company shall be manned by members of Division No. ...., who shall have their place on said cars in accordance with their age in the service on their respective lines as provided for in this agreement.

Section 14.—All runs of less than eight (8) hours shall be considered extra runs. First extra to have the preferred run open to him each day and so on through the list, and that the board be marked up at the time the last day run gets off. If the time-table is so arranged that there is a greater number of runs of eight (8) hours or more on Saturday and Sunday they shall be considered extra runs. Runs of the greater number of hours to be preferred runs regardless of starting point. Runs of an equal number of hours and the same starting point, the ones starting first to be preferred. (Details covering local conditions are omitted for obvious reasons.)

Section 15.—All bulletins issued by the officers of the company relative to the duties of the motormen and conductors shall be posted at all starting points, or each man shall be furnished a printed copy.

Section 16.—Motormen and conductors on city lines shall be paid (many details are inserted here).

Section 17.—This agreement and provision thereof shall continue in force and be binding upon the respective parties hereto until one year from date.

.....Railway.
By ..... President.
Seal.
.....Secretary.
Seal, For the Association,
By ....., President.
....., Secretary.

REGULATIONS FOR ELECTRIC CARS AND AUTOMOBILES IN LEIPZIG

Recent regulations for electric cars and automobiles in Leipzig have been issued in conformity with the municipal ordinances, which prescribe that electric street cars shall not run at a higher rate of speed than 9 miles an hour in the business sections: with trailers, 7.2 miles; in residential sections, 10.8 miles an hour, or 9 miles with trailers, and in the suburbs, 15 miles, or 12 miles with trailers. The penalty for exceeding the speed limit is a fine up to $15 or imprisonment for fourteen days, or both. In case of accident a higher penalty may be inflicted. The City Council, at a recent meeting, passed an ordinance prohibiting the use of automobiles in most of the streets of the inner city, and in other parts allowing them to be driven only along those streets which are traversed by electric cars.

EMERGENCY CAR AND OTHER WRINKLES ON THE ORANGE & PASSAIC VALLEY RAILWAY

A convenient and novel type of emergency car has recently been built in the shops of the Orange & Passaic Valley Railway, of Orange, N. J., and is illustrated in the accompanying engravings. The Orange & Passaic Valley Railway has about 10 miles of track and operates a belt line through the Oranges, connecting the steam and electric railway lines which traverse this populous territory, and which radiate from Jersey City and Newark. The line has up to within recently been operated independently, but is now part of the system of the Public Service Corporation, which has just been organized as a successor to the North Jersey Street Railway Company, to operate all of the lines in this part of New Jersey.

The emergency car, a plan view of which is shown in Fig. 3, was designed by W. B. Brown, master mechanic of the company. The frame is of seasoned white oak throughout, with all tenoning, mortising and studding close driven in white lead. The outside and inside sheathing is of selected white pine, with tongue and groove painted, so that any shrinkage will not show streaks. The entrances to the car consist of two doors, 4 ft. wide by 6 ft.



FIG. 1.—EMERGENCY CAR WITH TOWER RAISED



FIG. 2.—INTERIOR OF CAR HOUSE

6 ins. high, at each end of the car, one at the corner, as shown in the plan, and the other in the middle; also two sliding doors,

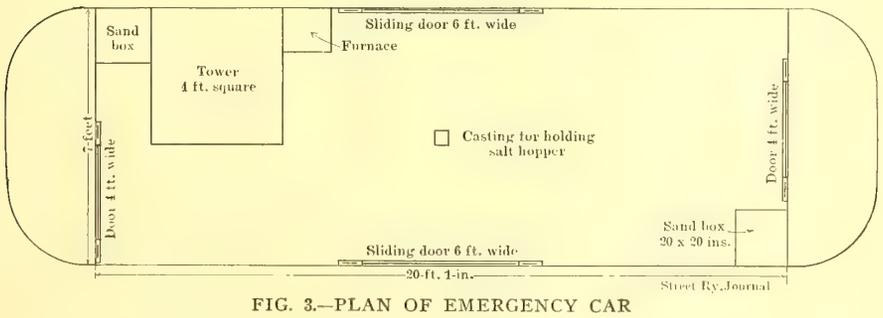


FIG. 3.—PLAN OF EMERGENCY CAR

6 ft. wide by 6 ft. high, in the sides of the car. The platforms are vestibuled and provided with Brill angle-iron buffers and Smith headlights. The tower is one used on a Trenton tower wagon. It is 4 ft. sq., and is raised by means of a windlass from the outside of the car. It is equipped on top with a swinging platform with collapsable sides. When lowered the roof is perfectly water tight, as the sides of the tower are fitted with rabbitted pieces, which fit inside of the sealing pieces on the roof. A novel feature of the tower is that directly under the tower platform are small boxes each containing a number of extra ears, solder and acid, the three materials most frequently used when the tower is raised. It has been found a great convenience to have a supply of these articles so easily available by being stored in a permanent compartment close to the hands of the men while working on the tower.

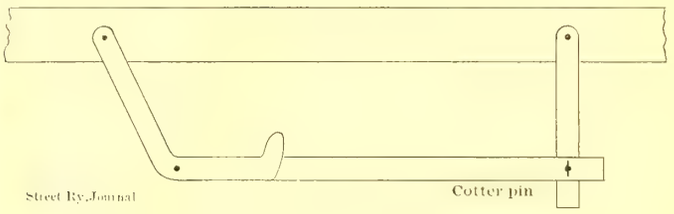


FIG. 4.—BRACKET FOR HOLDING LADDER

The sand-boxes, which are at each end of the car, are of the Brill type, with hoppers 20 ins. and 20 ins. x 32 ins. high. The hoppers hold forty-two pails of sand and are lined with sheet steel. There is room enough on the floor of the car for two dozen sand bags, as a supplementary supply, and this quantity is sufficient to sand the entire road. The sand-box is worked from the platform by hand, and the lever moves in a rack, which is provided with six notches, so as to give any sized opening up to the maximum, which is 2½ ins. In this way the flow of sand can be regulated according to the speed of the car.

Salt is not used in the sand-boxes, but when the track has to be salted a special hopper is placed in the middle of the car. At this point, as indicated in the plan, a casting has been located, provided with two cast-iron sockets. To these sockets hose or leading pipes can be connected to carry the sand directly to each track, and as these leaders are midway between the wheels they are always directly

over the track. The salt hopper is of oak, 26 ins. long by 16 ins. wide, and the salt is shoveled into it as required.

A feature of the emergency car is its compactness and the method by which all needed parts have been stowed away to take up the least amount of room. This can be seen from the plan. Adjoining the base of the tower in the inside of the car is a small box, 15 ins. sq. by about 35 ins. high, for holding the primus No. 4 flame kerosene furnace for soldering. Several sizes of these furnaces have been tried, but the one mentioned has been found the most desirable, as it will melt solder in six minutes. Underneath the furnace-box is a small drawer for holding the salammoniac for cleaning the irons. A spring is attached to the inside of this drawer so that it is self-closing. The racks for holding the supplies are attached to the stationary part of the tower, which is inside the movable part, while the span wire and other coils of wire are hung over hooks attached to the walls of the car and are strapped down to prevent their swinging.

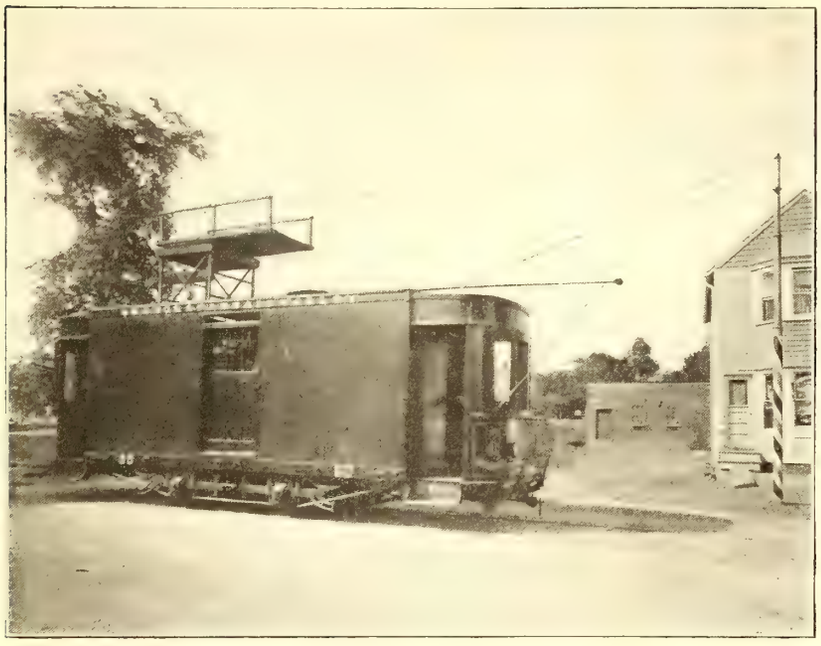


FIG. 5.—STRINGING LIVE TROLLEY WIRE

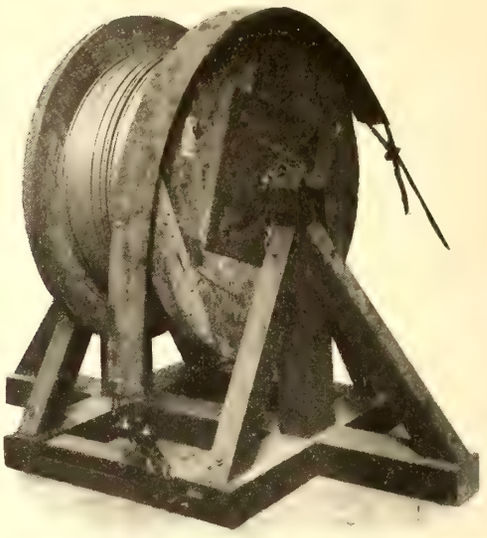


FIG. 6.—REEL FOR PAYING OUT LIVE TROLLEY WIRE

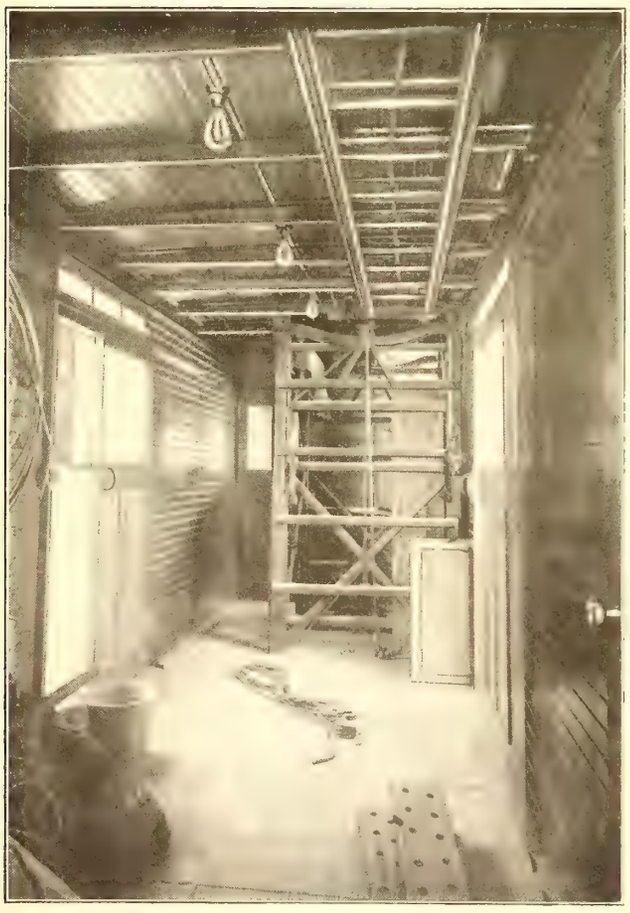


FIG. 7.—INTERIOR OF EMERGENCY CAR

One of the most ingenious features of the emergency car is the method of stowing away the 25-ft. ladder which is hung from the roof. A diagram of the bracket used for holding this ladder is shown in Fig. 4. It can be released by the removal of the cotter pin and bolt shown, which requires only a second or two, when the frame drops down. A 25-ft. extension ladder is long enough for all ordinary work, but a 36-ft. ladder can be carried in the car in case it is necessary to send two men up a pole to adjust a hot feeder or do other heavy work.

Another ingenious feature of the car is the provision made for stringing a live trolley wire. The Orange & Passaic Valley Company, with others, has suffered somewhat from trolley wire thieves, and it has been sometimes a matter of vital importance to be able to put up new trolley wire in a hurry. For this purpose, the reel of trolley wire is mounted on the frame shown in Fig. 6, the frame being carried in the middle of the car. The free end of the wire is then passed through the roof over two guide wheels, which are electrically connected through a cut-out switch to the controller. The wire to be strung can then be attached to the live overhead system and can be connected to the span wires as the car reaches them by men on the roof of the car, while the car receives power from new wire through the roof connection described. The wire in the car is kept taut by means of a band-brake, shown in Fig. 6, as surrounding one flange of the reel. The pressure on this band-brake is regulated by a block and fall attached to the end of the brake and to a ring in the floor. As, of course, the wire in the reel is alive the band-brake is insulated, as shown, by two globe strains, but the reel itself is not otherwise insulated, as it is found that the wood insulation of the reel, frame and car are sufficient if care is taken in paying out the wire.

Door cranes are not used, as it has been thought they would be in the way. Instead narrow windows are placed over the tops of the side doors, as shown in the side view of the car. In case any heavy stuff has to be lifted in or out of the car these windows are opened and a 4-in. T-bar is laid across, from one

top door frame to the other, to carry a block and fall, and this arrangement is found to answer all practical purposes. The side doors have a self-locking latch so they cannot be opened from the outside. The bell cord is carried on one side of the car only, to avoid interference with the coils of wire which are hung inside the car.

Special fender castings were designed, so that when the fender is raised it clears the buffer entirely, so that cars can be pushed directly by the buffer instead of through the fender. The car is equipped with rings in staples screwed into the sills for hauling, and also with a 14-in. dedenda gong. This gong is considerably larger than those used on the ordinary cars and is of a different sound, so that the approach of the emergency car can be recognized for some distance.

The car is mounted on a Peckham single truck and a convenient step for the side-door on each side has been provided by riveting an angle-iron to the top side bar.

When the tower is raised men can work with comfort on a 22-ft. 6-in. trolley wire.

SAND DRIER

The method of drying, screening and storing sand used in the car house of the Orange & Passaic Valley Railway is very ingenious and convenient, as practically all handling of the sand is done by machinery. The sand-drying apparatus is all contained in a small room about 12 ft. sq. with brick walls, adjoining the car house, and shut off from it by a fireproof door, as the sand-drying furnace contains a fire.



FIG. 8.—SAND VALVES IN CAR HOUSE



FIG. 9.—INTERIOR OF SAND-DRYING ROOM

The sand is received in carload lots, and is dumped directly into a hopper. From this hopper it is shoveled into the drier, which consists simply of a spherical stove with an exterior cylindrical casing of sheet-iron. Directly over the hopper surrounding the stove is a hood connecting with a flue surrounding the stove-pipe and leading out into the open air, so that as the moisture which is dried out of the sand rises it is caught by the hood and passes outdoors through the flue. As the dry sand falls from the drier it passes through the screen, or is shoveled through the screen as the occasion demands, and then falls into a pocket, from which it is elevated by a bucket conveyor driven by a small 2-hp motor to a sand bunker above. It is then in condition to be used at any time. From this bunker three pipes are led through the wall of the car house at an angle of 45 degs. Each pipe is provided with a home-made gate valve, and any motorman desiring sand can get out as much as he wants in a pail. The sand valves are shown in Fig. 8, and the interior of the sand-drying room in Fig. 9.



FIG. 10.—GENERAL VIEW OF CAR HOUSE

CAR HOUSE

The exterior and interior of the car house are also illustrated herewith. The floor is of concrete with concrete pits, and at one end is a brick building for the offices of the company, waiting rooms for the passengers and room for the conductors and motormen. The car house proper is divided into two bays, one of which contains the repair tools and is heated in winter. Here most of the pit work is done. The storage bay is not heated. The car house has a capacity of sixty cars.

THE SPRINKLER

A slight improvement has been added to the sprinkler, which is worthy of mention. The sprinkler is a double ender with two jets at each end, supplied through a 5-in. pipe. The flow of water was controlled by a valve in this pipe, but its use has been discontinued and a 3-in. tap has been put near the end of each of the four sprinklers. This gives a control over either side of the sprinkler and is economical of water, as there is less spill when the water is turned off.

AN EMERGENCY TRACK BRAKE USED BY THE UNITED RAILROADS OF SAN FRANCISCO

From the time street cars were first run in San Francisco the necessity of a brake which would stop cars on heavy grades and on slippery rail became very apparent. This necessity is explained by the fact that San Francisco is very hilly, and also that during the winter season the drizzling rains and fogs make the rail very slippery. To give an idea of some of the grades it might be stated that electric cars are operated on 17 per cent down and on 14 per cent up grades. Cable cars are operated on 18 per cent grades, and one electric line, with counterbalancing device, is operated on a 25 per cent grade.

The first experiment with track brakes was made in 1883, when the Market Street Railway Company built a cable line on Market Street, the principal business street of San Francisco. The brake was similar in principle to the brake which will be hereafter described. It was placed on the rear truck and operated by a lever placed alongside of the grip lever. The cars were also equipped with wheel brakes, those on the front truck being operated by a foot lever, and those on the rear truck by an ordinary staff and handle on the rear platform, the two being independent of each other.

In 1893 the Market Street Railway Company consolidated with several other lines, and in 1894 commenced to change the motive power of some of its lines from horse and cable to electric. The first cars were equipped with the ordinary hand-wheel brakes. It was immediately discovered that an emergency brake other than a wheel brake was required. The cable cars were, in a measure, safer than the electric cars, for as long as a grip on the cable was maintained the car could at least not go faster than the cable. The electric cars had no such safeguard. In 1895 G. W. Douglas, then master mechanic of the Market Street Railway Company, started to experiment with track brakes on electric cars. Twelve single-truck cars, running over the steepest grades, were equipped with track brakes, and operated quite successfully until 1899. The electric system kept growing rapidly, and Mr. Douglas kept pace with it by improving on his brake. In 1899 he reconstructed his brake and made it applicable to double as well as to single trucks. This is the brake which is now so successfully used in San Francisco.

Primarily, the brake (see Fig. 1) consists of a hand lever, *A*, on the left-hand side of the controller, connected by a brake-rod, *B*, to an arm, *C1*, keyed on a shaft, *D*, extending across the truck. This shaft is connected on each end by means of a short lever, *E*, keyed to the shaft, to a connecting link, *F*, and to a toggle lever, *G1*. The connecting lever, *F*, is connected to a lever, *H*, keyed to a short shaft, *I*, and to a toggle lever, *G2*. A shell, *J*, for holding the shoe is fastened to the two toggle levers. By pulling back on the hand lever, *A*, the shaft, *D*, turns from left to right, tending to make the short lever, *E*, assume a vertical position. This motion is also transmitted to lever, *H*, by means of connecting lever, *F*. The simultaneous parallel movement of levers *E* and *H* cause the toggle levers *G1* and *G2* to force the shoe to rail, thus braking the car.

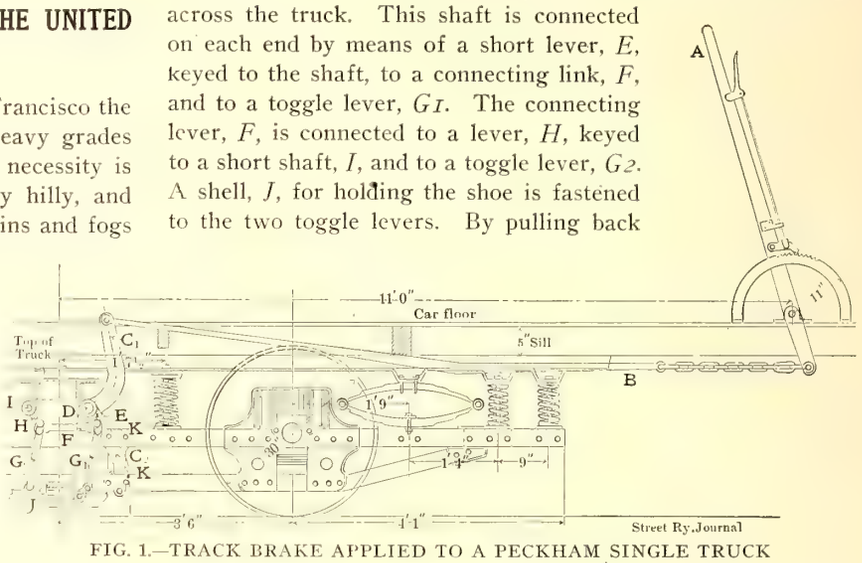


FIG. 1.—TRACK BRAKE APPLIED TO A PECKHAM SINGLE TRUCK

In order to adapt this brake to a Peckham single truck it is necessary to fasten a flat iron, *K*, bent, as shown, to the side frames, using the holes on each side of one of the spiral body springs. Two angle-irons are placed transversely across the truck, and fastened to the bent iron, *K*. To these angle-irons the brass boxes for holding shafts *D* and *I* are bolted. The large shaft, *D*, is held in position by three boxes, one on each end and one next to the arm, *C*. The short shaft, *I*, is held by two boxes, one on each side of lever *H*. It was also found advisable to use heavier iron than is usually furnished on trucks to connect the pedestals. Instead of using one brace, *K*, two are used, being so placed as not to interfere with the toggle levers.

To operate the track brake from the other end of the car an arm, *C2*, is keyed to the shaft *D*, the brake-rod being placed under and on one side of the motor, as shown in Fig. 2.

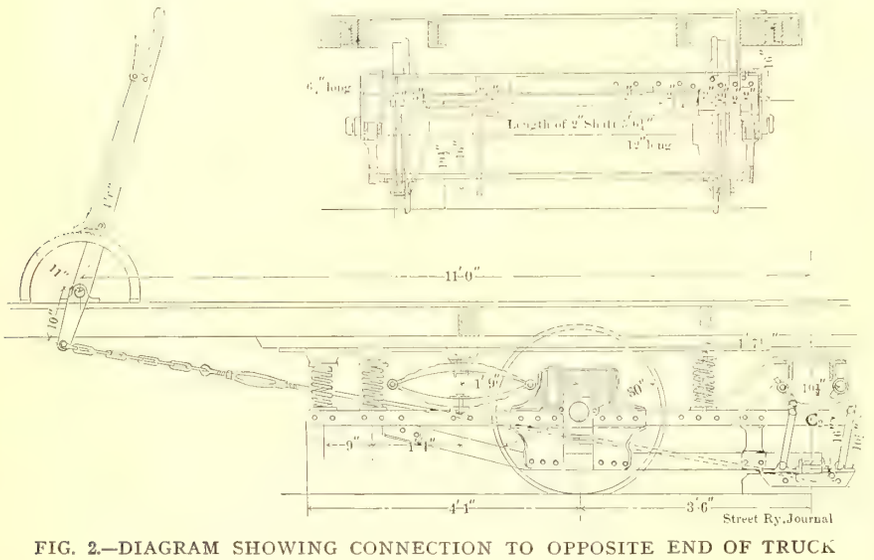


FIG. 2.—DIAGRAM SHOWING CONNECTION TO OPPOSITE END OF TRUCK

Considerable ingenuity is required to place these brakes on some cars on account of the sills of the car body not being in the proper position. Arm, *C1*, for instance, in many cases has to be placed under the seat, as the floor may have to be cut. The same result could be accomplished by raising the car body by means of placing a riser on the top rail of the truck.

This brake is placed on double trucks in practically the same manner as on single trucks, except that each truck has an independent brake, operated from the end of the car nearest the truck. On double trucks it is not necessary to provide angle-irons, as the boxes for holding shafts are bolted to the transom angles. Fig. 3 shows the track brake as applied to a

Brill 27-G double truck, and Fig. 4 shows its application to a Peckham 14-B 3-S double truck.

Fig. 5 shows the standard shoe used in San Francisco. This shoe is made of Oregon pine and costs about 3 cents. The material to be used for shoes was the subject of many experiments. All kinds of hard and soft wood, all kinds of metal, combinations of metal and wood, and metal with all kinds of

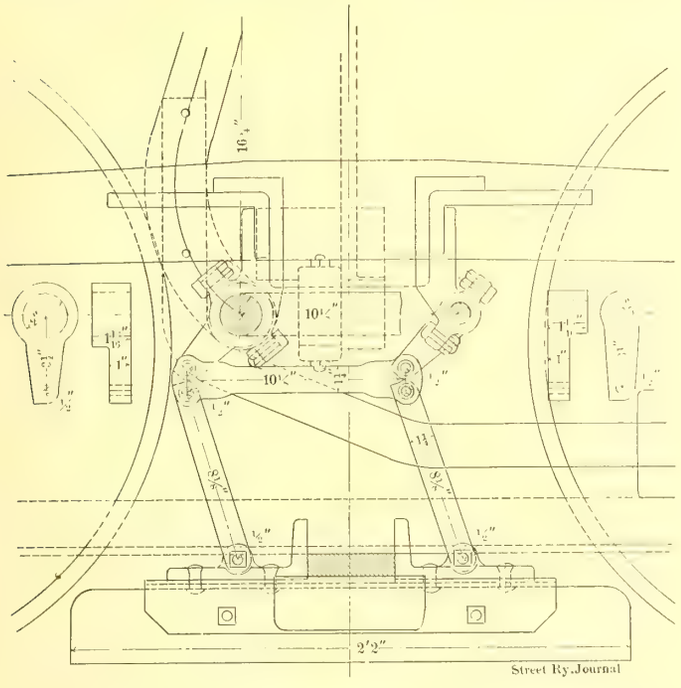


FIG. 3.—TRACK BRAKE APPLIED TO BRILL 27-G TRUCK

inserts were experimented with. For cheapness, general utility and highest braking efficiency the Orgon pine shoe was found superior to anything else. The shell for holding the shoe is made in two parts, held together by two bolts. The bolts pass through the recesses in the shoe, not only clamping the shoe by means of the shell, but also keeping the shoe from slipping backward or forward. In order to facilitate the removal of worn-out shoes, sections of rail slightly longer than the shoe, are hinged in the car house tracks. The cars are placed with

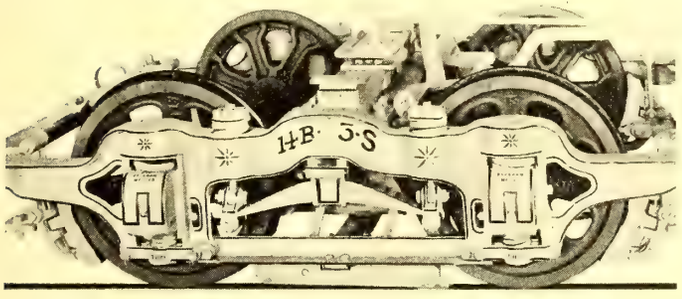


FIG. 4.—TRACK BRAKE ON PECKHAM 14-B 3-S TRUCK

the shoes over these hinged rail sections, the section of rail swung out, and by loosening two bolts the shoe drops out. The time required for replacing four shoes on a double-truck car is about five minutes.

As stated in the title this brake is an emergency brake. It is not intended to be used on curves, crossings, switches, etc., on account of the liability of tearing out the shoes. It is used, however, regularly in coming down steep grades, making service stops on grades, and in many cases for service stops on level streets on a slippery track.

It is especially valuable for making quick stops in San Francisco, on account of the style of cars. San Francisco cars, as a rule, are open on both ends, and have a closed section in the center. The seats are all longitudinal, thus leaving a kind of a cab for the motorman. The wheel brakes are operated by a lever on the right side of the controller. The track brake lever is on the left-hand side. If a quick stop is desired the motorman takes hold of one lever with each hand, and by

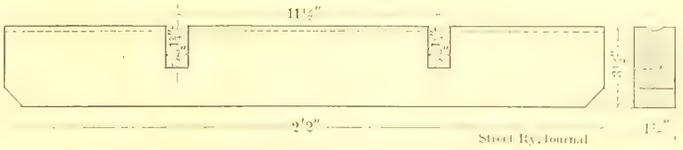


FIG. 5.—STANDARD TRACK BRAKE-SHOE

throwing his weight back on these levers he applies both track and wheel brakes simultaneously.

A test was made with a double-truck car, 40 ft. long and weighing 32,500 lbs., to find how quickly the track brakes would stop the car. The car was run down a 10 per cent grade at full speed for half a block. The track brake, alone, was then applied, and the car stopped within 60 ft. A similar test was made with the wheel brakes, and although the wheels were locked so that every wheel was "skidded," the car was not stopped until a distance of 260 ft. had been gone over.

TRACKLESS TROLLEY CAR-SLED

The accompanying cut illustrates a trackless trolley car-sled, manaufactured by theAllgemeine Elektricitäts-Gesellschaft, of Berlin, Germany, under the patents of Carl Stoll. The regular car body is mounted on three pairs of wheels, the two motors used being placed on the center axle. When it is desirable to use the car as a sled, runners are substituted for the



TRACKLESS TROLLEY CAR SLED

third pair of wheels, and the other wheels are fitted with special ice-gripping tires. Owing to the flexibility of the current-taking device, these cars and sleds can be steered from one side of the street to the other very readily. As vehicles of this character can be safely operated at moderate speeds, they should prove of value for handling urban passenger traffic and light freight business.

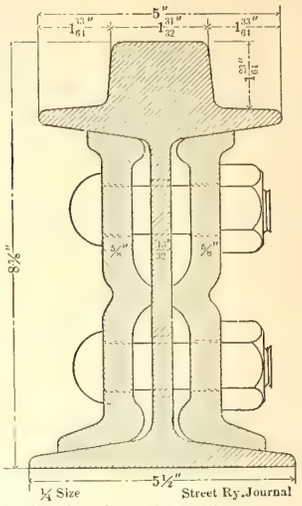
By an order of the Supreme Court of Connecticut the construction of an electric road between Wallingford and Montowese has been authorized. This will complete the through electric line between New Haven and Boston by way of Meriden.

TRACK CONSTRUCTION AT KANSAS CITY

Under the supervision of Ford, Bacon & Davis a large amount of track construction and reconstruction is going on at Kansas City on the lines of the Metropolitan Street Railway Company. All the cable lines are to be abandoned and 35 miles of cable road are to be changed to electric.

The rail used at Kansas City is peculiar, being practically a girder rail with a narrow tram on each side of the head. This type of rail has been used in Kansas City for many years. It is advantageous from an operating standpoint because dirt slides off the head of the rail onto the tram, so the rail is always clean. The standard rail adopted for the new construction is the Lorain Steel Company's 106 lbs., section number 364, which is reproduced here. Guard rails are 119 lbs. For the support of the rails concrete is depended upon to a large extent. In fact, where there is a good street foundation the track is laid without ties, and held to gage by tie-rods and supported on concrete beams. The tie-rods are placed 6 ft. apart. The concrete beams are 2 ft. wide and extend 8 ins. underneath the base of the rail. The joints are cast-welded.

Fig. 1 shows some of the construction without ties, with the moulds in place ready for the cast-welded joints. The moulds are covered with sand, so that the joints will cool slowly after being cast. If the street is already paved with good asphalt pavement the entire pavement is not removed, but trenches are cut in the asphalt pavement for the rail, as seen in Fig. 2, and grooves for the tie-rods. It is, of course, important that there be a good foundation for the paving in this case, so the settling of track and paving will be even. Asphalt paving is not carried fully up to the rail, because there is danger of vehicle-wheel wear near the rail. A row of toothing stones is placed each side of the rail, as seen in Fig. 3. Where there is not a good street foundation ties are laid every 6 ft., as shown in Fig. 4. The



SECTION OF RAIL USED IN NEW CONSTRUCTION, KANSAS CITY



FIG. 1.—MOULDS SET READY FOR WELDING



FIG. 2.—TRENCHES FOR BLOCKS IN ASPHALT PAVING



FIG. 3.—VIEW ON CENTRAL AVENUE, SHOWING METHOD OF LAYING PAVING



FIG. 4.—VIEW ON SUMMIT STREET, SHOWING SPACING OF TIES AND TIE BARS

track is laid with fish-plates on the joints. After the concrete is set the fish-plates are taken off and the joints cast-welded. Concrete is then laid around the joint. The track is laid with ⅛-in. opening between the rail ends, which is filled when the joint is cast-welded.

NEW TYPE OF SUBURBAN CARS ON THE ILLINOIS CENTRAL RAILROAD

As is generally well known the Illinois Central Railroad does a very large suburban business between the center of Chicago and the towns south of that city. As the road has four tracks for the greater part of this distance, and as the stations average a mile or less apart, the service is very similar to that of an elevated railroad, so that the new departure made by the company in the way of cars especially fitted for this traffic is extremely interesting. At the time of the Chicago World's Fair the company built a number of side entrance cars especially for the World's Fair traffic; and although the cars were in many respects very crude it was found possible to load 1000 passengers in ten seconds and unload them in the same amount of time, and on one occasion five trains, each carrying 1000 passengers, were unloaded and discharged successfully from the same platform in four minutes. The total number of passengers carried during the day on which this record was made was 509,000, and no accident of any kind occurred.

The company has two sizes of suburban cars at present in use. One is of the same dimensions as those used on the elevated railways, with a seating capacity of forty-eight passengers. The other is known as a "large suburban" car; it is 51 ft. long, with a seating capacity of fifty-six passengers, and the seats are arranged as shown in Fig. 1. The successful experience with side-entrance cars during the World's Fair, however, has induced the company to try the plan again, and eight cars are being built to determine the practicability of this type of car for suburban service. The June issue of the "American Engineer and Railroad Journal" gives some particulars and plans of these cars, from which the accompanying information is obtained:

Plan No. 1 is intended for a road with terminal loops and platforms on the outside of the track, although it may be used without the terminal loops by having the platforms on the same side (east or west) of each track. Plan No. 2 serves the same

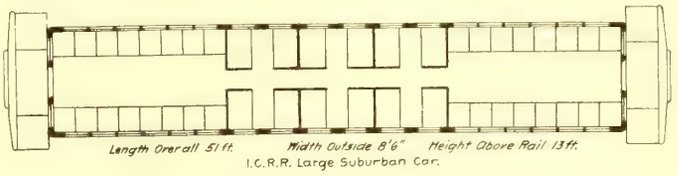


FIG. 1.—PLAN OF PRESENT SUBURBAN PASSENGER CAR

purpose as plan No. 1, with the further provision that passengers may enter and leave the car on both sides. This plan is intended for use where the platforms are principally on one side, with an occasional island platform on the other side of the track. The capacity of this car is the same as that of plan No. 1. Plan No. 3 is intended for use where there is considerable travel of moderate volume entering and leaving the car on both sides. The provision of having the aisle extend one-half length on each side, with cross aisle in the middle, is a desirable one where there is no great rush of travel, as it gives the seated passengers the same freedom from passing travel in and out of the car as does plan No. 1. There is, however, a loss of a few seats by this arrangement, this plan for the small car seating four passengers less than plans Nos. 1 and 2. Plan No. 4, with aisles and doors the full length on both sides of the car, is designed to meet the requirements of the very heaviest

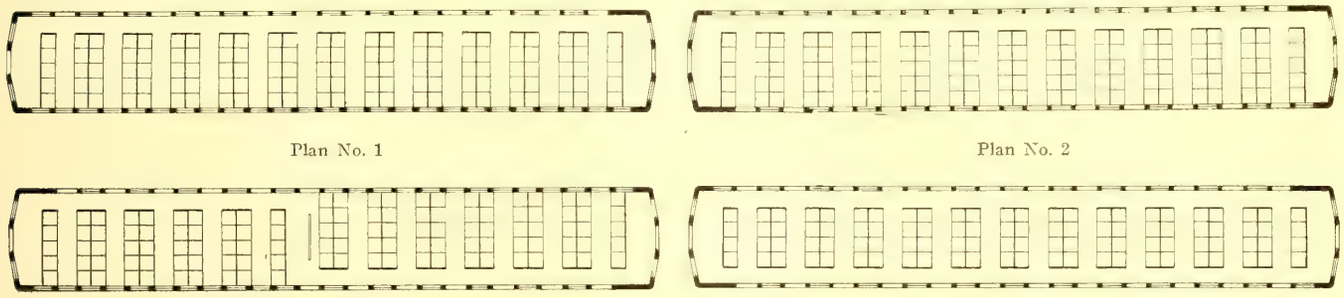


FIG. 2.—SEATING PLANS, SHOWING DIFFERENT ARRANGEMENT OF SEATS

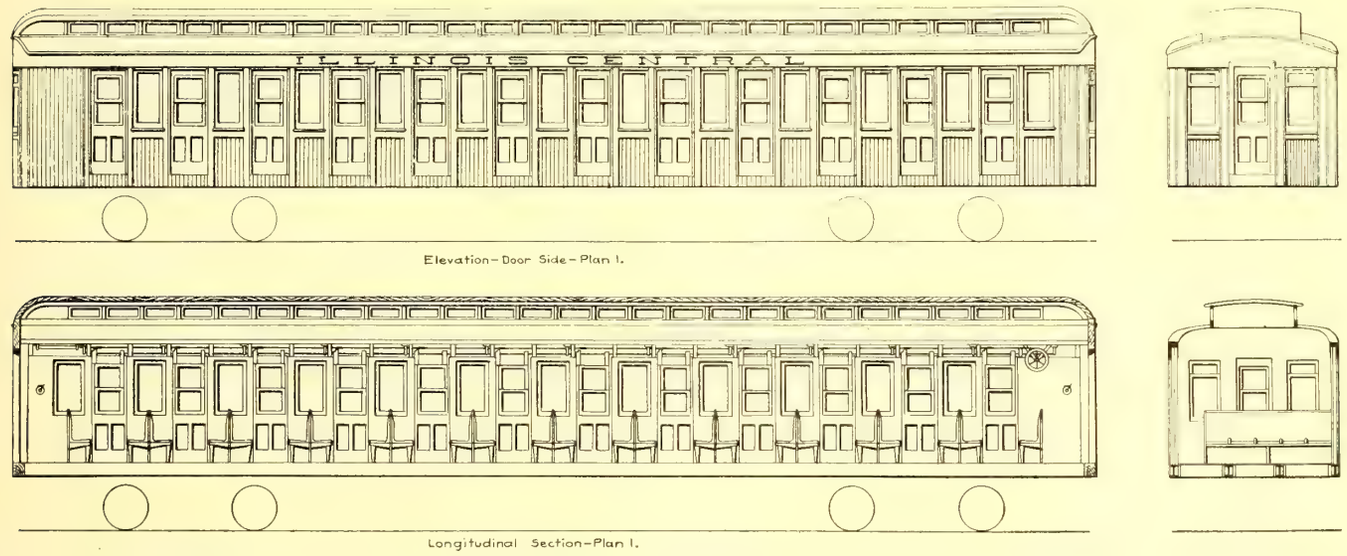


FIG. 3.—ELEVATIONS AND SECTIONS OF STEEL-FRAME, SIDE DOOR SUBURBAN PASSENGER CARS FOR ILLINOIS CENTRAL RAILROAD

travel, with frequent stops at intermediate stations having platforms on both sides of the track.

The weight of the new car per passenger by this construction will be greatly reduced, combined with an increase in the strength of the car beyond that of anything heretofore attained in car construction, as will be seen from the following figures:

	Length	Seating Capacity	Weight	Weight Per Passenger	Floor Strength	
					Safe Load Per Sq. Ft.	Ultimate Load Per Sq. Ft.
			Lbs.	Lbs.	Lbs.	Lbs.
Improved suburban car	65 ft.	120	78 000	650	160	800
Regular suburban car	51 "	56	38,000	679	76	380
Standard coach	61 "	62	86,000	1,387	81	405

The following table shows the seating, standing and total capacity of the different plans compared with the cars now in use:

	Seating Capacity	Standing Capacity		Total Capacity	
		Clear of Entrance and Exit	Full	Seats Standing and Clear	Seats Standing and Full
Plan 1	120	48	60	168	180
Plan 2	120	48	60	168	180
Plan 3	115	53	65	168	180
Plan 4	96	72	96	168	192
I. C. Suburban	56	0	41	56	97

In the matter of standing room there is great advantage to the passengers in that so large a number can stand clear of the entrances and exits. It is also an advantage to avoid having a large group of passengers standing together, particularly when dependent for support upon straps suspended from the roof of the car. The solid group of passengers which can gather in one mass in a car having a wide center aisle will be less able to resist the lunging effect of high rates of acceleration and retardation than when they can individually brace themselves against a rigid support of medium height, and thus avoid discomfort and frequently the distress that comes from the swaying of such a mass of passengers.

It is of more importance now than ever before that passenger cars should be constructed of the greatest strength consistent with reasonable weight. To obtain this result a metal frame work is necessary not only for the floor of the car but for the walls and roof, in order that when collisions occur, especially at high rates of speed, or when derailments occur and cars rub against the walls of tunnels or other structures, the floor and sides of the car will not be demolished, as is quite likely to be the case with lightly constructed wooden cars.

The greatly increased capacity of the improved suburban car is not due altogether to its larger size, as the following comparative statement shows that per foot of length the new car has 46 per cent greater carrying capacity than the old:

	Present Suburban	Improved Suburban			
		Plan 1	Plan 2	Plan 3	Plan 4
Length of cars	51 ft.	65 ft.	65 ft.	65 ft.	65 ft.
Length of cars, per cent	100	127	127	127	127
Passengers seated	56	120	120	115	96
Passengers seated, per cent	100	214	214	205	171
Passengers standing	41	60	60	65	96
Passengers standing, per cent	100	146	146	159	234
Passengers, total	97	180	180	180	192
Passengers total, per cent	100	186	186	186	198
Passengers per foot, seated	1.10	1.85	1.85	1.77	1.48
Passengers per foot, seated, per cent	100	168	168	161	134
Passengers per foot, standing	0.80	0.92	0.92	1.00	1.48
Passengers per foot, standing, per cent	100	115	115	125	185
Passengers per foot, total	1.90	2.77	2.77	2.77	2.95
Passengers per foot, total, per cent	100	146	146	146	155

The side doors may be operated either by hand or by compressed air, the controlling mechanism being located within the walls of the car and out of sight. The mechanism provides for the positive opening, closing and locking of the doors by air or by hand. It also provides for closing the doors, locking and unlocking, but not opening them, leaving that to be done by the passengers, which, during the season of cold weather, would probably be the preferable way. The doors may be operated from either end of the car, and if necessary also from the middle. The quickness with which the doors may be manipulated and the absolute control of them by the trainmen will greatly reduce the time of the stops.

There being no grab-handles on the outside of the car and no possible means of effecting an entrance when the doors have been closed, there is no temptation nor any opportunity for a belated passenger to get aboard after the train has started, neither is there any opportunity for a passenger to get off the train before it has come to a full stop, because all the doors are closed by air pressure and can be released only by the trainmen, which will not be done until the train has stopped. All movements, therefore, of entrance and exit can be made only when the train is standing at the station platform, and one of the principal hazards of the service is thus eliminated.

As to the opening and closing of the doors: the walls of the car being hollow and the doors moving between them, there is no chance for a passenger to be caught and injured by them when opened; when closed, the movement, at first rapid, is graduated automatically by air cushions, so that the final closing movement is gentle and safe. Should any portion of a passenger's garment become caught by the door when closing the elasticity of the air pressure against the door will admit of the garment being withdrawn without injury. Furthermore, the air cylinder for the operation of the doors being quite small, it has not sufficient power to cause injury by its pressure should a passenger inadvertently be caught in the doorway when the door is closing.

NOTES ON SUB-STATION PRACTICE

The modern electric railway sub-station may fairly claim to be one of the most interesting features of the system. Its development has grown apace with the long-distance transmission of power, and at present it is considered an almost indispensable requirement in the operation of roads depending upon the alternating current for their primary supply of electrical energy. Many improvements in location and design have been made in the sub-station since the early days of its being, but in the last analysis it is a necessary evil with an uncertain future, and an existence only justified by the continued use of direct-current low-voltage motors in railway practice.

Doubtless it will be a long time before the last rotary converter sub-station disappears from sight. It is far too useful to die a sudden commercial death. But the day which sees the successful operation of an alternating-current railway motor is going to mark the beginning of the end. As long as we have the sub-station with us, however, its proper location, design and operation will justly claim our consideration.

The controlling feature in sub-station location is the position it is to occupy in the general distribution system of the railway. The problem of power supply is of such vital importance that it often is folly to build a sub-station at one point on the system, while it ranks with the highest wisdom to locate it at another place. Central position with reference to the load distribution is of high consequence, and before the site is fixed careful calculations should be made showing the first cost and operating economy with that particular location for several schedules likely to be adopted. The influence of location upon the first cost and annual charges upon the feeder system should be considered for various loads, and compared with other locations on the same power basis, if possible. It is not enough to figure out the line, conversion and distribution losses for a given location on a single probable schedule. Figures should be prepared showing the estimated annual cost of operation, including fixed charges, under widely different schedules and distribution of equipments. The possibility of double tracking the road in

the future should be considered, and it should never be taken for granted that a location which shows greatest economy in yearly expense under the early conditions of operation is always going to remain the most economical situation. Too much stress cannot be laid upon the necessity of careful financial analysis before a sub-station is finally located. Such work pays every time. These are days when the elimination of waste is the battle cry of progress itself, and the engineer who makes such comparative figures upon widely different bases runs immeasurably nearer the goal of high efficiency in his final decisions than he who locates a sub-station merely by rule of thumb.

It is naturally a difficult matter to estimate the probable traffic which will be carried by the road for five years after it begins operation In fact, it is well nigh impossible to do this accurately, but the need of figuring over several widely different cases—of going to extremes—is all the more apparent. Every road has certain well defined limitations in the matter of schedules and number of transportation units which can be operated upon it. If these maximum conditions are borne in mind, and figures also made intermediate between the most severe conditions likely and the probable early business of the road, enough data will generally be secured to enable an intelligent judgment to be formed at the best location of the sub-station from the distributing point of view. The figures must be carefully made, as was stated before, but they often need not be carried out to precise refinements as to decimals.

Analysis of these conditions will frequently show little change in operating cost through quite a wide zone of territory. Considerable latitude in the choice of location thus may exist. In such cases other points in regard to situation have increased influence. It must always be kept in mind that the location and design of a sub-station are subservient to operating conditions, and the key to the whole problem is simplicity of arrangement.

Healthful surroundings for the attendants are of greatest consequence. Miasmic swamps and fever-smittten marshes are poor places for the practice of operating and first cost economy. Drainage should be good, and, if possible, thoroughly modern sanitary arrangements provided. Continuous service from the sub-station depends quite as much upon able-bodied attendance as upon liberally designed machinery, and if it is possible to locate a sub-station in a congenial place, judged by human standards, it should be done.

While it is usually advantageous to build a sub-station alongside the track of the road which it supplies, the simplest arrangement is sometimes found in locating it somewhat off the main line and running a spur track to it. In the case of an air-line high-voltage system between the power station and distributing points, it is often a grave step to turn the main high-potential wires from their course to traverse a new right-angled right of way to a sub-station situated on the railway track a mile off. Special work, additional unnecessary bends and turns are nearly as much to be avoided in laying out a 50,000-volt line as sharp curves in the path of a "Twentieth Century Limited" making 90 m. p. h. and behind time at that. In any such system continuity of service is of literally tremendous importance, and the experience of high-voltage power transmission in this country is showing that wires carrying current at enormous potentials cannot be run too directly in their course from point to point. It is, of course, possible that a sub-station may be located at an important turnout, and constitute a place of use to the car despatcher, and in such case it would not be feasible to locate it on the main air-line route of the transmission circuits. All such contingencies must be discussed before the choice of location is made, and no factor of importance left unconsidered.

When the conditions permit the establishment of a sub-station in connection with a car house, repair shop, ticket office or passenger station, a considerable gain for the road in the wages element of power cost may be effected. The cost of power at the direct-current bus-bars of a modern sub-station is largely conditioned by the labor item. Fortunate is the road which can utilize the spare time of its sub-station attendants in other ways than requiring them to doze away the day in the machine room with one eye and ear always upon the apparatus. In large city systems the choice of sub-station location is narrowed down usually to very close limits by the cost of real estate, and the labor problem is also less elastic in its demands. Here, as in the country, a car house is an advantageous neighbor, but in all cases the responsibility of the sub-station's continuous operation must be laid upon some one individual, and not divided among various nondescript employees in the belief that they will all be equally conscientious in regard to the plant. Apparatus should always be installed to give instant and loud notice of any failure of current supply or output.

When large water-cooled transformers are to be operated the question of water supply becomes of moment, although this is but a minor factor in the location of the sub-station.

Coming now to questions of design and construction, one of the first requirements is protection against fire. Whenever possible a sub-station receiving current at from 20,000 volts to 50,000 volts should be of brick, and be made as near fireproof as human skill can insure. It is advisable that such measures be adopted below those voltage limits, but the fire hazard is much greater with the high potentials, which must be treated with the respect due to lightning itself. Too much care cannot be taken in regard to the high-tension circuits. Complication in arrangement should be shunned like the plague, and there should be liberal elbow room from foundations to roof. Moisture must not be allowed to enter with the downward slant of the high-potential lines, and in cases where such circuits both enter and leave the building they should be separated by its full width if possible. The quality and type of insulators should be the same on both line and interior sub-station circuits, and all low-tension wiring kept entirely out of the neighborhood. As far as possible wires should run in plain sight, or in the case of low-voltage direct-current circuits beneath the floor in conduits, or basement that is instantly accessible. The various transformations of current should be effected in one continuous line of wiring path whenever possible. It is essential to avoid any doubling back of circuits, and it should be possible to stand in one place in the sub-station and see the successive chain of transforming operations without stirring from one's position. Of course, compromises must sometimes be made between these various desirable features, but they must all be duly considered, and given up only after the best of reasons preclude them. In country sub-stations there is little excuse for anything but the most faultless design, as the cost of real estate is of little importance as a factor in limiting elbow room. Cramped designs are to be abhorred. It is imperative that plenty of room be allowed between the different machines, transformers and switchboards, especially at the back of the latter. Far too often sub-stations are built in the most temporary manner in some old barn or shed—"anything to get the road running," is the cry. Expensive machinery demands something better than cheap housing.

When storage batteries are installed in sub-stations the acid fumes and electrical machinery must be absolutely prevented from becoming acquainted. It is to the credit of the manufacturers that this precaution is seldom omitted. It is always desirable that a spur track of the road, or else main line, be carried close up to a large double or sliding door, big enough to permit the entrance and exit of the largest single piece of apparatus which the station is to contain. An overhead crane is useful in very large sub-stations, but in the majority of cases it can be dispensed with at small loss to the road.

If a sub-station is one of a series of distributing points it should always be possible to cut it out of circuit in case of

trouble without interrupting the current supply of any of the other stations. Common sense would seem to indicate the importance of locating the sub-station telephone in a sound proof booth, and yet there are plenty of installations to be found in modern practice that are almost worthless because of the noise made by adjacent machinery. The telephone should be so placed that the operator can see the switchboard instruments plainly, and thus report the loads, voltages, etc., to the headquarters on demand. A reliable clock should not be omitted in the outfit.

If air-blast transformers are installed it should be a simple matter to arrange for the supply of cool air from out of doors, rather than to pump in the warm air of the machine room. Cleaning of apparatus should always be done by air blast, and a small motor-driven compressor supplied for this purpose. With its absence of steam-driven machinery there is little excuse for a sub-station being kept in anything but immaculate condition. Plenty of windows should be provided, and the walls painted white or some light color that will show up the accumulation of dust and dirt. Provision should always be made for a small store room and work bench, where minor supplies can be reached or light repairs undertaken. Various car supplies can also be doled out as required, if the sub-station is a factor in the transportation department.

Switchboard apparatus should be as simple as is consistent with the size and character of work to be done. While space should be left on the panels for the usual full complement of instruments, it is often a needless expense to install frequency and power factor indicators and a multiplication of alternating-current ammeters, voltmeters and indicating wattmeters. It is important, however, to install an ammeter in each direct-current feeder circuit and in connection with the rotary or motor generator sets, a voltmeter which will indicate the potential of the high-tension line, another for the direct-current bus-bars and a third for use in parallel operation of generating machinery; and almost, above all, a direct-current recording wattmeter for each of the operating rotary converters or motor generators.

Unauthorized persons should not be permitted to browse around or in the sub-station during the absence of the attendant. While the free admission of interested visitors should be encouraged, they must be made to understand that such incursions are accomplished at their own risk. The station must never become a house of refuge for tramps or other discredited wanderers, and when the attendant is afar off it should be kept locked.

The matter of records is constantly growing more important. Blanks should be freely provided by the operating company for periodic tabulation of readings from the instruments previously mentioned. In addition, a daily record of unusual happenings should be forwarded to the main office for filing. This will include the number and time of circuit breaker openings, the jotting down of official visits and inspections, variations from the ordinary routine of machine operation, failure and repair of apparatus, etc.

The direct-current circuits should usually be so connected with the sub-station that they may be operated past it, through it, or to it, as the case may require. The value of such sectioning at times of line trouble or tests is high.

Lastly, the sub-station attendants should be well considered in the matter of wages, hours and days off. It should be made possible for them to take one day in seven away from the confining limits of the plant. Cheap attendance in sub-stations is dear at any price, and wages should be at least attractive enough to attract reliable men. As long as things go well, sub-station work is not very onerous, but when emergencies arise the story is different. It is a pretty good plan to gradually advance sub-station attendants to more responsible and desirable power house and mechanical department positions as opportunity permits, and by a kind of rotation in office qualify them for wider opportunities. Discipline is here as important as in the city power station, and it is also quite as desirable for the management to appreciate the joys and sorrows of the sub-station life as to concern itself with the hours and pay of its other employees. Two or three of the best technical journals should regularly find their way into the sub-station, and a proper place be provided for the writing down of records and reports. In a few words, the whole sub-station situation should be made the most of as long as it is with us, and the cardinal doctrines of simplicity, efficiency, cleanliness, order and convenient location exemplified in practice, coupled with that firm yet liberal treatment of employees which is inseparable from good management.

STREET AND ELEVATED RAILWAY MILEAGE, CARS AND CAPITALIZATION IN THE UNITED STATES AND CANADA

The accompanying table showing the mileage, number of cars and capitalization of the street railways in the United States and Canada for the year 1902, has been compiled from the 1903 edition of "American Street Railway Investments." An examination of the table shows the total mileage in the United States to be 26,429, with 71,312 cars, capital stock $1,632,073,254, and funded debt $1,274,459,491, making the total capital liabilities $2,906,532,745. The mileage in Canada is 815, with total capital liabilities of $46,450,152.

The increase in the mileage in the United States for the year was 3245 miles, or 12.3 per cent, the percentage for the various geographical divisions being as follows: The New England States show 336 additional miles of track, an increase of 8.3 per cent; the Eastern States, 999 additional miles, an increase of 14.5 per cent; the Central States, 1532 additional miles, or 16.6 per cent; the Southern States, 105 additional miles, or 12.5 per cent; the Western States, 273 additional miles, or 16.6 per cent. There were 60 miles of new track built in Canada during the year.

The increase in capital stock for the companies in the United States was $271,361,016, and the increase in the funded debt was $219,007,674, making an increase in total capital liabilities of $490,368,690. The total capital liabilities of the companies in Canada were increased $4,513,514.

The supplementary table published below, in which statistics are given for the several divisions as to capitalization and cars per mile of track and capitalization and miles per capita, are also of interest. The Eastern States lead in the first three items, but New England has more track per capita than any other section of the country. The largest increases in capitalization occur in New York, where it amounts to $101,121,479; Pennsylvania, $63,228,823; Virginia, $30,657,000; California, $26,931,560, and Rhode Island, $23,795,800. These increases are due in most cases to the formation during the year of large holding companies in a few cities in each State.

Statistics of Mileage and Capitalization Per Capita and Cars and Capitalization Per Mile of Track

	Capitalization Per Mile of Track	Cars Per Mile of Track	Capitalization Per Capita	Miles of Track Per 100,000 Capita
New England States	$59,213	2.5	$43.15	73
Eastern States	165,328	3.7	69.91	42
Central States	92,021	2.3	35.37	38
Southern States	90.847	1.9	8.90	10
Western States	89,313	1.5	24.19	27
Grand average	109,975	2.6	38.56	34

The statistics published in these tables were compiled from the annual "American Street Railway Investments," published by the Street Railway Journal, and the several reports from which the information was taken are in the main for the year ending Dec. 31, 1902. In a few cases the figures on capitalization had to be estimated, but these were in all cases small roads, so that the percentage of estimated values is very small.

STREET AND ELEVATED RAILWAY MILEAGE, CARS AND CAPITALIZATION IN UNITED STATES AND CANADA.

COMPILED FROM THE STATISTICS OF THE VARIOUS PROPERTIES CONTAINED IN "AMERICAN STREET RAILWAY INVESTMENTS," EDITION OF 1903.

STATES.	No. of Roads.	ELECTRIC RAILWAYS. Track Mileage.		Motor Cars.		Trail and Service Cars.		CABLE RAILWAYS. Track Mileage.		Grip Cars.		Trail Cars.		HORSE RAILWAYS. Track Mileage.		Cars		STEAM RAILWAYS. Track Mileage.		Cars.		TOTAL RAILWAYS. Track Mileage.		Cars		CAPITAL STOCK. Total.		Increase for Year	FUNDED DEBT Total		Increase for Year	CAPITAL LIABILITIES Total		Increase for Year.	STATES
	1902	1901	1902	1901	1902	1901	1902	1901	1902	1901	1902	1901	1902	1901	1902	1901	1902	1901	1902	1901	1902	1901	1902	1901	1902		1901	1902		1901	1902		
New England States.																																	**New England States.**
Maine	20	329	350	426	450	59	52	..	..	..	..	..	..	3	3	4	4	..	..	..	..	332	353	489	506	$4,089,348	$4,547,075	$457,727	$5,009,419	$5,708,000	$698,581	$9,098,867	$10,255,075	$1,156,208	Maine
New Hampshire	17	159	223	206	245	34	58	..	..	..	..	..	..	..	..	..	..	..	..	..	..	159	223	240	303	4,237,000	4,914,900	677,900	2,818,500	10,043,500	7,227,000	7,055,500	14,958,400	7,902,900	New Hampshire
Vermont	10	91	95	94	98	2	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	91	95	96	100	1,765,124	1,825,000	59,876	1,345,000	1,450,000	105,000	3,110,124	3,275,000	164,876	Vermont
Massachusetts	122	2,309	2,466	6,712	7,256	41	24	..	..	..	..	..	..	3	..	244	..	..	..	..	..	2,312	2,466	6,997	7,280	73,510,492	85,055,060	12,144,558	36,311,235	40,058,000	3,746,765	109,851,727	125,713,060	15,861,273	Massachusetts
Rhode Island	8	318	347	753	765	93	103	..	..	..	..	..	..	..	..	..	..	..	..	..	..	318	347	846	868	16,972,000	27,725,000	10,753,000	5,719,500	18,762,500	13,042,800	22,691,500	46,487,500	23,795,800	Rhode Island
Connecticut	22	527	591	1,052	1,116	88	102	..	..	..	..	..	..	..	..	..	..	..	..	..	..	527	591	1,140	1,218	23,772,940	23,851,240	78,300	15,557,000	16,751,000	1,194,000	39,329,940	40,602,240	1,272,300	Connecticut
TOTAL	199	3,733	4,072	9,243	9,930	317	341	..	..	..	..	..	..	6	3	248	4	..	..	..	..	3,739	4,075	9,808	10,275	124,346,904	148,518,265	24,171,361	66,780,954	92,773,000	25,982,046	191,137,858	241,291,265	50,153,407	TOTAL
Eastern States.																																	**Eastern States.**
New York	130	2,608	3,043	11,463	14,834	676	1,721	..	..	..	..	..	..	110	110	1,025	1,025	a194	..	2,717	..	2,912	3,153	15,881	17,580	288,011,467	348,706,598	60,695,131	245,683,474	286,109,782	40,426,348	533,694,901	634,816,380	101,121,479	New York
New Jersey	50	838	907	1,750	1,800	146	242	..	..	..	..	..	..	9	..	39	25	..	..	..	..	847	907	1,935	2,057	79,925,180	85,252,300	5,327,120	64,702,500	73,733,000	9,030,500	144,627,680	158,985,300	14,357,620	New Jersey
Pennsylvania	199	2,472	2,842	6,308	7,000	444	448	..	..	..	..	..	..	..	..	..	..	3	..	23	..	2,475	2,842	6,775	7,448	176,675,742	227,484,286	50,808,544	138,743,685	151,163,964	12,420,279	315,419,427	378,648,250	63,228,823	Pennsylvania
Delaware	8	62	127	108	173	2	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	62	127	110	175	1,920,000	4,020,000	2,100,000	900,000	3,705,000	2,805,000	2,820,000	7,725,000	4,905,000	Delaware
District of Columbia	8	139	316	500	602	480	552	..	..	..	..	..	..	..	..	..	..	..	..	..	..	239	316	980	1,154	28,205,000	31,438,500	6,233,500	19,920,000	30,226,350	10,306,000	48,125,000	64,664,850	16,539,850	District of Columbia
Maryland	11	442	486	1,256	1,491	356	220	..	..	..	..	..	..	..	..	..	..	..	..	..	..	442	486	1,612	1,711	30,404,000	31,759,000	1,355,000	51,698,694	52,251,695	553,001	82,102,694	84,010,695	1,908,001	Maryland
Virginia	17	300	371	493	578	60	60	..	..	..	..	..	..	..	..	..	..	..	..	..	..	300	371	553	638	9,856,250	25,086,250	15,230,000	14,829,500	30,257,000	15,427,500	24,685,750	55,343,250	30,657,500	Virginia
West Virginia	10	148	222	198	300	11	3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	148	222	209	303	3,603,000	4,053,000	1,050,000	3,684,000	4,089,000	405,000	7,287,000	8,742,000	1,455,000	West Virginia
TOTAL	433	7,109	8,314	22,076	26,778	2,175	3,238	..	..	..	..	..	..	119	110	1,064	1,050	197	..	2,740	..	7,425	8,424	28,055	31,066	618,600,639	761,399,934	142,799,295	540,161,853	631,335,791	91,173,938	1,158,762,452	1,392,735,725	233,973,273	TOTAL
Central States.																																	**Central States.**
Michigan	32	1,153	1,199	1,642	1,741	164	168	..	..	..	..	..	..	2	2	2	2	..	..	..	..	1,155	1,201	1,808	1,911	32,703,400	34,068,400	1,365,000	30,325,000	33,773,000	3,448,000	63,028,400	67,841,400	4,813,000	Michigan
Ohio	82	2,107	2,881	4,052	4,499	240	390	7	7	72	76	..	..	..	..	..	..	2	..	3	..	2,116	2,888	4,367	4,965	124,655,350	154,061,050	29,405,700	64,339,000	78,592,500	14,253,500	188,994,350	232,653,550	43,659,200	Ohio
Indiana	32	804	1,026	923	1,097	213	180	..	..	..	..	..	..	7	7	13	28	..	..	..	..	811	1,033	1,149	1,305	24,233,600	29,175,900	4,942,300	26,843,500	31,701,500	4,858,000	51,047,100	60,877,400	9,830,300	Indiana
Kentucky	12	222	250	535	569	257	284	..	..	..	..	..	..	3	..	6	..	..	..	..	..	225	250	798	853	7,596,900	8,300,900	704,000	8,263,300	8,604,300	341,000	15,860,200	16,905,200	1,135,000	Kentucky
Wisconsin	22	405	507	580	783	211	77	..	..	..	..	..	..	..	..	..	..	..	..	..	..	405	507	791	860	10,795,500	15,239,500	4,444,000	12,267,050	13,818,050	1,551,000	23,062,550	29,057,550	5,995,000	Wisconsin
Illinois	55	1,724	1,871	4,000	4,031	216	801	82	82	708	559	2,645	2,433	18	10	16	10	10	10	99	45	1,834	1,973	7,684	7,879	158,791,060	165,197,660	6,406,600	93,189,900	99,610,650	6,420,750	251,980,960	264,808,310	12,827,350	Illinois
Minnesota	9	351	383	781	811	304	304	..	..	..	..	..	..	3	..	3	..	..	..	..	..	354	383	1,088	1,115	23,625,495	25,186,495	1,561,000	13,726,000	13,881,000	155,000	37,351,495	39,067,495	1,716,000	Minnesota
Iowa	24	378	442	410	729	188	113	..	..	..	..	..	..	9	4	9	4	..	..	..	..	387	446	607	846	13,398,000	16,788,000	3,390,000	6,624,000	11,273,000	4,649,000	20,022,000	28,061,000	8,039,000	Iowa
Missouri	22	829	974	2,240	2,394	60	71	38	33	211	187	224	198	10	8	13	9	..	..	..	..	877	1,015	2,748	2,859	53,479,600	66,497,800	13,018,200	63,555,000	86,379,000	22,824,000	117,034,600	152,876,800	35,842,200	Missouri
TOTAL	290	7,973	9,533	15,163	16,654	1,853	2,388	127	122	991	822	2,869	2,631	52	31	62	53	12	10	102	45	8,164	9,696	21,040	22,593	449,278,905	514,605,705	65,326,800	319,102,750	377,633,000	58,530,250	768,381,655	892,238,705	123,857,050	TOTAL
Southern States.																																	**Southern States**
North Carolina	8	45	62	82	109	14	11	..	..	..	..	..	..	2	2	3	3	2	..	2	..	49	64	101	123	1,465,600	1,815,600	350 000	1,075,000	1,375,000	300 000	2,540,600	3,190,600	650,000	North Carolina
South Carolina	5	69	73	102	107	30	16	..	..	..	..	..	..	3	3	6	8	..	..	..	..	72	76	138	131	2,012,000	2,012,000	...	3,028,000	3,035,000	7,000	5,040,000	5,047,000	7,000	South Carolina
Georgia	12	274	330	439	459	26	22	..	..	..	..	..	..	11	6	9	6	..	..	..	..	285	336	474	487	14,911,400	16,736,400	1,825,000	12,823,000	14,072,500	1 249,500	24,734,400	30,808,900	3,074,500	Georgia
Florida	7	54	63	55	58	12	8	..	..	..	..	..	..	6	6	4	4	9	9	18	18	69	78	89	88	1,131,000	1,606,000	475,000	994,300	1,532,000	537,700	2,125,300	3,138,000	1,012,700	Florida
Alabama	11	180	213	295	287	56	110	..	..	..	..	..	..	7	7	7	7	20	..	43	..	207	220	401	404	8,755,000	8,475,000	280,000	6,892,000	7,633,000	771,000	15,647,000	16,138,000	491,000	Alabama
Mississippi	6	25	39	39	59	2	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	25	39	41	61	685,500	885,500	200,000	630,000	680,000	50,000	1,315,500	1,565,500	250,000	Mississippi
Tennessee	13	257	268	392	394	110	110	..	..	..	..	..	..	..	..	..	..	17	17	21	21	274	285	523	525	9,625,000	9,632,000	7,000	7,765,000	8,100,000	335,000	17,390,000	17,732,000	342,000	Tennessee
Louisiana	6	207	207	554	611	52	7	..	..	..	..	..	..	9	9	14	14	..	..	..	..	216	216	620	632	16,095,100	32,538,000	16,442,900	12,354 000	12,521,000	167,200	28,449,100	45,059,200	16,610,100	Louisiana
Arkansas	6	44	65	99	119	26	27	..	..	..	..	..	..	8	..	11	..	25	..	10	..	77	65	146	146	1,170,500	1,200 000	29,500	1,159 500	1,400,000	240,500	2,330,000	2,600,000	270,000	Arkansas
TOTAL	74	1,155	1,320	2,057	2,203	328	313	..	..	..	..	..	..	46	33	54	42	73	26	94	39	1,274	1,379	2,533	2,597	55,851,100	74,900,500	19,049,400	46,720,800	50,378,700	3,657,900	102,571,900	125,279,200	22,707,300	TOTAL
Western States.																																	**Western States.**
South Dakota	1	....	....	....	....	....	....	....	....	....	....	....	....	2	2	2	2	....	..	....	....	2	2	2	2	100,000	100,000	.....	.....	.....	.....	100,000	100,000	.....	South Dakota
Nebraska	6	112	115	180	200	60	52	....	....	....	....	....	....	22	19	21	23	....	..	....	....	134	134	261	277	3,777,500	5,687,500	1,910,000	1,280,000	4,110,000	2,831,000	5,057,500	9,797,500	4,740,000	Nebraska
Kansas	12	112	112	108	116	63	55	....	....	....	....	....	....	15	17	22	26	....	..	....	....	127	129	193	197	2,750,000	2,665,000	85,000	1,325,000	1,595,000	270,000	4,075,000	4,260,000	185,000	Kansas
Indian Territory	1	....	20	....	9	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	..	20	..	9	....	500,000	500 000	.....	.....	418,000	418,000	.....	918,000	918,000	Indian Territory
Oklahoma	1	....	7	....	7	....	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	..	7	....	9	.....	160,000	160,000	.....	.....	160,000	160,000	.....	320,000	320,000	Oklahoma
Texas	20	310	343	436	548	65	50	....	....	....	....	....	....	17	9	28	10	....	....	....	....	327	352	529	608	8,886,000	16,187,000	7,301,000	8,475,000	10,775,000	2,300,000	17,361,000	26,962,000	9,601,000	Texas
Colorado	9	234	245	377	377	82	62	....	....	....	....	....	....	2	2	2	2	77	86	84	84	313	333	545	525	8,205,000	11,305,000	3,100,000	9,214 000	9,564,000	350,000	17,419,000	20,869,000	3,450,000	Colorado
Montana	5	61	61	71	74	17	25	....	....	....	....	....	....	....	....	....	....	....	....	....	....	61	61	88	99	2,120,000	1,395,000	*725,000	1,546,500	1,196,500	*350,000	3,666,500	2,591,500	*1,075,000	Montana
Idaho	1	4	4	2	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	4	4	2	2	54,000	54,000	.....	.....	.....	.....	54 000	54,000	.....	Idaho
Utah	3	97	105	101	103	26	26	....	....	....	....	....	....	....	....	....	....	8	..	2	....	105	105	129	129	3,400,000	3,400,000	.....	1,263,000	1,263,000	.....	4,663,000	4,663,000	.....	Utah
Washington	11	199	255	200	301	113	26	26	21	61	75	45	67	..	..	....	....	....	....	....	....	225	276	419	469	11,815,000	16,889,100	5,074,100	7,960,000	10,909,000	2,949,000	19,775,000	27,798,100	8,023,100	Washington
Oregon	8	138	159	214	241	36	96	2	2	16	4	2	....	3	3	2	2	6	..	9	....	149	164	279	343	3,067,000	4,807,000	1,740,000	5,173,000	9,978,000	1,805,000	8,240,000	14,785,000	6,545,000	Oregon
California	34	969	1,113	1,047	1,103	159	244	86	84	539	561	40	40	39	39	140	84	27	16	71	58	1,121	1,252	1,996	2,090	68,385,190	69,421,750	1,036,560	46,414,000	72,309,000	25,895,000	114,799,190	141,730,750	26,931,560	California
Arizona	2	11	11	10	10	7	7	....	....	....	....	....	....	3	5	4	5	....	....	....	....	14	16	21	22	75,000	77,500	2,500	25,000	61,500	36,500	100,000	139,000	39,000	Arizona
TOTAL	114	2,247	2,550	2,746	3,093	628	645	114	107	616	640	87	107	103	96	221	154	118	102	166	142	2,582	2,855	4,464	4,781	112,634,690	132,648,850	20,014,160	82,675,500	122,339,000	39,663,500	195,310,190	254,987,850	59,677,660	TOTAL
United States	1,110	22,217	25,789	51,285	58,658	5,301	6,925	241	229	1,607	1,462	2,956	2,738	326	273	1,649	1,303	400	138	3,102	226	23,184	26,429	65,900	71,312	1,360,712,238	1,632,073,254	271,361,016	1,055,451,817	1,274,459,491	219,007,674	2,416,164,055	2,906,532,745	490,368,690	United States
Canada	40	755	815	1,902	1,973	355	333	..	..	..	..	....	....	..	..	..	....	39	39	73	98	794	854	2,330	2,404	26,848,100	28,903,894	2 055,794	15,088,538	17,546,258	2,467,720	41,936,638	46,450,152	4,513,514	Canada

NOTATIONS.—*a* includes 178 miles of elevated track, 68 in Brooklyn and 110 in Manhattan and the Bronx. *b* includes 120 miles of elevated track in Chicago. * Indicates decrease.

THE KANSAS CITY FLOOD

BY W. O. HANDS

As most of the readers of this paper know, the Kansas, or Kaw, River, which runs through Kansas City, burst through its banks on May 31, 1903, and left all the low lands in a state of destruction. Connecting Kansas City, Mo., and Kansas City, Kan., were fourteen bridges. These caught the drift that came down the river and filled the regular channel, throwing the water out on each side—into the residence district on one side and into the packing house, stock yards and wholesale district on the other. Careful estimates of the loss have been made by different persons, and a fair average would place it at about $15,000,000 within the limits of the two Kansas Cities.

The fourteen bridges mentioned were, with one exception, swept entirely away, and with two exceptions were of steel. Parts of them, weighing a ton or more, have been found 16 miles down the river. But for the most part the drift pushed them around to the river bank, broken and twisted beyond all possibility of repair. The Metropolitan Street Railway Company lost four bridges and a temporary trestle. In the four bridges was 2100 ft. of truss spans. The "L" road lost 900 ft.

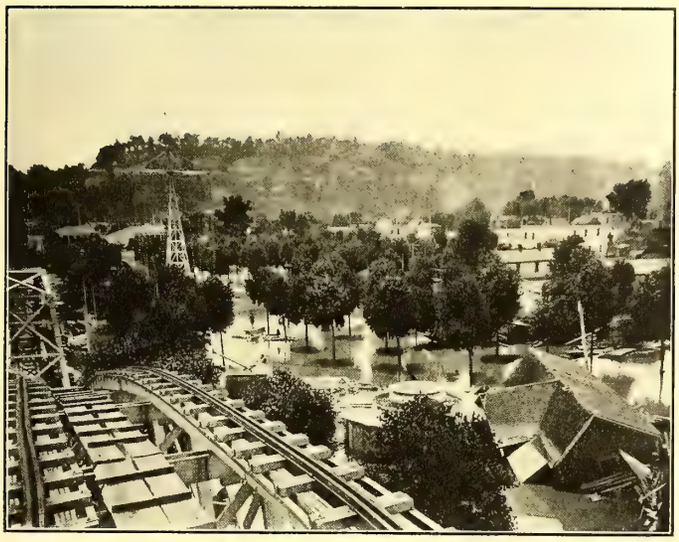


FIG. 2.—VIEW OF "ELECTRIC PARK" JUNE 7, SHOWING COTTAGE RESTING ON ELECTRIC FOUNTAIN

of steel and 1500 ft. of wooden structure. The temporary trestle that was washed out had been erected but a few weeks previous, for the purpose of diverting traffic until the old bridge could be rebuilt.

By noon, Sunday, four of the Metropolitan Railway Company's power houses were under water and out of operation. pany's electric power houses were under water and out of operation. This stopped practically all the electric cars. To make matters worse the city waterworks were flooded, and the city was without water. This caused all the cable power houses to shut down temporarily until water could be hauled from ponds or wells. A spring in an old abandoned power house basement had nearly filled the basement, and a portable pump forced this water to two cable power houses and kept them supplied. Several small reserve generators in these cable power houses were put to work, and by noon, Tuesday, a number of the lines, both cable and electric, were giving fair service.

The water continued to rise until noon, on June 1, when it stood nearly stationary for two days, then began to slowly recede. But not until June 7 was it possible to begin any repairs, either to machinery or streets, and on account of the crippled condition of the waterworks it was necessary to haul water to operate some of the power houses until June 15. It is not possible yet to estimate the loss to the electrical machinery. In the two principal power houses the water reached a little more than half-way up on the big generators and soaked into the thousands of small interstices, leaving them full of slimy mud, which was hard to remove, especially where it dried. To clean them a hose, with a very small nozzle, which threw a small stream of water at great pressure was used, and kept going day and night until the machinery was thoroughly clean. In the meantime steam fitters and carpenters had been busy surrounding the generator with pipes and a huge wooden box.

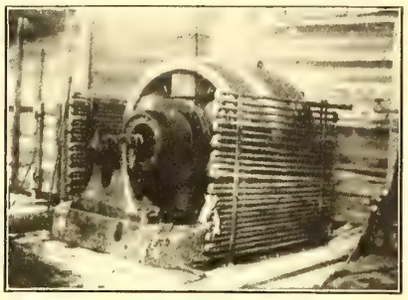


FIG. 1.—METHOD OF DRYING OUT A ROTARY

Steam was turned into the pipes, the doors of the box closed, and the temperature kept at 160 C. to 180 C. for forty-eight hours. Then a heavy current of 7½ volts was sent through the machine while it was slowly run. This was the plan used with nearly every one of the electric machines, both big and little. Fig. 1 shows the steam coils about one of the small rotary converters. The plan has been very successful, as only two coils have been lost in the large machines, but as the full load has not been put on them yet several lines are running only part of their complement of cars. The engines, boilers and pumps required a great deal of cleaning up, but were found to be otherwise uninjured. This experience goes to show that modern machinery, especially electric machinery, will stand more abuse than is generally supposed. One of the plants works at 6600 volts, and it is the opinion of the company's electricians that no further trouble will be experienced.

"Electric Park," which is located in the East Bottoms, was to have opened May 31; but on that date 7½ ft. of water stood all over the park. Several houses were washed into the grounds, and one cottage rested directly on top of the electric fountain, as shown in Fig. 2. This picture was taken from the top of the Loop the Loop June 7, one week after the highest part of the flood, but while 2½ ft. of water still covered the park.

The damage done to the elevated structure is partly shown in



FIG. 3.—PARTLY SUBMERGED ELECTRIC LIGHT STATION AND WRECKED ELEVATED STRUCTURE, CENTRAL AVENUE POWER STATION IN DISTANCE

Fig. 3, which also shows the partly submerged electric light power house in the foreground and the Central Avenue power house of 5500 hp in the distance. The bridge connecting the

space between these power houses was a steel double-deck, double-track structure, and was entirely destroyed, as was also part of the connecting structure on both sides of the river. The twenty-five heavy copper cables that were carried by the bridge and structure were the direct cause of the collapse. Fig. 4 shows the west end of the structure, about 30 ft. of which is left standing, in fairly good condition, but just beyond this



FIG. 4.—WEST END OF L ROAD

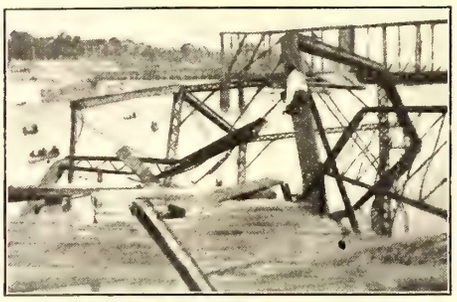


FIG. 5.—WRECK OF JAMES STREET BRIDGE



FIG. 6.—WASHOUT ON JAMES STREET

again the structure, which was of wood, is entire gone for 600 ft.

Fig. 5 shows the destruction of the James Street Bridge, which was entirely of steel. This bridge stood several feet above the water, and its collapse was due to the piers in the center of the river being entirely washed out. The abutments are standing in good condition. This was one of the last bridges to go out, and a mass of drift, over ½ mile long and the full width of the river, struck it.

In many places the street is entirely washed away for 20 ft. to 60 ft., as shown in Fig. 6. James Street is entirely gone on



FIG. 7.—FORMER SITE OF KANSAS AVENUE BRIDGE

both sides, although the old concrete cable slots span the chasm without the slightest deflection.

Of all the bridges that cross the Kaw River but one stood the terrible pressure of the drift that came against it, and it stands a monument to the good judgment and nerve of superintendent of terminals of the Missouri Pacific Railway, W. S. Carson. When he heard the water was rising he filled both tracks with the heaviest engines at his command and then hired a boat and kept as close as safety would allow. It is said that for sixty hours he did not sleep nor leave the immediate vicinity of the bridge. Were it not for this bridge Kansas City would be cut off from all its Western connections.

In the meantime craft of every conceivable kind is plying between the two Kansas Cities until bridges are built, which will not be long. The Metropolitan Street Railway Company will soon have finished the first new bridge over the Kaw. It will be a temporary one built on piles, which are now driven, and by June 23 cars will be running over it. It is being built at James Street. Other temporary pile bridges will connect the Kansas Avenue ends and the Twelfth Street Bridge in Armourdale. It will require a great deal of work to put the elevated road in operation again.

Fig. 7 shows how completely the Kansas Avenue Bridge was swept away; not a stone of the original structure is in sight.

The practical reader will see by this hurriedly written article that much hard work and trying delays are ahead of the officials of this company before cars will be running with their accustomed regularity. But it is a pleasure to note how such trying incidents as these draw the heads of the different departments together, and to see the interest taken, even by the humblest employee, in trying to give the very best possible service. The public notices this and shows its appreciation by not complaining of having to hang on the straps and by filling up the center of the cars.

COMMUTATION TICKETS

The Cleveland & Southwestern Traction Company has adopted a new form of commutation tickets which gives practically 3-cent fare in all the towns on its system. They are in the form of coupon books containing 200 tickets. One class is good for the individual only and is not transferable, and sells at $6, while another class is good for any member of a family and sells at $8. Each coupon entitles the holder to a ride over a 5-cent division of the road, and as many coupons are taken up as the holder rides divisions. The individual tickets are good for sixty days and the family tickets for six months. With the individual tickets the rate is about 1 cent per mile. These books take the place of the old form of commutation books, which were available only between specified points. The plan saves the expense of printing a large variety of books and gives a greater latitude to the holder.

IMPROVEMENTS AT DAVENPORT AND ROCK ISLAND

The Tri-City Railway Company, which is operating lines in Davenport, Ia., Rock Island and Moline, Ill., expects soon to shut down its steam power station and hold it simply as a reserve. Power will be obtained from the People's Power Company, which has a large water-power at Moline, obtained by means of a dam across that part of the Mississippi which flows between the Illinois shore and the island upon which the Rock Island arsenal is located.

General Manager J. F. Lardner, of the Tri-City Railway Company, is a prominent director in the People's Power Company. The latter company also furnishes electric light and power in Davenport and in Rock Island.

The Tri-City Railway Company is now building its own cars. The new cars being built are 44 ft. long over all, with cross-seats and center aisles, adapted for either summer or winter use.

HIGH-SPEED ELECTRIC RAILWAY PROBLEM*

BY A. H. ARMSTRONG

Among the many questions to be considered in a new railway project, perhaps the one of primary importance is the question of the proper speed at which to operate, as depending upon this factor is not only the first cost of the road, but its cost of operation and probable receipts. It is the purpose of this paper to touch briefly upon some of the fundamental relations existing between first cost of a railway system, its probable cost of operation and schedule speed, discussing also the probable traffic receipts to be secured with different methods of operation. In considering so broad a problem in a paper of this length it will be necessary to omit detailed proof of many of the statements made, but the method of arriving at the conclusions will be outlined. Most of the data presented is obtained from a very elaborate series of experimental tests, so that the results obtained may be considered of direct practical application.

Owing to the wide field covered by the electric railway motor it is not possible to consider all classes of railways, and therefore this discussion is limited to the relatively high-speed roads. It is a mistaken idea that acceleration problems are met with only in city or elevated work where the stops are frequent. Although the so-called high-speed roads stop at comparatively infrequent intervals, the relation existing between stops and schedule speeds often calls for the most serious consideration of fractional speed running of the motors. Such roads really act as tributaries to large city street railway systems and must be able to operate over several miles of city tracks at slow schedule and with frequent stops, and also be adapted for operation at 40 m. p. h. or 50 m. p. h., with infrequent stops on a private right of way.

While each road presents its own local characteristics they can generally be divided into two broad classes, those having frequent stops and those having very few stops. Both classes of service will probably parallel one or more steam lines and must make a schedule speed that will compare favorably with that obtaining on the competing steam road. This high schedule speed must also be made with more frequent stops than given by the steam service, and in nearly all cases over a track which has many sharp curves, which have the effect of still further increasing the number of stops. Interurban roads having very infrequent stops, say one stop in 5 miles or 10 miles, private right of way, and an alignment free from curves of less than 3 degs., can give a service equal or superior to any competing steam line, and can furthermore provide the frequent service which has proved one of the valuable assets of electric roads. Moreover, the generating station, feeder system, motor capacity and power consumption will be moderate in first cost. The problem of high-speed electric service, therefore, is comparatively simple, provided the alignment is free from sharp curves and the stops are very infrequent, and such a service can be operated at a less cost and will attract more traffic than the competing steam line with its antiquated method of operating with steam locomotives.

Suburban roads, however, that pick up their load at frequent intervals along the route and still have to compete with parallel steam lines, present problems much more difficult to solve from an economic standpoint. It is the custom of such roads to establish stopping points, say 1 mile or less apart, and stop at these points only on signal. During certain portions of the day, however, cars will be obliged to stop at nearly all these stations, and will either fall behind their schedule at such times or will have too much leeway during the remainder of the day when stops are much less frequent. Moreover, owing to the considerable city running at necessarily slow speeds, these suburban roads must make as good time as possible on the suburban route in order to bring the passengers from the more distant points within a reasonable time, including city running. In fact, such roads when paralleling steam lines operating on private right of way through the city, and moreover giving excellent service morning and night to commuters, are compelled to face very serious engineering and economical problems due to the tremendous aamount of generating apparatus, line copper and motive power required to give equally good service.

A suburban road will develop a considerable amount of traffic, due to its frequent service, but there comes a time when such roads will extend beyond the zone of half-hour runs into the city and try to reach the outlying districts hitherto belonging exclusively to the steam lines. The frequent service will always be a valuable asset and one that cannot be duplicated with the steam locomotive, except at higher cost of operation, but if it takes considerably longer to reach the city by means of the electric line than by the steam road with its better facilities for high speed, the electric line will fail to obtain the proportion of suburban business to which it has been accustomed in its more limited scope. In other words, it fails in its purpose, due to the frequent stops to which its previous popularity was due.

In considering the proper speed at which to operate a new electric line, it is necessary, therefore, to go very carefully into local details and especially canvass the competition with existing steam lines not only when operated in their present form, but also consider the possibility of their adopting electricity as a motive power.

In considering the possible speeds of a car or train of cars the investigator is met with the necessity of obtaining some accurate data on the question of car and train friction. The greater part of the data now existing on this subject has been obtained with trains hauled by steam locomotives. Many of these results were obtained by draw-bar pull, and, hence, neglected the wind-friction of the locomotive, and those taken by indicator diagrams are open to the objection that the steam locomotive is not square ended like a car, and wind-friction results so obtained are not applicable to the operation of the train electrically without locomotive. Moreover, all these results were obtained with more than a single car in the train, and do not apply to suburban electrical operation which almost universally uses single car trains. Tests are being made from time to time with electrically operated trains, and due to the refinement of the carefully calibrated voltmeter and ammeter it is possible to obtain wind-friction values at various speeds and with different number of cars in a train with greater accuracy than in the previous steam tests. These results are not at all complete and the only attempt known to the writer to obtain friction values with different number of cars was made by W. J. Davis, Jr., through the courtesy of the International Railway Company on their Buffalo & Lockport line in March, 1900. Using these tests as a basis the writer has drawn up three friction curves in Fig. 1, designating them A, B and C.

The C curve will hold approximately for single car operation where the car weighs in the vicinity of 40 tons. The B curve applies to the operation of two such cars in a train, and the A curve to a train of such cars, say eight or more in a train. These curves are not published with the idea that they are correct, in fact, the speeds at which they were obtained do not exceed 60 m. p. h., and hence extension beyond this speed is based upon a formula which will follow curve shape up to 60 m. p. h. As the results obtained by using them are not dependent upon their numerical values, intermediate points being easily interpolated, it is not of prime importance that the three friction-curves given represent accurately the conditions as set forth. In fact, with the different shaped cars now in use and the different cross-section of cars having the same weight, etc.,

* Read at the twentieth annual convention of the American Institute of Electrical Engineers, Niagara Falls, N. Y., June 30, 1903.

it is hardly possible to make one friction-curve which would apply accurately to all cases. It is probable, however, that the curves given have the general shape and the numerical values applying to average conditions. The friction curves have been extended to maximum speeds approaching 90 m. p. h. in order that questions of motor capacity, train energy, possible schedule speeds, etc., can be followed up to maximum speeds equal to or better than those in vogue on the present steam roads. As will be pointed out later in this paper, the consideration of the proper method of operating a railway service at these high maximum speeds leads to very interesting results as determining the size of trains and frequency of service to be adopted.

With the friction curves in Fig. 1 as a basis, the curves in Figs. 2, 3 and 4 have been calculated, showing the possible schedule speeds and energy consumption required for these speeds up to and including 75 m. p. h. maximum. The method used in making up these curves is similar to that pointed out in a paper entitled "A Study of the Heating of Railway Motors," presented by the writer at the annual meeting of the Institute in 1902. As indicated in that paper the

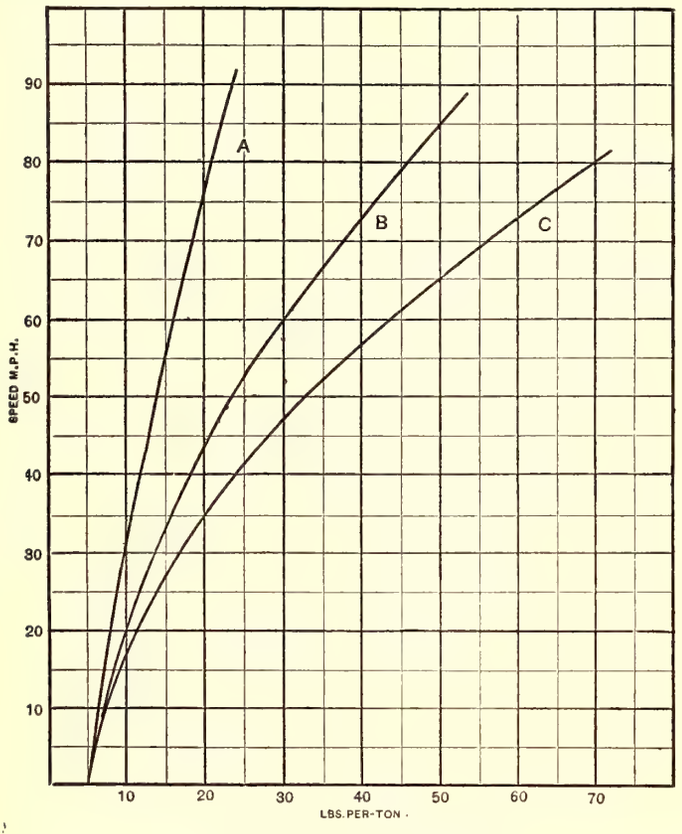


FIG. 1.—FRICTION CURVES

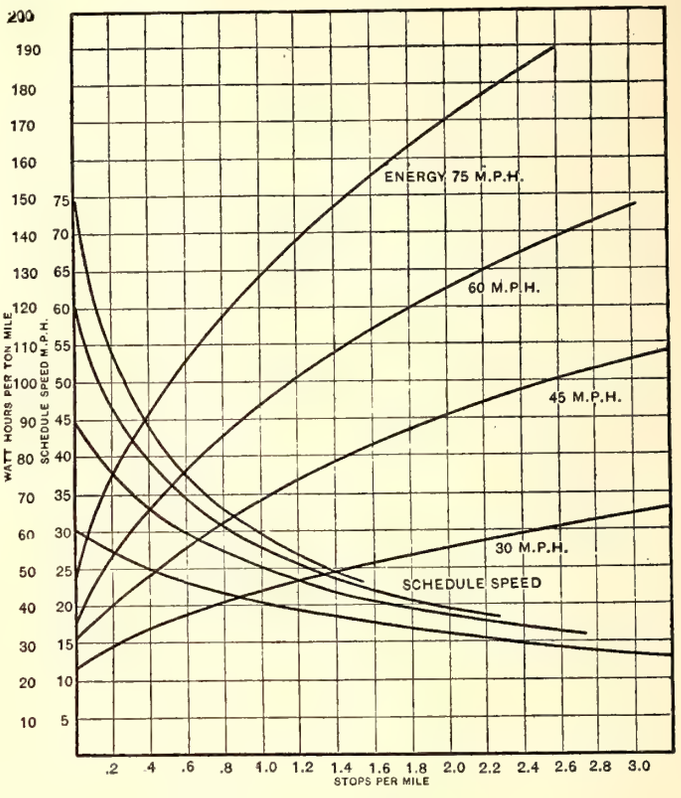


FIG. 2.—SPEED AND ENERGY CURVES (FRICTION CURVE A)

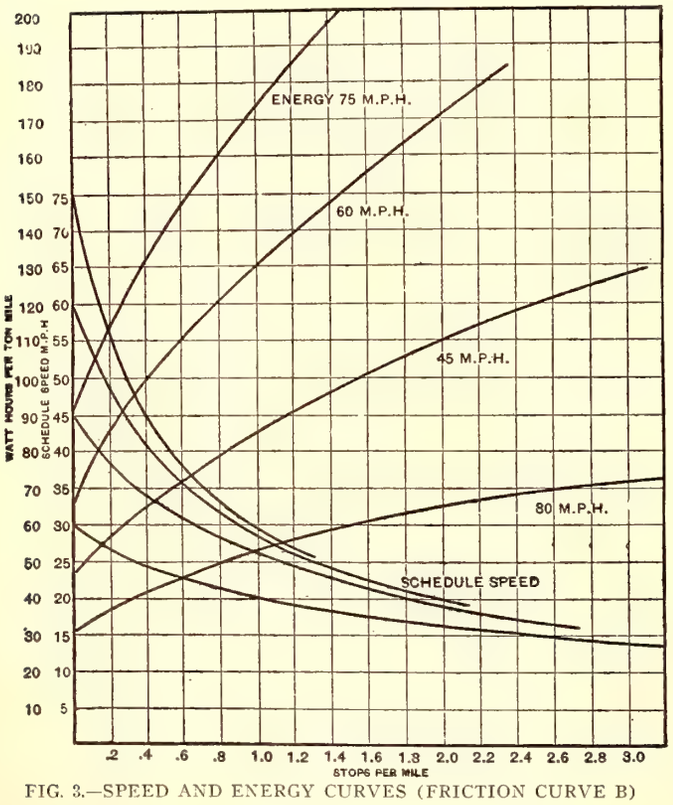


FIG. 3.—SPEED AND ENERGY CURVES (FRICTION CURVE B)

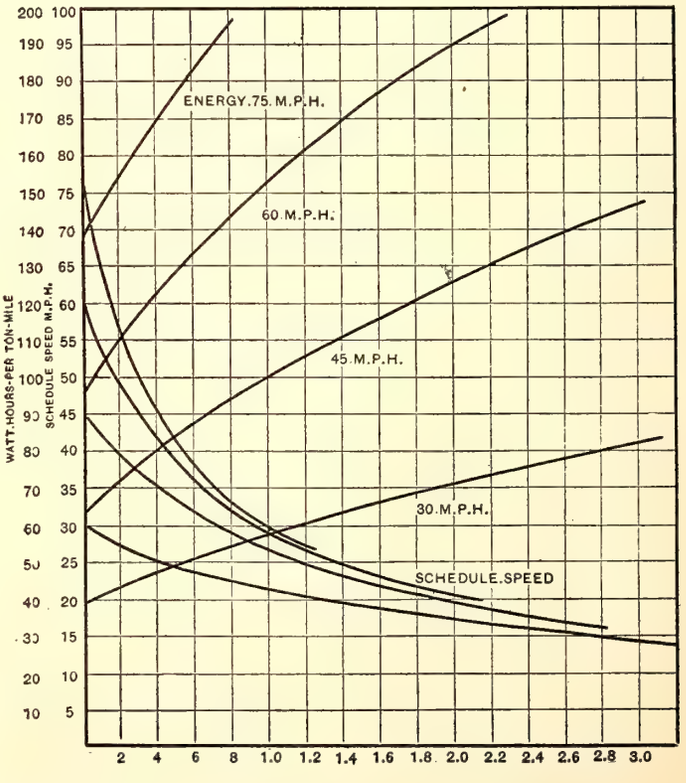


FIG. 4.—SPEED AND ENERGY CURVES (FRICTION CURVE C)

rate of acceleration and rate of braking do not have a marked effect on the energy consumption or possible schedule speeds for these comparatively high-speed roads. The shape of the motor characteristic also is not a determining feature and can be neglected without introducing a possible error of more than a few per cent. The controlling factor in all of these curves is the friction curve, which includes track, rolling, journal and wind-friction.

The constants assumed in calculating the above curves are those pertaining to average high-speed suburban work as folows:

Gross accelerating rate..... 120 lbs. per ton
Braking effort (average)..... 120 " " "
Duration of stop..... 15 seconds each

Track assumed to be perfectly straight and level.

In the above curves due consideration is given to all the losses occurring during acceleration with the standard series-parallel controller and direct-current motors. If the curves are to be used for alternating-current motors allowance must be made for the difference in accelerating efficiency of the two types of motors and their methods of control. The inertia of the rotating parts of the equipment generally amounts to 5 per cent, and this value is taken throughout, being perhaps a little high for the higher speeds and low for the lower speeds. The speed-curve of a standard 125-hp motor is used throughout. The energy curves given are somewhat affected by the amount of coasting done, although this is not so determining a factor in this high-speed work as it is in slow-speed rapid transit accelerating problems. In order that the energy curves should be conservative, they are plotted with only 10 seconds of coasting permitted, and therefore the schedule speeds given are nearly the maximum possible, and the energy curves given are also practically the maximum possible with the maximum speeds assumed. Should power be shut off earlier and more coasting permitted, the energy consumption would have been decreased and the schedule speeds decreased somewhat also, especially with the more frequent stops per mile.

An inspection of these three sets of curves will bring out the very great effect of the wind-friction when using trains of one or two cars at very high speeds, in fact, at 75 m. p. h. maximum speed the operation of single-car trains becomes impracticable with light 40-ton cars of standard construction, and even at 60 m. p. h. is questionable. To quote from the curves, it requires an energy consumption of 47 watt-hours per ton-mile for a train of several cars, as against 137 watt-hours per ton-mile for a single car operating at 75 m. p. h. without stops; that is, a single car operation would demand 3.7 times the energy per ton that would be required for the operation of a train of many similar cars. Even a two-car train will require but 92 watt-hours per ton-mile, or only 67 per cent of the energy required per ton for single car operation. As these values are for constant speed running, while more or less frequent stops would obtain, a comparison at say one stop in 4 miles would be nearer the actual results in practice. Here a single car requires 157 watt-hours per ton-mile, a two-car train requires 120 and a train of several cars 79 watt-hours per ton-mile. The results would indicate that in a class of service calling for very high maximum speeds, the tendency of electric roads will be to follow steam railroad practice and operate trains of several cars at more infrequent intervals rather than follow present practice of suburban electric roads and run single cars at frequent intervals. It will be a question for local consideration whether sufficient additional traffic would be gained by the operation of single cars, say on half-hour headway, or trains of two or three cars on one-hour headway or more, the latter requiring but 60 per cent or 70 per cent of the power per ton moved, and also effect a considerable saving in train crew expenses. As the maximum speed of the service is reduced the difference in energy consumption between single cars and trains of cars is also reduced, and at 30 m. p. h. a single car will require but slightly more energy per ton than a train when operated at the frequent stops characteristic of low-speed service.

Another very interesting feature which is well known but perhaps not fully appreciated is brought out by the curves of schedule speeds possible for different maximum speeds. Thus, with one stop in 8 miles it is possible to make a schedule of 61 m. p. h. with maximum speed of 75 m. p. h., and a schedule of 28 m. p. h. with maximum speed of 30 m. p. h. If stops be increased so that they average one per mile, however, the schedule speed possible with a maximum speed of 75 m. p. h. is dropped to 29 m. p. h., while the 30 m. p. h. maximum speed permits of a schedule speed of 22 m. p. h. Thus while 30 miles is but 40 per cent of the higher maximum speed it permits a schedule at one stop per mile of 76 per cent of that possible with 75 m. p. h. maximum speed. The fallacy of using high-speed equipments for frequent stops is forcibly brought out by referring to the energy curves in Figs. 2, 3 and 4. With one stop per mile it requires 200 watt-hours per ton-mile with 75 mile maximum speed equipment, and the 30 miles maximum speed equipment can obtain 76 per cent of the same schedule with an expenditure of only 28.5 per cent of the energy. The two values taken for the maximum speed are the extreme, but serve the purpose of bringing out the tremendous price paid for high schedule speeds at frequent stops. The conditions of acceleration and braking are the same in both these equipments, while if higher schedule speeds were required with, say, one stop per mile, a higher rate of acceleration and, if practical, a higher rate of braking would be adopted. The difference in energy values would be considerably reduced thereby, but neither the average rate of acceleration nor the braking could be very largely increased without incurring the possibility of discomfort to passengers.

Before considering the application of the previous curves to a concrete case, it is necessary to include the effect of the different friction curves at high speeds upon the capacity of the motor equipment. In the paper by the writer at the last annual meeting of the Institute, the manner of fully determining the capacity of a motor for any service was indicated. The details of this method will not be gone into in the present paper, but for convenience a sample motor capacity-curve of a 125-hp equipment operating at a maximum speed of 45 m. p. h. is shown in Fig. 5.

The means taken to determine the capacity of this motor is to obtain from a series of temperature runs made upon an experimental track the degrees rise per watt loss in different parts of the motor for different ratio of losses for armature and field. It is obvious that so long as the motor losses and their distribution are the same, the temperature rise of the different parts of the motor will also be practically the same. This assumes that the car will travel at the same average speed, which is not necessarily the case owing to the fact that the same motor cycle could be obtained with a considerably different train cycle. A service capacity-curve similar to Fig. 5 on the 125-hp motor is therefore not absolutely correct unless the thermal capacity curves be obtained from actual tests giving the same train cycle as that indicated. It is not necessary to conduct so elaborate a series of tests, as a sufficiently close result can be obtained for practical purposes by obtaining the experimental thermal capacity curves at moderate average speeds upon an experimental track, and assuming that the conditions of ventilation so obtained will hold true for all the schedule speeds. It is admitted that a source of error is thus introduced and that motor-service capacity curves will read too conservative at the very high speeds and will possibly be too liberal at the lower speeds; but conservatism at speeds approaching 75 m. p. h. could not be criticised as poor engineering, and the results given in following curves are therefore presented with full con-

fidence that they will meet a long felt want and will, moreover, be approximately correct for types of motors similar to those serving as basis of calculation and experiments.

An inspection of the curves given in Fig. 5 discloses the fact that for a given temperature rise the capacity in tons per motor is practically a fixed amount. For example, a temperature rise of 60 degs. C. will be obtained with approximately 16.2 tons per motor over a range extending from one stop in 4 miles to five stops per mile. It is thus sufficient to associate a given motor and gear ratio with a definite car weight which it can operate with a given temperature rise, and with any schedule speed which the number of stops per mile will permit. This at once affords a means of comparing motors of different capacity by means of the "tons per motor" which is permitted for, say, 60 degs. rise and a given maximum speed equipment. In presenting the curves in Fig. 6, the results of a large number of experiments and calculations are incorporated on motors of similar design, giving the relation between the commercial one-hour rating of the motor and the number of tons which that motor will carry at maximum speeds of 30 m. p. h., 45 m. p. h., 60 m. p. h. and 75 m. p. h. The curves of 30 m. p. h. and 45 m. p. h. are probably accurate, those at 60 m. p. h. may be open to the criticism of being conservative, and at 75 m. p. h. with the superior ventilation afforded by the schedule speeds incident to such high maximum speeds, the motor capacity curves perhaps indicate too low a ton weight for 60 degs. rise. As no electric road as yet affords means of obtaining experimental values at this high maximum speed, the degree of error cannot be determined and in any case should not exceed more than a possible maximum of 15 per cent. Figs. 7 and 8 are plotted for 60 degs. also, but using friction curves B and C, so that by means of Figs. 6, 7 and 8 it is possible to determine the capacity of motor required for any maximum speed and any weight of train; while from Figs. 2, 3 and 4 the possible schedule speed and energy consumption can be obtained for any maximum speed and frequency of stops. The maximum speeds of 30 m. p. h., 45 m. p. h., 60 m. p. h. and 75 m. p. h. have been chosen as covering the present field of electric railroading, and intermediate values may be readily interpolated.

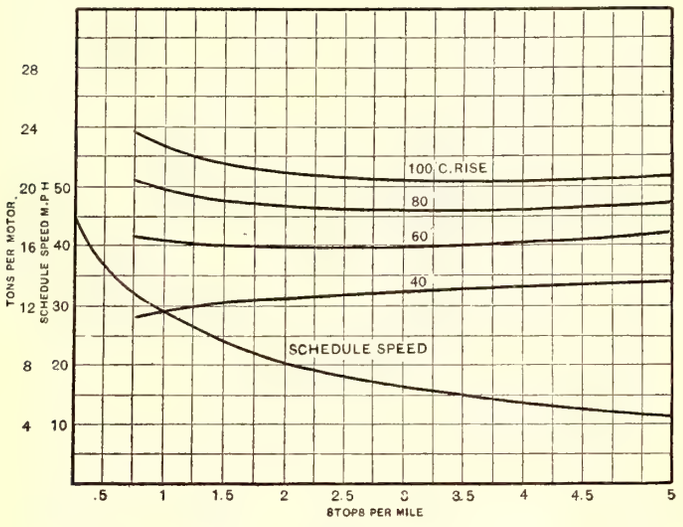


FIG. 5.—MOTOR CAPACITY CURVES, 125-HP MOTOR (FRICTION CURVE B)

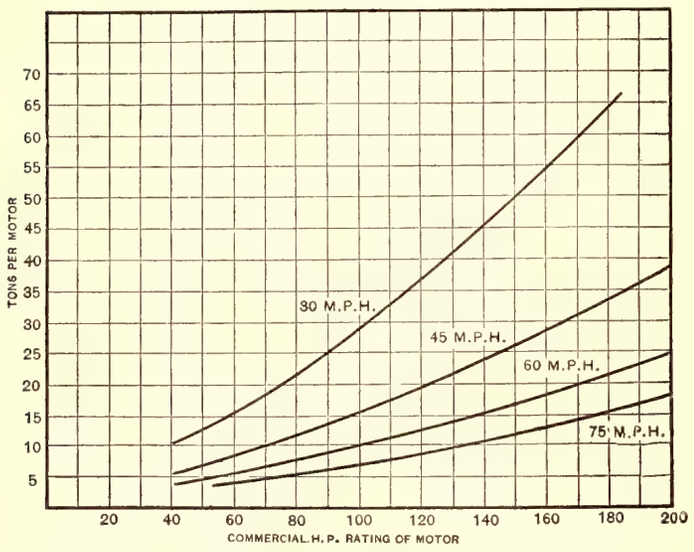


FIG. 6.—MOTOR CAPACITY, 60 DEGS. C. RISE (FRICTION CURVE A)

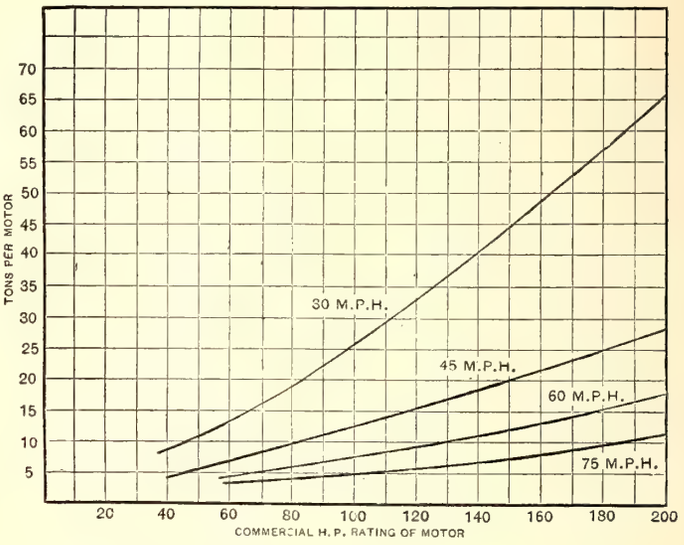


FIG 7.—MOTOR CAPACITY, 60 DEGS. C. RISE (FRICTION CURVE B)

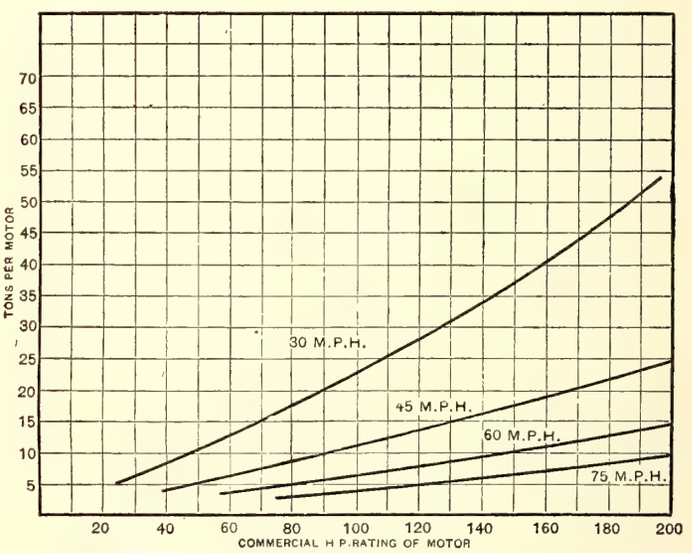


FIG. 8.—MOTOR CAPACITY, 60 DEGS. C. RISE (FRICTION CURVE C)

The relation between the commercial one-hour rating of a railway motor and its service-capacity performance is very difficult to express. In fact, it is almost impossible to compare two motors differing essentially in their mechanical design, as the stand-test of a motor has no direct bearing on its service performance with its different distribution of losses and better facilities for ventilation. It is necessary, therefore, to obtain by experiment the performance of each individual motor under conditions approximating service operation, and determine the relation of stand-test to service operation for the particular motor in question. By carrying on a series of exhaustive tests on each individual motor it becomes possible to plot the results of such tests in curve form and show the relation between stand tests and service capacity, provided motors are of the same general design. Having obtained the capacity in tons

per motor for different maximum speed equipments, the results were all found to follow the general law noted in Fig. 5, that is, the temperature rise was found to be practically constant over a wide range in stops per mile and schedule speed. With this simplification it becomes possible to compile curves 6, 7 and 8, giving the capacity-motor required for any train weight, schedule and frequency of stops, the motors all being of similar design. These curves are all plotted with motors of the closed type, it being assumed that in miscellaneous operation advantage cannot be taken of opening ventilators. Where motors can be operated partially or fully open, the capacity, especially at high speeds, will be considerably increased. It is probable, however, that motors operating at speeds approaching 60 m. p. h. to 70 m. p. h. will be upon a surface track where it would be advisable to protect the motor from dust and moisture, and thus operate closed.

The results brought out by curves 6, 7 and 8 are very instructive as determining the probable trend of very high-speed electric railroading where trains of one or more cars are used. For example, a 40-ton car equipped with four motors, thus giving 10 tons per motor, will require a 133-hp motor for 60 degs. rise when operating a train of several cars at 75 m. p. h. maximum speed, while the same weight of car would require a motor of at least 230 hp if operated as a single car with the same temperature rise and similar design of motor. That is, the motive power is doubled in going from train to single-car service. Thus not only is train friction the determining feature of energy values, but it is the controlling feature as well of the motor capacity required to perform a given high-speed service.

As pointed out in the earlier part of this paper it is not necessary that the friction curves A, B and C shall in themselves correctly give the numerical values for train, single-car and two-car work. The general shape of the curves is undoubtedly that pertaining to their respective size of train, and as the three curves are taken and subsequent calculations are all made upon a three-curve friction basis, it is relatively an easy matter to interpolate and obtain the energy, schedule speed and motor capacity required for any train friction expressed in pounds per ton. The friction curves are of use, therefore, only in determining the fundamental values of train energy and motor capacity given in the subsequent curves, and the energy, schedule speed and motor capacity can be obtained from these curves whether the friction pertaining to the case in hand is, say, 33 lbs. per ton at 50 m. p. h. for single-car operation, or more or less than this value. The application of the motor and energy curve is, therefore, universal, and it is only necessary to obtain sufficient experimental data of the particular type of car or train proposed to determine accurately its friction for a given maximum speed and obtain the various values required by interpolation in the curves given.

Having obtained the data upon which to base calculations for the proposed electric road, perhaps the best method of showing its application would be to take a concrete case. Let the distance from A to B be, say, 100 miles, or great enough to get over the consideration of location of sub-stations in relation to the length of the line. Assume also that the proposed road will parallel a steam line, or that there are other reasons necessitating a high schedule speed, that stops will occur every 4 miles, and will be of 15 seconds duration, and that the motors will be direct current, supplied from sub-stations, fed from a single central generating station. It is desired to know the effect that single car or train operation will have upon first cost and cost of operation.

It is assumed that the competing steam road will have a schedule speed in the vicinity of 40 m. p. h. Such express trains as exceed this schedule will offer such very infrequent service, and will, furthermore, be so restricted to their through travel that they will not enter as a factor for consideration. By referring to Fig. 4 we find that a schedule speed of 40 m. p. h. can be obtained, with a maximum speed of approximately 48 m. p. h. with one stop in 4 miles. The energy consumption will be 82 watt-hours per ton-mile, and the motor capacity will consist of four 110-hp motors operating a single 40-ton car with a temperature rise of 60 degs. (Fig. 8). The energy consumed at the car will, therefore, be 131 kw or 144 kw at the sub-station bus-bar, allowing an average drop of 10 per cent in the third rail. With a sub-station bus-bar potential at 600 volts, each car will average 240 amps.

Assuming that the road will be double track, with 80-lb. track rails and 100-lb. third rail, the distance apart of the sub-stations will be approximately 13 miles, with a maximum drop of 170 volts when two cars are passing midway between sub-stations, one of which is accelerating. This drop is permissible, as it is momentary only. Each sub-station must be able to accelerate one car and supply another at full speed, or must give 850 amps. momentary output and a sustained output of 500 amps. The sub-station will, therefore, be called upon to deliver momentarily 510 kw, and should contain not less than one 300-kw rotary converter, and preferably two, one being a reserve. This size of converter is based upon the assumption that cars run always as single units and not in trains, and that converters can stand a momentary overload of 100 per cent. With half-hour service cars will be spaced 20 miles apart, so that there will be required a generator capacity of two cars every 20 miles (double track) or 340 kw, assuming 15 per cent loss in rotary converter sub-stations and transmission line. The generating station capacity per mile of track will, therefore, be 17 kw, and the sub-station 46 kw with reserve, and 23 kw with no reserve. Taking the cost of generating station in round numbers at $100 per kilowatt, and sub-station at $35, the cost of a 40-ton car complete with four 110-hp motors, controllers, etc., at $9,000, we arrive at the following approximate cost for installing:

APPROXIMATE FIRST COST PER MILE, SINGLE-CAR TRAIN

Generating station	$1,700
Sub-stations with reserve	1,610
Equipment (plus 20 per cent reserve)	1,120
Total	$4,430

The above total of $4,430 thus represents the approximate first cost of the various items noted when operating a single 40-ton car every half-hour at 40 m. p. h. schedule speed and stopping 15 seconds once in 4 miles. Following through the same process with two 40-ton cars operating on one-hour headway at 40 m. p. h. schedule with the same track and third-rail construction, we arrive at the following conclusions:

Watt-hours per ton-mile, 63; train energy at train (80 tons), 202 kw; distance apart sub-stations, 9.1 miles; size sub-station, two 400-kw units.

Each train, consisting of two 40-ton cars, will consume 224 kw at the sub-station, or 264 at the generating station, allowing the same percentage of loss as above. These trains making the same schedule speed at double the headway will be spaced 40 miles apart and the generating capacity will, therefore, be 528 kw every 40 miles, or 13.2 kw per mile. The sub-stations, consisting of two 400-kw units (with reserve), every 9.1 miles, will have capacity per mile of 88.0 kw. Expense for cars will be the same as before and the following approximate costs obtain:

APPROXIMATE FIRST COST PER MILE, TWO-CAR TRAIN

Generating station	$1,320
Sub-stations	3,080
Equipments	1,120
Total	$5,520

The first cost of the two-car train system will be $5,520 as against $4,430 with single-car train. The energy consumed

for the two methods of operation is 17 kw per mile of track with single car as against 13.2 kw per mile with two-car train. Thus, while the two-car train at one-hour headway will cost 24½ per cent more to install (for the items mentioned only) it will consume but 77.6 per cent of the energy required to operate a single car individually.

The difference in power required is 3.8 kw per mile of track. Assuming twelve hours per day operation at the above headway, the total kilowatt-hours per day will be 45.5, which, at $.007 per kilowatt-hour, would be $116.50 per year, or 10 per cent on $1165. It would, therefore, pay to invest the $1,090 per mile of track difference in cost between one-car and two-car operation, as found above, provided the same receipts could be secured with one-hour headway as with 30-minute headway. The relation of traffic receipts and frequency of travel is a question which can only be determined experimentally, and while the desirability of the two-car service seems evident from the data at hand in the above case, it might result in a falling off of receipts to such an extent as to more than make up the saving in operating expenses. There is an additional saving in train crew expenses which was not entered into above, and which would amount to something more than half as much as the cost of power. With two-car operation it is possible to reduce the motor capacity per car from four 110-hp motors to four motors of approximately 95 hp, thus reducing the cost of the equipment item. Owing to the fact, however, that it might be desired to operate a single car during certain parts of the day, which would result in overheating the smaller motor equipment, it would be more conservative to consider the same size of equipment whether one-car or two-car train were operated. With more than two cars in a train advantage could be taken of the smaller equipment required, but it is probable that in two-car work this advantage of the smaller motor possible for two cars would only result in the cooler operation of these motors when operated in two-car trains and would show up, therefore, in the repair account rather than as a first cost. The sub-stations with two-car trains being placed somewhat closer together would have a labor account per mile of track in excess of that for single-car operation. This may be balanced against the saving which would result from smaller crew expenses of the two-car train.

These examples serve to illustrate the very broad application of the foregoing curves. Although it has been necessary to assume a number of constants, acceleration, braking, coasting, etc., these constants are those pertaining to average operation and can vary considerably without making a serious difference in the results. The curves given are not, therefore, absolutely correct, but are sufficiently so for approximation purposes. For the slower speed work where stops are more frequent and where acceleration is a more important factor, it will be necessary to have more complete curves to determine the proper rate of acceleration, especially if the problem is one calling for very high schedule speeds in relation to the number of stops.

As previously stated, it is not necessary that friction curves A, B and C should represent the actual friction in pounds per ton of train, two-car and single-car work. Having the motor capacity and energy values for three different friction rates at a given maximum speed, it is possible to interpolate and secure the proper motor capacity and energy value for the friction value corresponding to the case in hand. The importance of the wind-friction as affecting electrical operation at a very high speed in service with the very small light trains of one or more cars, will probably lead to the construction of special cars reducing wind-friction to a minimum when the higher maximum speeds are put into commercial operation. No conclusive data is at hand upon the effect of different shaped car ends on single or two-car operation.

The compilation of the above curves entailed a large amount of careful work, and the writer is very much indebted to E. F. Gould for his very valuable assistance.

USE OF AUTOMATIC MEANS FOR DISCONNECTING DISABLED APPARATUS*

BY H. G. STOTT

This subject may preferably be divided into three sections, as follows:

(a) Generating apparatus.

(b) Transmission apparatus.

(c) Receiving apparatus.

(a) Generating Apparatus.—That no overload device should be used in the generating plant to disconnect disabled apparatus may be stated as a general proposition.

Experience has probably been responsible for the evolution of the art to a point where it has become not only possible, but necessary to eliminate all overload devices.

Only a brief statement of the reasons for abandoning the use of overload apparatus will be necessary.

In case of an accident to one generating unit, the other units in multiple with it will immediately begin to force current into the disabled one, and the increased load on the good units, due to their normal load plus the short-circuit current supplied to the crippled unit, will, in all probability, trip all the circuit breakers simultaneously, thus interrupting the service.

Without automatic circuit breakers the overload on the good units would cause the potential of the system to fall so low that the service would, in all probability, be as completely interrupted as in the former case, unless the attendant succeeds in locating and disconnecting the crippled unit immediately. Should he fail to do so the service will inevitably be interrupted and a great deal of damage done to the crippled unit by the current from the good machines.

It is then evidently necessary to have some means of discriminating between a current coming out of the machine and one going into it. Modern apparatus can safely carry 200 per cent or more load for a few minutes, but if a unit has become crippled it will immediately cease to be a generator and become a receiver. All that is necessary to do then is to install on each generator a suitable circuit breaker which will operate only when the direction of flow of energy through it is reversed.

This type of safety device has been developed for both direct-current and alternating-current apparatus, so that it operates quite satisfactorily.

As an additional precaution in large plants a second reverse current relay should be installed which will merely light up a letter or number in front of the operator so that in the event of the failure of the first automatic device the faulty machine may be quickly disconnected by hand. These reverse current relays should have a time-limit and current-limit attachment, which should be set for not less than three seconds, so that a slight reverse current, or one of momentary duration, such as is liable to occur at the moment of multiplying, will not operate the circuit breaker.

(b) Transmission.—When transmitting power through overhead and underground cables it is essential to successful operation to be able automatically to disconnect the feeders from (1) the generating station, and (2) if there are duplicate transmission lines, from the receiving station.

(1) At the generating station this should obviously be done by an overload circuit breaker whose operation is delayed by a time element which may be set at from 1 second to 10 seconds, according to the local conditions.

This is all the protection necessary or desirable where only one transmission line exists.

(2) With two or more transmission lines in multiple an entirely different set of conditions exist, as in case trouble develops in one, current will be fed back from the receiver end

* Opening of discussion at the twentieth annual convention of the American Institute of Electrical Engineers, Niagara Falls, N. Y., July 1, 1903.

into the fault through the good feeders; the result will be that all the feeder overload breakers at the generating station will trip, thus shutting down the entire line and, in all probability, shutting down all synchronous receivers on the system, due to the resultant fall in potential.

Reverse current relays at the receiver end of the feeders operate satisfactorily, provided the fault is not severe enough to drop the potential.

If, however, the fault amounts to a short circuit the potential at the receiver end will fall so low that the potential coil of the differentially-wound relay will not receive enough current to enable the relay to operate.

Reverse current relays on the receiving end of feeders are not as yet to be depended upon, but recent improvements give promise that we may soon expect to find a satisfactory solution of this important problem.

When only two feeders are in use a method devised by L. Andrews, of England, seems to be very satisfactory. At the receiver end the two feeders are connected together through a choking-coil wound entirely in one direction. The current is drawn from a tap in the center of this winding. Under normal conditions the feeders supply equal current through each half of the winding to the tap, but as the currents pass in reverse direction through the winding the resultant flux is nil and, therefore, the resultant inductance is nil, the only loss being that due to the ohmic resistance of the coils.

Should a short circuit occur in one of the lines, the current from the other line will flow through both halves of the reactive coil in the same direction, thus producing a strong choking effect and limiting the current to an inconsiderable amount.

As the overload circuit breaker on the faulty feeder at the generating station will trip immediately, it is then only necessary for the attendant at the receiving station to open-circuit the section of the reactive coil connected to the faulty cable and short-circuit the other half connected to the good cable. This device, I am informed, has given excellent results in England, but for obvious reasons would not be suitable for more than two feeders.

Where possible, the safest plan at present is, in the writer's opinion, to run the feeders entirely separate at the receiving end, only putting the direct-current end of the rotaries in multiple; or in cases where low-tension alternating-current (2000 volts or less) is supplied, putting the secondaries in multiple. If, under these conditions, reverse current relays are installed at the receiving end of the feeders they will operate very satisfactorily, as the reactance of the rotaries and transformers will be sufficient to limit the reverse current in the faulty cable, thus allowing the reverse current relays to operate, as there has been no serious fall of potential.

The greater the number of feeders used between the generating station and the sub-station the better this method becomes, as, for instance, with two cables a fault in one will only reduce the capacity 50 per cent until the operator can synchronize all the apparatus which was running on the faulty cable, and as the apparatus and converters will continue to run at full speed only a few minutes will be necessary to synchronize on the good feeder, which will in the meantime carry the whole load, so that no interruption to service will occur. With three cables this would mean a loss of capacity of 33.3 per cent, and with four cables 25 per cent, etc.

(c) Receiving Apparatus.—This should be treated in exactly the same way as the generating apparatus, namely, use reverse current relays only to operate the circuit breakers on the rotaries, etc., and use time-element overload relays only on the low-tension feeders leaving the sub-station.

These remarks apply generally to both direct-current and alternating-current apparatus, with the exception of the part devoted to transmission apparatus, which, of course, only applies to alternating-current transmission.

THE INTERURBAN TERMINAL STATION AT INDIANAPOLIS

Bids have been opened for the construction of the elaborate interurban terminal station planned by the Indianapolis Traction & Terminal Company for the use of its lines and the lines of the interurban companies operating into Indianapolis. The building will be erected at Market Street and Wabash Street. It will be a ten-story structure, and, according to the provisions under which bids were submitted, the building must be ready for occupancy by April 1, 1904. The building is to have a 163-ft. front in Illinois Street, and extend 70 ft. in Market Street and Wabash Street. On the north side will be sheds, waiting rooms and tracks running the entire length of the building and extending about 100 ft. The general plan of the tracks will be like that of the Union Station. A high iron fence will surround the inclosure. Entrance will be through a 15-ft. archway in Illinois Street. The cars will enter the station from Market Street and Ohio Street. The offices of the terminal company and the interurban companies will be in the building. The work of building the cross-town line and constructing the down-town loop and making various extensions of the street railway system, required by the city as a consideration for the terminal station franchise, will be taken up as soon as the building is begun.

INTRAMURAL ROAD FOR THE ST. LOUIS EXPOSITION

As recently noted in these columns, the management of the Louisiana Purchase Exposition has decided to build an intramural railway for transportation inside the fair grounds. This road will be put in operation as soon as possible, in order that it may carry visitors and others who may wish to make use of it before the opening of the exposition. It is expected to have it in operation this summer. The St. Louis Car Company has been given an order for ten 14-bench open cars mounted on St. Louis Car Company No. 47 trucks. The present tracks in the grounds, which have been laid for use during construction, will be utilized as far as possible.

DISTRIBUTION SYSTEM OF THE UNION RAILWAY COMPANY OF NEW YORK

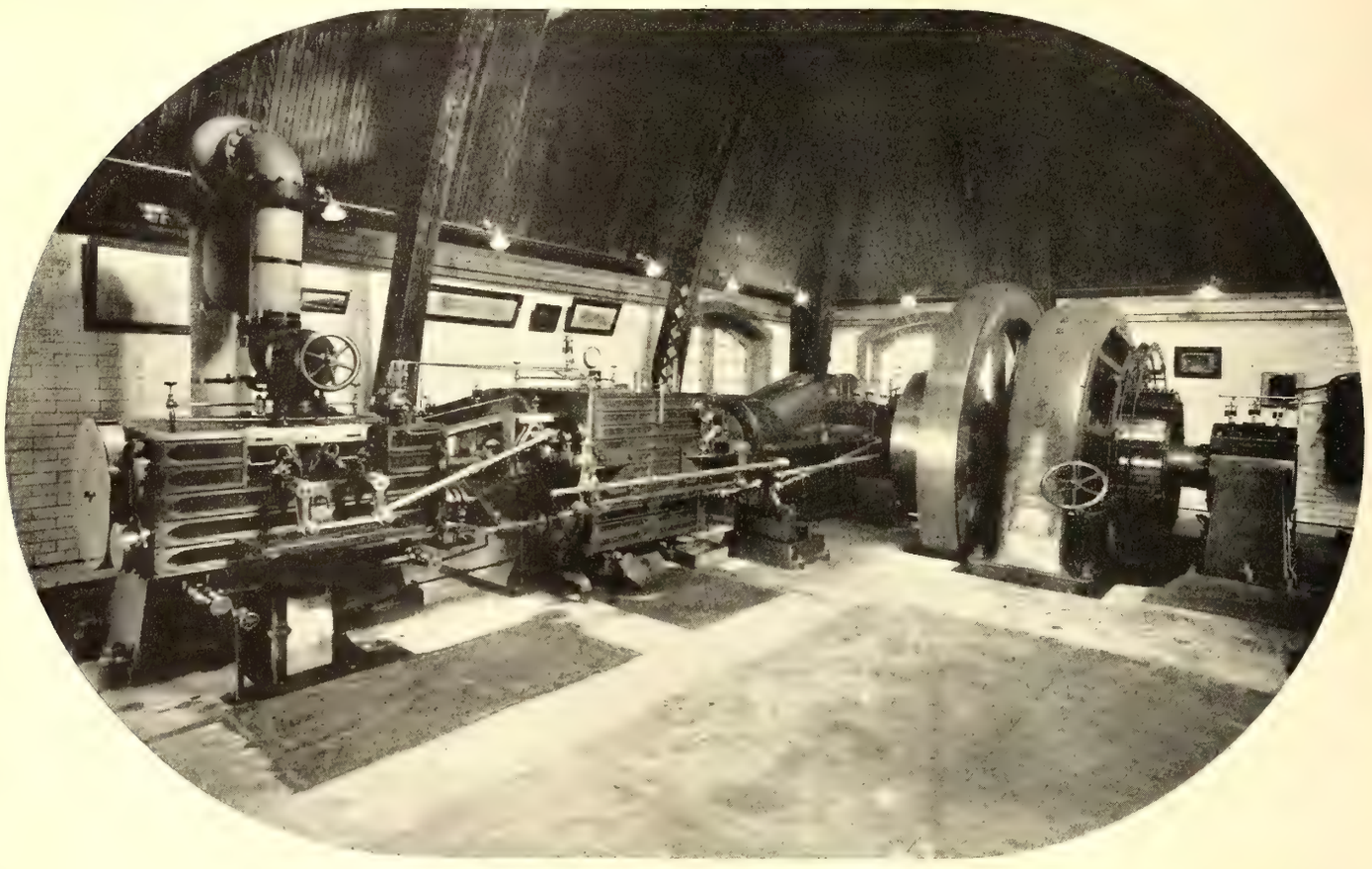
The Union Railway Company of New York City is building three new sub-stations in the vicinity of New York, one at West Farms, one at Mount Vernon and the other at Yonkers. They will be equipped with Westinghouse apparatus and will be supplied from the power station of the Interurban Street Railway Company, at Kingsbridge. The sub-station at West Farms will contain nine 375-kw oil-insulated static transformers, divided into three groups, supplying current to three 1000-kw rotary converters. The switchboard consists of high-tension alternating-current receiving panels with electrically-operated oil circuit breakers, low-tension alternating-current rotary panels and load panel, with direct-current rotary panels and load panel; also about twenty direct-current feeder panels. The other two sub-stations, now in course of construction, will have similar equipments, excepting that the capacity in each case will be three 500-kw units instead of three 1000-kw units.

RATE WAR IN INDIANA

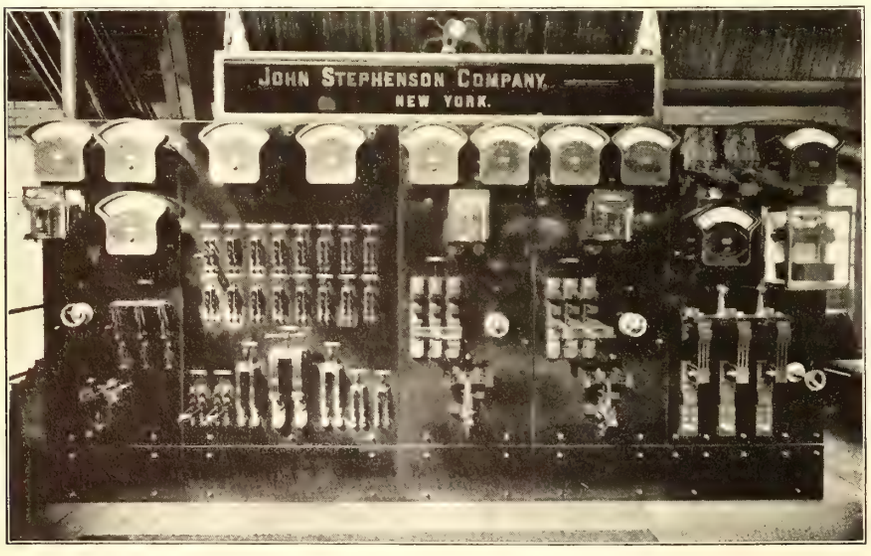
War has been declared by the Wabash Railroad Company against the Fort Wayne & Southwestern Traction Company and the Wabash & Logansport Traction Company. The Wabash agent in Logansport, Ind., has received instructions to make the fare between that city and and all points along the line to and including Fort Wayne the same as that charged by the interurban companies. This is the first rate war in Indiana between the railroads and interurban electric lines.

IMPROVEMENTS AT THE STEPHENSON WORKS

A number of improvements and additions to the equipment have lately been made at the car shops of the John Stephenson Company, at Elizabeth, N. J., including the installation of a 450-hp generating set and a large number of additional motors, aggregating upwards of 200 hp, and making the total capacity of the motors approximately 1100 hp. The company has also recently installed three portable motor-driven air compressors for the operation of pneumatic tools in the woodworking departments and machine shop, and a 5-in. forger operated by a 15-hp electric motor.



NEW UNIT IN STEPHENSON POWER PLANT



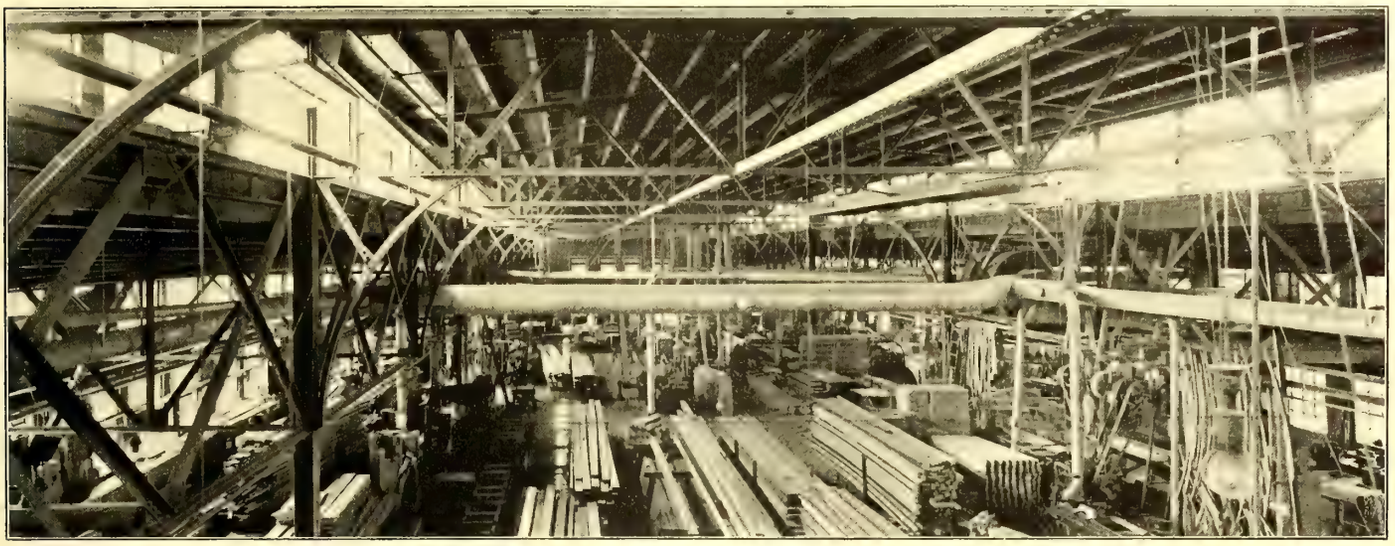
SWITCHBOARD FOR TROLLEY, POWER AND LIGHTING PLANT AT CAR SHOPS

POWER PLANT

When the original plant was installed in 1898 it was thought that ample provision had been made to anticipate the requirements for several years, but since then the business has extended so rapidly that the shop facilities in every department have long since been taxed to their utmost, and there is consequently a much larger demand for power than was originally provided. The initial power plant comprised two 150-kw General Electric direct-current generators, directly connected to two Harrisburg Ideal self-oiling engines rated at 240 hp each. The engines were designed for a working pressure of 125 lbs. to the square inch. The size of the cylinders is 16 ins., with 16-in. stroke, one right-hand and one left, the piston rods being fitted with metal packing. The speed of these units is 150 r. p. m., but they may be run up to 200. The engine shaft is a solid forging 7¼ ins. in diameter, extended on one side and supported by an out-board bearing for the armature of the generator. The fly-wheels are extra heavy for this type of engine.

The generating set which has just been installed by Edward H. Ludeman, of New York, comprises a horizontal engine, made by the Fitchburg Steam Engine Company, directly connected to a General Electric generator, and it practically doubles the capacity of the original equipment. The engine is of the horizontal slow-speed type, making 150 r. p. m. It has 20-in. and 34-in. cylinders with 28-in. stroke. The engine is rated at 450 hp when operating at 115-lb. steam pressure, non-condensing, but it can develop 600 hp. The generator armature and the fly-wheel are mounted on a steel shaft 15 ins. in diameter. The fly-wheel rim weighs 26,090 lbs. The bearings are 12 ins. in diameter and 24 ins. long, and are supplied with water-cooling chambers. The steam valves on both cylinders are double-ported, and are operated by the cam-valve motion. They respond quickly to the governor in opening and closing. The exhaust valves are driven by a separate eccentric, and the

inlet valves by the governor eccentric. The low-pressure piston is fitted with metal rings to provide against excessive wear. The main bearings are removable from the housings, and the cheek pieces may be adjusted readily. The generator, which is directly connected to this engine, is a General Electric direct-current machine, with a capacity of 1200 amps. at 250 volts.



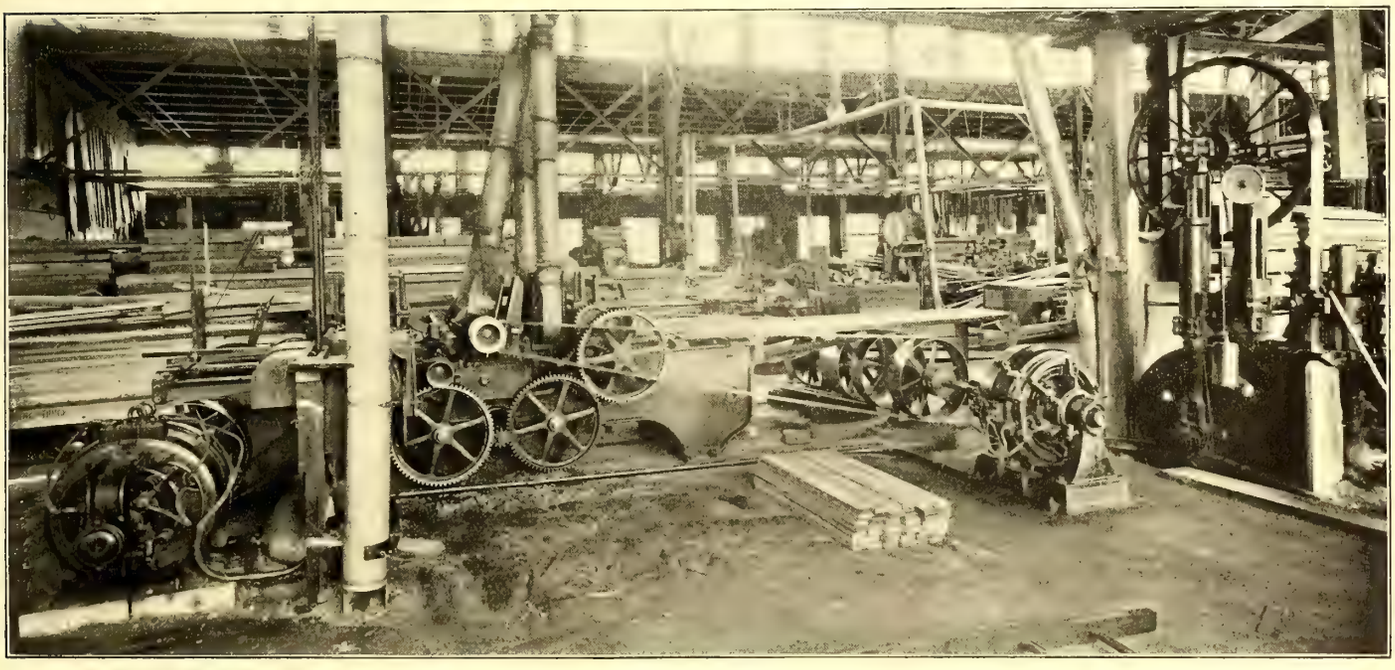
85-HP MOTOR DRIVING SHAVINGS EXHAUST SYSTEM IN MILL

This generating plant supplies current for operating the entire works, and it is located in the base of the 275-ft. clock tower, east of the main buildings, occupying a room 52 ft. sq. and 30 ft. high. In addition to the engines and generators already mentioned, this room contains a 25-kw General Electric motor-generator, which is utilized to operate the trolley line and furnish current for testing purposes, the main switchboard, the steam-driven air compressor and pump for furnishing the water supply, and an underwriters' pump for the system of fire protection. The floor is of cement, the sides of brick with Potsdam red sandstone trimmings, and the roof of curved rafters. The interior is finished in cream-colored glazed brick and the dome in oiled yellow pine. The appearance of the engine room may be gained from an inspection of the accompanying views, showing the new generating set and the switchboard.

DISTRIBUTION SYSTEM

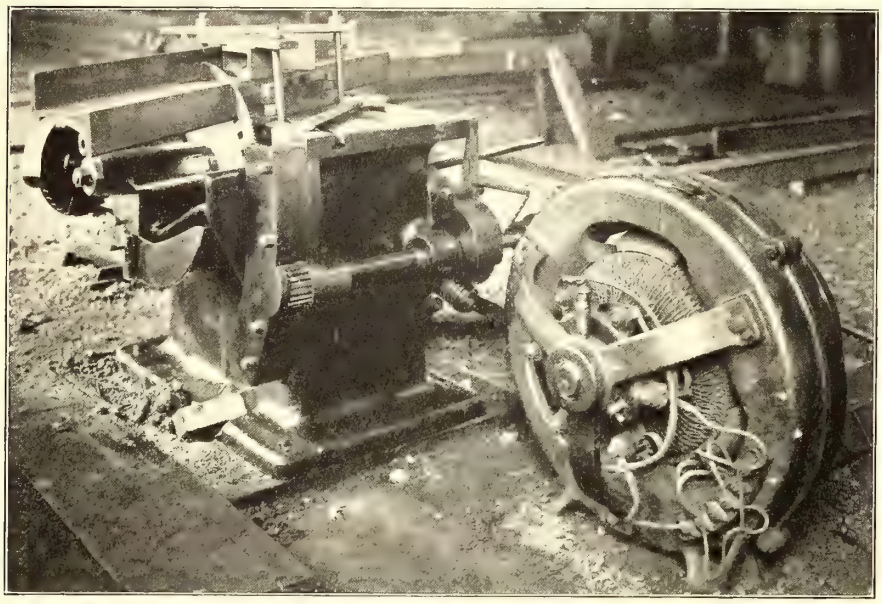
When the additional unit was installed a new panel was added to the switchboard, which is made on 1½-in. slate, enameled on the front side and carrying the power and lighting circuit switches, main switches, field switches, Weston illuminated dial ammeters and voltmeters and Thompson recording watt-meters, all mounted in an iron insulated frame. The bus-bars at the back of the board are ½ in. x 4 ins., and all exposed copper carrying current is thoroughly insulated. The board now comprises five panels, three for generators, one for the motor-generator and one feeder panel.

The mains from the switchboard are carried underground through a tunnel which connects all of the buildings, and is used also for carrying the service water-pipes, steam-pipes and hot-water heating pipes. There are no electric wires overhead in any part of the grounds, excepting the trolley wires for the electric railway and the transfer tables. The system of distribution provides for separate power and lighting circuits for each building, and the switches controlling these circuits are marked on the main switchboard. At the present time 107 motors, aggregating 1100 hp, are connected upon this system, and 3000 incandescent lights and thirty enclosed arc lamps are



MOTOR-DRIVEN PLANER IN MILL

also supplied with current. Throughout the works local distribution in each department is effected through panel boards carrying knife switches and enclosed in slate-lined iron boxes with hinged doors. All work is screwed or bolted into place,



MOTOR-DRIVEN COLD METAL SAW IN BLACKSMITH SHOP

and great care has been exercised to make the installation as nearly fireproof as possible.

AUXILIARY EQUIPMENT

An interesting feature of the system is the provision that has been made for supplying water for fire-fighting purposes and for consumption in all parts of the works. Two wells were driven near the engine room, one 250 ft. deep and the other 300 ft. An Ingersoll-Sargeant air compressor in the engine room supplies air at 80-lbs. pressure to a Pohle air-lift pump in each well, and thus forces the water to the surface and discharges it into an underground storage reservoir, alongside the engine and boiler houses, which has a capacity of 100,000 gals. The underwriters' pump, which is also installed in the engine room, has a capacity of 1000 gals. per minute, and is supplied from this reservoir, but there is also a connection with the city mains so that ample water supply is always assured when needed. This fire pump, which, according to the underwriters' regulations, must be kept constantly in motion, furnishes all the water necessary under ordinary conditions for the several departments.

MOTOR SERVICE

As has already been mentioned, the machinery throughout the works is operated by electric motors, and several interesting illustrations are herewith presented. In the original plan it was proposed that each machine should have its individual motor directly connected to it, but in practice it was frequently found much more desirable to group several machines and drive them by a motor through shafting. This was particularly the case in the woodworking department, where the largest number of motors was required. At the present time fifty motors are in daily operation in the mill and ten in the cabinet shop. These range in capacity from ½ hp up to 85 hp, the largest one being used for operating the shavings exhaust system which takes up and transmits to the boiler room the refuse from the wood mills. In the blacksmith shop and in the machine shop the original plan of furnishing separate motors for each machine was followed to a much larger extent than in the woodworking departments, although this practice was not adopted exclusively; in fact, a large number of the iron-working machines are now grouped together and belted to shafting, which is driven by one motor. In the paint shop, finishing shop, brass shop and buffing shop motors furnish power for operating whatever machinery is needed.

ELECTRICALLY OPERATED FORGER

One of the most interesting applications is found in the temporary structure which has just been erected as an addition to the blacksmith shop for the large forging machines shown in the accompanying cut, together with the two heating furnaces in which the iron is brought to the proper condition for working it. The heading, upsetting and forging machine was built by the Ajax Manufacturing Company, of Cleveland, and will be used largely in the production of forgings for trucks. This machine is capable of producing forgings of great variety in either square or round stock 5 ins. and under, and will operate on flat stock up to 15 ins. width, making bolts, upsets and special shapes. It has a lock and automatic stop between the pitman and header slide, arranged to give one or more blows as desired, and stop with dies wide apart. This is effected without the use of a clutch or similar device, so that the machine does its work



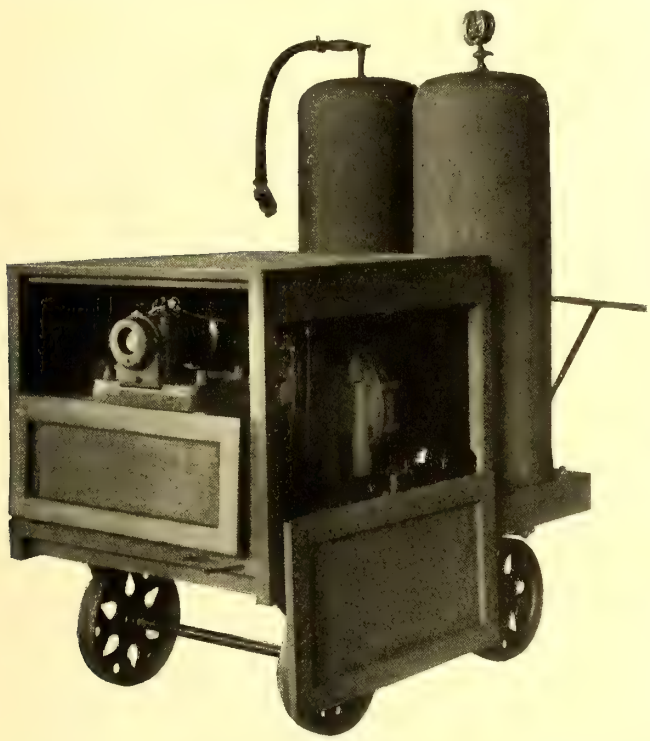
FORGER FOR LARGE WORK

without shock and is practically noiseless. The gripper slide is connected to and driven by the header slide, and each is provided with heavy liners to prevent wear on the bed casting and to provide means for realignment of the slides in case of wear. The crank shaft and the pinion shaft are of steel, and run in solid sleeve-boxes let into the bed casting, which is bored out to receive them. This construction is claimed to be possible only by the use of a single crank shaft. The machine is powerfully geared, the teeth being cut from the solid. The gear, pinion and fly-wheel are each firmly keyed to their respective shafts. The machine requires 15 ft. x 9 ft. floor space; the diameter of the belt wheel is 56 ins., and the speed of the

belt wheel is 175 r. p. m., the width of the belt is 8 ins., the ratio of gearing is 5 to 1, and the total weight of the machine 85,000 lbs. A 15-hp motor furnishes power for operation. This machine effects a considerable saving in time and labor, as it will turn out as much work in one day as twenty-five men. Moreover, it eliminates repetition in handling and heating the pieces, and as much of this work is very heavy the economy in time and labor is very great, while the saving in power is correspondingly large.

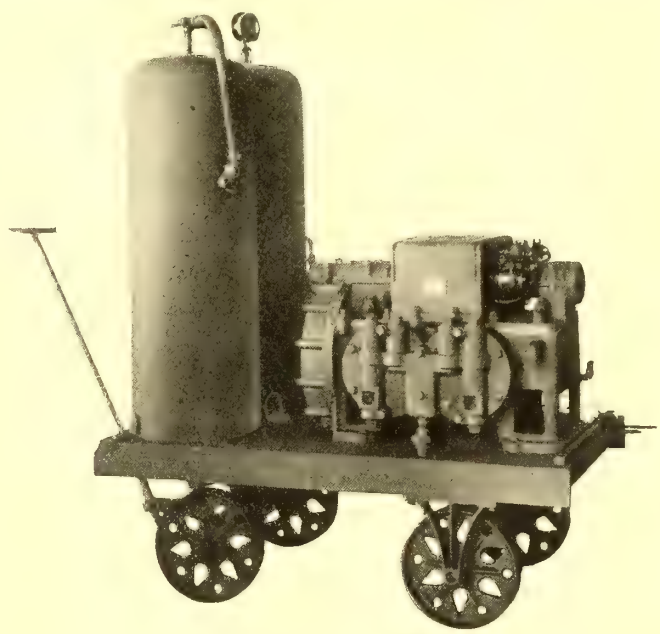
MOTOR-DRIVEN AIR COMPRESSORS

Another addition to the equipment that has greatly increased the capacity of the shops is the introduction of pneumatic tools, power for which is furnished by three portable air compressors of the Christensen type, driven by electric motors. One of these equipments was first installed in the mill, where a temporary connection for the motor driving the compressor had been made with the power circuit from which current is taken for the motors operating saws, planers and other woodworking machinery. These outfits are moved from point to point about the shops wherever compressed air is required. They have been found very convenient and economical, as they can be used for heavy work which could not be brought to the immediate vicinity of the main power plant, as in the example cited, where the mill is half a mile from the generating plant, and the cost of transmitting compressed air such a distance for this work would be prohibitive. Moreover, the multiplicity of compressor plants about an establishment of this size, should equipments be installed permanently in all departments where pneumatic tools could be used to advantage, would increase the cost of apparatus beyond all reasonable limit, especially as there would be only occasional demands for compressed air and the outfit would not be operating under advantageous conditions.



ENCLOSED MOTOR AND GOVERNOR ON AIR COMPRESSOR

The compressors are shown in detail in the two views of the machines themselves which are here presented. Each equipment consists of one Christensen type "H," size D-4, intermittent running compressor, having a piston displacement of 50 cu. ft. of free air per minute, one automatic governor, by means of which the compressor is stopped and started at maximum and minimum pressures respectively, two 16-in. x 45-in. seamless cold-drawn steel reservoirs with pet cocks, one pressure gage, one switch, one fuse and one length of ¾-in. air hose with stop cock and coupling head, all mounted, complete with necessary wiring and piping, on a four-wheeled truck. These may be provided with a cover for the electrical parts, as shown in one of the cuts, and fitted with doors, giving access to the governor and armature. Such an arrangement is particularly desirable in mills where dust and dirt are ever present. These illustrations also give a very good idea of the compactness of this apparatus, the dimensions of the outfit being: Length over all, 5 ft.; width, 3 ft., and height 5 ft. 5 ins.; net weight of complete equipment approximately 1625 lbs. These equipments have been found to be very economical in power consumption, as they are only in operation the actual length of time necessary to compress the amount of air required for the work in hand, and the fact that they are portable and can be taken from place to place in the shop, wherever work is being done, greatly reduces the cost of installation, as it eliminates the expense of long pipe lines and the loss in transmission. The machines shown in the illustrations are not water jacketed, as they are intended for intermittent running at the ratio of one hour in three, but Christensen compressors are also made in water jacketed patterns for portable use, for continuous operation. The compressor and governor and some of the other apparatus in these portable equipments are of the same general pattern as that used in connection with the Christensen air brakes on electric cars. The whole equipment has been designed for simplicity, durability, compactness, economy of operation and accessibility of parts for repairs.



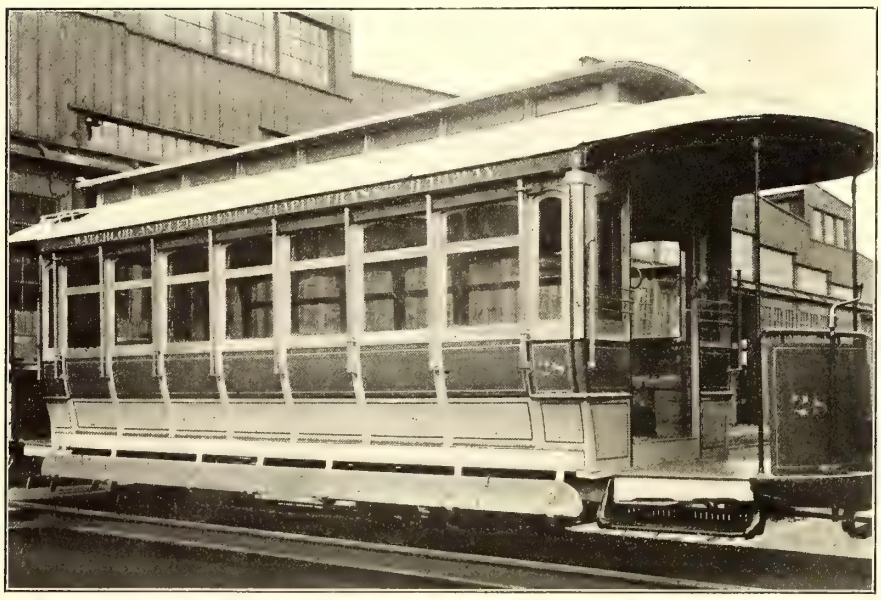
PORTABLE AIR COMPRESSOR

NEW DOWNTOWN SUB-STATION FOR ST. LOUIS TRANSIT COMPANY

Among other improvements to be put in before the World's Fair, the St. Louis Transit Company will place a new sub-station near the center of its downtown load at Eighteenth Street and Locust Street. This will be a rotary converter sub-station with extensive storage battery auxiliary. There will be seven or eight General Electric rotary converters of 1000-kw capacity each, with step-down transformers to reduce from 6600 volts, three-phase. Contracts have been let for Chloride storage batteries, to give 600 volts across their terminals, and be capable of discharging 5000 amps. for one hour. The batteries will be in the basement of the sub-station building, and the rotary converters and boosters on the first floor. The St. Louis Transit Company has ordered fifteen 1000-kw rotary converters for delivery before the opening of the World's Fair, several of which will go in sub-stations already established.

THE CONVERTIBLE CAR IN IOWA

The accompanying illustration shows the style of convertible car (Brill patent) recently built by the American Car Company, of St. Louis, for the Waterloo & Cedar Falls Rapid Transit Company. This railway system, as the name indicates, is an interurban road, but the company also operates the city lines of both Waterloo and Cedar Falls, and at the former the operation with the convertible is intended. The system is extensive, some 40 miles of lines being in operation, and 36 miles



CONVERTIBLE CAR FOR THE WATERLOO & CEDAR FALLS

of additional lines are in course of construction. The exceedingly fertile valley of the Cedar River, through which the lines run, is thickly dotted with towns and villages, with the two important railway centers from which the company takes its name. Within the last year or two this type of convertible car has come into considerable use in the States of the Middle West, in Illinois, Michigan, Indiana and others, seeming to indicate that the double-sheet steel panels, with their ⅝-in. air space between, are amply sufficient to keep the car warm in the severe wind storms of winter that are characteristic of the comparatively level land in that region.

The general dimensions are as follows: Length over end panels, 20 ft. 7 ins.; length over crown pieces, 25 ft. 1 in.; from panel over crown piece, 4 ft. 6 ins.; width over sills, 6 ft. 10 ins.; width over posts at belt, 7 ft. 9 ins; from center to center of posts, 2 ft. 7 ins.; sweep of posts, 5 ins.; side sills, 5¼ ins. x 6 ins.; end sills, 4¼ ins. x 6 ins. The side sills are plated on the outside with ⅝-in. x 6-in. steel. The side posts are 3⅜ ins. thick, and end posts, 3¾ ins. The interior is finished in white ash, with decorated birch ceilings, making a bright, attractive appearance. Six revolving double seats on each side and single seats at the corners afford a seating capacity of twenty-eight. The inside trim is of solid bronze. A guard rail slides behind the grab handles on either side, and is shown in raised position under the water board, held up by gravity catches. The Brill 21-E truck which is used has a wheel base of 7 ft. 6 ins. The wheels are 33 ins. diameter. Motors of 25-hp are used. Total weight of car body and truck is 13,000 lbs.

TRANSFERS IN NEW YORK

Acting upon the decision of Judge O'Gorman in the last transfer suit in New York, the Metropolitan Street Railway Company announced on June 27 that it would no longer refuse transfers between its cars at various corners or to the cars of the Third Avenue system. The new transfer regulations will go into effect Aug. 1, and will be practically universal.

ALTERNATING-CURRENT INSTRUMENTS

The electrical instruments herein described, which embody a number of interesting features, are manufactured by Elliott Brothers, of London, England, who are well known as makers of mathematical, electrical and optical instruments.

Fig. 1 illustrates a small alternating-current ammeter, switchboard type, provided with a separate series transformer,



FIG. 1.—ALTERNATING-CURRENT AMMETER

consisting of a straight bar for connection in the main circuit and a thoroughly insulated secondary winding connected to the instrument terminals. This method has the advantage of permitting the placing of the instrument at a little distance from the transformer, and the instrument is thus entirely insulated from the main circuit.

Fig. 2 shows a portable standard wattmeter with two transformers. There are two pairs of terminals on the indicating instrument, one pair of which is shown connected to the secondary winding of a small portable series transformer, the primary winding of which forms part of the main circuit. The other pair of terminals on the indicating instrument is con-

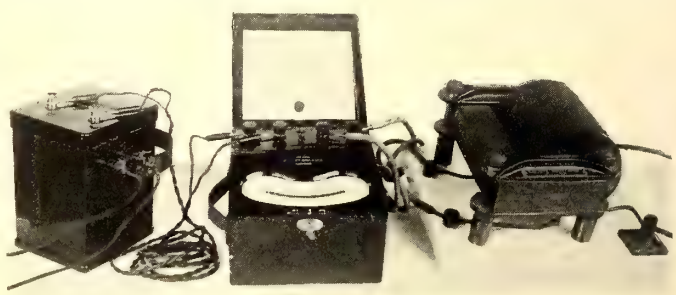


FIG. 2.—PORTABLE ALTERNATING-CURRENT WATTMETER

nected to the secondary terminals of a step-down transformer, whose high tension is connected across the high-tension mains. Under these conditions the instrument is entirely insulated from the main circuit. The design of the transformers having received special attention, the indications of the instrument are independent of errors due to change of frequency within wide limits, and to change of shape of curve due to variation of load with alternating-current generator.

It has been found with the type of transformers adopted that errors in wattmeter indications due to a change of the value of the power factor from 1 to 6 are, in all cases, less than 1½ per cent.

The step-down transformer method is employed in the case of wattmeters for use on circuits above 600 volts; for lower pressures resistances are used in circuit with the high-resistance coil in the instruments.

Fig. 3 illustrates a power factor indicator of the illuminated dial type. The indications of the instrument give the factor by which the volt-amperes should be multiplied to obtain the true watts.



FIG. 3.—POWER FACTOR INDICATOR.

The standard portable alternating-current ammeter, shown in Fig. 4, is provided with a separate series transformer having four ranges in one case. By this means one indicating instrument can serve to measure the following maximum currents, 5 amps., 25 amps., 100 amps. and 400 amps. This equipment can be used on a circuit of 5000 volts or 6000 volts, and it is stated that the portable instrument is perfectly safe to handle.

This firm has also designed a portable polyphase wattmeter for two-phase or three-phase circuits. By using suitable sets of transformers with this instrument it can be made to indicate directly the total output of a three-phase circuit even when the loads are not equally balanced between the phases.

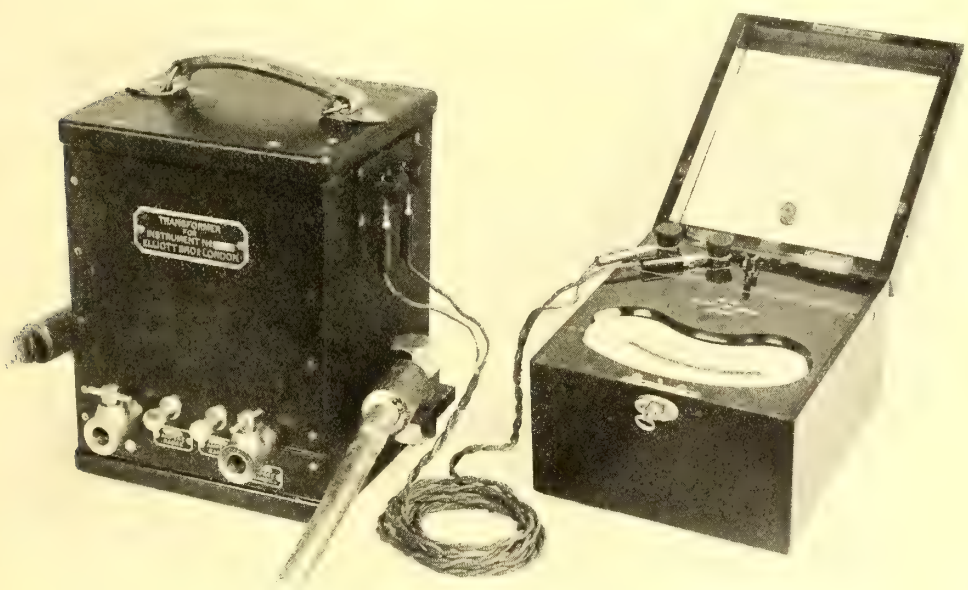
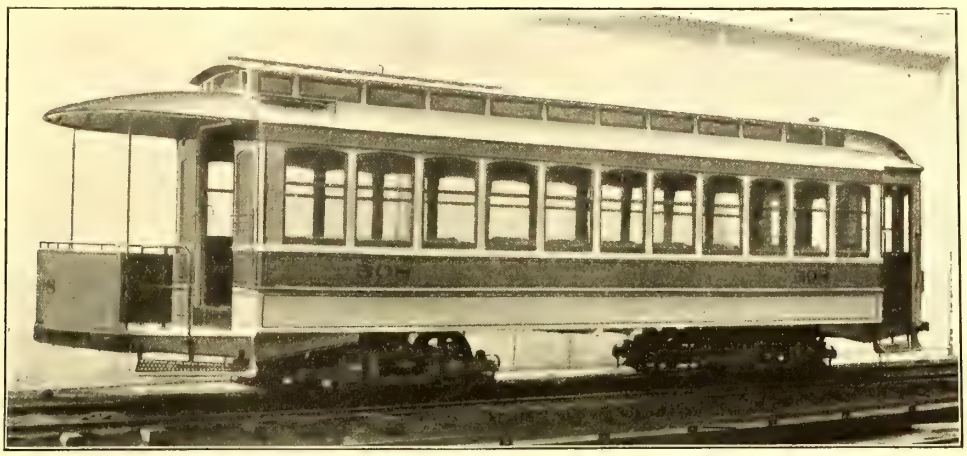


FIG. 4.—PORTABLE ALTERNATING-CURRENT AMMETER

The Stark, Ohio, Electric Railway Company has had all its motormen and conductors sworn in as special officers in Mahoning and Stark Counties. They will have authority not only on the company's property but will have power to pursue and capture any one who attempts to escape. Failure to suppress lawlessness renders the employee liable to a fine of from $5 to $25.

SEMI-CONVERTIBLE CARS FOR TOLDEO

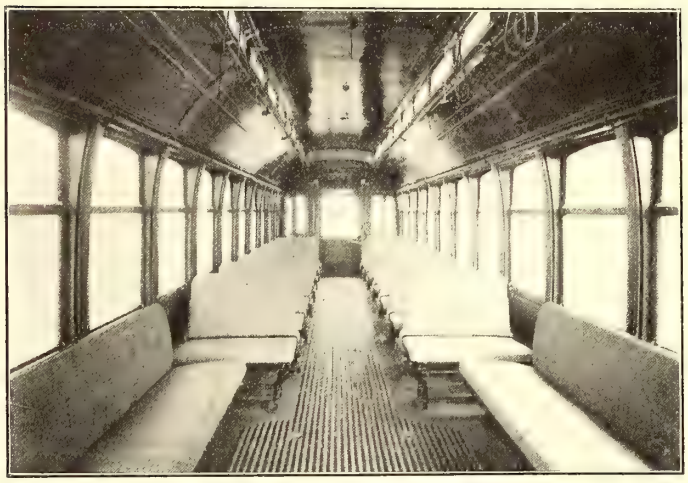
The Toledo Railways & Light Company has lately received ten Brill semi-convertible cars. Some interesting features are combined in these cars that experience has apparently approved in relation to the conditions found in Toledo. The cars run in one direction, and therefore the entrance is from one side. "Detroit" platforms are used at the rear for the purpose of loading and unloading from that end only, the pipe rail (shown in the illustration) divides the platform and keeps the entrance clear. The illustration of the interior of one of the cars shows the seating arrangement, with longitudinal seats at the rear, to prevent crowding at the door. Unfortunately, the cross-seats were made to face the rear when the photographs were taken, creating a wrong impression as to the direction which cars are to run; as has been said, the cars run only in one direction, and, therefore, the cross-seats will always face the forward end. The cross-seats are 34 ins. long, and the aisles 26 ins. wide. The wide aisles are obtained by having the seat-ends between the posts against the side lining, there being no wall window pockets to interfere. The width over the posts at belt is 8 ft. 2 ins. The front end of the car is vestibuled and has a folding door on the right side. The sheathing is of steel, extending from the vestibule post around to the corner post of the car. The deck at this end is of steam-car form, while at the other end the deck ends in the ordinary monitor style, in conformity with the open platform; from center to center of window posts is 2 ft. 8 ins.; thickness of side posts, 3¼ ins., and of corner posts, 3¾ ins. The window sashes slide into pockets in the side roofs when not in use. An unusually low window sill is allowed in this car because of the absence of wall window pockets. The interiors are finished handsomely in natural cherry. The seats are spring cane, and the seating capacity of each car is forty-four. The wide aisle and wide space near the rear door, together with the large platform, afford much larger amount of standing room than usual.



SEMI-CONVERTIBLE CAR, WITH DETROIT PLATFORM, FOR TOLEDO

Structurally the cars are very substantially built. Side sills, 4 x 7¾ ins., are plated on the inside with ⅜-in. x 12-in. steel. The end sills are 5½ ins. x 6⅞ ins. The platform timbers are plated with angle-iron and the ends are stiffened and protected by Brill patented angle-iron bumpers. Length of cars over end

panels is 30 ft. 8 ins.; length over vestibules, 41 ft. 4½ ins. From panel over crown piece at the rear, 6 ft.; from panel over

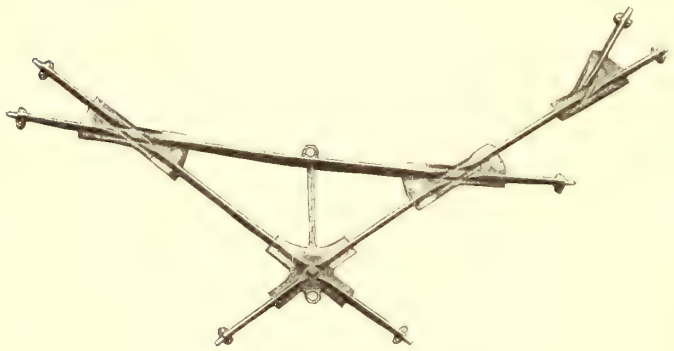


INTERIOR OF CONVERTIBLE CAR

crown piece at the front end, 4 ft. 8½ ins. Width over sills, 7 ft. 10½ ins., and over posts at belt, 8 ft. 2 ins. The trucks are Brill No. 27-F, with 33-in. wheels and 4-ft. wheel base. Four 50-hp motors are used per car.

SPECIAL OVERHEAD CROSSING

The Electric Tramway Company, of Birmingham, England, has from time to time designed and manufactured numerous special overhead fittings to suit the more onerous conditions of English Board of Trade requirements. In the construction of many of these appliances much ingenuity has been exhibited. The accompanying illustration shows a multiple-overhead crossing that this company has just made for the Nottingham Corporation. This crossing has been put up in the market



SPECIAL OVERHEAD FROG

place, where the traffic is very congested and the overhead wires cross in several directions. It was made in five sections, but when fitted together formed a solid cross-over, under which the trolley wheel ran very smoothly, with a barely perceptible "click." Other wires run parallel to the main lines of the crossing, there being altogether about thirty frogs and crossings at this spot.

PNEUMATIC REVOLVING CRANES

The extensive use of pneumatic revolving cranes by street railways has led the Garry Iron & Steel Company, of Cleveland, Ohio, to build cranes of this type to meet the wants of street railways. These cranes are made in two forms, called "B" and "C."

Form "B," which is shown in Fig. 1, has a capacity of 1000 lbs., 7-ft. reach, and 12-ft. 6-in. hook lift. The total height from the rail to the top of boom is 10 ft. 2 ins.

Form "C" cranes are similar to Form "B," but are designed for larger capacities, being made for 2000 lbs., 3000 lbs., 4000 lbs., 6000 lbs., 8000 lbs. and 10,000 lbs. capacity. The standard dimensions are as follows: Reach, 12 ft.; hook lift, 12 ft. 6 ins., and total height from rail to top of boom is 15 ft. 8 ins. A crane of this form is shown in Fig. 2.

Both of these forms are built mounted on a standard car, and arranged for standard gage. The gage may, however, be altered to meet special requirements, or cranes may be mounted on special hand trucks.

The cranes are usually equipped with a set of rail clamps,

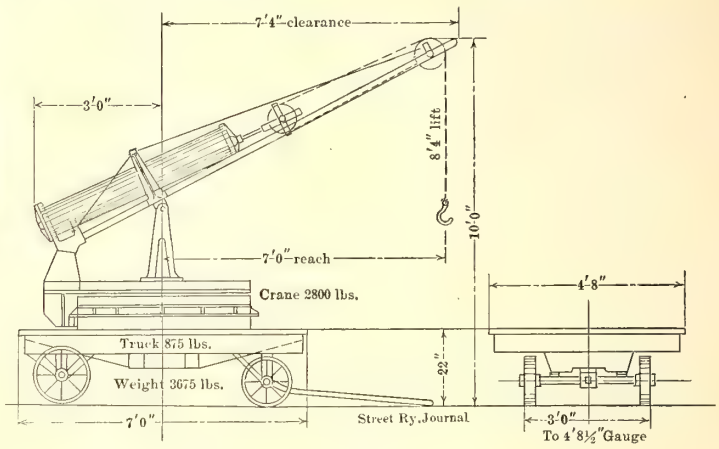


FIG. 1.—1000-LB. REVOLVING CRANE

which secure the car to the rail to prevent tipping when lifting the load; the machines in themselves are not heavy enough to prevent tipping without being anchored. In special cases cranes are furnished with counter balance on the turn-table, which obviates the use of the rail clamps.

The crane base is bolted directly to the car having a machined-ball race, containing 193 ground steel balls at its upper edge. The bottom of the base is machined to receive the cylinder, rack, guides, pivot and stop. The under side of the projecting ring is machined for rollers and brake; the brake bracket is equipped with rollers and air cylinder actuated by a foot valve, which is convenient to the operator and is attached to the turn-table. The hoisting cylinder is securely fastened

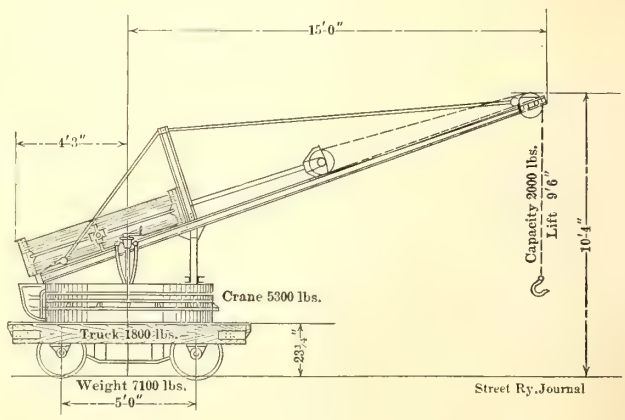


FIG. 2.—REVOLVING CRANE FOR HEAVY-DUTY

to the turn-table and the brake bracket, and is also supported on the top of turn-table by means of the vertical members of the boom proper, which are attached to the top of turn-table. The air for hoisting is applied to this cylinder. The brooms are made of heavy channels stiffened by top truss rods. The cables are usually made in two parts for 12-ft. 6-in. hook lift, which may be modified to suit the hook lift required. The air is so applied as to permit the operator to stand on the top of turn-table and handle crane for all movements without changing his position.

For traversing the car up and down the track either motor or hand traversing arrangement can be furnished.

Among recent orders for these cranes are the following: The New York Central Railroad, Lake Shore & Michigan Southern, Chicago, Burlington & Quincy, Standard Oil Company, American Car & Foundry Company, of Detroit, Mich.

The cranes described in this article are the Garry Iron & Steel Company's standard forms, but the company is prepared to build cranes to any specification. It also manufactures traveling cranes, electric cranes, hand cranes, roofing, siding and pneumatic painting machines, besides doing general machine and structural work.

BOOSTING EXTRAORDINARY

On the Creve Coeur Lake line of the St. Louis Transit Company last summer some voltage boosting was practiced which probably represents about the high-water mark for that work. On this line, with a load of 1400 amps., the voltage at the power station reached a maximum of 1700 volts. This was a line to a lake resort, on which the traffic was heavy only once a week. Since then the arrangement of feeders has been changed, so that such excessive boosting is not necessary. Last summer it was customary to operate this line with three railway generators in series, and to vary the voltage according to the load requirements by means of throttling the engines more or less as the load varied. A potential wire was run back from the point at which the boosted feeder tapped into the trolley line, so that the station attendants could keep the voltage on the distant trolley line as nearly 600 volts as possible at the point of feeding into the trolley line. No trouble was experienced with the insulation of the feeders, even though they were run at three times normal potential. The trolley line, which was fed through the boosted feeder, was not run as a separate section, but was connected in parallel with that portion of the line fed in the ordinary manner. This tended to prevent any dangerous rise of potential on the trolley wire itself. With the trolley wire, which was fed by the boosted feeder in parallel with the direct-fed trolley lines, the only effect of too high potential on the boosted feeder would be to open the circuit breakers on the generators supplying the boosted feeder.

LARGE SHIPMENT OF TIES

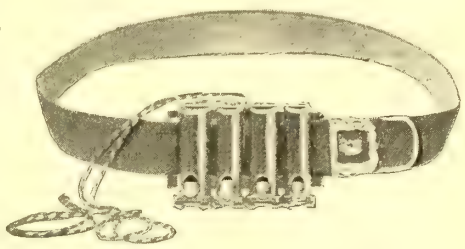
The interurban electric railway extension going on this year is evinced by the large demand for ties as well as for other material. A large part of the ties used in the Central West comes, as is well known, from Michigan, and the accompanying engraving shows a recent shipment made for one electric railway company from the tie yards of the Maltby Lumber Yards, of Bay City, Mich. This particular order represents eleven hours work, and there are a little over 5000 ties on these cars. The company also supplies cedar poles.



LARGE SHIPMENT OF TIES FROM MICHIGAN

RAPID READY-CHANGE CARRIER

Street railway conductors will be interested in the Rapid Ready-Change Carrier, illustrated herewith, by means of which change can be made quickly and correctly and as readily in the dark as in the light. This device, as illustrated, consists of four tubes attached to an adjustable belt, which is worn about the waist, either inside or outside the coat, according to weather conditions. These tubes have slots at the top for pennies, nickels, dimes and quarters respectively, which are released one at a time by the wearer of the carrier. By the manipulation of the finger and thumb the bottom coin is unlocked and readily removed. The tubes can be filled either at the top or bottom, but the coins can only be released at the bottom. They are particularly useful for street railway conductors who are often put to no little trouble and inconvenience in making change on a crowded car having many stops. Those having used them speak in the highest terms of them.



RAPID CHANGE CARRIER

Some of the advantages of this device are: (1) That it is more convenient than the coat pockets, and there is practically no wear and tear to the clothing. The saving in one coat alone will more than pay for the entire outfit. (2) The loss of money in making change under the old coat pocket method, by the sudden lurching of the car or from any other cause, is entirely obviated by the use of this device. A spring at the bottom locks and holds the money in tubes, and can only be manipulated by the wearer. (3) Fares can be more easily collected and change made much more quickly, especially in a crowded car, than under the present coat-pocket method. (4) The conductor always knows just what change he has and is thereby enabled to get rid of undesirable coins. (5) Change can be handled in cold weather with gloved hands, simply exposing the ends of forefinger and thumb. (6) They are very substantial and able to withstand the hardest usage. Being simple of construction they are not liable to get out of order. They can be worn either on a belt or hooked in the vest or coat pocket or the waistband of the trousers, and the weight being supported by the guard over the neck. The change carrier is manufactured by Charles F. Etter, of Harrisburg, Pa.

LONDON LETTER

(From Our Regular Correspondent.)

The two experimental trains which the Metropolitan District Railway put into service a few weeks ago, and which were described in a recent issue, are still continuing to give great satisfaction, and much valuable experience is being gained from them day by day which will enable the company to eliminate many possible slight difficulties when the specifications for the complete equipment are prepared. On the Ealing & Harrow line, where these trains are operated, stations 2500 feet apart are staked off, and the trains stop at them, remaining for twenty seconds, which is about the average period of a rest at all stations on the underground. The cars are running regularly 165 miles a day, and travel on a schedule of 15.7 miles per hour. Current readings are constantly taken, together with the acceleration, and full data is, therefore, arrived at for consideration of the cost of operation. The men are now being educated on this line, and it is hoped to commence a regular service of these trains for the public in a few days. In the meantime the work of laying the third rail in the underground tunnel has commenced, and about 500 men are working for a few hours every night when the present service of trains is stopped. It will, however, most probably be a year before electric trains are operated on the underground railway.

As stated recently in these columns, the city of Birmingham has determined on municipal tramways, having refused the offers which the British Electric Traction Company had made to the city. This was a setback at the time for the British Electric Traction Company, but Mr. Garcke has evidently no intention of resting, and is still drawing his line closer round the municipal boundaries. His most recent success in this way has been the purchase of the Aston District Council Tramways, Aston being practically a suburb or portion of Birmingham. The Birmingham officials are evidently much astonished and tremendously annoyed by this action on the part of the Aston Council, as they were already in communication with them with a view to their purchasing by the Birmingham Corporation.

The Town Council of the city of Wolverhampton has at last decided to refuse to accept from the Lorain Steel Company the surface contact system which they have been operating for the city for the past year. We have already referred to the report which was recently issued by Mr. Shawfield, and after about three or four days' discussion on this report by the Council they have voted by a large majority that the system has not come up to its requirements, not so far as operation was concerned, but as a financial proposition. A tremendous amount of argument has taken place, pro and con, but the fact that it was stated by those who had investigated the system that it would cost some thousands of pounds extra to operate the tramways compared with what it would cost had the tramway been on the ordinary overhead system, proved too much for the Town Council, and accordingly the decision above referred to was arrived at. The tramways committee has also decided upon carrying out a new policy, and has advised the Lorain Steel Company that it has not fulfilled the terms of its contract, and has requested the latter company either to remove the system or to proceed to arbitration. The tramways committee has also instructed Mr. Shawfield to prepare estimates and specifications for the equipment of the existing lines on the overhead system. Needless to say, the Lorain Company intends to proceed immediately to arbitration, and it has obtained Mr. Moulton, K. C., and Mr. Rufus Isaacs, K. C., to represent them. Naturally a curious state of affairs exists in Wolverhampton, as until the overhead system has been erected the Council will have to depend upon the surface contact system, which is now in operation, and the Lorain Company is so incensed by what it claims to be such unfair treatment by the Corporation that the company has refused to assist the Corporation in any way, and has withdrawn all repair parts and spare parts from the Corporation premises. A bitter fight may, therefore, be expected.

The Glasgow Corporation tramways have issued their traffic return for the year ending May 31. The mileage of line open for traffic (double track) now is 65, compared with 52 last year, the car miles run 14,608,750, last year 12,615,021; passengers carried, 177,179,549; last year, 163,678,190, and the receipts £653,199 18s. 2d., as against £612,826 2s. 4d. last year.

The London County Council has issued an analysis of the accounts for the past year of the local authorities and other companies undertaking the electricity supply of the metropolitan area. This return applies to thirteen borough Councils and fifteen companies now actually supplying electric current. The borough Councils return a supply of 16,736,056 units, and the companies a total of 62,736,054 units. For this the total revenue receipts were respectively £259,307 and £1,234,661, and the total expenditure is returned at £173,442 and £678,905, thus leaving a respective excess of revenue of £85,865 and £555,756. Allowing for interest paid on loans and repayment of loans, five of the borough Councils find a decreased balance of £13,075 and six a net increase of £5,951, while of the companies ten had an increased balance of £17,530 and five a decreased balance of £9,467.

A contract has been signed between the directors of the Wirrall Railway Company and the British Westinghouse Company for the electrification of the railway on the same system as that now successfully working on the Mersey Tunnel Railway. The Wirral Railway is about 15 miles in length, and connects Liverpool by means of the Mersey Railway with the residential district of the Wirral peninsula in Cheshire, West Kirby and New Brighton being the terminal points.

The London County Council has already decided to electrify the tramways in North London at present leased to the North Metropolitan Company. In a report the highways committee recommend that the Council do the work itself in accordance with its general policy—of arranging wherever possible for the use of an underground system of electrical traction on the tramways in the more central parts of London; reserving the use of the overhead trolley system of traction for the more outlying districts. The length of line for which it is suggested that the conduit system should be installed is about 26 miles, and includes all the tramway routes in the more central districts; while the length of tramways upon which it is proposed that the overhead system should be installed, and the use of which on those routes is not likely to cause inconvenience, is about 28 miles. In summary, it may be said that all the tramways "inside" the Angel, Highbury Railway Station, King's Cross (on the Northwest), Cambridge Road, Ampthill Square and Stamford Hill will be on the underground system, as will a number of the new lines already authorized. The consent of the borough Councils concerned will be necessary to the adoption of this scheme of electrification.

Some time ago Mr. James More, Jr., M. Inst. C. E., F. R. S. E., was appointed by the Leith Corporation to report to them upon the value of the present tramway undertaking, and to submit a proposal and estimate for converting the lines for overhead electric traction, along with a report as to the probable financial results. At a recent meeting of the tramways committee of the Leith Town Council this report was read and amplified by Mr. More verbally, with the result that the matter was remitted to a subcommittee to confer with the directors of the Edinburgh Street Tramways Company, with a view to the purchase of the Leith lines (at present operated by the company), and the reconstruction for the trolley system. At a subsequent meeting it was agreed to petition the corporation and the company that the system should be sold for £60,000. It is to be hoped that later, when the Leith trmaways are electrically equipped, some arrangement may be made with the Edinburgh tramways so that through cars may be run. At the present moment the muddle at Pibrig, where all passengers have to change, is a reproach to both cities.

A. C. S.

PRECAUTIONS ON JERSEY TROLLEY LINES

The new management of the Jersey trolley lines, operated by the Public Service Corporation of Newark, is exercising every precaution to make the service not only prompt and reliable, but safe in every way. Passengers on the trolley route between Jersey City and Newark last week had to walk across the draw of the Hackensack Plank Road bridge. President Thomas McCarter, of the Public Service Corporation, refused to run cars over the draw until its engineers declare the old structure safe. The cars were stopped on either side of the draw and thousands walked across.

Engineers of the Public Service Corporation made an examination of the draw on Monday and came to the conclusion that it was unsafe for traffic. Portions of the trusses and stringers have been patched and repatched with cleats and planks nailed or bolted upon the original timbers. President McCarter said that arrangements had been made for a thorough examination of the bridge and that the Public Service Corporation stood ready to pay its share of the cost of reconstruction.

General Manager Wheatley, of the Public Service Corporation, condemned as unsafe the vehicle elevator running between Hoboken and Jersey City Heights, and ordered it to be discontinued. Mr. Wheatley said that work on a new elevator would be begun at once, and that it would probably be completed in less than a month.

As indicated in these orders the new management is making a thorough examination of the property with the view of introducing a number of improvements in the equipment and operation of the system.

MEETING OF THE INSTITUTION OF CIVIL ENGINEERS

A meeting of the British Institution of Civil Engineers was held at London, June 16 to 19, and at the meeting several papers of electric railway interest were presented. In the railway section a short paper was read by S. B. Cottrell, of the Liverpool Elevated Railway, on "The Relative Advantages of Overhead, Deep-Level, and Shallow-Subway Lines, for the Accommodation of Urban Railway Traffic." The Liverpool road is the only elevated railway in England, and the first to be operated by electricity. Mr. Cottrell believes that this type of road solves the problem of urban communication along a line of docks, but that, owing to its unsightly character, roads such as are in operation in New York, Boston and Chicago would not be allowed along important public streets in British cities. Deep-level railways have the advantage that they can be constructed without interfering with sewers, gas pipes, etc., and in the author's opinion the tubes for such lines should not be less than 13 ft. 6 ins. in diameter. The time for ascending or descending in elevators requires from one minute to two minutes. The subject of ventilation has not yet been satisfactorily settled. The especial advantage of shallow railways is that persons can reach the trains without using elevators, and that they are self-ventilating. He, therefore, advocates for urban traffic (1) elevated railways, if they can be constructed in back streets where compensation would be immaterial, and their unsightly appearance would not be objectionable; (2), shallow subways, where they can be constructed, and the cost is not prohibitive; (3) deep-level railways. In all cases electric traction is preferable to any other.

Lieutenant-Colonel H. A. Yorke also read a paper in the railway section on "The Organization and Administration of an American Railway." He pointed out that the president exercises much more power in the management of an American road than does the chairman of the board of directors of an English road, and cited a number of cases in which the president is also an engineer. The president is assisted by a number of vice-presidents, each of whom supervises one of the departments into which the administration is divided, and which usually are the legal department, treasurer's department, traffic department and operating department. The division between the two latter is that the traffic department has charge of the rates, interchange of business with other railways and the commercial relations with the public; the operating department, the construction and maintenance of the road, its equipment, stations, personnel and discipline of the service. In England these two departments are usually united, but Colonel Yorke believes the American plan better. The operating department, which is in charge of the general manager, is usually sub-divided into the road department, the machinery department, and the transportation department. The first is in charge of the chief engineer, the second under the superintendent of motive power, and the third under the general superintendent, all of whom report to the general manager. Roads exceeding 300 miles in length are generally divided into divisions, which do not usually cover more than 100 miles, each in charge of a division superintendent, who has a trainmster, a master mechanic and a division engineer or road-master.

In the section devoted to shipbuilding, Professor Rateau, of Paris, read a short paper on "Steam Turbines." He referred to the advance made in the art during the last ten years, due especially to the endeavors of Messrs. Parsons and De Laval, although in the history of turbines the services of the French engineer, Tournaire, should not be forgotten. He pointed out that the turbine can be more exactly designed than the piston engine, as the latter has losses at admission and exhaust ports and from cylinder condensation, and that with turbines the expansion of the elastic fluid can be pushed to its extreme limit much more conveniently than in the case of piston engines. Professor Rateau believes that for low-pressures, turbines are more advantageous than reciprocating engines, while they generally use more steam than the latter when the pressure of the exhaust is that of the atmosphere or higher. He divides steam turbines into "action" and "reaction" turbines. He classes the Parsons among the latter, as the steam acts on the blades at once by its pressure and its velocity. In this type of turbine there is a difference of pressure on the two faces of the wheel, causing a longitudinal thrust, and making it necessary also to reduce to a minimum the clearance between the movable wheels and the walls to prevent leakage. It is also indispensable that the distribution of the steam should be effected over the whole circumference of the movable wheel in order to avoid movements of pulsation very prejudicial to efficiency. In the action turbine, the steam only acts on the movable wheels by its velocity, and each wheel revolves in a casing, in which the pressure is uniform. It is, therefore, possible to provide sensible clearance between the moving and fixed parts, and consequently to disregard the wear of the shaft bearing. It is further possible to project the steam on to one point only of the circumference. The prototype of the simple-action turbine is that of De Leval. The author, however, has constructed on the same principle a multiple-action turbine, composed of a number of wheels, which run with very little loss from friction or other leakage, and are capable of direct connection to commercial dynamos.

There were two papers in the section devoted to "Application of Electricity." One of "High-Speed Electric Traction on Railways," by Mr. Jacomb-Hood; the other on "The Position and Protection of the Third Rail on Electric Railways," by W. E. Langdon. Mr. Jacomb-Hood gives simply a brief review of the important problems to be overcome. Mr. Langdon recommends the employment of a fourth rail between the two wheel rails, as insulated, or, at all events, an independent rail return, a plan followed in the Mersey tunnel, the Metropolitan District, the Metropolitan and other British lines, and a protected third rail, also that the support of the latter should be independent of the track ties. He adds a list of third-rail roads, to which the editors of this paper have made some additions:

Name of Railway	From Top of Positive Rail to Top of Track Rail, Inches	From Track Gage-Line to Center of Positive Rail, Inches
Main-Line Railways, Electric and Steam Service		
Baltimore & Ohio Railroad (old location)	1¾	24
Baltimore & Ohio Railroad (new location)	3½	30
New York, New Haven & Hartford Railroad	1½	Center.
Paris-Orleans Railway, France	7⅞	25⅝
Milan-Gallarate, Italy	7½	26⅝
Mersey Railway, Liverpool	4½	22
North-Eastern Railway, Newcastle	...	19¼
Paris-Versailles Railway, France	7⅞	25⅝
Fayet-Chamonix Railway, France	9	23
Wannseebahn, Berlin	12⅝	33½
Interurban Railways, Electric Service only		
Albany & Hudson Railroad, New York	6	27
Aurora, Elgin & Chicago, Illinois	6 5-16	20⅛
Lackawanna & Wyoming Valley, Pennsylvania	6	20⅜
Grand Rapids, Grand Haven & Muskegon, Michigan.	5¾	20⅜
Seattle-Tacoma Electric Railway, Washington	7½	20
Elevated and Underground Electric Railways		
Metropolitan West Side Elevated, Chicago	6¼	20⅛
Lake Street Elevated, Chicago	6½	20⅛
South Side Elevated Railway, Chicago	6¾	20⅛
Northwestern Elevated Railway, Chicago	6½	20⅛
Brooklyn Elevated Railway	6	22¼
Kings County Elevated Railway, Brooklyn	5¼	19½
Boston Elevated Railway Company	6	20⅜
Manhattan Railway, New York	7½	20¾
Central London Railway, London	1½	Center.
Liverpool Overhead Railway	1½	Center.
Berlin Elevated, elevated portion	7	....
Berlin Elevated, underground portion	9	....

WATER WHEELS FOR THE PUYALLUP RIVER

The Pelton Water Wheel Company has been awarded a contract for four impulse and reaction wheel units, and two exciter wheels, with accessories, to be installed in the Puyallup River, Washington, power plant, now under construction by Stone and Webster interests. Each of the four large wheels is to drive a 3500-kw General Electric alternator, for furnishing power to Seattle, Tacoma and the neighboring districts, as well as the Puget Sound Electric Railway, formerly known as the Seattle-Tacoma Interurban Railway, and described in the issue of May 2, 1903.

The wheels are of the disc type of cast steel, approximately 10 ft. in diameter on the centres of the buckets, and are to run at 225 r. p. m. The exciter wheels are of rated capacity. Each drive a 150-kw exciter, and will be run at from 600 r. p. m. to 800 r. p. m. The ultimate capacity of each main wheel is 7500 hp. Each wheel unit is to be composed of two wheels, and the governors are to be the Lombard type "L," hydraulic mechanism, with electric control. There are to be two nozzles for each unit, consisting of a combination needle and deflecting nozzle, arranged with 24-in. inlets and heavy ball joints of cast steel. Either one or both nozzles may be operated by hand, and they are counterbalanced to reduce the inertia of the moving parts.

The effective head of water is 850 ft. minimum.

Sunday, June 28, was the greatest day in the history of the Brooklyn Rapid Transit Company, so far as the passenger traffic was concerned. Every car that could possibly be used was put in commission, and it is estimated that over 1,500,000 passengers were carried, 250,000 more than on the best day hitherto.

LAKE STREET ELEVATED DISSENSIONS

Stockholders in the Lake Street Elevated Railroad Company, of Chicago, met in Chicago June 22, and appointed a protective committee. Over fifty stockholders were in attendance. The sense of the meeting was expressed in the following resolutions:

Whereas, It has been reported from time to time that the securities committee of the Lake Street Elevated Railroad Company, in the plan to be submitted by them, will provide for an assessment of $10 per share against the stock of said company, and,

Whereas, It has also been reported from time to time that for the purpose of freezing out the stockholders in case said stockholders should not accept said plan and pay said assessment, default would be made in the payment of the interest on the first mortgage bonds, and that said bonds have been acquired by interests allied with the Northwestern Elevated Railroad Company for the purpose of foreclosing the mortgage securing the said bonds, and thus wiping out all of the stock of said road, and,

Whereas, The stockholders have been unable to acquire any accurate information as to the intentions of the management of said road, and as to whether said management would protect the interests of the stockholders of this road in the event of said attempted foreclosure against the aggressions of the interests controlling the Northwestern Elevated Railroad. Therefore, be it

Resolved, That the owners of stock in said Lake Street Elevated Railroad Company assembled in this meeting hereby appoint Charles T. Gray, James Bolton, E. A. Dicker, W. H. Colvin and R. H. Donnelly as a protective committee to take such action to protect the stockholders as in their judgment may be necessary, and to call a meeting of the owners of stock of said company at any time to take action on any plan that may be submitted; and, be it further

Resolved, That each person present at this meeting will make an effort to ascertain and learn the names of other owners of stock and furnish the names of such owners to the said committee to the end that the owners of the stock of said company, by uniting together, may be prepared to protect their interests as it may become necessary.

A PECULIAR DAMAGE CLAIM AT KANSAS CITY

A most remarkable suit for damages was recently brought against the Metropolitan Street Railway Company, in Kansas City, and results of the tests made by the company in connection with this may be of value should similar claims ever arise elsewhere. A woman brought suit against the company, claiming that immediately after alighting from a car, at a certain corner, a bolt of lightning, or flash from "the overcharged trolley wire" struck her, and that she fell unconscious in the street, where she lay for some time before being discovered. Of course the claim was preposterous on the face of it to any electrical man, but the company began to investigate to learn if there could be any possible cause for an optical illusion, which would give a basis for such claims. It was found upon investigating the corner at which the accident happened that there was an electric light wire hanging a short distance above the trolley wire, and that by raising the trolley wire the electric light wire could be brought into temporary contact with the trolley wire and that a flash would result, such as would occur from a partial short circuit. This flash would cause a small amount of burning metal to drop away from the point of contact. But this metal never reached the ground in a molten state, in fact would be entirely burned in the air so as to leave no trace at the point where it apparently was falling. In order to investigate the possibilities of injury from sparks from a cause of this kind, an apparatus was rigged up in the power house, whereby a cross could be produced between two lines with several hundred amperes flowing. A white sheet was spread under the point where the flash occurred to catch the red-hot sparks. It was found impossible, however, to discover any traces of these sparks, as whatever metal was set free by the short circuit was immediately consumed before it struck the sheet. Assistant General Manager Satterlee then stood directly under the short circuit and tried repeatedly to catch enough sparks on his coat to burn it, but they proved to be too minute, either to be felt or to burn the coat. Of course it is conceivable that enough molten metal might be caused by a short circuit so that a drop would fall several feet, but this experiment demonstrated that it would take a very heavy short circuit indeed, and one long continued, to melt enough metal so that this metal would not be entirely oxidized or burned in the air before falling any distance.

SIGHT-SEEING SERVICE IN SEATTLE, WASH.

The Seattle Electric Company proposes instituting a sight-seeing car service on its city lines this summer. A lecturer will accompany each car and point out to tourists the principal points of interest, historical and otherwise. Los Angeles is the only city on the Coast that has as yet this feature added to its street car service, but it is very popular in Eastern cities.

SENSATIONALISM IN BOSTON

Several of the Boston daily papers jumped out of the traces last week in a wild race to print the sensational details of a comparatively slight accident which occurred in the East Boston tunnel on the night of June 19. With the memories of the terrible explosion in the old Tremont Street subway still in the public mind, considerable credence was given to the livid accounts printed in some of the morning journals, although later investigation showed that not only were the early reports grossly exaggerated, but many of them were entirely false.

The accident was caused, according to best belief, by the compressed air in the section extending westward from Atlantic Avenue under State Street, which escaped through a seam of sand in one of the drifts with force enough to cause a cave-in of a portion of the street. One laborer was killed, another severely injured, and several others bruised.

Borings taken in the immediate vicinity of the cave-in preparatory to the work gave no indications of the existence of a fissure in the clay at that particular point, the excavation of the large Atlantic Avenue shaft strengthened the supposition that the ground was solid, and every precaution had been taken to provide against such accidents by bracing the adjacent buildings, and constructing enormous bulkheads to save Atlantic Avenue and the elevated railway structure from danger. The accident will only delay the work of connecting the tunnel with the Atlantic Avenue station by about ten days; neither water nor gas service was injured in the slightest degree, and the trains of the Boston Elevated Railway Company ran regularly by State Street, simply reducing their speed to about 3 miles per hour as a precaution.

Barring the regretable loss of one life and the injuries sustained by another the accident was one of small consequence, and as far as can be seen, unavoidable. In almost every great piece of engineering work accidents are certain to accompany the construction period from the very temporary nature of the things which are being utilized and built, and a casualty list of some sort seems inseparable from the creation of the great fabrics of civilization. In the vast majority of cases there is little or no reason for the display of literary fireworks by either the lay press or the public, and the judgment of sane and reasonable minds in this unfortunate, but comparatively slight, Boston accident attaches no blame to the officials in charge of the tunnel construction, because there is every reason to believe that human foresight and skill had done its best to avoid injury to either human life or the property adjacent to the rapid transit route.

MASSACHUSETTS ELECTRIC COMPANIES

The order of the Railroad Commissioners fixing the price of $120 for $2,000,000 Boston & Northern stock, and $105 for $1,009,500 of Old Colony stock, has been accepted by the Massachusetts Electric Companies. The latter company owns nearly all the stock of the other companies.

The Boston & Northern and Old Colony companies have cancelled their notes with the proceeds of the new stock issue, except notes amounting to less than $1,000,000, which are held by savings banks on a year's time.

The above issue gives the Massachusetts Electric Companies 167,000 shares of underlying stock for its treasury, dividends upon which are to provide the necessary funds to pay all charges and 4 per cent upon the $17,432,400 of outstanding preferred stock.

The gross earnings of the sub-companies are showing an average weekly increase from 7 to 10 per cent over last year.

Since the organization of the Massachusetts Electric Companies in 1899 between $9,000,000 and $10,000,000 has been spent in improvements.

PROGRESS ON THE EAST BOSTON TUNNEL

The Boston Transit Commission will soon call for bids on the Scollay Square section of the East Boston tunnel. This is the last large contract on the work east of the subway.

Through a larger part of the course of the tunnel the material encountered has been solid and compact, the harbor section coming wholly within the blue clay stratum. A small sand pocket, presenting difficulties, was encountered immediately under Atlantic Avenue, where the East Boston section was connected with the State Street end of the tunnel. As the side drifts approached the bulkhead at the foot of State Street it was found that the ground would not hold the high air pressure of 22 lbs. per square inch used in driving the work under water. It was found possible to use a pressure of 12 lbs. per square inch by placing a temporary lining of cement on the sandy walls and roof, filling each crack and completely sealing the whole pocket.

RAPID TRANSIT IN BROOKLYN RELIEF FOR BRIDGE CRUSH

It is announced that the Brooklyn Rapid Transit Company intends to make the extensions proposed by Chief Engineer William Barclay Parsons, of the Rapid Transit Commission, for the improvement of transit facilities in Brooklyn. The estimated cost of this work is $20,000,000, all of which will be paid for by the railroad company. The plans provide for the connection of the Brooklyn and Williamsburg Bridge by means of a subway in Manhattan, and for extensions of the surface and elevated lines in Brooklyn. They also provide for the removal of the elevated trains from the present bridge to give more room for the passage of trolley cars and trucks. The subway connecting the Williamsburg Bridge with the Brooklyn Bridge will carry the elevated trains running across the Williamsburg structure. Should the Maiden Lane-East River tunel be built the subway will be extended to connect therewith. When the elevated trains are removed from the bridge structure the trolley tracks can then be moved into the space now occupied by them. Engineer Parsons' plans also call for the placing of a third track on all the Brooklyn elevated lines, the construction of lines extending from the Franklin Avenue station of the Fulton Street line to the Blackwell's Island Bridge and the Williamsburg Bridge, and other minor extensions. Mr. Parsons' plan was given in detail in the STREET RAILWAY JOURNAL of March 21, 1903.

The announcement has also been made that differences between the parties at interest in the improvement of the surface car terminus facilities at the Manhattan end of the Brooklyn Bridge have been amicably adjusted, and work on the plans approved many months ago will be resumed at once. Contracts for the materials necessary to carry out the plans were completed soon after the order for the additional loops was given by the Bridge Commissioner, and most of the material is now ready. Some of the shoring necessitated by the proposed elimination of a part of the mezzanaine floor has already been done. The four new loops are to be built inside the present loops or further away from Park Row than those now in use. In order that they may be of the required size the roadways on either side of the bridge, near the Manhattan terminal, will have to be widened. The present galleries also will have to be cut away in part, and a new gallery built. Some of the present stairway also will be affected and a new stairway will have to be erected. Much of the interior work of the Manhattan station, in fact, will have to be reconstructed.

The four new loops, it is believed, will materially relieve the congestion at the Manhattan terminal during the evening rush hours and will enable the company to operate more cars at more frequent intervals, the present loops being insufficient to accommodate the great number of cars crossing the bridge when traffic is at its height. The carrying out of this plan also will effectually settle the proposition of Neils Poulson, president of the Hecla Iron Works, to build an overhead loop at the Park Row end of the bridge.

TRAMWAY ATHLETICS IN ENGLAND

About twelve months ago the employees of the Liverpool Corporation Tramways formed an organization named the Tramways Social, Athletic and Thrift Society, which now has a membership of about 1500. The tramways committee has assisted this society by providing a clubroom at each of the depots, where the daily newspapers are furnished and games played. Glee, entertaining and musical parties have been formed in the entertainments section; swimming, cricket, lacrosse and football clubs in the athletic section; while in the thrift section special terms have been arranged for the supply of everyday requirements in the homes of the men. C. R. Bellamy, the general manager of the Liverpool Corporation Tramways, has taken great interest in this society. He recently hit upon the happy idea of giving a silver challenge shield for annual competition among the depot football teams. The shield measures 21 ins. x 16 ins., and is surmounted by the city arms, chased in high relief. The centre is occupied by a boldly bossed plaque, bearing the following inscription: "Presented to the Liverpool Corporation Tramway Employees' Social, Athletic and Thrift Society by C. R. Bellamy, C. E., general manager, for annual competition between the depot football teams, April, 1903." Above this, and occupying the upper portion of the shield, is a very fine engraving of the latest type of city car, while the lower portion is occupied by a boldly-executed group of football players. The shield, which is surmounted by laurel leaves, rests on a scalloped shell foot, flanked by dolphins. The Smithdown Road team was the first to win the trophy. On accepting the shield, the captain of the team said that all the men in the service appreciated what Mr. Bellamy did for them.

CHANGES IN THE WESTINGHOUSE PUBLICATION DEPARTMENT

The Westinghouse Companies' Publishing Department is extending the scope of its work, and has made several important changes lately in its organization.

W. M. Probasco is appointed an assistant manager of the department, in charge of advertising, exhibitions and conventions, with headquarters at the New York office.

H. F. J. Porter is appointed an assistant manager, in charge of articles, publications, general publicity and superintendence of department, with headquarters at East Pittsburg.

Mr. Probasco has long been identified with the Westinghouse interests, and for several years has been associated with the publishing department. His familiarity with all branches of the Westinghouse organization and acquaintance with the general field fit him particularly for the special work upon which he will hereafter be engaged.

Mr. Porter is well known through his long association with the Bethlehem Steel Company, of Bethlehem, Pa., first as its representative at Chicago, later at South Bethlehem, and then in New York City. Mr. Porter has also achieved a high reputation as an author and lecturer on engineering subjects, especially those connected with the steel industry. During his connection with the Bethlehem Company Mr. Porter devoted the greater part of his time to the study of the use of hollow-forged, open-hearth and nickel steel shafts to power station service, and this naturally brought him into relation with the street railway and electrical industry. He has attended most of the conventions of the American Street Railway Association, and was largely instrumental in securing the introduction of this type of shaft in electric railway power stations.

ANNUAL REPORT OF THE MEXICO ELECTRIC TRAMWAYS ROAD

The fifth annual report of the Mexico Electric Tramways, of Mexico City, Mex., was submitted at the annual meeting of the company, held in London on May 28. The result of the company's operations, after charging interest on the debentures of the Compania de Ferrocarriles del Distrito Federal de Mexico, and after payment of the 3½ per cent on the share capital of the company (under the terms of the lease), shows a net profit of $136,600, which, at the rate of exchange of 18½d., gives the sum £10,529 11s. 9d. to be carried forward to the credit of the London profit and loss account.

The interest received on the debentures of the Compania de Ferrocarriles del Distrito Federal de Mexico (held by this company) and the dividend declared by the Compania de Ferrocarriles del Distrito Federal de Mexico on its share capital (all of which is held by this company) is then added, and after charging expenses and obligations, etc., against the same, a net balance is shown to the credit of profit and loss account of the sum of £20,260. The usual dividend of 6 per cent has been paid on the preference shares. During the year the company issued 112,987 preference shares, completing the issue of the 500,000 preference shares authorized. One small, but important, addition to the service in the city was made during the last year. The total distance now operated on by electricity is about 72 miles. During the year 31,132,030 passengers were carried, as against 26,709,225 passengers during the previous year, being an increase of 4,422,805 passengers. The receipts amounted to $2,400,788, as against $2,103,175 in 1901, showing an increase of $297,613.

MOTOR-DRIVEN WOODWORKING MACHINERY

The S. A. Woods Machine Company, of South Boston, Mass., has for several years past recognized the advantages derived by using electric drive, and has given particular attention to equipping its woodworking machinery with specially designed motors, the machines being built to conform to motor speeds. This makes their machines particularly suitable for electric railway repair shops. Among the tools brought out for electric drive is a horizontal hollow-chisel mortiser. This machine requires a floor space 6 ft. x 5 ft., and weighs 4000 lbs. The machine will mortise from 5-16 in. to 1½ ins. The table, which is extra long and moved by hand wheel, will clamp timbers up to 10 ins. thick on regular machine. It can, however, be furnished for greater thickness if desired. The belt for the bit spindle wraps two-thirds of its diameter, and has an automatic tightener, preserving uniform tension. The pneumatic pulley on the bit spindle is claimed to give at least 30 per cent additional traction. Among other tools manufactured by this company for railways may be mentioned timber dressers, planers, moulders, hand jointers, boring machines and railway saws.

NEW CHRISTENSEN AIR BRAKES SALES AGENTS

On account of the resignation of J. E. Eldred, who has been in charge of the Chicago sales office of the air-brake department of the National Electric Company, F. C. Randall, the general manager of the air-brake sales department of this company, has made a redistribution of the territory to be covered by the several sales agents of the National Electric Company, and orders for Christensen air brakes will be handled by the following corps of sales agents:

The territory heretofore covered by Mr. Eldred has been subdivided into three parts to be handled by J. S. Hamlin, J. J. Nef and S. I. Wailes. Mr. Hamlin will make his headquarters at the Chicago office, No. 1020 Old Colony Building. Mr. Hamlin was formerly general sales agent of the Neal Duplex Brake. Mr. Nef will also make his headquarters in the Chicago office. Mr. Nef was formerly connected with the Standard Air Brake Company. S. I. Wailes will make his headquarters at the Cincinnati office. Mr. Wailes was formerly connected with the engineering department of the Brooklyn Rapid Transit Company.

W. A. Grauten will make his headquarters at the Brown Palace Hotel, Denver, Col. He remains in charge of the Pacific Coast territory. H. N. Ranson remains in charge of the Cleveland office of the company at No. 812 Prospect Street.

J. T. Cunningham, who has charge of the New England territory and New York city, will make his headquarters at the general sales office, 135 Broadway, New York city. W. W. Power, who looks after the company's interest in Pennsylvania and in the Southeastern States, will make his headquarters at the Philadelphia office, 1402 Erie Avenue.

J. D. Maguire will be connected with the general sales office as special representative of the air-brake department, and in charge of sales of electrical machinery for the Eastern District. Mr. Maguire was formerly president of the Magnet Wire Company, of New York city.

SLIGHT STRIKE AT ONEONTA

There was a slight strike last week among the laborers on the construction end of the Oneonta, Cooperstown & Richfield Springs Railroad, just a few miles south of Mohawk, where the line is hastening its connections with Mohawk and Herkimer. This road operates a high-speed passenger and freight electric service in Central New York from Oneonta to Mohawk, a distance of 67 miles. The road is practically complete, with the exception of a few miles on the northern end.

The trouble was caused by a disagreement between the New York owners of the property in regard to the control of the line, during which the payments to the sub-contractors have been withheld. It is understood that negotiations for settlement of the differences are now under way, and that work will be resumed immediately. In the meantime arrangements have been made for satisfying the demands of the laborers.

The company will have track connections with the Ulster & Delaware, Delaware & Hudson, Delaware, Lackawanna & Western and the West Shore Railroads, and is already handling a large amount of carload freight on the part of the line which is in operation, and it has a very promising future when fully completed.

MORE PAY AND SHORTER HOURS FOR JERSEY TROLLEYMEN

The Public Service Corporation, which controls the big trolley roads in Hudson County, N. J., issued an order June 26 arranging a uniform scale for motormen and conductors, and fixing ten hours as the limit for a day's work. Men who have been continuously in the service for more than ten years will receive 22 cents an hour; over five years, 21 cents an hour; over two years, 20 cents an hour, and less than two years, 19 cents an hour. The new schedule went into effect on July 1. The employees of nearly all the lines controlled by the company have been working 12 hours a day.

INTERBOROUGH RAPID TRANSIT COMPANY APPLIES FOR ADDITIONAL SUBWAY FRANCHISE

Two new franchise applications have been made to the New York Rapid Transit Commission by the Interborough Rapid Transit Company, of New York. The first application is for the right to build a subway down Broadway, from Forty-Second Street to Union Square (Fourteenth Street). The second application requests a franchise to construct an elevated structure as part of the rapid transit system from 130th Street and Manhattan Street, where there is a subway station, down to the Fort Lee (N. J.) ferry.

STRIKE ENDED AT DUBUQUE

The strike on the lines of the Union Electric Company, at Dubuque, Ia., was ended June 23, having been on since May 6. A full account of the beginning of this strike was given in the Street Railway Journal of May 30. The main point at issue was the demand of the strikers that none but union men be employed; that all new men be required to join the union within thirty days of the time when they were put on to practice, and that whenever men were expelled from the union they should also be discharged from the employ of the company. There was also a demand by the employees for the reinstatement of three former employees, who were officers of the union, who had been discharged some time previous to the time that the demands of the strikers were first presented. This demand, however, came after the first demands were presented. The company, of course, refused to give the management of its employees over into the hands of a union, and in its reply to the demands of the strikers, quoted the anthracite coal commission, which, in its decision, allowed no discrimination between union and non-union men.

The strike was marked by severe rioting at various times, and the local authorities were notably lax in preventing lawlessness Men were brought in from outside to operate the cars, but there were periods during which no cars were operated, because of the entire lack of police protection and the great amount of mob violence. The rioting became so bad that at last the business men held a meeting and made a formal demand of the Mayor for police protection of the cars, so that the company could operate. The Mayor told the company he would do all in his power to prevent any acts of violence, and that afternoon the cars were started out of the barns. This was the signal for even more severe rioting, which the police and sheriff could not or did not stop. This led to the calling out of the militia, and the local company was put on duty at once. The rioting continued, and the company refused to operate cars again until the arrival of more troops. The Governor would not send any more, so the business men got together and circulated a petition for more companies of militia. With this the Governor sent three companies to the city. The next day the cars were put in operation, and more rioting followed. Then Governor Cummins arrived on the scene, with Labor Commissioner Brigham, of Iowa, and President Urick, of the State Federation of Labor.

This was the beginning of a settlement, which was finally signed at the rooms of the Dubuque Club, June 23. As one of the Dubuque papers mildly puts it, "the settlement can hardly be called a compromise," as it contains practically the same terms for which General Manager Dame stood out at the beginning of the controversy. The company agrees not to discriminate against the union, but it shall be free to engage or discharge its employees without regard to membership or non-membership in any organization. Provisions are made for the appeal of grievances from the superintendent to higher officers of the company. The company is to provide free transportation for trainmen when not in uniform. Any trainmen called for duty shall not receive less than five hours' pay for any one day, regardless of the time actually employed. This does not include the regular reports for duty of extra men unless they are assigned to work. The company will recognize the union to the extent of treating with its members either individually or through a grievance committee, in the consideration of any differences which may in future arise between the company and its employees belonging to the union. The three discharged men will not be taken back, but will be given clearance cards, stating that their services have been generally satisfactory.

PEACE IN RICHMOND STRIKE

As a result of the strict enforcement of the law by the militia in Richmond, no further disturbances have occurred, although on June 25 an incendiary attempt was made to destroy the Virginia Passenger & Power Company's trestle bridge on the Seven Pines road. The company is operating cars on all its Richmond lines under military protection. The cars are being liberally patronized, and, so far as Richmond is concerned, the strike seems to be a thing of the past. It is feared, however, that there may be trouble in Manchester if the company attempts to operate cars there, as the police force is very small and the Mayor of Manchester sympathizes with the strikers.

OPENING OF BOSTON & WORCESTER ROAD

The first car of the new Boston & Worcester Street Railway to run into Worcester entered that city on June 26, the occasion being the trial trip and official tour of inspection of the Massachusetts Railroad Commissioners. In a few days the line will be opened for traffic.

NEW PUBLICATIONS

The Car Builder's Dictionary. 1903 edition, 374 pages, 4971 illustrations. Published by the Railroad Gazette, New York. Price $5.00.

This book, which is compiled for the Master Car Builder's Association by Rodney Hitt, assisted by Messrs. Waitt, of the New York Central Railroad; Lentz, of the Lehigh Valley Railroad, and Appleyard, of the New York, New Haven & Hartford Railroad, has won its place as a necessity in the library of every master car builder and those interested in the details of steam railway rolling stock. The book has passed through four editions, viz., 1879, 1884, 1895 and 1903, and the present edition brings the definitions and standards up-to-date, with the latest practice of the Master Car Builders' Association. Following the practice inaugurated in the 1895 edition, some space has been devoted to electric railway rolling stock, and ten pages are given to car bodies, ten to motors, controllers and multiple unit systems, and three to trucks. The editors do not claim that this part of the book is at all complete, but recommend another work, devoted exclusively to this branch of car building. The 1903 edition of the dictionary also includes a new feature in a department of car shop machinery, in which all of the principal tools used in repair shop practice are illustrated. Owing to the growing tendency toward unification in steam and electric railway work the dictionary will be found very useful to many electric railway car builders and master mechanics.

Die Betriebsmittel der Elektrischen Eisenbahnen. By E. C. Zehme. Published by C. W. Kreidel, Wiesbaden. 322 pages, including 315 illustrations and 66 lithographed plates. Price, 27 marks.

This book, whose title would be expressed in English as Electric Car Appliances, has been compiled with a great deal of care, and while most of the practice described is that followed on the Continent, enough attention has been given to American and English apparatus to make the work representatively international. The author is the first, so far as we know, to devote an entire book to this one subject, but has treated the theme with a completeness which is praiseworthy. The book is not divided into chapters, but the topics discussed, in their order, are trucks, wheels, axles, car springs, brakes, sand and salt boxes, fenders, car bodies, heaters, electric locomotives, electric motors, gearing, controllers, multiple unit systems and trolleys. More attention has been given to the mechanical side than to the electrical, as of the 322 pages, only forty-four are devoted to motors, and of these a large part of the space is given up to the mechanical features. As an example, it might be said that nineteen lithographed pages are given up to illustrating different types of trucks, eight good sized plates to journal boxes, and nine to couplings. The book is well printed and illustrated.

The New England Street Railway Club has just issued an electric railway guide called The Trolley Wayfinder. The guide gives the distance, fare and time from Boston to points touched by trolley cars throughout New England, and also from Boston to New York, and New York to Philadelphia. The price of this guide is 10 cents, mailed to buyer. Copies may be obtained by addressing John T. Lane, Herald Building, Boston, Mass.

The publishers of the "Cassier's Magazine" have just issued in pamphlet form the article on the bonus system which appeared in their machine shop number, published a few weeks ago. Of the various methods of encouraging increased production among workmen, especially in engineering works, no system has ever produced such satisfactory results as some form of a bonus system, but a bonus system without some method of imparting the necessary information both to the employer and the employee is not likely to prove workable. This pamphlet discusses the system in detail, and gives reproductions of the blanks used. It is sold for 10 cents.

HALF-FARE FOR CHILDREN

An opinion has been given by the corporation counsel, of Chicago, that elevated railroad companies can be compelled by the city to carry children under 12 years of age for half fare. It is proposed to introduce an order in the Council that proceedings be commenced against any or all of the elevated railroad companies if they decline to obey the law. The surface companies, on demand of the Council, made an arrangement that two children could travel for 5 cents, but that one child must pay 3 cents. The surface lines, however, had once adopted the half-fare system, but had dropped it several years ago. The elevated roads have always charged full fare. The order, if passed, will mean a considerable difference in the income of each road, and may affect the Union Loop, which gets a percentage of each fare.

KINGSTON'S PARKS

The Kingston Consolidated Railroad Company has just issued a very interesting pamphlet descriptive of Kingston Point Park, with a number of attractive views illustrating it. The pamphlet contains a brief description of the spot itself, and relates some historical incidents connected with its early days, which, of course, add to the interest of visitors as well as to that of the residents of Kingston who frequent this resort. The company furnishes an excellent service and makes it possible for visitors to reach these points conveniently and with comfort. Trolley lines run through the principal streets of the city, and pass a number of very picturesque points on the line to the park.

CHICAGO MAY LOWER VAN BUREN STREET RAILWAY TUNNEL

The Illinois Supreme Court has decided that the city of Chicago may lower the Van Buren Street tunnel in the interest of Chicago River navigation. This decision is the result of a mandamus petition brought by the city to compel the West Chicago Street Railway Company (Union Traction Company) to lower its Van Buren Street tunnel to a depth of 21 ft. In making this decision, the court holds that even if the railway company should be compelled to lower its tunnel its right to build tunnels, as authorized by its charter, would not be taken away.

PERSONAL MENTION

MR. C. B. GREEN has been appointed trainmaster of the Columbus, Buckeye Lake & Newark Traction Company, succeeding C. W. Hoisinton, who has resigned.

MR. M. J. LOFTUS, who resigned his position as general manager of the Indianapolis & Martinville Rapid Transit Company, has been appointed superintendent of the Columbus, Grove City & Southwestern Railway Company.

MR. EDWIN C. FABER, at present general manager of the Elgin, Aurora & Southern Traction Company, has been appointed to a similar position with the Aurora, Elgin & Chicago Railway, succeeding Mr. Warren M. Bicknell, who goes with the Lake Shore Electric Railway. Mr. Faber will be succeeded by Mr. John T. Huntington, at present auditor of the Cincinnati, Dayton & Toledo Traction Company. Mr. Faber was formerly general superintendent of the Cleveland Electric Railway Company under Mr. Ira McCormick.

MR. D. A. BELDEN has resigned as general manager of the Birmingham Railway, Light & Power Company, and has accepted a position as president of the New Hampshire Traction Company. His headquarters will be at 50 Merrimack Street, in Haverhill. The New Hampshire Traction Company is a holding company for the following lines in Massachusetts and New Hampshire: Exeter, Hampton & Amesbury Street Railway Company; Hudson, Pelham & Salem Electric Railway Company; Haverhill & South New Hampshire Street Railway Company; Lawrence & Methuen Street Railway Company, and Lowell & Pelham Street Railway Company.

MR. GEORGE O. NAGLE, who, for some time, has been connected with Stone & Webster, with headquarters in Boston, has been appointed to the position of general manager of the Wheeling Traction Company, of Wheeling, W. Va. Mr. Nagle was born in Milton, Pa., Dec. 31, 1868. He received his early education in Lima, Ohio, moving to Chicago in 1886. Shortly after this he entered the employ of the Chicago, Burlington & Quincy Railroad, first in the ticket auditor's office, and later in the general auditor's office. In February, 1891, he entered the employ of the Chicago City Railway Company as junior in the claim department. Six months later he was promoted to the position of private secretary to the superintendent, which place he held until appointed superintendent, on Jan. 18, 1898. After Mr. Nagle resigned from the Chicago City Company he became connected with Stone & Webster, of Boston, taking the position of manager of the Savannah Electric Company, which controls the lighting and street railway properties of Savannah, Ga. Mr. Nagle remained at Savannah as manager for several years. Early in the present year he retired from the management of the Savannah company to take general charge of the firm's Southeastern properties. Mr. C E. Flynn, who has been manager of the Wheeling system, is planning to take a vacation for the next few months to look after some personal matters, but will engage in railway work again later in the year.

TABLE OF OPERATING STATISTICS

Notice.—These statistics will be carefully revised from month to month, upon information received from the companies direct, or from official sources. The table should be used in connection with our Financial Supplement "American Street Railway Investments," which contains the annual operating reports to the ends of the various financial years. Similar statistics in regard to roads not reporting are solicited by the editors. * Including taxes. † Deficit. *a* Including taxes, damages, tolls and rents.

Company	Period	Total Gross Earnings	Operating Expenses	Net Earnings	Deductions From Income	Net Income, Amount Available for Dividends
AKRON, O.						
Northern Ohio Tr. & Light Co	1 m., May '03	74,258	40,231	34,027	22,427	11,600
	1 " " '02	60,747	33,911	26,836	17,123	9,713
	5 " " '03	311,011	178,057	132,955	108,765	24,189
	5 " " '02	251,306	148,773	102,533	80,202	22,331
ALBANY, N. Y.						
United Traction Co.	1 m., Apl. '03	134,501	97,085	37,416	24,645	12,771
	1 " " '02	117,072	81,527	35,545	23,603	11,941
	4 " " '03	505,004	349,954	155,050	97,295	57,755
	4 " " '02	464,409	339,293	125,116	92,806	32,310
BINGHAMTON, N. Y.						
Binghamton St. Ry. Co.	1 m., May '03	20,312	10,066	10,246	------	------
	1 " " '02	17,194	9,118	8,075	------	------
	11 " " '03	203,029	115,579	87,450	------	------
	11 " " '02	187,658	103,986	83,672	------	------
BUFFALO, N. Y.						
International Tr. Co.	1 m., Apl. '03	295,332	167,669	127,663	127,168	549
	1 " " '02	250,850	142 515	108,336	123,422	†15,086
	4 " " '03	1,154,805	662,577	492,227	505,471	†13,244
	4 " " '02	998,919	580,979	417,940	497,053	†79,113
CHICAGO, ILL.						
Chicago & Milwaukee Elec. Ry. Co.	1 m., May '03	20,042	7,157	12,886	------	------
	1 " " '02	16,441	7,353	9,088	------	------
	5 " " '03	71,238	32,104	39,134	------	------
	5 " " '02	61,189	30,987	30,202	------	------
CINCINNATI, O.						
Cincinnati, Newport & Covington Light & Traction Co	1 m., May '03	100,891	*a*59,088	41,203	20,997	20,206
	1 " " '02	92,536	*a*50,322	42,214	21,067	21,148
	5 " " '03	469,141	*a*279,888	189,253	105,328	83,925
	5 " " '02	428,111	*a*246,059	182,052	104,694	77,358
CLEVELAND, O.						
Cleveland & Southwestern Traction	1 m., May '03	39,038	22,146	16,892	8,182	8,709
	1 " " '02	25,045	13,073	11,973	5,362	6,611
	5 " " '03	156,304	98,045	58,259	40,896	17,363
	5 " " '02	103,194	63,584	39,609	26,808	12,802
Cleveland, Painesville & Eastern	1 m., May '03	18,699	10,519	8,180	------	------
	1 " " '02	18,254	10,165	8,089	------	------
	5 " " '03	71,639	44,423	27,215	------	------
	5 " " '02	65,429	38,799	26,630	------	------
DETROIT, MICH.						
Detroit United Ry.	1 m., May '03	375,707	*$221,302	154,405	81,194	73,211
	1 " " '02	334,867	*185,678	149,189	78,868	70,321
	5 " " '03	1,649,252	*994,691	654,561	407,942	246,619
	5 " " '02	1,485,380	*855,826	629,554	383,490	246,064
DULUTH, MINN.						
Duluth-Superior Tr.	1 m., May '03	52,389	28,594	23,795	10,225	13,570
	1 " " '02	44,475	20,288	24,187	9,745	14,442
	5 " " '03	235,379	144,019	91,360	50,994	40,366
	5 " " '02	196,910	110,278	86,632	48,189	38,443
ELGIN, ILL.						
Elgin, Aurora & Southern Tr.	1 m., May '03	39,148	21,791	17,354	8,333	9,020
	1 " " '02	35,115	19,628	15,488	8,333	7,154
	5 " " '03	168,544	102,178	66,366	41,668	24,699
	5 " " '02	152,583	92,167	60,415	41,668	18,749
FINDLAY, O.						
Toledo, Bowl'g Green & Southern Traction Co	1 m., May '03	24,778	15,229	9,549	------	------
	5 " " '02	108,072	69,127	38,945	------	------
HAMILTON, O.						
The Cincinnati, Dayton & Toledo Trac. Co.	1 m., May '03	46,174	25,022	21,152	16,051	5,102
	1 " " '02	40,114	21,922	18,193	16,799	1,393
	12 " " '03	489,493	271,812	217,681	193,673	24,008
ITHACA, N. Y.						
Ithaca St. Ry. Co	1 m., May '03	11,247	4,860	6,388	1,747	4,641
	1 " " '02	10,419	10,701	†282	1,910	†2,192
LONDON, ONT.						
London St. Ry Co	1 m. May '03	13,145	8,950	4,195	2,224	1,971
	1 " " '02	12,234	7,886	4,348	2,410	1,938
	12 " " '03	59,345	40,752	18,594	10,734	7,860
	12 " " '02	51,421	34,609	16,813	11,306	5,507
MILWAUKEE, WIS.						
Milwaukee El. Ry. & Lt. Co.	1m., May '03	246,285	121,408	124,878	71,702	53,175
	1 " " '02	218,633	103,835	114,797	65,638	49,159
	5 " " '03	1,186,992	612,780	574,212	352,313	221,899
	5 " " '02	1,052,179	505,111	547,068	323,539	223,529
MINNEAPOLIS, MINN.						
Twin City R. T. Co.	1 m., May '03	339,735	159,328	180,407	78,328	102,079
	1 " " '02	296,991	136,964	160,028	76,233	83,794
	5 " " '03	1,570,909	753,627	817,282	391,928	425,354
	5 " " '02	1,356,556	649,003	707,553	380,300	327,253
MONTREAL, CAN.						
Montreal St. Ry. Co.	1 m., May '03	172,987	112,141	60 846	20,614	40,232
	1 " " '02	178,408	86,780	91,628	18,672	72,955
	8 " " '03	1,362,563	872,072	490,492	140,470	350,022
	8 " " '02	1,257,518	786,238	491,280	124,907	366,373
NEW YORK.						
Interurban St. Ry. Co.	3 m., Mar. '03	3,724,805	1,835,805	1,889,000	2,174,596	†285,596
OLEAN, N. Y.						
Olean St. Ry. Co	1 m , May '03	7,534	3,014	4,520	2,010	2,510
	1 " " '02	4,822	2,137	2,685	1,319	1,366
	10 " " '03	67,430	34,799	32,631	18,232	14,399
	10 " " '02	50,990	26,062	24,927	14,731	10,196
PEEKSKILL, N. Y.						
Peekskill Lighting & R. R. Co	1 m., May '03	9,308	*4,960	4,348	2,083	2,265
	11 " " '03	96,712	*59,256	37,456	22,918	14,538
PHILADELPHIA, PA.						
American Railways	1 m., May '03	114,149	------	------	------	------
	1 " " '02	97,695	------	------	------	------
	11 " " '03	1,122,339	------	------	------	------
	11 " " '02	908,350	------	------	------	------
PUEBLO, COL.						
Pueblo & Suburban Traction & Lt. Co.	1 m., May '03	39,496	------	------	------	------
	5 " " '03	191,083	------	------	------	------
ROCHESTER, N. Y.						
Rochester Ry.	1 m., May '03	102,238	50,656	51,582	25,534	26,047
	1 " " '02	88,453	48,062	40,391	24,749	15,642
SYRACUSE, N. Y.						
Syracuse R. T. Co.	1 m., May '03	66,584	38,329	28,255	20,222	8,053
	1 " " '02	57,769	32,558	25,211	19,025	6,186
	10 " " '03	687,633	383,950	303,683	216,685	92,998
	10 " " '02	632,420	349,466	282,955	209,221	73,734
TOLEDO, O.						
Toledo Rys. & Lt. Co.	1 m., May '03	135.416	70,726	64,690	40,837	23,853
	1 " " '02	117,006	60,246	56,759	37,851	18,908
	5 " " '03	630,633	329,400	301,234	200,935	100,298
	5 " " '02	548,602	288,224	260,378	189,179	71,190
YOUNGSTOWN, O.						
Youngstown - Sharon Ry. & Lt. Co	1 m., May '03	41,397	*$24,873	16,524	------	------
	4 " Apl. '03	161,955	*102,495	59,460	------	------
	12 " Dec. '02	444,986	*244,972	200,014	------	------

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EDITORIAL NOTICE

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Block Signal Systems

A recent serious collision on a well-equipped road calls attention to the inevitable personal factor in the safe operation of electric roads. From the best reports yet received the accident, a head-on collision, resulted from an injudicious motorman running by a danger signal and not keeping his car under close control. If anything should serve to accentuate the value of strict discipline it is such an unfortunate occurrence. Of course, on large double-track or even single-track systems it is possible to provide automatic block devices which cut off current from a section in which a danger signal is set, but such schemes are rather complicated and troublesome, and on most roads we regard them as at present impracticable. The next best thing is a proper block signal system, plus rigid discipline of the operating force. This is quite sufficient to insure safety under all practical working conditions, but its value turns upon the control of the human factor. The recent tendency to trade union rule on street railways we believe to be directly responsible for the undoubted difficulty of enforcing proper discipline on many roads. The personal reliability of a motorman is not, and never will be, a proper subject of arbitration. Either he obeys orders and displays proper discretion in the performance of his duties or he does not—there is no middle ground. The modern fast interurban car requires an unusual degree of skill and judgment on the part of the motorman, and these qualities are not insured by his membership in the union. We wish the public could be brought to a full understanding of the fact that any interference with the discipline of a road is a direct menace to public safety. Yet the arbitration of questions of discipline is one of the commonest features of union demands. Only last week we noted another instance of it, which we regard as without exception the most obnoxious and dangerous feature of unionism.

Second-Hand Apparatus on New Roads

The use of second-hand apparatus in street railway work is a subject worthy of no small consideration in times of uncertain deliveries and crowded factories. Conditions often justify the purchase of worn machinery for temporary operation, especially when the load on a plant has increased so rapidly that, pending the delivery of new units, the original installation is inadequate to handle the traffic, or when the resources of the operating company will not permit the adoption of the latest types of engines and generators. It is also true that very often perfectly modern machinery can be purchased second hand, simply because a large road can frequently afford to operate machinery for a short time and then discard it for large units or to complete a polyphase installation.

It would be foolish and untrue to claim that all the second-hand apparatus on the market is either good or bad exclusively. Most of us have seen machinery which proved to be a genuine bargain when purchased and operated after giving good and faithful service to its original buyers; on the other hand, there is no reasonable doubt that many railway engineers have looked with pity upon the painful operation of asthmatic second-hand engines and sputtering generators which no repair shop could redeem, and whose excessive appetite for steam and thermal radiating capacity turned the operating records into chronicles of extravagance and inefficiency. It is safe to say that too much cannot be known about second-hand machinery before its purchase. If possible it should be thoroughly tested before acceptance, always inspected, and in every case its history ought to be scrutinized with extreme care. If this plan is followed there should be no trouble.

Second-hand apparatus is usually purchased by established operating companies rather than for brand new systems, and there is good ground for believing such a course to be the part of wisdom. A case in point is furnished by a new Eastern road recently placed in operation. The line connects a large city with a fertile suburban territory, and when fully completed will join several important towns and another prominent city to the original municipality. Rolling stock, roadbed, track and overhead work are all of exceptionally high quality, but the engine room of the power station contains four ancient generators, three of which were old timers in the days of the Chicago Exposition of 1893, all being belted to two engines, which were used to supply power to one of the earliest electric roads in

New England. Innumerable troubles have appeared since the road started, and at times the power has been so poor that but a single car could be operated on the line. No records of fuel consumption have as yet been kept at the power station, but evidence indicates that it will be impossible to run the plant economically as long as the obsolete machinery is retained. Even the single car has been repeatedly stuck on heavy grades of 3 per cent to 6 per cent on account of the inability of the power station properly to carry the load. The old machinery mars the appearance of the whole plant, destroys all chance of good efficiency records, introduces a heavy depreciation factor at a period in the road's life which would ordinarily be unencumbered with such charges, and illustrates a penny-wise-and-pound-foolish policy which is strongly out of place in a system otherwise thoroughly commendable. The outcome will doubtless be the purchase of modern generating units, but it is reasonable to infer that in buying the old apparatus the will-o'-the-wisp of getting something for nothing received more attention than the strict business-like and progressive requirements of the situation.

The Limit of Speed on Highways

The Massachusetts Railway Commission has just made a ruling on the permissible speed of trolley cars which seems to call for comment. The cause was an application for ratification of a town act allowing a speed of 20 miles an hour on certain streets. The decision of the Commissioners was adverse, and in connection with it they promulgated a general line of action looking toward limit of speed in highways and better control of the cars. Like most of the effusions of this body it is somewhat vague in its requirements, but it seems to cover the following points: 1. No single-truck car to run more than 15 m. p. h. unless by special permission. 2. Slow down at all crossings to such a point that car can be stopped "immediately." 3. Slow down on curves "to meet the condition of limited vision." 4. Test working of brakes at reduced speed before coasting a heavy grade. 5. When skirting narrow road slow "to meet this condition whenever such road is in rightful use by others." 6. Slow when necessary in using traveled road on which other vehicles have rights. Now, these rules are concocted with rightful intent, but what on earth do they really mean? How about double-truck cars? One seldom cares to run the single-truck cars at high speed, anyhow, and rules to be much of use must include all cars. What is stopping "immediately"—in 2 ft. or in 50 ft.? Rules 5 and 6 seem devised to protect vehicles and pedestrians, but we defy any two motormen to agree on their practical meaning. We approve of proper regulation of speed on public highways, but we believe that the limit allowed electric cars should be at least as high as that permitted to automobiles. An electric car which is confined to a track that all may see is no more dangerous than a "vermillion devil" at the same speed dodging all over the highway. Moreover, the former is a public convenience, while the latter, from the standpoint of 99 per cent of the people, is a public nuisance. The essence of safety is to limit all vehicles using the public highway to speeds at which they are under such control as to make the highways safe, and more particularly to punish with inexorable severity accidents due to reckless speed. A legal limit of speed is a farce unless offenders against public safety at any and all speeds are treated to an old-fashioned brand of swift justice.

Report on Electrolysis in St. Louis

The question of electrolysis appears still to present itself occasionally and cause unnecessary alarm to city authorities and other owners of subterranean metallic structures.

At one time a considerable degree of concern was felt throughout the country as the result of the discovery of electrolytic damage in a number of places. This has properly given way, in the majority of cases, to the calmer attitude brought about by the full and complete scientific investigations made in many localities, and furthermore by proof of the fact that the damage has been very much exaggerated. It has been conclusively shown that all trouble from this cause can completely and easily be overcome by proper maintenance of track and bonding and the rational use of return feeders, coupled (in some instances) with a connection of the water pipes at the neutral or positive areas to return conductors. The apprehension which formerly existed was undoubtedly the result, in many cases, of the misguided enthusiasm of certain investigators and of alarming statements made by those incompetent properly to consider the subject.

In this connection attention should be called to a recent report made to the city of St. Louis by E. E. Brownell. If this report does not cause something of a renewal of apprehension on the part of waterworks engineers, it will doubtless be because they are now too well informed upon the subject to be misled.

We learn from this report that "electrolytic corrosion must be wholly governed by Ohm's law. To disregard this well-known law of electrochemistry would be equivalent to attempting to break down all the defined laws of chemistry. This rule or law must be conceded as absolute." Again, we are informed that "all metallic piping lines, cables, etc., that lie in direct contact with the earth through which these currents traverse must suffer more or less electrical dissociation, depending entirely upon Ohm's law."

It will be new to scientists that Ohm's law is a law of electrochemistry. It was generally thought to be a law expressing the relation between electrical pressure, resistance and current flow, and that the conspicuous case where it does not apply is that of electrolytic conduction. Nevertheless, the writer of the report referred to bases his whole calculations in utter disregard of local potentials or counter electromotive forces set up by chemical affinities and polarization, and armed only with an imperfect knowledge of Ohm's law, undertakes to solve the complicated problems of electrochemistry.

A similar reversal of accepted electrical laws is characteristic of most of the computations contained in the report. Thus, it is commonly understood that a resistance measurement between pipe and rail, if it were possible to make such measurement with any degree of accuracy, would express the earth resistance between the entire connected rail system on the surface and the entire connected pipe system below the surface. From this report, however, we learn that each such measurement represents the resistance of the earth at the point measured, and that the flow of current from pipe to rail, or vice versa, can be obtained by dividing the observed potential difference by the observed resistance, and that the total current flow between rail and pipe may be found by adding the several results so obtained at each of the points of measurement. It would appear that this was an excellent method of making out a case of damages, but we do not understand why Mr. Brownell

should have limited himself to ninety-two measurements when the 122,980 lbs. of metal which he gravely asserts to be removed from the pipes of St. Louis every year, could have been multiplied ten or one hundred times by the simple process of taking ten or one hundred times as many measurements.

Incidentally in the report we learn that "The electrical state of the earth in St. Louis is indeed quite extensive and serious, with great electrical distortion." We extend to St. Louis our condolence in being afflicted not only with boodle aldermen but with an electrical state which is indeed quite "extensive and serious"—if this report is to be believed.

The "great distortion" may be judged from the table of currents given by Mr. Brownell and calculated on the above extraordinary basis, which shows currents simultaneously passing in opposite directions between rail and pipe. Thus we learn that on Vandeventer Street there are 625 amps. flowing out of the pipe, and 40 amps. flowing into it; but we are informed that in the entire city 6149 amps. are leaving the pipes, while 6407 amps. are entering them, and we marvel that enough more readings were not taken so that 61,490 might have been found leaving and 64,070 found entering. We are not informed what becomes of the excess of current entering, but we may perhaps infer from the report that it is absorbed and becomes a permanent part of the water supply. From these figures as a basis we learn that "according to Ohm's law the amount of metal removed electrolytically from the distributing system is 122,980 lbs.;" for Mr. Brownell is "convinced and thoroughly satisfied that the application of Ohm's law is the only correct and practical basis of calculating the rate of electrolytic dissociation."

The average of Mr. Brownell's resistance measurements is .051 ohms, and with the 6149 amps. which he finds flowing it is evident that the earth drop in St. Louis must be 313.6 volts, so that Mr. Brownell may, perhaps, be conservative in saying that "the electrical state of the earth in St. Louis is indeed quite extensive and serious."

The report fairly bristles with other interesting and remarkable remarks, and were it not for the serious influence that such statements, accompanied by a great showing of authoritative assertion, may have with those not sufficiently familiar with the subject to recognize the true facts we should regard the document as wholly humorous, but as it is just this sort of misinformation which is responsible for much of the alarm which has arisen from time to time, we are compelled to take a more serious view.

That some electrolytic corrosion is still going on where railway return systems are not properly kept up there can be no doubt. There can also be no doubt that much that is ascribed to corrosion by street railway currents is either not electrolytic at all, or is due to local action where metals of different composition are buried adjacent to one another, such corrosion being often found in places where no electric railways exist. But where electrolysis does exist the determination of the extent and cause is a problem worthy of the best skill, experience and technical training, and should not be left to those who cannot properly diagnose the situation.

Incidentally, we note in the St. Louis report that the city of Buffalo, though "it can probably boast of the best track construction of any city using the single trolley," is nevertheless losing "not less than 24,000 lbs. of iron per year." A letter written this month by the Deputy Water Commissioner of Buffalo says, however: "We have not experienced any trouble from electrolysis. I have not found a leak on any of our mains which would indicate that as the cause." Evidently the city of Buffalo does not know how badly it is suffering, or else Mr. Brownell is again mistaken.

Overdoing the Park Business

For several years the street railway park has been coming more and more to the front as a factor tending to increase the gross earnings of urban systems. It is a long stride from the simple rustic seat by the shore of a suburban pond to the complicated product of the landscape gardener and amusement manager's skill, which daily draws thousands of recreation seekers into its interesting domains. Great progress has been made in the laying out and operation of these parks, and many comforts added to increase their popularity, but it is well to remember that there are economical limits to the expenditures which may be made with safety.

Experience, for instance, has shown that it is hazardous to start in on a very elaborate scale in creating a park property where there is not enough traffic to warrant the expenditure. We have in mind a case in the South where the owner followed this course, and finally has invested over $75,000 in such a proposition. As it is impossible to earn anything like a fair return on such an investment as this, he is now trying to sell out at a figure considerably below the original cost, and the railway company which he is approaching naturally hesitates to accept such a burden of fixed charges accompanied by the relatively low-earning capacity entailed. The park, naturally, attracts a great many people, but the returns do not amount to enough to make it a paying venture.

As it is very easy to spend a large sum in park development, it behooves the street railway manager to move with great caution before recommending the establishment or purchase of any high-cost park, however attractive it may appear on the surface. Especially is it desirable that a park be located on the main line of an electric road, for the operating difficulties in attempting to handle a park from a spur track connection are by no means imaginative. The passengers in the through cars do not want to be delayed while the car is run out to the park and back, and it becomes necessary to operate special cars to the park, which is an expensive alternative. It is also probable that a park located but two or three miles from a city or town will do a better business than one a good deal farther away. On the other hand it should not be within easy walking distance of the centers of population.

It is far better to begin in a small way and spend money on a park as it is justified by the increase in net earnings shown in the financial reports, than to sink large sums of money in uncertain ventures of high first cost. Nothing in these comments is intended to decry the street railway park as an income and traffic producing agency, for the experience with such attractions in this country speaks for itself. We simply wish to emphasize the need of watching out for the dangers of overcapitalization and to apply to the park business the tried and trusted maxim—"Make haste slowly!" It is a pretty good plan to do some thoroughly conservative work with pencil and paper in the way of interest and operating expense problems before committing oneself strongly in favor of liberal expenditures for enterprises related to transportation, but not of immediate connection with it.

NOTES ON THE DES MOINES CITY RAILWAY

The Des Moines City Railway operates what was one of the first street railway systems of the country to adopt the electric traction. The company has always been somewhat original in its methods of working out various problems as they came up, and the practice in Des Moines has in many cases not followed the "cut and dried" standards of practice found elsewhere. This company's ordinary schedule calls for fifty-seven cars.

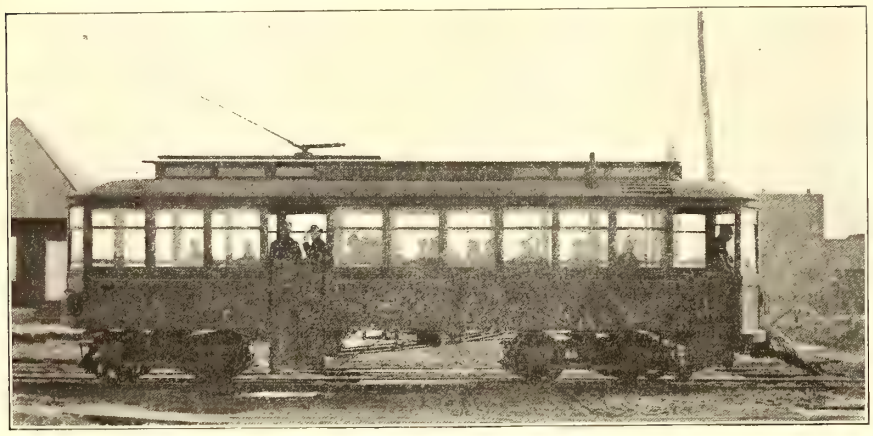


FIG. 1.—DES MOINES CAR, WITH SIDE ENTRANCE AND NO REAR PLATFORM

All cars are operated on the telephone despatching system. Telephone booths are located at the end of each line, by which communication is had with the chief despatcher. All cars pass the company's waiting room and the Union depot. A despatcher, or starter, is located at the waiting room in addition to the telephone despatcher.

ROLLING STOCK

Probably the most originality is found in the company's rolling stock. A number of types of cars have been tried since the company began to operate double-truck cars. While it is unnecessary to mention the several types that have been tried, there is considerable interest attached to the car which bids fair to become the company's standard for both summer and winter use. This car is shown in Fig. 1. The first striking thing to be noted about it is that there is no rear platform. The entrance is at the side. The Minneapolis type of gate is used. It is opened and closed by a lever on the motorman's platform, and is opened by the motorman only when the car is at a standstill. This gate is of wood, as seen. In some respects this car may be compared to the standard Denver car described in the Street Railway Journal of Feb. 7, 1903, which is also a side-entrance car. Aside from having the entrance only at the side, however, these two cars have very little in common. In the Des Moines car the compartment in front of the side entrance is closed like an ordinary car body. This compartment is 22 ft. long. It is peculiar in its seating arrangement, cross seats being installed on one side of the car and a side seat on the other side. This gives a very wide aisle, to facilitate passage when the car is crowded, but when the car is lightly loaded, as it is during much of the day, all the passengers desiring can have cross seats, which seats, as is well known, are, as a rule, preferred. The rear compartment, which is 14 ft. long, has side seats, and is a smoking compartment. In winter this compartment is closed except that there is no partition between the entrance and the smoking compartment, that is, the entrance to the car forms a part of the smoking compartment. The length of the car over all is 40 ft. It is equipped with Taylor trucks. This type of car the management thinks is the most popular with the public of any car that has been tried, as it caters to the desires of various people. In winter there is a half-open smoking compartment, which is much more satisfactory to smokers and those who desire to ride outside than would be a crowded rear platform. The ordinary compartment for non-smokers is in no way interfered with. The entrance is not nearly as likely to be obstructed by standing passengers as is the rear platform. By letting the windows down in summer it becomes a pleasant summer car. The absence of a rear platform gives the car a somewhat peculiar appearance to those unaccustomed to it, but this, of course, is no particular ob-

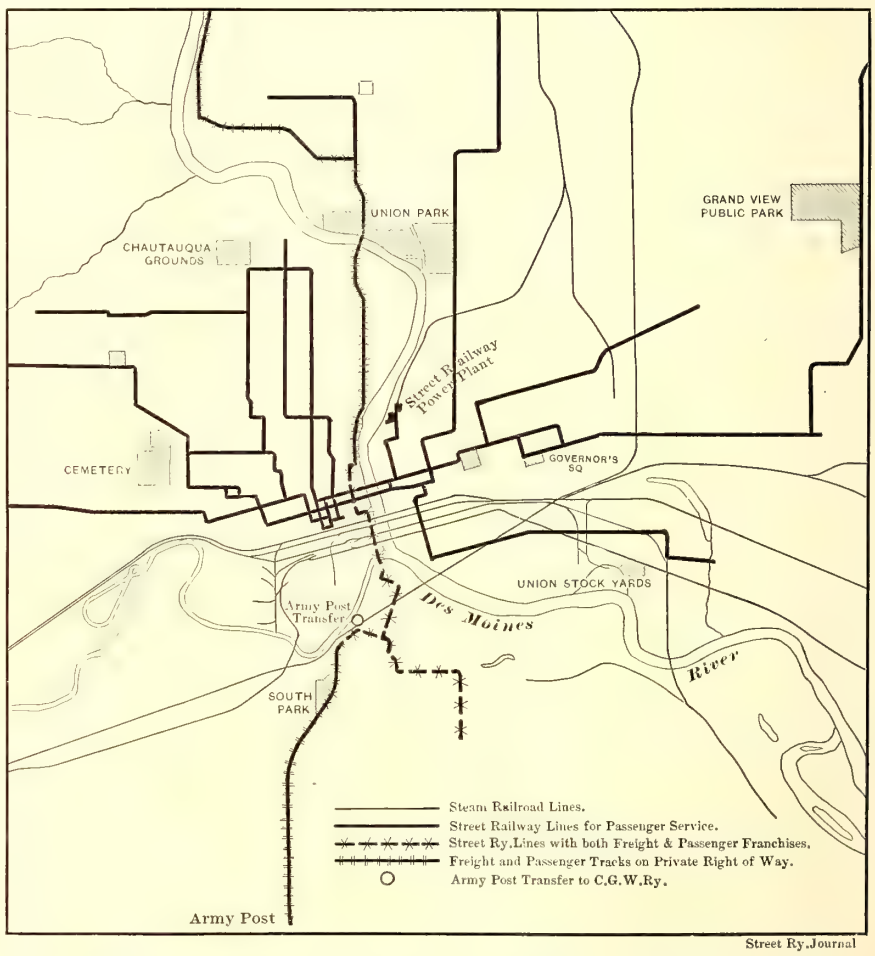


FIG. 2.— MAP SHOWING SYSTEM OF DES MOINES CITY RAILWAY



FIG. 3.— BOX FREIGHT CAR USED AS TRAILER IN DES MOINES

jection. In fact, on the whole, it is more desirable to have the trucks near the rear end of the car, with but little over-hang, than it is to have an excessively long rear platform hanging out beyond the rear truck and putting unusual strain both on the truck and track. The car shown in Fig. 1 has the sheathing boards running lengthwise or horizontally instead of vertical, as is customary. This was an experiment. The management considers, on the whole, that the vertical sheathing is the best.

south lines almost directly through the heart of the city, with sidings to a number of manufacturing establishments. The accompanying map, Fig. 2, shows the Des Moines City Railway system, which comprises seventeen routes and 55.29 miles of single track; 35.96 miles of streets are operated; 21 miles of the track is in brick paving, the balance being in open dirt streets. The map, Fig. 2, shows the route over which the company's franchises permit it to haul freight, and also that por-

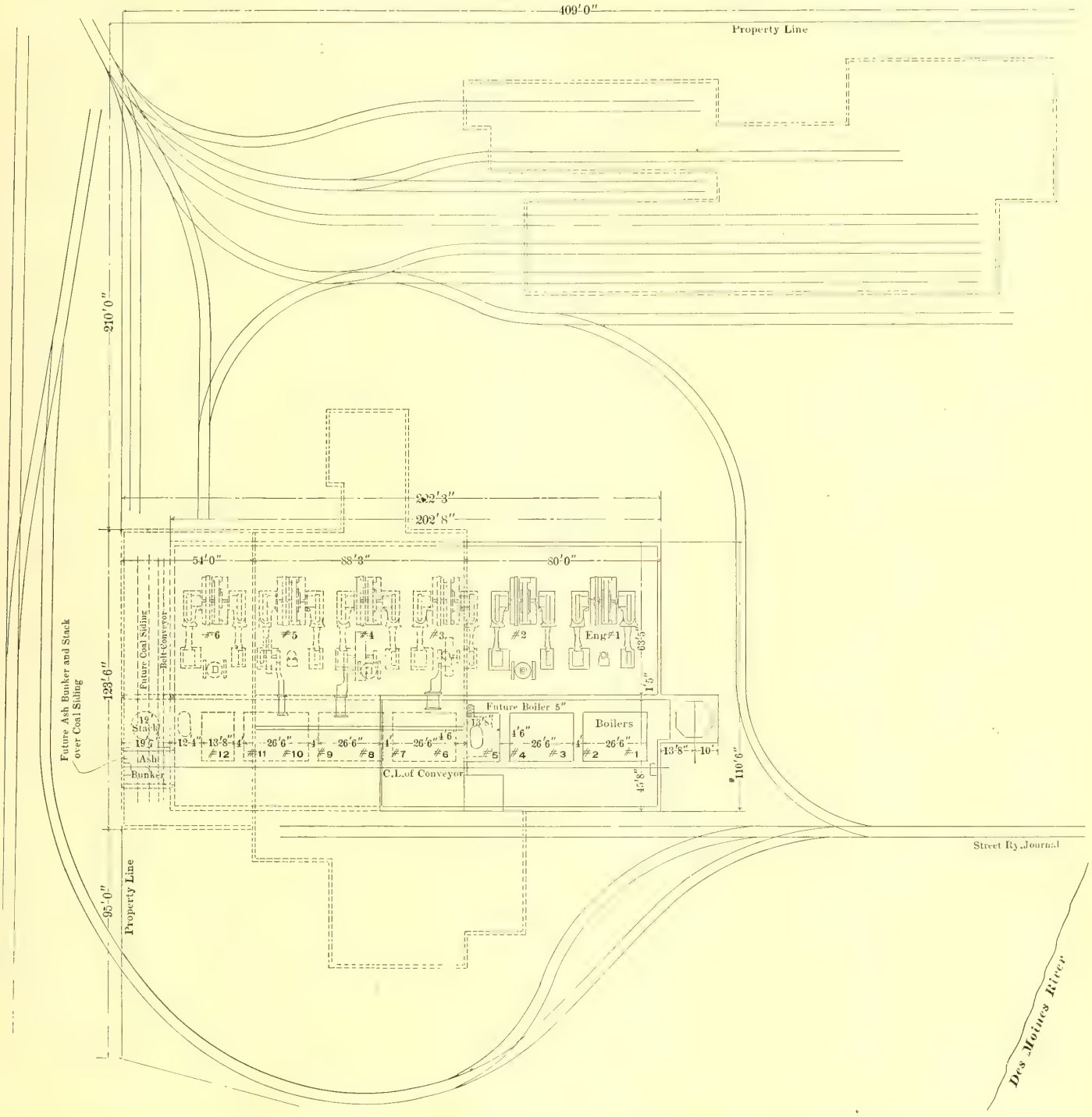


FIG. 4.—PLAN OF POWER STATION AND CAR HOUSE, SHOWING ENTRANCE CURVES

Of course, this car is run only single-ended, as are all the company's cars. It is equipped with sand-boxes on both sides of the motorman's vestibule, of unusually large capacity, being 8 ins. wide, 24 ins. long and 24 ins. high. The Niles Car & Manufacturing Company and the American Car Company have both recently supplied this company with new cars of a similar type to this.

FREIGHT BUSINESS

The company has some very valuable freight handling franchises, whereby it can haul freight over one of its north and

tion of this route which is over a private right of way. Of course, the company can haul its own material over any part of the system. The extent of the freight business carried on by the Des Moines City Railway is not generally known over the country, and no doubt will be of interest to other companies which may desire to get similar rights in their respective cities. The Des Moines City Railway Company has forty-five freight cars for taking care of its freight traffic. The business is principally in the hauling of coal and brick. The Flint Brick Company, at the northern border of the city, furnishes a large

amount of freight, as do also coal mines in that locality. The Des Moines City Railway Company's freight line in reality takes on the nature of a city junction and transfer railway for freight purposes, as far as its usefulness is concerned, although



FIG. 5.— ELECTRIC FREIGHT TRAIN IN DES MOINES

regular city passenger traffic is carried over this same route. Freight is handled with a locomotive made at the company's shops. In this conection it should be mentioned that the northern end of the line joins the belt line outside the city limits, owned by the Interurban Railway Company, an allied corporation. The Interurban Railway Company operates the interurban line from Des Moines to Colfax. Passenger traffic for the interurban line to Colfax goes over Walnut Street and then north to the northeast corner of the city, past Grandview Park, as seen. Freight traffic from the interurban line is taken across the belt line, which is not shown on the map, Fig. 2, and is brought down over the Des Moines City Railway Company's freight line, which parallels the river. The interurban belt line crosses and exchanges freight with two steam roads, the Chicago Great Western and the Chicago & Northwestern. Connection is made with several other steam roads near the heart of the city. South of Des Moines is a United States army post, reached by the Interurban Railway Company's line. Freight is hauled out from Des Moines over this line, and this is the only railroad to the army post. Figs. 3 and 5 will give an idea of the rolling stock used for freight handling by the Des Moines City Railway and Interurban Railway Company. Most of the freight cars are owned by the Des Moines City Railway Company.

NEW POWER STATION

The company is now enlarging its power house and taking out antiquated apparatus which has heretofore been kept as a reserve. The power house and car house are located near the center of the city, as seen on the map, Fig. 2. The map of the company's property, showing the general arrangement of the power houses, is given in Fig. 4. The Chicago & Northwestern Railway adjoins the property at the left, and the Des Moines River at the right. The storage tracks at the southern part of the property occupy space which is to be devoted to the new car shops mentioned later. Only that portion of the power house shown by full lines is completed. That part of

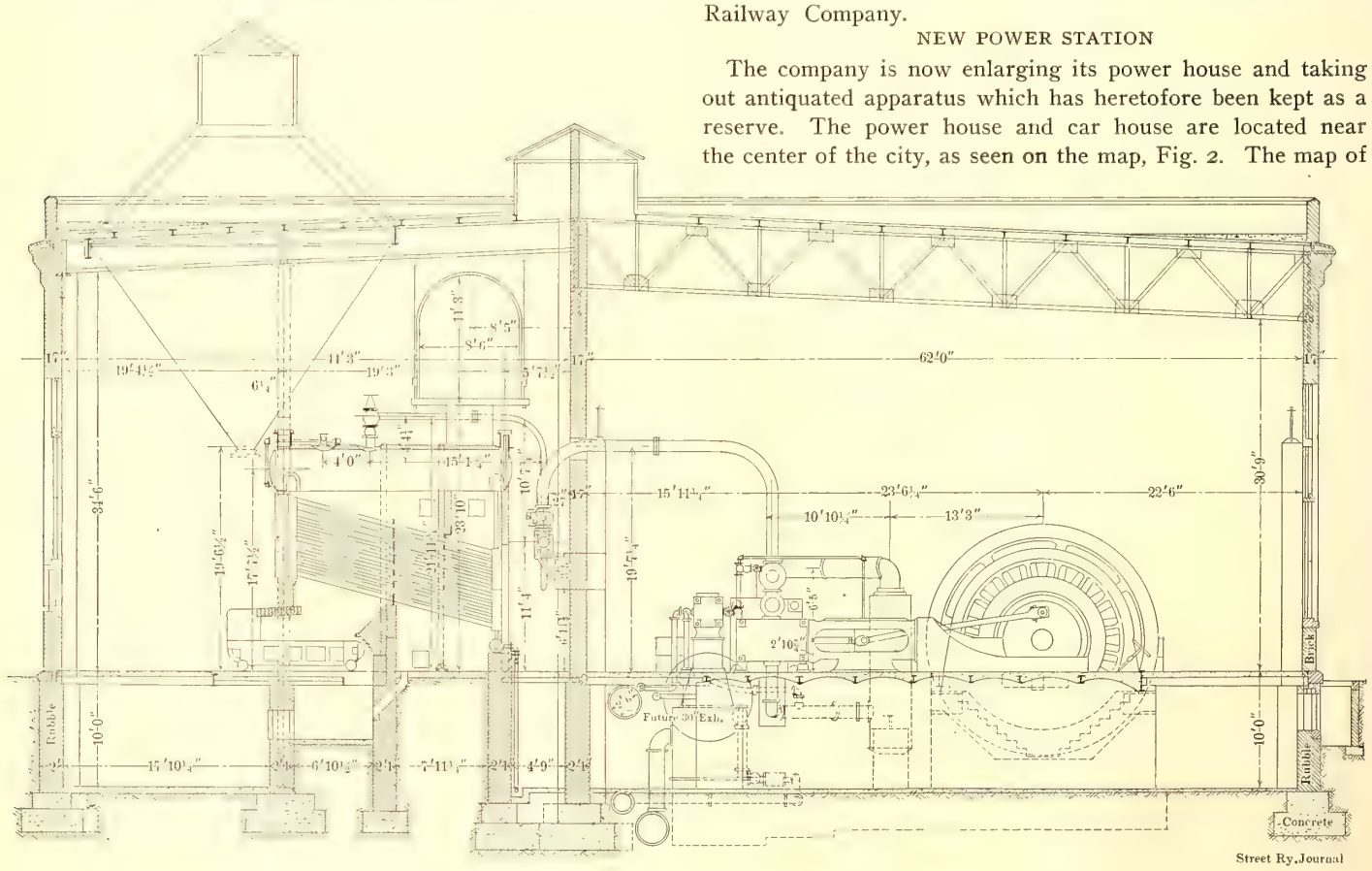


FIG. 6.— CROSS SECTION OF NEW POWER STATION

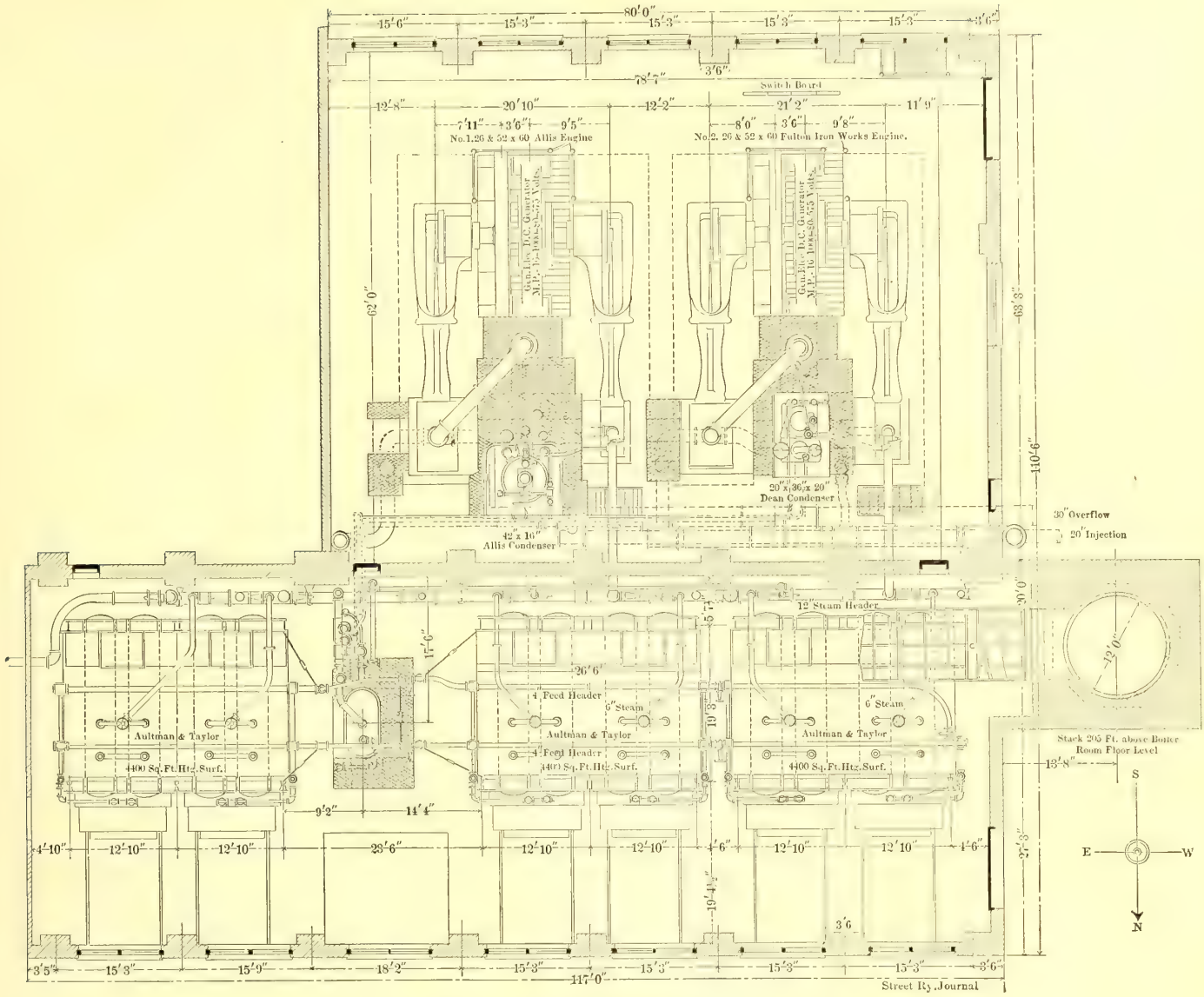
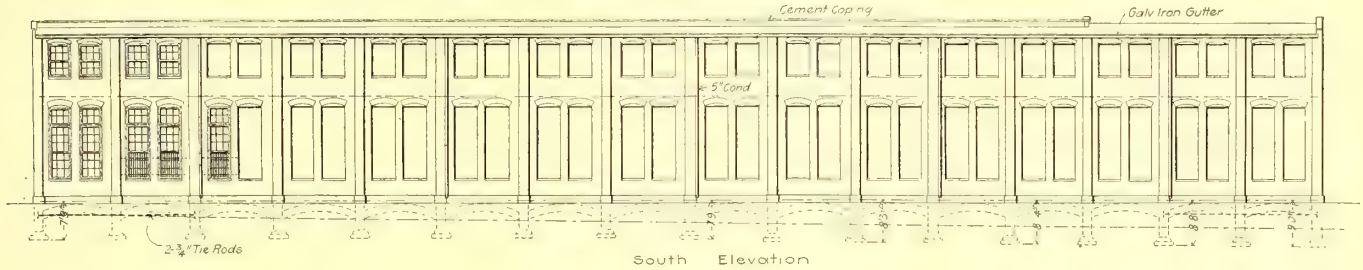
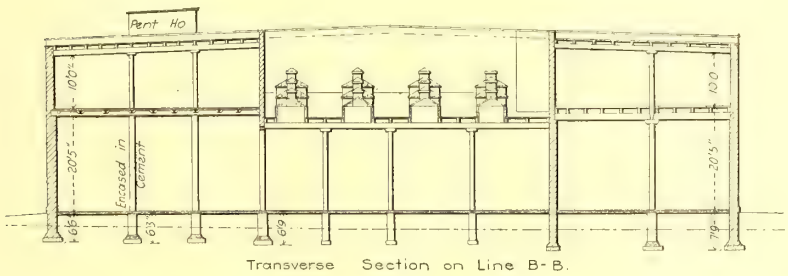


FIG. 7.— PLAN OF POWER STATION, SHOWING PIPING





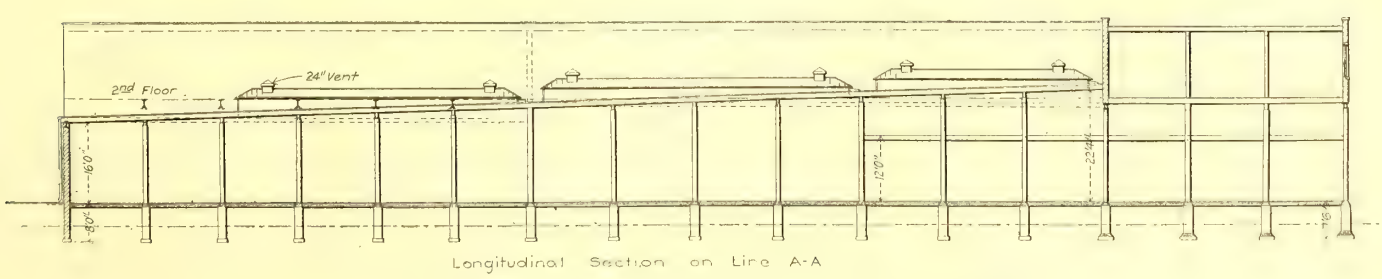
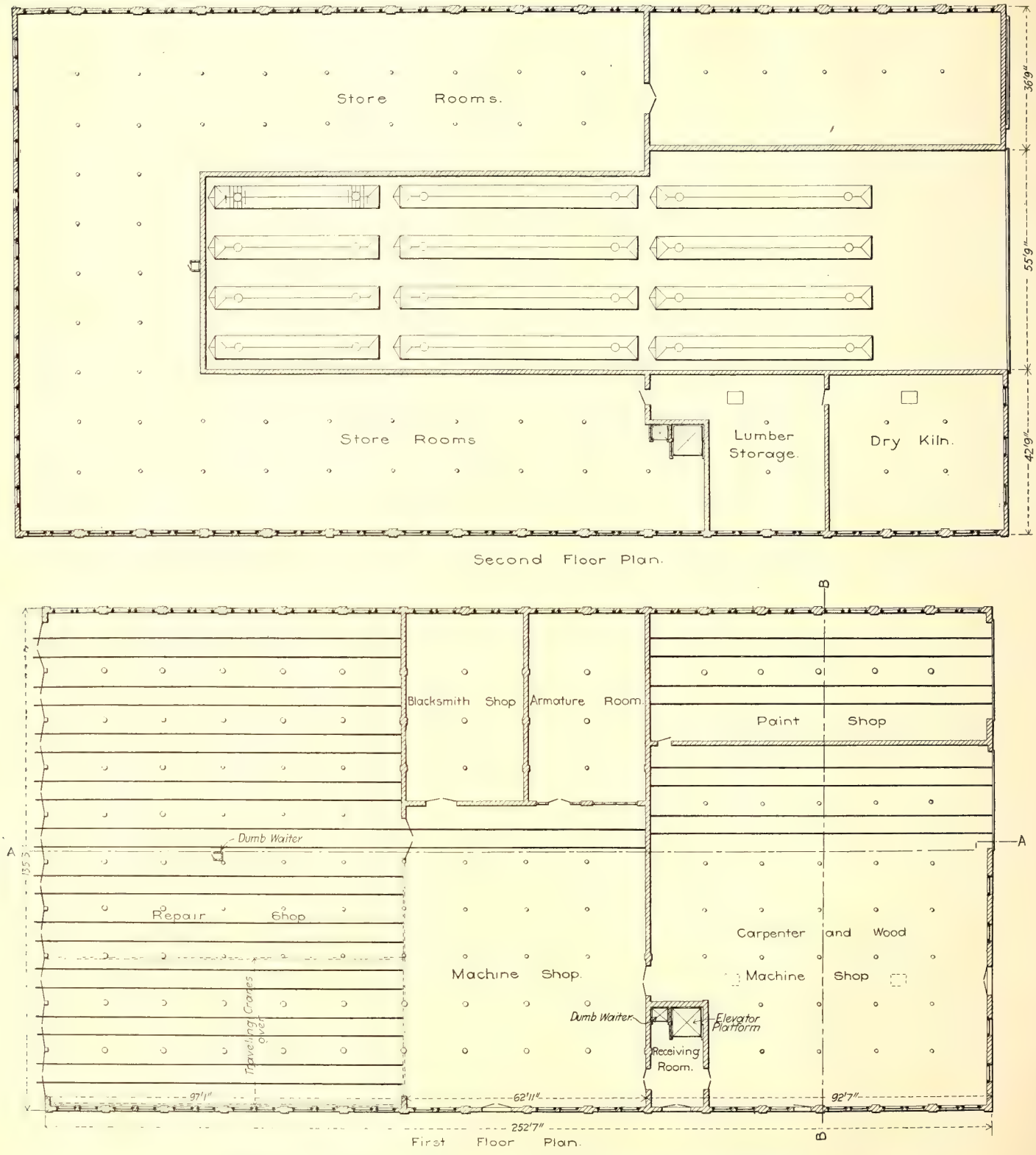


FIG. 8.—SIDE ELEVATIONS AND SECTION OF NEW REPAIR SHOPS

the power house shown by dotted lines is on ground heretofore occupied by the old power house and shops. The old power house had simple non-condensing Corliss engines, belted to a line shaft, which drove a lot of D-62 generators. The saving made in operating expenses when the old power house was shut down and the road was operated with the large compound, sub-station at Mitchellville. In case the interurban lines are extended, as they probably will be, so that a large amount of alternating current is required for transmission, alternating-current generators can be put in and the present inverted rotary converter can be used as a regular rotary converter at some sub-station. The boilers are of Aultman & Taylor make.



FIGS. 9 AND 10.—PLANS OF FIRST AND SECOND FLOORS, NEW REPAIR SHOPS

condensing direct-connected units, was something enormous. Fig. 7 is a plan of that portion of the power house which has just been completed, and Fig. 6 is a sectional elevation. The generators are 1050-kw direct-current General Electric, connected to Allis-Corliss compound engines. To supply the Interurban Railway Company's Colfax line an inverted rotary converter of 300 kw has been put in, which, with the aid of step-up transformers, gives 13,000 volts three-phase for transmission to a

NEW SHOPS

The company has always done a great deal of its own car rebuilding and repair work, and has also built some of its own cars. This will be done on a larger scale than ever before when the new shops, plans of which are seen in Figs. 8, 9 and 10, are completed. The company maintains its own iron foundry, which is a rather unusual practice with street railway companies. This is kept in a small building by itself. A

cupola capable of melting 1½ tons of iron at a heat is installed. The company casts its own brake-shoes and all the small cast-iron parts needed in car maintenance.

FEEDERS ACROSS THE RIVER

Feeders are taken directly across the river from the power station with a single span on a pole tower, from one side to the other. The method of laying the return feeder in the bed of the river is interesting. In the winter, when the river was frozen thickly over, some 50-lb. rail, with cast-welded joints, was laid on the ice. When the ice melted in the spring this sank, and the company had a permanent return feeder from the east to the west side of the river.

CAR FOR STATE FAIR TRAFFIC

The Des Moines City Railway Company handles its greatest crowds at the time of the Iowa State Fair, which is held every fall, east of the city. At that time every bit of rolling stock available has to be brought into service for temporary use in hauling State Fair crowds. Additional trailers like the one shown in Fig. 11 have been constructed. They are rather peculiar in appearance, but they serve well to handle the crowds and were not expensive to build.



FIG. 11.—TRAILER FOR USE DURING STATE FAIR

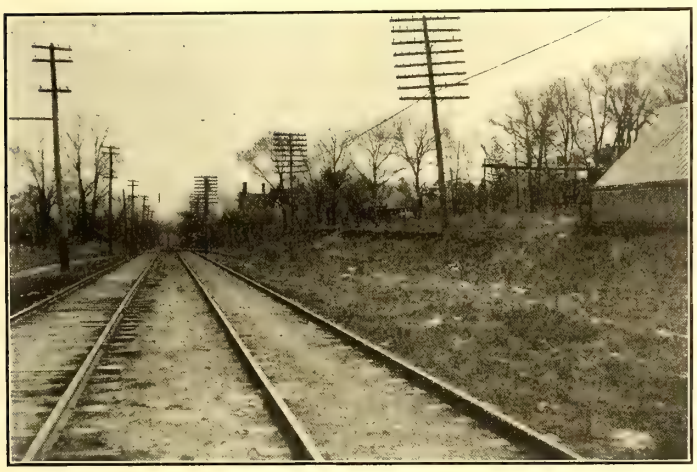


FIG. 12.— DOUBLE TRACK ROAD ON PRIVATE RIGHT OF WAY.

A DESIRABLE LOCATION FOR TRACKS

Fig. 12 is a view in one of the outlying residence portions of the city, showing one of the company's principal lines, which is on a private right of way paralleling one of the finest boulevards. This track is an inheritance from an old steam dummy line. It is too bad there have not been more such lines the country over, as the private right of way is so desirable, from an operating standpoint, because of the freedom from interference by steam traffic, the freedom from paving maintenance and the greater ease with which the track can be kept clear of dirt and in good operating condition. It serves the entire population located along the boulevards without in any way interfering with pleasure traffic on the boulevards. It is, perhaps, too much to expect that this method of operation over a private right of way will be extended, but upon seeing how well the arrangement works one cannot help regretting that more routes over private right of way were not secured in the earlier days of street railway business.

INGERSOLL PARK

At Ingersoll Park, in the western part of Des Moines, the company this spring built one of the largest and best equipped park theaters in the United States. Fig. 13 is a view taken during the construction this spring. As seen, it is located on the hillside or the banks of a lagoon. The high side furnishes the necessary slope for the main floor. It has a gallery, and is especially designed to be cool and comfortable in all weather. This opera house seats 4200, and is practically as complete in is appointments for staging high-class productions as any metropolitan opera house. The interior will be fitted with 1000 incandescent lamps, and folding opera chairs for the seats. The proscenium will be 34 ft. wide and about 26 ft. high. Other details regarding this opera house were given on page 744 in this journal for May 16, 1903. It is an undertaking in which President J. S. Polk, of the Des Moines City Railway Company, has taken great pride. He has taken pains to see that it is as good as it could be made.

The company is practically under the same management as it has been in years past, the officials now being as follows: President, J. S. Polk; secretary and superintendent, A. G. Maish; treasurer and general manager, George G. Hippee; master mechanic and chief engineer, J. E. Welch. For 1902 the gross receipts were $483,150; operating expenses, $310,075; net earnings, $173,075.



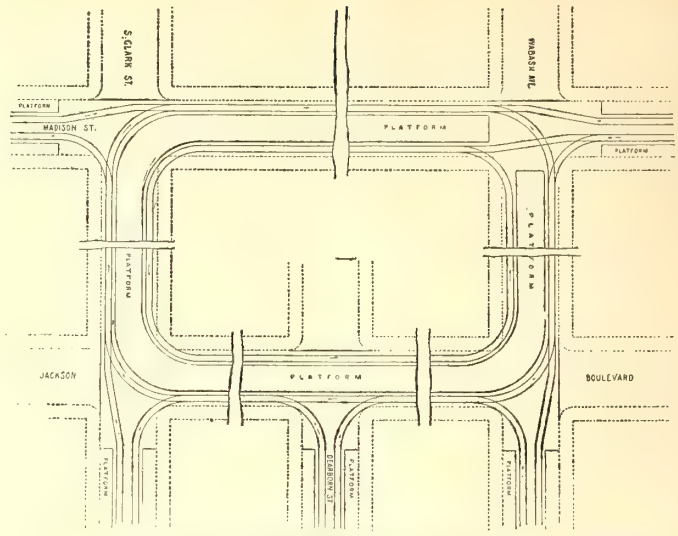
FIG. 13.— SUMMER THEATRE IN COURSE OF CONSTRUCTION AT INGERSOLL PARK

The Brooklyn Rapid Transit Company carried nearly 2,000,000 passengers on July 4. This breaks the company's record.

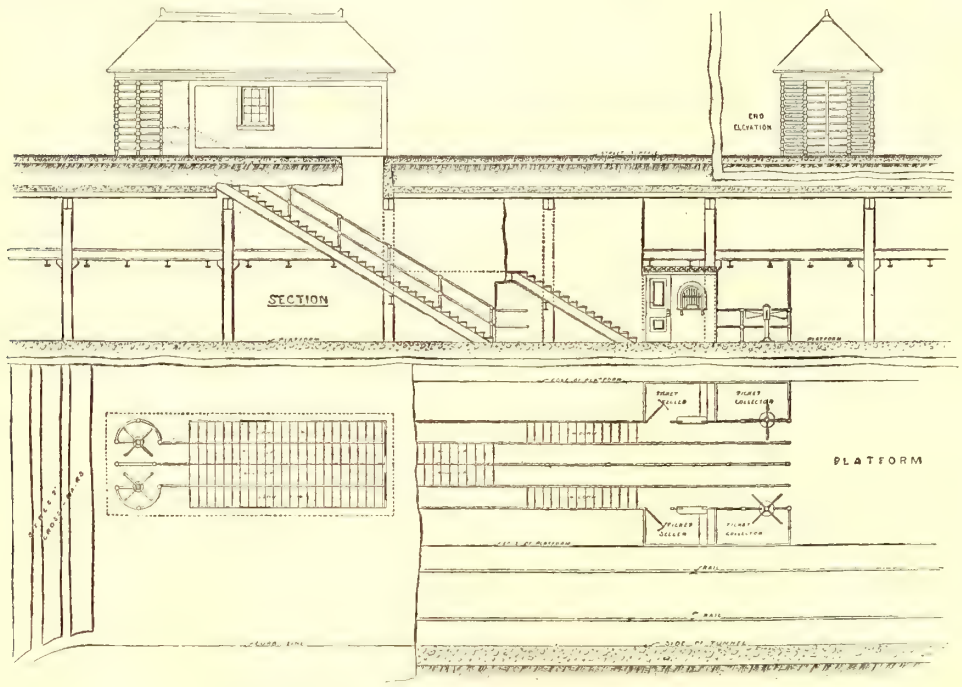
PROPOSED INNER CIRCLE SYSTEM FOR CHICAGO

The recent discussion of the underground street railway problem of Chicago has brought out a number of plans besides those submitted by Mr. Arnold with his report. Among these is one by A. S. Robinson, lately chief engineer of the Northern Michigan Railroad, which consists essentially of one inner circle or loop subway, upon which cars of open construction will move only in one direction, acting as a transfer, and stopping at all stations. This subway, surrounding four, six or nine blocks, as might be finally determined upon, would be centrally located and accessible to the street car lines coming in from the North Side, West Side and South Side. For the sake of illustrating his system Mr. Robinson has indicated this loop or belt line as surrounding the nine blocks bounded by Clark, Jackson, Wabash and Madison in the map.

The street railway lines reaching the downtown district would enter their respective subways about as indicated in Mr. Arnold's plans, and approach the belt line, or, as Mr. Robinson calls it, the "Inner Circle," in the most direct manner, thus eliminating as much unnecessary curvature as possible.



PLAN SHOWING INTERSECTIONS WITH BELT LINES



PLAN AND SECTION OF BELT LINE TERMINAL

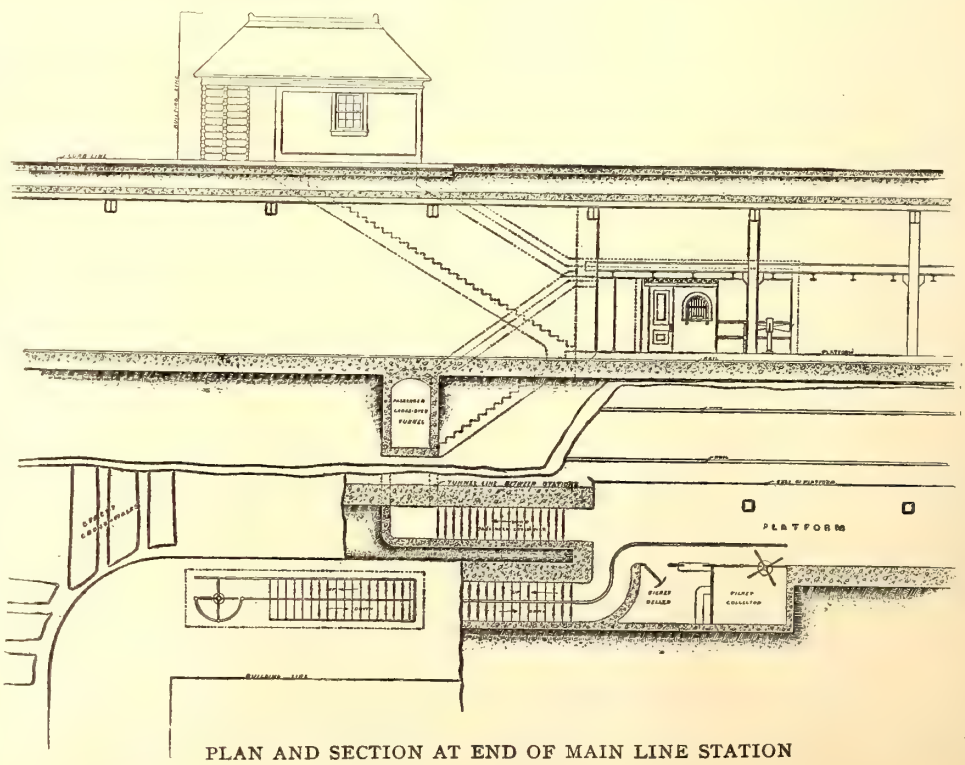
These main lines, as they may be called, would each form loops in the downtown district and pass into the same subway with the inner circle belt line, and be separated from it by the passenger platform, thus making the "belt" on one side and the main line cars on the other, running in the opposite direction to the inner circle cars.

Those portions of the main line loops in the subway that are parallel with the inner circle would all be connected up, thus making another or outer belt in the same subway as the inner circle belt, and separated from it by the passenger platform. The latter belt would serve for the transfer of through cars, if desired, from one main line to any other.

It will be seen from a study of the accompanying illustrations that, with one exception, there are no grade crossings in the whole system, and that all cars, of whatever main line, while in the belt subway run in the same direction. The inner circle, using an independent track, allows cars to be run in the opposite direction, thus facilitating the rapid transfer of passengers.

The one exception of grade crossing is at the northeast corner of the inner circle, where connection is made with the main lines for supplying cars to and removing them from the inner circle during the rush hours. This crossing, however, is in a track that is used only by the occasional through cars, and hence the danger of grade crossing accidents is reduced to a minimum.

Mr. Robinson calls attention to the fact that in the inner circle system here submitted he has secured the minimum depth of tunnel, as the sub-



PLAN AND SECTION AT END OF MAIN LINE STATION

way station platforms are only about 19 ft. below the street surface. Accessibility is another feature that recommends the scheme, as the greatest distance patrons would have to walk to reach a subway station entrance would be 1½ blocks.

Simplicity of arrangement is attained, as the main lines come into the business portion of the city and leave it in the most direct manner, and the whole system of subway tracks downtown can be easily understood by everybody. Simplicity of operation is assured by the fact that each main line terminates in a loop down town, and cars run always in the same direction. These also insure safety, which is increased by the absence of grade crossings.

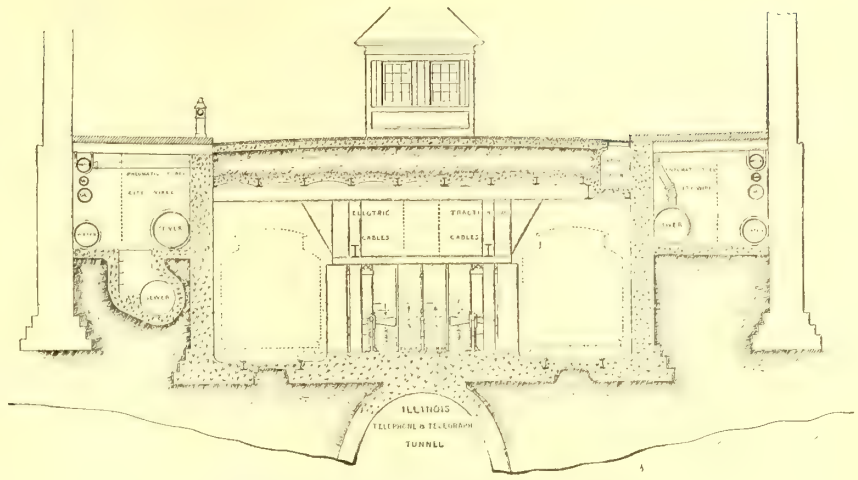
Rapidity of service, which is an essential element in any practical system, is claimed for this plan, as cars can be run on both main lines and inner circle on headway distance only.

The lines cover the business district in such a manner that the possibility of congestion of traffic at any point is said to be reduced to a minimum.

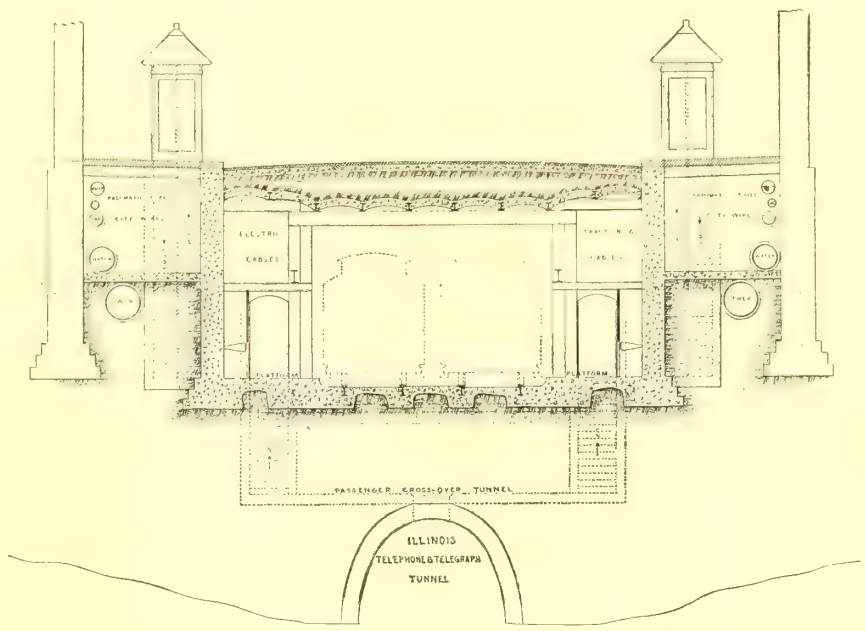
Through traffic, originating on, say, the South Side and terminating on the North Side or West Side, may be accommodated in two ways, namely, by taking the proper through car, or by taking any inbound car, leaving it at any point on the belt platform, taking the first approaching inner circle car and transferring at any point where the loop of the desired main line is opposite the inner circle.

Local traffic terminating and originating in the downtown district will be accommodated in the same manner.

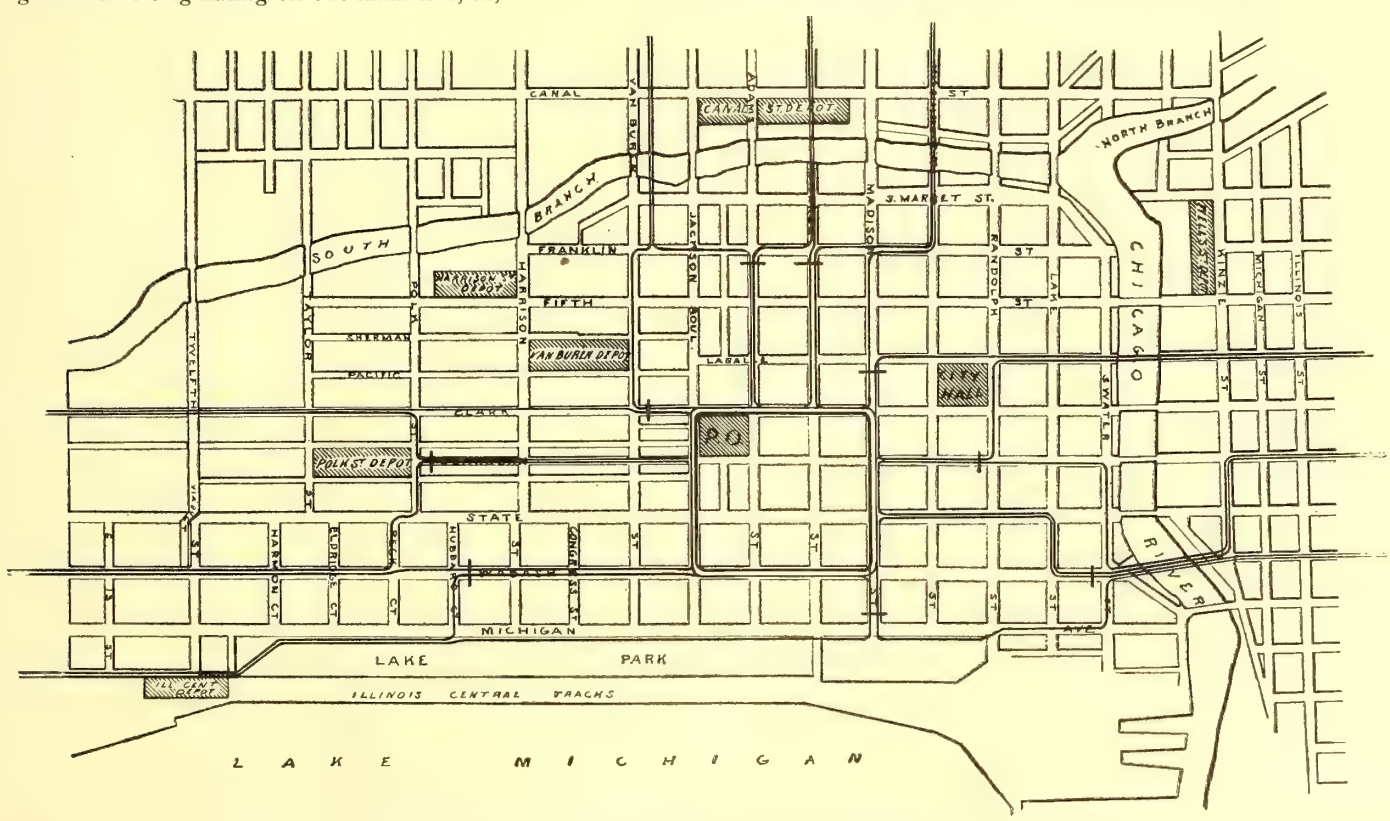
Entrance to the subways, especially to the inner circle, may be as many and at as frequent intervals as the traffic demands. A further means of assisting transfer by providing for traffic originating on one main line, as,



CROSS SECTION OF BELT-LINE TUNNEL



CROSS SECTION OF MAIN-LINE TUNNEL AT STATION



MAP OF CHICAGO BUSINESS DISTRICT, SHOWING PROPOSED INNER CIRCLE

for instance, Indiana Avenue, and terminating on a neighboring line, as on the north end of Michigan Avenue, is effected through passenger cross-over tunnels, which will be provided at the point where these two (or any other two) lines first come in contact, as shown by short lines on the map, crossing the streets.

In this manner, this class of traffic can be transferred without entering the inner circle.

These belt lines, passing around nine blocks, as assumed, give a continuous platform twelve blocks long, all of which is available for discharging and receiving passengers from the lines coming from the North Side, West Side and South Side, thus giving the maximum length of platform for the operation of trains, and this, too, in addition to the stations on the main lines away from the inner circle, of which there could be one at each street intersection or oftener as the traffic demands.

PRIVATE TELEPHONE SYSTEM OF THE MANHATTAN RAILWAY COMPANY

On April 20, 1903, an independent telephone system was placed in service on the Manhattan Railway division of the Interborough Rapid Transit Company, of New York. This installation is particularly noteworthy, as it is one of the first of its kind in the East, and is one of the largest private exchanges not connected with the Bell system. The entire equipment, exclusive of the cable work on the elevated structure, was installed by the Lambert Schmidt Telephone Manufacturing Company, of New York, under the direction of Hugh Hazelton, electrical engineer of the Manhattan Railway Company. Mr. Hazelton was assisted by W. H. Kinlock, who is now in charge of the system.

This installation is of the central energy type, the battery being located at a central point. The maximum distance from the central station to instruments at the extreme end of the line is about 8½ miles. If any one at the extreme end of the line were to talk to a person at another instrument in an adjoining room, the total length of the circuit would, therefore, be about 17 miles. It will be noted that this distance is considerably greater than is ordinarily allowed for telephoning on central energy systems. At first there was some apprehension that the longer lines might not give satisfactory service on account of their extra resistance and capacity, but the Lambert Schmidt Company made a special study of this question, and succeeded admirably in adapting its system to meet the special conditions.

This equipment comprises a complete telephone exchange with switchboard, motor-generator charging sets, ringer sets, and storage batteries. There are at present about 300 telephones in use over the lines of the Manhattan Railway. A telephone is located in each passenger station and switch tower, and telephones are also provided for all of the offices, power house, sub-stations and car shops.

The exchange is located at Ninety-Ninth Street and Third Avenue, in rooms specially built for it above the car shops of the company. Fig. 1 is a floor plan of these rooms, showing the general arrangement of the apparatus.

The main operating room, part of which is shown in Fig. 2, contains the telephone switchboard, the distributing frame, fuse rack, relay and coil racks, and the wire chief's desk.

The switchboard, which is of handsome design, is built of mahogany. The front and rear panels can be readily removed, thus making all parts easily accessible. About 300 lines are at present in use, but the present arrangement of the board permits the ultimate use of about 600 lines. Positions are provided for six operators, each position containing fifteen pairs of inter-



FIG. 2.—SWITCHBOARD IN MAIN OPERATING ROOM

communicating plug circuits consisting of double supervisory lamp signals and combination ringing and listening cams. The cords are colored white, brown or green, each cord being of a color different from the adjacent ones. The switchboard is also provided with a testing section on which a voltmeter and cord circuits are placed for making ordinary line tests.

The board is operated as follows: When subscriber takes receiver off hook, the line lamp lights up as well as a larger lamp placed at the bottom of each set of line lamps. The operator answers by inserting plug in jack, which extinguishes the lamps. Upon learning the desired number, the operator inserts mate of plug in jack of called subscriber. The supervisory lamps light up again and remain so until the called subscriber responds by taking off the receiver. While conversation is being carried on both lights are extinguished, but when the subscribers have stopped talking and have hung up their re-

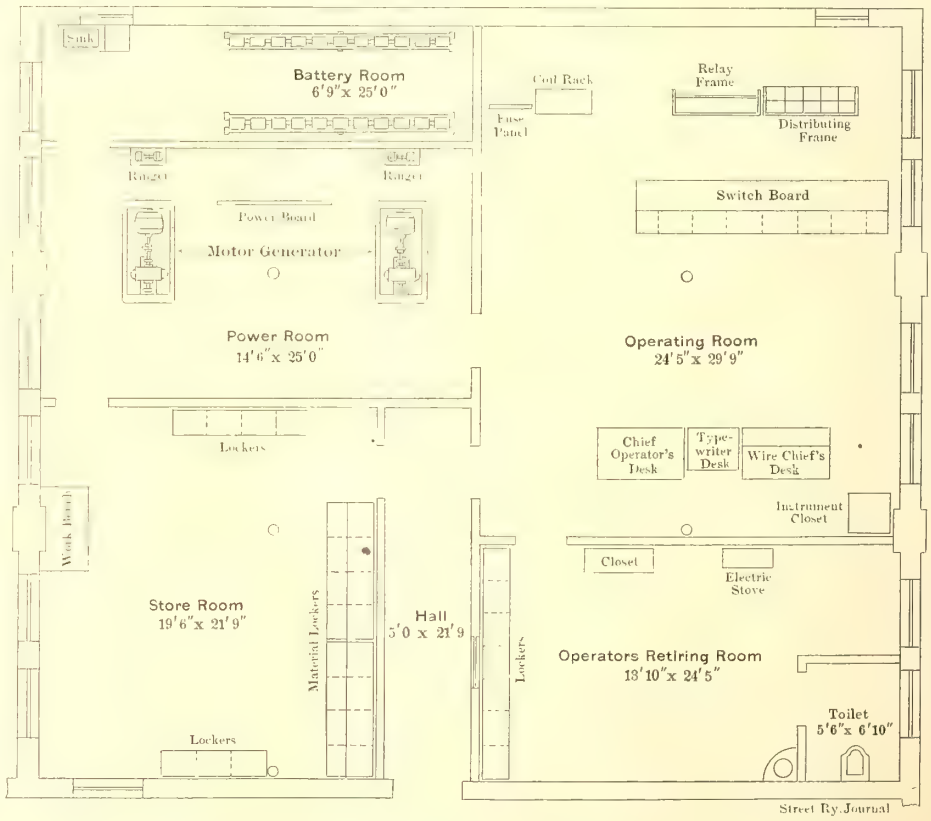


FIG. 1.—PLAN OF TELEPHONE STATION, MANHATTAN ELEVATED RAILWAY

ceivers, the operator knows that connection is no longer desired, and takes down the plugs.

For night service an extra relay is put in, which causes a bell to ring in addition to the lighting of the lamp signals. This feature makes it unnecessary for the night operator to watch the entire board, and also serves to attract his attention if he is doing something else.

The incoming lines run to one side of the distributing frame,

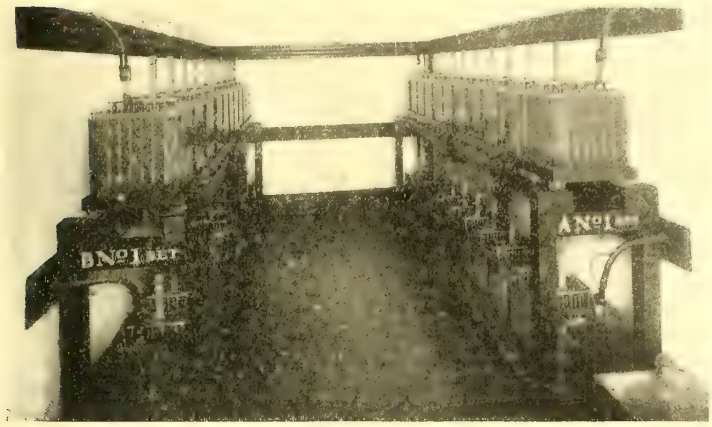


FIG. 3.—STORAGE BATTERY PLANT

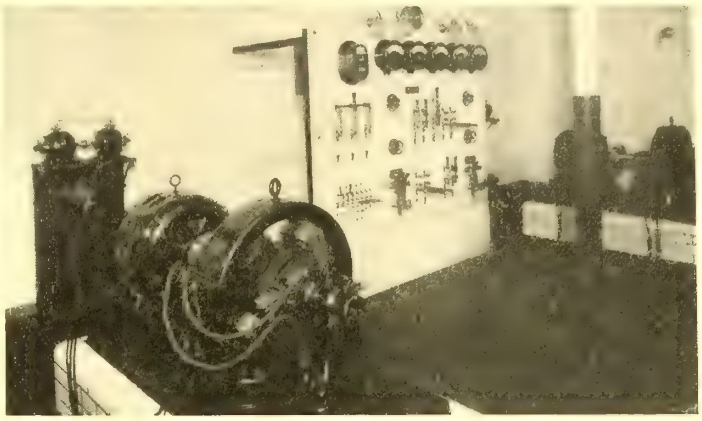


FIG. 5.—POWER BOARD

which is placed behind the switchboard, and are jumpered across to the other side, from where they connect with the relays and the jacks.

The battery is connected to fuse panel, where fuses are provided for each cord circuit and all other principal leads. Lightning protection is secured by using carbon blocks with perforated strips of mica between.

The wire chief's desk is placed in front of the switchboard and is so arranged that the man in charge of it can act both as monitor and wire chief. It is provided with cord circuits and the necessary connections for observing the service, and is also provided with a complete testing outfit for making special tests.

The entire power equipment, consisting of charging sets, ringing sets and batteries, is in duplicate. Each charging set consists of a 5-hp 390-volt, three-phase General Electric induction motor directly coupled to a 3-kw, 30-volt Holtzer-Cabot telephone generator running at 750 r. p. m. The current for running these motors is obtained from the Ninety-Ninth Street substation through step-down transformers. Each set is mounted on an iron base supported by a white enamel brick foundation about 12 ins. high. The ringing current is obtained from Holtzer-Cabot motor-generator sets, the motor taking about 24 volts from the storage battery, and the generator delivering 75 volts alternating current.

The batteries, which are mounted in the tiled-brick room, shown in Fig. 3, are of the Chloride Accumulator type, size E-11, furnished by the Electric Storage Battery Company. Each set consists of eleven cells in parallel and two in series. Only one set is used at a time, one being charged while the other is discharging. The battery room is provided with a ventilator which readily carries off the fumes from the cells.

A wiring diagram of the power circuits is shown in Fig. 4. In the lower part of the figure are shown the motor-generator sets and the ringer sets above them, with the transformers between. The battery connections are clearly indicated in the middle of this figure.

Fig. 5 is an illustration of the power board. This board is of white Italian marble, 6 ft. 6 ins. square. The two voltmeters are arranged so that the voltage of the charging machines, as well as that of each storage cell, can be read. Besides the two Weston voltmeters there are three Weston ammeters. The middle ammeter indicates the current discharged from the battery in circuit to the board. Each of the other ammeters serves to indicate the charging current from either of the charging sets. The main switch for controlling the current received from the sub-station is mounted on the left of the board. Above this switch is a Westinghouse polyphase wattmeter, which measures the incoming current. Beneath the main switch small switches are placed for controlling the ringers. The switches on the center of the board are used for charging the batteries, and for connecting the batteries to fuse panels. They consist of four positive switches and one negative switch. There are two positive switches for each battery, while the negative switch is common and the negative side is grounded. Two I. T. E. under-and-overload circuit breakers are provided for protecting the batteries when charging.

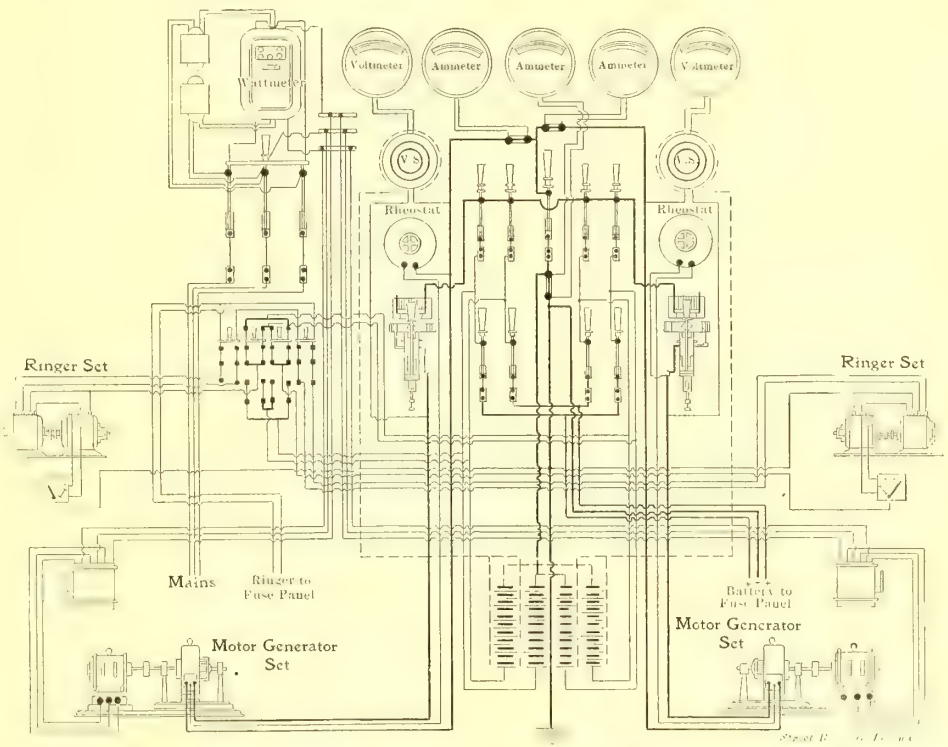


FIG. 4.—WIRING DIAGRAM OF POWER CIRCUITS

All outside wiring consists of lead-covered cables ranging in

size from 5 to 120 pairs. They are suspended from a galvanized guy wire fastened to the elevated structure with iron brackets or hangers. The cables are spun to this guy with a marline and are potheaded at each station. The wires are brought out to binding posts mounted on hard rubber strips in an oak junc-

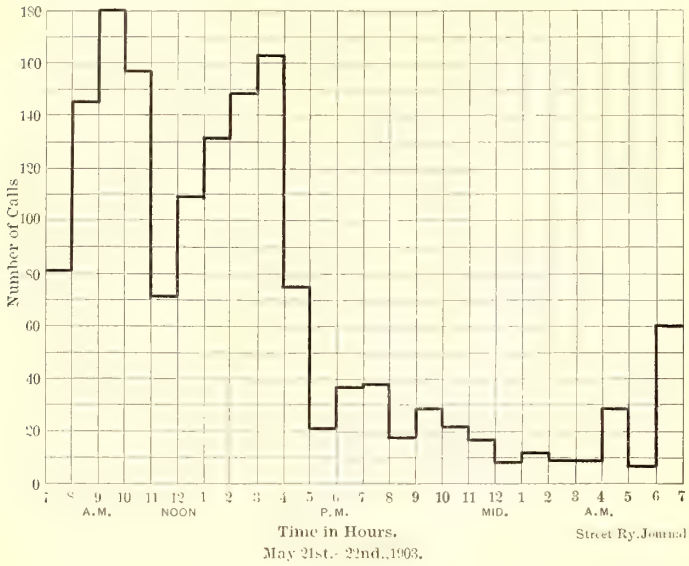


FIG. 6.—TELEPHONE CALLS PER HOUR, MAY 21-22, 1903, MANHATTAN RAILWAY COMPANY

tion box placed inside the station waiting-room. This construction permits rapid testing and arranging of connections. It is a well-known fact that lead sheathing deteriorates very rapidly when subjected to vibration, and, therefore, every precaution was taken to minimize the vibration as much as possible. An installation of lead-covered cables, supported from an elevated structure in the manner above described, has been in service in Brooklyn for seven or eight years with satisfactory results. The cables were installed by the Manhattan Railway

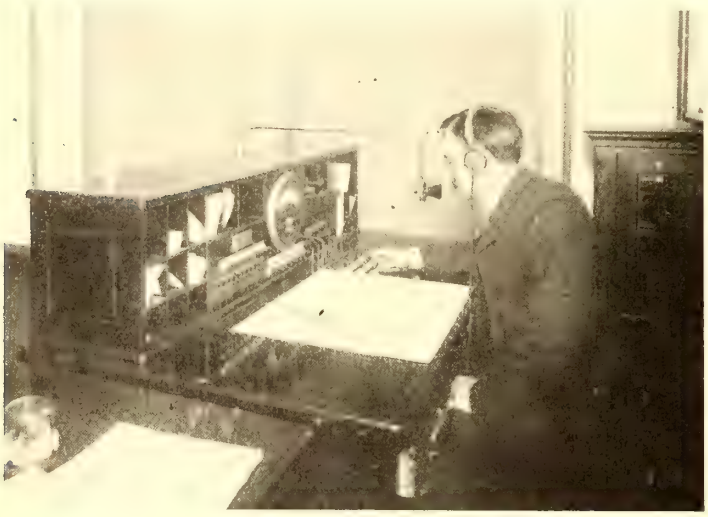


FIG. 7.—WIRE CHIEF'S DESK.

Company, and it was only after considerable experimenting that the present method of cable suspension was adopted.

The force required for the operation of the system consists of Telephone Engineer W. H. Kinlock, eight telephone operators and five repair men. Women operators are employed for the day service, but the night service is taken care of by men. The operators work in three shifts, which are so arranged that during the busiest hours there are five operators at the board. The curve shown in Fig. 6 indicates graphically the number of calls at different hours of a representative business day. Fig. 7 shows Mr. Kinlock seated at the wire chief's testing desk.

This system is extensively used for the general business of the company, and is proving very valuable for facilitating intercommunication between the company's offices, stations, car shops and switch towers. In cases of accidents, where it is important to cut off the current on a given section of the line, the proper sub-station can be quickly notified by telephoning from the nearest telephone station. It is not the company's intention, however, to supplant the Morse system now in use for despatching trains. When the Interborough Rapid Transit Company's subway is completed, additional telephones will be installed and connected with the Ninety-Ninth Street Exchange, the present board having been designed with that object in view.

PERPETUAL FRANCHISE IN OHIO

The street railway interests of Columbus, Ohio, scored a noteworthy victory on June 25 when the Circuit Court upheld the principle that electric railways may hold perpetual rights in the streets of a city. The court held that the Columbus Railway Company has franchises in perpetuity in East Main Street, State Street, Oak Street and West Broad Street, four of the most important thoroughfares in the city, and dismissed quo warranto proceedings brought by E. L. Taylor, prosecuting attorney of Franklin County, Ohio, to oust the company from its claims. A motion for a new trial was overruled and the case will be carried at once to the Supreme Court of the State.

Judge A. N. Summers, of Springfied, wrote the syllabus, which is as follows:

"The right to construct and operate a street railway in the streets of a city prior to the act of May 14, 1878, was a franchise privilege granted by the State upon condition that the city consent to its exercise.

"Such consent given prior to said act without limitation of time or to a corporation with successors during the term of its charter is revocable only by legislative authority.

"A franchise or privilege to construct and operate a street railway granted and consented to prior to said act without limitation of time is perpetual, but subject to be determined by the General Assembly under section 2, article 1, or under sections 1 and 2 of article 13 of the constitution.

"The limitation in said act of the consent to the term of twenty-five years was prospective in its operation and not the exercise by the General Assembly of any of the powers reserved to it by said sections of the constitution."

The suit was filed in April, 1901, and the petition set forth in brief that the street railway company contended illegally that its franchises in the streets named remained in force perpetually. The company set up the defense of estoppel, claiming that the city, county and State were barred by the statute of limitations from preventing it from using the franchises exercised for twenty-one years.

INDIANA INTERURBAN AT 65 MILES AN HOUR

Some remarkably swift runs have been made recently by one of the interurban cars of the Union Traction Company of Indiana, as high as 65 miles an hour having been recorded. The test was made with a Westinghouse four-motor equipment, each motor having 110-hp capacity, instead of the two-motor equipments previously used.

The run between the Muncie and Indianapolis terminals, a distance of 56.55 miles, was made in 106 minutes—an hour and 46 minutes. There was the usual great loss of running time in getting out of Muncie, passing through Anderson, going into Indianapolis and passing through twelve or fifteen towns along the route.

The average speed under even these unfavorable conditions was 32 miles an hour, which meant that the car had to work up to 60 miles an hour on several long stretches of straight track.

THE CENSUS REPORT ON THE STREET RAILWAY INDUSTRY

The long expected census report on street and electric railways, entitled "Bulletin No. 3," has just been issued by the Census Office, and is a very valuable and bulky volume, containing a large number of tables and 193 pages. The report, which was issued by W. M. Steuart, chief statistician of manufactures, has been prepared under the direction of T. Commerford Martin and E. Dana Durand, special experts, and is very much more complete than that issued for 1890. The statistics cover the reports of 817 operating electric railway companies and 170 leased companies, making a total of 987 companies. These companies owned or controlled 22,576.99 miles of single track. The par value of the capital stock and funded debt outstanding, as reported, amounted to $2,308,282,099. The average net capital liabilities per mile of single track owned for the companies reporting both factors were $96,287. The total income and expenses of the operating companies amounted to $250,504,627 and $219,907,650, respectively. The companies gave employment on the average during the year to 133,641 wage earners, and paid $80,770,449 in wages. There were 7128 salaried officials and clerks employed, to whom $7,439,716 was paid in salaries. The roads carried 5,871,957,830 passengers of all kinds.

The report states that the Census Office in collecting these statistics has almost invariably received the hearty co-operation of the street railway companies, all of which, with the exception of twenty-two, have furnished complete returns. Some of these companies reported that the information concerning financial operations was not available, and in two or three cases the information was refused on the ground that it was of a private character. In addition a further report is being prepared containing detailed statistics for all street and electric railway companies, with an analysis of the same; also a discussion treating in detail the development of the modern street railway system, the generation and distribution of electric current, car equipment and a variety of other features upon which the technical efficiency and economy of the street railway service depend. Details will also be given as to the methods of installing and operating interurban street railway systems and of handling passengers, freight, mails, express, etc. The growth of mileage and traffic will be discussed, and the effect of this development upon distribution of population. Other subjects which will receive consideration are capitalization, the relation of expenditures to receipts, and the general financial results of operations, the terms of franchise, rates of fare, accidents, safety appliances, etc., and the wages and conditions of labor.

A few of the details of statistics given in Bulletin No. 3 are given below.

TABLE 1.—NUMBER OF COMPANIES AND MILES OF SINGLE TRACK GROUPED ACCORDING TO MOTIVE POWER: 1890 AND 1902.

CHARACTER OF POWER	1902		1890		PER CENT OF INCREASE.	
	Number of Companies	Miles of Single Track	Number of Companies	Miles of Single Track	Number of Companies	Miles of Single Track
United States	849	[1]22,589.47	761	8,123.02	11.6	178.1
Electric	747	[2]21,920.07	126	1,261.97	492.9	1,637.0
Animal	67	259.10	506	5,661.44	[3]86.8	[3]95.4
Cable	26	240.69	55	488.31	[3]52.7	[3]50.7
Steam	9	169.61	74	711.30	[3]87.8	[3]76.2

[1] Includes 12.48 miles of track duplicated in reports of different companies.
[2] Includes 6.06 miles operated by compressed air.
[3] Decrease.

Table No. 1 shows the number of companies and miles of single track grouped according to motive power in 1890 and 1902, the statistics contained in the Bulletin covering all of the street railways in the United States that were in operation during any part of the year ending June 30, 1902.

Of the total single-track mileage, 21,914.01 miles, or 97 per cent, were operated by electric power, and 416.36 miles, or 1.9 per cent, by other mechanical traction, while only 259.10 miles, or 1.1 per cent, were operated by animal power, as compared with 69.7 per cent in 1890. Of the total trackage in use by all companies 84.3 per cent was owned by the operating companies and 15.7 per cent leased. It appears from the reports that 3,424.96 miles of single track were on private right of way

TABLE 2.—COMPANIES GROUPED ACCORDING TO LENGTH OF LINE: 1890 AND 1902.

	1902		1890	
	Number of Companies	Length of Line	Number of Companies	Length of Line
Total	[1]817	16,651.58	[2]691	[3]5,119.53
Under 10 miles	394	1,957.16	557	2,304.49
10 to 20 miles	219	3,148.94	99	1,353.42
Over 20 to 30 miles	76	1,878.54	16	400.39
Over 30 to 40 miles	34	1,197.83	7	251.74
Over 40 to 50 miles	25	1,117.05	4	178.04
Over 50 to 60 miles	16	892.86	2	101.57
Over 60 to 70 miles	12	785.22	2	130.33
Over 70 to 80 miles	7	532.46	1	76.48
Over 80 to 90 miles	6	515.30	1	84.42
Over 90 to 100 miles	3	277.12	----	----
Over 100 miles	25	4,349.10	2	238.65

[1] Operating companies.
[2] Exclusive of 15 lessor companies.
[3] Exclusive of 663.94 miles estimated in 1890.

owned by the company. Occasionally the railway is built on a private right of way not owned by the company, an example of which would be a toll bridge owned by a bridge company, to whom payment for the privilege of using it was made.

TABLE 3.—AVERAGES FOR OPERATING COMPANIES: 1890 AND 1902.

ITEMS	1902	1890
Average per company:		
Length of single track	27.65	11.51
Capital stock and funded debt outstanding	$2,825,314	$677,388
Number of passenger cars	74	46
Number of fare passengers carried	5,886,848	2,865,454
Number of employees	164	100
Average number of employees per passenger car	2	2
Average number of fare passengers carried per car	79,774	62,237
Average number of fare passengers per car mile	4.43	[1]

[1] Car mileage not reported in 1890.

There were 377.11 miles of single track on right of way of this character.

In Table 2 the operating companies reported in 1890 and 1902 are grouped according to the length of line. The "length of

TABLE 4.—RELATION OF STREET AND ELECTRIC RAILWAYS TO POPULATION, 1890 AND 1902.

GEOGRAPHIC DIVISIONS	Year	Population[1]	Total Number of Fare Passengers Carried	Average Number of Rides Per Inhabitant
United States	1902	75,994,575	4,809,554,438	63
	1890	62,622,250	2,023,010,202	32
Increase		13,372,325	2,786,544,236	31
North Atlantic	1902	21,046,695	2,618,528,979	124
	1890	17,401,545	1,141,187,460	66
Increase		3,645,150	1,477,341,519	58
South Atlantic	1902	10,443,480	332,541,075	32
	1890	8,857,920	101,647,174	11
Increase		1,585,560	230,893,901	21
North Central	1902	26,333,004	1,344,000,951	51
	1890	22,362,279	538,309,887	24
Increase		3,970,725	805,691,064	27
South Central	1902	14,080,047	210,103,861	15
	1890	10,972,893	98,005,026	9
Increase		3,107,154	112,098,835	6
Western	1902	4,091,349	304,379,572	74
	1890	3,027,613	143,860,655	48
Increase		1,063,736	160,518,917	26

[1] Population shown for 1902 is that reported at the census of 1900.

line," as given in the report, means the length of the roadbed, or, in the case of a railway lying entirely within city limits, the length of street occupied. In determining the length of single track switches and sidings are included, and double track is reckoned as two tracks.

Table 3, giving averages, indicates the increase since 1890 in the size of the companies and their equipment.

The extent to which street and electric railways are used,

TABLE 5.—INCOME ACCOUNT, OPERATING COMPANIES: 1902

Gross earnings from operation			$247,553,999
Operating expenses			142,312,597
Net earnings from operation			105,241,402
Income from other sources			2,950,628
Gross income, less operating expenses			108,192,030
Deductins from income:			
Taxes—			
On real and personal property	$5,835,542		
On capital stock	2,931,352		
On earnings	2,719,287		
Miscellaneous	1,592,818		
		$13,078,899	
Interest—			
On funded debt	35,223,284		
On real estate mortgages	93,078		
On floating debt	2,769,549		
		38,085,911	
Rent of leased lines and terminals		25,518,225	
Other deductions from income		912,018	
			77,595,053
Net income			30,596,977
Deductions from net income:			
Dividends on $45,047,155 preferred stock		2,053,202	
Dividends on $305,897,861 common stock		13,828,908	
			15,882,110
Surplus for year			14,714,867

and the increase in their use as measured by the average number of rides per inhabitant, are shown by Table 4, which gives the total population, number of fare passengers carried, and average number of rides per inhabitant, for the United States and for each geographic division.

Of the total number of operating companies 252 reported that they generated electricity for sale for light and power purposes.

Table 5 presents the principal totals in the form of income account prescribed by the Street Railway Accountants' Association of America. There were 578 operating companies reporting a net income amounting to $34,352,684, and 220 reporting a net deficit of $3,755,707. The difference between these amounts, $30,596,977, is shown as the net income for all

TABLE 6.—PRINCIPAL SUBDIVISIONS OF OPERATING EXPENSES WITH PER CENT THAT EACH ITEM IS OF TOTAL: 1902.

ITEMS	Amount	Per cent of total
Total	$142,312,597	100.00
Maintenance of ways and structures	12,118,296	8.52
Maintenance of equipment	16,676,532	11.72
Operation of power plant	23,062,328	16.20
Operation of cars	62,454,679	43.88
Miscellaneous	25,812,009	18.14
Wages, supplies, etc., incidental to electric service	2,188,753	1.54

operating companies. The item of $2,950,628, "income from other sources," consists principally of the interests on deposits, loans, bonds and other securities; but it includes also income from other operations carried on in connection with street railways, such as waterworks, ice plants, etc.

The operating expenses, $142,312,597, are analyzed in Table 6, together with the percentage which each total forms of the aggregate. In this connection it should be stated that a condensed balance sheet for all the companies was contained in a preliminary bulletin issued by the bureau and published in the Street Railway Journal for May 9, 1903.

The report takes up very thoroughly the mechanical and electrical equipment of each road. These are given in detail for each road, whereas the financial information is given by States only. In glancing over the statistics of track equipment it will be seen that the style and weight of rail varies greatly. Thus the minimum weight of rail per yard varies from 15 lbs., reported for the Paso Robles Street Car Company, of Paso Robles, Cal., to 113 lbs., reported for the Kingsbridge Railway Company, of New York, N. Y. The maximum weight varies from 15 lbs., reported by the Paso Robles Street Car Company, of Paso Robles, Cal., to 135 lbs., reported by the Union Traction Company, of Philadelphia, Pa. Of the 817 operating companies 367 use T-rails exclusively, and 390 reported T-rails in connection with girder, groove or full groove.

There were 66,784 cars of all classes reported. The largest number, 3612, reported for a single company is given for the Boston Elevated Railway Company, of Boston, Mass., which includes cars operated on both surface and elevated tracks. There were 60,290 passenger cars, and 6494 cars used for express, work, or other purposes. Comparing the number of passengers carried and the passenger car mileage with the number of cars, it appears that each car carried on the average 97,395 passengers and traveled 18,003 miles during the year. Of the passenger cars, 32,658 were closed and 24,259 open. Combination closed and open cars were reported by 105 companies, the total number being 3134, of which 1203, or 38.38 per cent, were used by twenty-two companies in California. Combination passenger and express cars were used by ninety-nine companies, the number being 239. The use of express, freight or mail cars was reported by 205 companies, the largest number being shown for the St. Louis & Belleville Electric Railway Company, of Belleville, Ill., an interurban freight line operating between East St. Louis, Ill., and Belleville, Ill. There were 1727 snow-plows and 793 sweepers reported.

Steam was used by 540 companies as the primary motive power to generate electric current. The statistics concerning steam power classify the engines according to horse-power. There were, in all, 2336 engines, with a total horse-power of 1,298,133, or 556 hp per engine. Of this number 1588 engines each were reported as having 500 hp or under, with a total horse-power of 420,551, or an average of 265 for each engine. There were 431 engines having a horse-power of over 500 but under 1000 each, the total horse-power being 297,757, or 691 per engine, and 317 engines having a total horse-power of more than 1000 each, the total being 579,825 hp, or 1829 per engine. The Pittsburg Railways Company, of Pittsburg, Pa., reports forty-seven engines, which is the largest number returned by a single company. The greatest amount of steam horse-power, 79.075, is reported by the Interurban Street Railway Company, of New York, N. Y. The greatest number of large engines, i. e., engines having more than 1000 hp each, is reported by the Union Traction Company, of Philadelphia, Pa., which had twenty-one engines with a total of 37,800 hp, but the Interurban Street Railway Company, of New York, N. Y., with only fifteen engines, reported a horse-power capacity of 78,600, while the Boston Elevated Railway Company, of Boston, Mass., with twenty engines, reported a total of 48,200 hp.

There were 159 water-wheels, with horse-power of 49,153, used as the primary power in the generation of electric current. The average horse-power per water-wheel was 309. There were 129 wheels of 500 hp or less, twelve of over 500 and under 1000, and eighteen of 1000 and under 2000. Of the total horse-power 34,215, or 69.61 per cent, was reported by sixteen companies in the States of California, Georgia, Maine, Minnesota and New York. The largest plant of this character was shown for the Twin City Rapid Transit Company, of Minneapolis, Minn. This company reported the use of twelve water-wheels, ten of which had 1000 hp each.

There were 441 alternating-current generators reported, with a total of 231,924 hp. These machines were used by 163 companies.

Of the 5,871,957,830 passengers carried, 4,809,554,438, or 81.91 per cent, were fare passengers, and 1,062,403,392, or 18.09 per cent, were transfer passengers. The transfer passengers included those using free transfers, also in a few cases those using transfers for which an additional payment was required. There were 4455 transfer points reported. The average number of fare passengers per mile of single track operated in the United States was 208,600. In preparing this average only the companies from which complete statistics were received are

considered. The average ranges from forty-eight, reported for the Chicago General Electric Railway Company, of Chicago, Ill., a small road operating only one car by storage batteries, to 2,142,857, reported for the Los Angeles Electric Incline Railway Company, of Los Angeles, Cal.

The fare passengers per car-mile for all companies averaged 4.43, and ranged from .01 for the Chicago General Electric Railway Company, of Chicago, Ill., to 69.15 for the Monongahela Incline Plane Company, of Pittsburg, Pa. It was impossible to obtain information concerning car hours from a large percentage of the companies. However, 390 companies furnished this information. Their total car hours for the year amounted to 65,869,342, of which passenger cars formed 65,403,287, or 99.29 per cent, and freight, mail, express and other cars 466,055, or .71 per cent. The fare passengers per car-hour for the companies reporting both factors averaged 33.28, and ranged from .02 for the Chicago General Electric Railway Company, of Chicago, Ill., to 89.24 for the Worcester & Southbridge Street Railway Company, of Worcester, Mass.

Pleasure parks are a feature of the modern street railway business, and often a large source of income, and so have some space devoted to them. The number reported amounted to 352, but does not include pleasure parks belonging to cities, towns or communities and entered by the street railway companies.

INTERURBAN CAR TESTS

The data presented on this subject by W. E. Goldsborough and P. E. Fansler, in a paper before the American Institute of Electrical Engineers, at the twentieth annual convention, at Niagara Falls, June 30, were secured in a series of tests made on the cars of the Union Traction Company of Indiana. Clarence Renshaw, who was prominently identified with this work, contributed an exhaustive review of the subject to the STREET RAILWAY JOURNAL, of Oct. 4, 1902. The present paper gives the detailed reports and explains the circumstances affecting the results, thus forming a valuable record for reference. The work was divided under two general heads, namely, "General Tests of Equipment" and "Special Car Tests."

The objects of the general tests on the interurban and limited cars were: First, to determine in detail the kilowatt-hour consumption of individual cars, both local and limited, between stated points, en route from Muncie to Indianapolis and vice versa; secondly, to average these results and to determine the maximum and minimum kilowatt-hour consumption over the route; thirdly, to ascertain, in so far as possible, the general effect of stops and the personality of the motormen as factors in car consumption economy.

In accumulating data for these purposes, an observer was placed on each of the interurban cars operating between Indianapolis and Muncie throughout the three days of the general test.

The special car tests were undertaken to ascertain how nearly the car equipments were being worked up to their rated capacity. The first point to be considered in connection with such tests was arranging adequate means for accurately determining the cycle of current fluctuations and the temperatures of the windings and cores. It should be kept in mind, in this connection, that in street railway service motors are subjected to more variable conditions than are ordinarily to be found in industrial plants, and, consequently, it is very much more difficult to predict the exact effect upon the motor of operating it for propelling a car over a given road than it is to predict the capacity of a motor for the handling of a certain load in stationary practice.

The schedule speed of local trains between Indianapolis and Muncie is 23 m. p. h. On clear stretches running through the country the speed frequently runs up to 50 m. p. h., but in general, averages about 38 m. p. h. In the towns, however, a slower rate of speed is required, which brings the schedule in the country to 27 m. p. h. When operating within the city limits of Anderson and Muncie 20 miles an hour are not, in general, exceeded, and at Indianapolis the rate varies from 21 miles in the suburbs to 10 miles in the business districts. The schedule speed in Indianapolis is 10.28 miles.

It is noticeable that the maximum rate of power consumption in all cases occurs in the cities. The power consumption per car-mile in Anderson being greatest, in Muncie least and in Indianapolis more or less of an average between the other two places. This increase in the power consumption in the cities is due to the slower speeds, more frequent stops, and, very often, to low voltage. As between cities the maximum power consumption in Anderson is 4.84 per car-mile, whereas in Indianapolis it is only 3.62 per car-mile.

The least power consumption per car-mile reported is on one of the westward trips between Yorktown and Daleville, where as low a value as 1.43 kw-hour per car-mile is given. This is but 30 per cent of the maximum consumption cited for the eastern trip in Anderson.

The urban and interurban data brings out very clearly the fact that within the city limits the car consumption per car-mile is considerably greater than in running through the country. The maximum values for city service run as high as 7.6 kw-hour per car-mile and average 5.88, whereas in the country the maximum value either east or west does not exceed 3.45 kw-hour per car-mile and averages not more than 2.87 per car-mile. During the eastbound trips the urban cars on the average consumed 17 per cent of the power running 10.4 per cent of the distance, their power consumption in the cities per car-mile being on the average 74 per cent in excess of what it was in the country.

The number of stops made by a car on different trips undoubtedly has quite an effect upon the amount of power consumed. The greater the number of stops the greater the amount of time deducted from the regular running time, and, the greater must be the acceleration of the train to enable it to make up the lost time. This is quite clearly brought out by the fact that the limited trains average on their eastern trips only 103 kw-hours, whereas the local trains average 129 kw-hours on their eastern trips, an increase of 35 per cent. As a rule the limited trains after leaving Indianapolis only stop once at Anderson in their run to Muncie. Going west the limited trains usually pull in at sidings to allow eastbound trains to pass. This probably accounts for the fact that the kilowatt-hour consumption of the westbound limited trains is somewhat greater than the kilowatt-hour consumption of the eastbound limited trains, although the westbound limited trains are relatively running down grade, Muncie having an elevation of about 100 ft. above Indianapolis. The number of stops made by the local cars outside of the cities averages about 34.

An average taken of the runs made by the local cars, east and west, shows them to be very much the same. For instance, the average of the eastbound locals is 129 kw-hours, and of the westbound 131 kw-hours, practically the same.

The best run going east shows a car consumption of 111 kw-hours; the highest car consumption going east is 162 kw-hours, a difference of 49 per cent. The average of the eastern trips made by the first car mentioned is 115 kw-hours, and the average of the trips made by the other car is 139 kw-hours, a difference of 21 per cent. Among the westbound local trains this car shows the highest consumptions, which indicates that its running gear was affected in some particular. As the two cars are of the same weight and equipment, and as the runs made by them are sufficiently close together to admit of the supposition that the average stops made during the day by the two cars is very much the same, it is assumed that the difference in power consumption is caused by the equipment of one car being in better condition than that of the other, as the

personal equation of the motorman in the operation of his car in local interurban service is practically without effect where a number of runs are taken into consideration.

A comparison is made of the performance of all the limited trains in service. The most noticeable thing in connection with the data given is that the variations in the power consumption per trip in the limited service are very much less than those in the local service. As between the different runs by limited cars, the tables show again that the differences in the consumption of eastbound trains are less than the differences in the consumption of westbound trains. The minimum possible power consumption per trip whether east or west is 95 kw-hours, or practically the same as that given for the local trains. The fact that the limited runs show up so much better than do the local runs is undoubtedly due to the number of starts in the limited trips being very much less, the limited cars having the right of way and the best motormen being in charge of them.

The variation in the power consumption of limited cars running through the cities does not vary in excess of 50 per cent between the maximum and minimum values, whereas, in the case of the local cars differences as great as 300 per cent are recorded. The maximum urban consumption per car-mile by the limited cars is 4.42 kw-hours, against 5.88 by the local cars. The best urban performance shown by the limited cars is 2.31 kw-hours per car-mile, against 2.92 by a local car. The best average urban consumption for the limited cars is 2.8 kw-hours on eastbound trips against 3.79 kw-hours by the local cars. In general, therefore, at all points, the limited cars show better handling, more uniform records and records which are much lower than the average of the local car performance. Occasionally, however, a car in local service will show a better record over a short distance than will the limited cars.

The comparison of limited east and westbound trains shows little difference between them. The consumption of the westbound trains is uniformly slightly higher than that of the eastbound. This is a distinct characteristic of the traffic over this system.

Another interesting phase on this subject is brought out by the results which are given in a table showing the work of the different motormen given in terms of the minimum, average and maximum power consumption of the cars in their charge during the three days of the general test. The best trip going east shows a power consumption of 108 kw-hours, which is 43 per cent less than the highest car consumption, 154 kw-hours recorded. It is interesting to note that these minimum and maximum records were made by the same man, the average of his three trips, however, is 126 kw-hours, which differs but by 1 per cent from the average of all his eastbound trips. These results, more than any others, bring out the fact that the variations in the power consumption in local service are chiefly due to conditions existing at the time of specific runs. The average of the first man going east is 8 per cent higher than his average going west. The average of the second man going east is 6.5 per cent. less than his average going west. The third man shows the greater consumption on his eastbound trips; the fourth man the greatest on his westbound trips, and so on for the others. Apparently, a motorman who so operates his car as to produce a greater power consumption on his eastern trip than on his western, does so consistently, possibly, through some personal idea as to the way in which his car should be conducted over different portions of the road. For instance, the first man's minimum, average and maximum is less on his western trips than on his eastern; in the same way the work of the second man shows that on his eastern trip his minimum, average and maximum were consistently less than the minimum, average and maximum on his western trips. This condition holds true for five out of the seven men reported as operating local cars.

CENTRAL TERMINAL STATION PLANS FOR NEW YORK

Plans have been submitted to the Board of Estimate by Bridge Commissioner Lindenthal and Henry Hornbostel, his consulting architect, for a new municipal building and railroad terminal combined, to cover the blocks and triangles between Tryon Row, Duane Street and William Street.

The present scheme is a much more elaborate one than that outlined by the Mayor, and it is not expected that it will be put in execution in its entirety for many years. The purpose in submitting it at this time is to secure the adoption of a plan that will be followed in the development of the idea, and thus insure harmony in the completed work. To illustrate this it is but necessary to mention some of the provisions of the plans, which include the erection of a building along the northern side of Chambers Street, the architecture of which conforms to that of the new Hall of Records. This is to be the city's administrative building. It is suggested that all the buildings in the City Hall Park, except the City Hall, but including the old County Court House, be removed, and that the site of the postoffice be purchased and added to that of the park. The City Hall would then stand alone in a garden which would have within it no other masonry than some ornamental entrances and a flight of granite steps, these opposite the rear entrance of the City Hall and leading by a viaduct over Chambers Street to the suggested administration building.

The practical part of the plans are those relating to the new city and railroad terminal building. The part of the structure to be used as a railroad station will face on Tryon Row, extending back about 600 ft., and will be as high as the new Hall of Records. In the basement will be passages and stairways to the present subway station, and to the stations in Park Row and Center Street of the contemplated subway extensions. On the ground floor are to be the surface car tracks. To provide ample accommodation for passengers Chambers Street and Park Row are to be bridged over by the building. William Street is to be straightened so as to form a continuous thoroughfare with Center Street. The sidewalks will be placed in the arcades, from which stairways will lead to a level slightly above. On this level ten trolley loops will be provided for the Brooklyn cars.

The first floor above the Brooklyn trolley car level is set aside for the elevated railroads. It is planned to have four tracks for these trains and five platforms, permitting sixty six-car trains to arrive and depart every hour. Incoming and outgoing passengers will have separate passageways. The second floor will be for the Brooklyn Bridge trains. It will have a capacity of sixty trains an hour, and will be so arranged as to furnish room for the trains on the suggested loop connecting the Brooklyn and Manhattan bridges.

Above these is planned to have five office floors with an area of 36,000 sq. ft. each. The rental value of this space is estimated at $360,000 a year.

The feature of the whole construction will be a campanile to be built at the northern base of the terminal building. As now designed, it will be about 650 ft. tall and contain forty-two stories. It would give room for nearly all the offices the city now has to rent in private buildings. It is proposed to build the campanile, at first, only to the level of the roof of the station structure.

Mr. Lindenthal estimates the cost of the new building at $9,025,825. To complete the campanile would cost an additional $1,468,800.

It would require an expenditure of not less than $30,000,000 to carry out, in their entirety, the whole of the plans Messrs. Lindenthal and Hornbostel have drawn. But Mr. Lindenthal intimates that this vast outlay would be justified in view of the splendid results, financial as well as artistic, which would be obtained. The scheme of architectural magnificence presented would, he says, rival the Place de la Concorde in Paris, Trafal-

gar Square in London, the Schloss-Platz in Berlin or the Rathaus Platz in Vienna. It would enable the city to save nearly all of the $900,000 it now pays out yearly for rentals, besides earning an income for the space it would not require for public offices.

The plans were referred to the chief engineer of the Board of Estimate for report. Afterward a committee of the board will be appointed to take up the matter.

SOME RECOMMENDATIONS CONCERNING ELECTRICAL AND MECHANICAL SPECIFICATIONS OF TROLLEY INSULATORS*

BY SAMUEL SHELDON AND JOHN D. KEILEY

At present there appears to be no standard basis for comparison of the relative merits of insulators which are supplied for use in ordinary overhead trolley line construction. It is obviously desirable that there should be a definite basis upon which a proper selection can be made.

With a view to formulating specifications of such materials, it was found necessary, on account of the lack of published data on the subject, to conduct a series of tests to determine the electrical and mechanical properties of these materials. The tests were made upon samples obtained in the open market from the stocks of well-known manufacturers. Some of the results of these tests are given, and recommendations concerning specifications of certain types are appended.

Determinations were made of the tensile strength of the samples, of the voltage necessary to perforate the insulation or arc between conducting parts, of the mechanical softening temperature, and of the relative magnitudes of the insulation resistances.

TENSILE STRENGTH

These tests were made in the usual manner, the samples being pulled apart by means of a Riehle 30,000-lb. universal machine. U-shaped pieces of round steel were passed through the metal eyes of such samples as globe, Brooklyn strain, and terminal strain insulators, and were clamped in the jaws of the machine. The insulated bolts were passed through a hole of proper size in a steel plate. The threaded end was connected with a steel eyebolt by means of a steel threaded sleeve, and the tension was exerted between the eyebolt and the plate. The results obtained from breaking the samples are here given, the product of different manufacturers being represented by the letters *A*, *B*, *C* and *D*. The numerals represent the tension in pounds at the time of break.

While some samples gave way in the eyes others broke in the insulation. It is very desirable that strain insulators should be so designed that when subjected to a test for tensile strength they should give way in the eyes. As these insulators are subjected to an uncertain strain while being installed and after being in use, it is of great importance that one may be able to depend upon the fact that, if the eyes be intact, the insulation is also in good condition.

BREAKDOWN VOLTAGE

In carrying out these tests the two metal portions or conductors of the insulators were connected respectively with the two high-pressure terminals of a 1.200 step-up transformer, whose low-pressure terminals were connected in series with a regulating rheostat to a supply of alternating current at a frequency of 60. A dead-beat voltmeter was connected to the low-pressure terminals. By manipulating the rheostat any desired voltage could be impressed upon the low-pressure coil, and its value could be determined from the voltmeter. The high-pressure voltage would be 200 times as large, provided the secondary was unloaded, that is provided the insulator was unpunctured and there were no arcing present. The test was started with a low-impressed voltage, which was gradually raised until a sudden drop in the voltmeter reading indicated that a breakdown had occurred. The maximum reading multiplied by 200 is the breakdown voltage. The results given in the accompanying table were obtained:

MANUFACTURER	TENSILE STRENGTH IN LBS.				DIELECTRIC STRENGTH IN VOLTS (BREAKDOWN TEST)			
	A	*B*	*C*	*D*	*A*	*B*	*C*	*D*
2½ in. globes	3710	5950	7725	6320	8010	8610	5610	7500
" "	4510	5770	7475	6890	....	7610	5110	6110
" "	....	....	....	....	....	....	4510*	5910
3 in. globes	4210	11190	5450	....	11410	12810	8010	....
" "	5300	8930	5550	....	10810	10810	9010	....
Small Brooklyns	9990	10320	5520	....	....	14810	6710	35000
" "	11130	9010	6450	....	....	....	5510*	....
Large Brooklyns	11490	19670	18510	....	8010	14410	11410	....
" "	10510	17140	18250	....	4210	13010*	7610*	....
" "	....	....	....	....	4010*	....	....	....
Insulated bolts	6370	6130	7360	3280	12010	14450	12210	arc at
" "	4495	5490	9010	2925	13010	14450	10010	25000

* Tested under tensile strain of 4500 lbs.

The voltage necessary to rupture the dielectric would undoubtedly have been less than the amounts given if the duration of the application of the high-pressure had been increased. In practice, trolley insulators are seldom subjected to a voltage greater than that of the generators or converters. Occasionally, however, they are subjected to moderately high voltages of short duration which arise from the disappearance of magnetic flux that has been created by short circuits. The values given which are followed by an asterisk were obtained from tests on insulators which were, at the time, under a tensile strain of about 4500 lbs. The dielectric strength is slightly reduced by strain, but in all the samples tested it was sufficiently high to meet the requirements of present practice.

HEAT TESTS

Oftentimes when a trolley wire breaks it becomes heated on account of the grounding of a broken end. Sometimes the insulating material in the round top hangers softens under the influence of the heat communicated from the wire and allows the ear and suspended wire to drop to the ground. Efforts were made to determine the temperature of the insulation at the time of softening. A hanger was screwed into a regular ear, and was suspended in an inverted position in a doubled walled oven. A wire was attached to the suspended cap and was passed through a hole in the bottom of the oven. To this wire was attached a weight of 100 lbs. This weight is equal to that of about 200 ft. of No. 000 copper trolley wire, and it is quite possible that a hanger might be subjected to this strain. The temperature of the oven was raised by means of burning an arc lamp which was enclosed in it. As the temperature rose to a certain point the insulating material softened and the suspended weight pulled the round top cap of the hanger away from its bolt. This temperature was noted on a mercury thermometer whose bulb was placed near the ear. Unquestionably, the temperature varies very much at different points inside the insulating material, such material being a good heat insulator as well as an electrical insulator. The material next to the metal, however, is probably the hottest, and the temperature is nearly that of the metal. It is at this point that it softens most. The results obtained from three samples were: *A*, 168 degs. C.; *B*, 168 degs. C., and *C*, 145 degs. C.

Appreciating the uncertainty of such a test another method was devised which tested the hangers under working conditions. This method gives but relative results. Under the circumstances they are more to be desired than absolute values of temperature.

A soft iron round rod, ¼ in. in diameter and 20 ins. long, was clamped by an ordinary trolley ear, whose ends had been

* A paper presented at the twentieth annual convention of the American Institute of Electrical Engineers, Niagara Falls, N. Y., June 30, 1903.

cut off so as to leave a length of 5½ ins. This was suspended by means of a wire stirrup underneath a beam, as shown in Fig. 1. Into the ear was screwed the bolt of the round top hanger to be tested. To the cap of the hanger was suspended a weight of 200 lbs. A current of 200 amps. was then sent through the iron. The time which elapsed between closing the circuit and the separation of the parts of the hanger under the influence of the weight was noted.

These times in minutes were as follows:

A	*B*	*C*	*D*
50	34	94	74

Two similar samples from the same manufacturer were tested, one with the cap underneath, as above described, and the other with the ear beneath. The times between the closing of

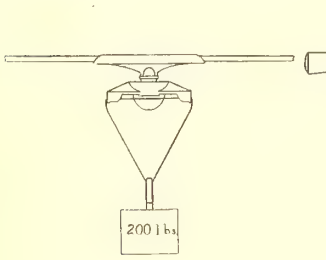


FIG. 1

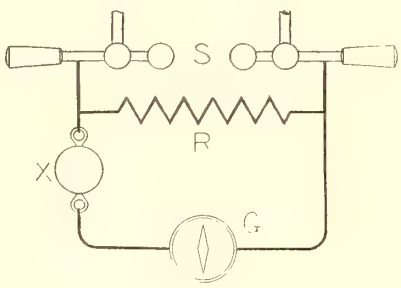


FIG. 2

the circuit and the breaking down of the insulators were respectively 31 minutes and 33 minutes. This indicates that the position in regard to vertical arrangement during test is immaterial.

Efforts were made to determine roughly the character and the composition of the insulating materials employed by each manufacturer. Upon ignition, by applying a lighted match, each of the insulating materials burned quietly with a very small flame. There was some smoke and in all cases the characteristic odor of burning shellac. Each sample when placed in alcohol went partially into solution, leaving a residue. Mica and asbestos were present in some of the residues.

If the binding material be, in all cases, shellac, it is evident that the softening temperature is an indeterminate quantity. Shellac is somewhat viscous at ordinary temperatures, and its viscosity rises rapidly with increase of temperature. Insulating bolts, one from each manufacturer, were placed in boiling water and were allowed to remain until they had assumed the temperature of the water, i. e., 100 degs. C. In each case the insulating material had softened so as to permit of moulding under slight pressure. The viscosity, at a given temperature, is also dependent upon the relative amount of shellac to the other material present. This amount is liable to variation in samples of the same type from the same manufacturer.

INSULATION RESISTANCE

The resistance of an ordinary strain insulator is very large, and, if it were not for the large number of them which are connected in parallel on a trolley system, no consideration need be given to this point. It is difficult to determine rapidly the individual resistances in ohms, hence the following method of determining the relative resistance values was devised.

A Holz machine when run at a constant speed, owing to its practically infinite internal resistance, functionates as a constant current generator. For obtaining the comparative values of the resistances of the insulators, such a machine was used as a source of e. m. f., and an arrangement of apparatus, as shown in Fig. 2, was employed:

where S = spark gap of the Holz machine.

X = insulator under test.

G = a mirror galvanometer.

R = a resistance in which is included the leakage resistance of the Holz machine, and of the connecting wires.

By connecting together the two terminals of the insulator X, by means of a copper wire, practically all of the current I, which is produced by the machine, is made to pass through the galvanometer and it produces a deflection θ_x. Upon removing the copper wire a current i_x will flow through the galvanometer, giving a deflection θ_x.

This deflection will be inversely proportional to the resistance of X. The rest of the constant current I will pass through R, which includes the leakage paths. Representing this current by i_R, there exists the following relations:

$$I = i + i_R$$
$$I - i = i_R$$
$$i_R R = i_x X = (I - i_x) R$$
$$X = \frac{I - i_x}{i_x} R$$

Since I and i_x are proportional to deflections θ and θ_x respectively,

$$X = \frac{\theta - \theta_x}{\theta_x} R$$

By substituting for X another insulator, its resistance can be quickly determined in terms of R in a similar manner. This method is better suited for getting the comparative resistances of insulators of the same shape, than for getting their absolute resistances. A portion of an insulator's conductance unquestionably consists of surface leakage.

The resistances obtained are given below in terms of an arbitrary standard:

2-IN. GLOBES			2½-IN. GLOBES		
A	*B*	*C*	*A*	*B*	*C*
61	98	1.7	27	36	1
55	76	12.0	55	18	1.5
			61	37	1

SMALL BROOKLYNS		LARGE BROOKLYNS		
B	*C*	*A*	*B*	*C*
35	40	0.7	39	27
35	43	0.8	41	27

SPECIFICATIONS

Specifications for the various forms of insulators used in trolley construction must vary with local conditions and with the policy of the user. Specifications for Globe and Brooklyn Strain insulators should cover the following points:

1. Dimensions.
2. Size of eye.
3. All samples tested shall break in the eye.
4. The average ultimate tensile strength of all samples subjected to mechanical test shall not be less than A pounds, and no individual sample shall show a tensile strength of less than 85 per cent of the average tensile strength of all the samples that are tested.
5. The average break-down voltage, for samples which have been broken in the eye in the mechanical test, shall not be less than B volts, and no individual sample shall break down at less than 90 per cent of B volts.

As to the values to be specified for ultimate tensile strength and break-down voltage, the following are suggested, where high-class insulators for use on 500-volt lines are to be specified.

	Ultimate Tensile Strength in lbs.	Breakdown Voltage
2½-in. globes	6,000	7,000
3-in. globes	9,000	10,000
Small Brooklyn	9,000	10,000
Large Brooklyn	18,000	10,000

Owing to the comparatively low softening temperature of the insulating materials generally used, and to the close proximity of the working conductor when in service, it is important that specifications for round top hangers should impose a test for softening temperature. The following "hot rod test" is suggested:

Round top hangers when suspended free from draft in an

inverted position by means of a bronze ear weighing 8 ounces and being 5½ ins. long, the ear clamping the middle of a round rod of soft iron ¼ in. in diameter, and of at least 20 ins. length between connectors, must be able, without breaking down or becoming permanently deformed by more than 1-16 in., to sustain a weight of 200 lbs. from the cap for one hour, a current of 200 amps. being passed continuously through the iron rod, the rod being cold at the start.

SIGNALS IN STARTING ELEVATED TRAINS

Brooklyn, N. Y., June 24, 1903.

EDITORS STREET RAILWAY JOURNAL:

"The Buffalo Express" recently stated that more power was required to start a car than to stop it—two bells being necessary in the first case, while one was sufficient in the second. This reasoning was probably meant to apply to surface roads, but it is true in an exaggerated degree in the case of the elevated railroads in New York, since they have adopted the electric traction. On this road it ordinarily takes ten bells to start a six-car train, each conductor or guard having to pull twice on a bell rope that only extends the length of one car, while the guard on the forward car does not pull his bell rope until the bells on all the other cars have been rung in succession.

If the bell in the motorman's apartment was electrically connected with all the train gates in series then the last gate that was closed would ring the bell to start the rain. This arrangemen would also relieve the guards from the necessity of handling a bell rope at all, and they could then give their entire attention to the gates, which at times is desirable. There would also be an element of increased safety in this scheme, as under the present methods, after the rear guard has closed his gates and rung his bell, the train may not start immediately, but naturally he does not want to open his gates again for a late comer, not knowing when the train will start. But with the system here advocated the fact of even one single gate being reopened after being once closed would be an assurance that the motorman's bell could not ring. Or in case the gates were all closed the train might not start, owing to the road being blocked by a semaphone signal, in which event it would be perfectly safe to open any of the gates again if found necessary. Opening a gate a second time is not advocated as a general thing, but if necessary on rare occasions it could be done with safety. Of course, the motorman would not want the bell ringing all the way between stations, so he could open a switch in the bell circuit after the train had gone about its own length, and then close this switch again at the next stop. This switch might be arranged to work automatically, so as to be closed when the train is at rest, and open when train is in motion, but the first plan mentioned seems the more simple and reliable.

This scheme would probably complicate the matter of coupling up a train in the yard to get it ready for a run, but it would simplify the bell ringing to start a train, and the bell ringing takes place at each station, while the coupling operation takes places only once a day, or not more than once for a round trip in the most extreme case.

WALTER GRIBBEN.

THE TRANSFER QUESTION IN NEW YORK

New York, June 27, 1903.

EDITORS STREET RAILWAY JOURNAL:

I notice in your last issue a decision of the Supreme Court in the case of the Interurban Street Railway Company which must be regarded by everyone as extremely sensible. The attempt to force the issue of free transfers by a writ of mandamus is a serious assault on the liberties of traction companies in general, as well as a most dangerous attempt to establish a bad precedent. When adequate legal remedies exis' the resort to the summary power of the court is a grave menace to the foundations of our system of free government. Courts have something else to do than to superintend the operation of traction companies, and if they have power at will to order corporations and persons to do this, that and the other without limit, it would seem to the plain rational citizen that the ordinary system of civil government is superseded, and its officers reduced to supernumeraries.

Injunctions and writs of mandamus are extreme measures, only to be used in cases of dire necessity, and then with great judgment and caution. They are not intended to supersede ordinary government or ordinary legal processes, but to supplement them in certain rare cases where ordinary remedies are inadequate. There should be no government by injunction when any other kind of government is possible, and it is very fortunate that the present attempt at coercion by summary process failed.

The question of transfers at any particular point must be settled for the benefit of the whole community, not solely in the interest of the residents along one particular line. The sober-minded members of this community believe that the Metropolitan street railway companies are trying to give the best possible service to the public. They may make mistakes, but this policy is certainly not one of them, and it is unfortunate that a statute requiring transfers at all connecting points, that might be suitable in a small city, should be made to apply to an immense system like that of the Interurban Street Railway Company.

A. P. JOHNSON.

TIME-TABLE OF THE PROVIDENCE & DANIELSON RAILWAY

The Providence & Danielson Railway Company, like many other interurban lines, collects 5-cent fares at different points along the route and has adopted an ingenious method of indicating to the passenger where these different fares are collected. The company issues a pocket time-table and places an

WEST BOUND.

STATIONS.	Mls	5c. Fare Collected after leaving Stations indicated by Stars.
Providence (Mkt. Sq.) *	0.0	5 45 6 45 7 45 8 45 9 45 10 45 11 45 12 45 1 45 2 45 3 45 4 45 5 45 6 45 7 45 8 45 10 45
City Line *	3.4	5 10 6 10 7 10 8 10 9 10 10 10 11 10 12 10 1 10 2 10 3 10 4 10 5 10 6 10 7 10 8 10 9 10 11 10
Pocasset *	5.7	5 20 6 20 7 20 8 20 9 20 10 20 11 20 12 20 1 20 2 20 3 20 4 20 5 20 6 20 7 20 8 20 9 20 11 20
Moswansicut Lake	9.2	5 40 6 40 7 40 8 40 9 40 10 40 11 40 12 40 1 40 2 40 3 40 4 40 5 40 6 40 7 40 8 40 9 40 11 40
North Scituate *	10.1	5 45 6 45 7 45 8 45 9 45 10 45 11 45 12 45 1 45 2 45 3 45 4 45 5 45 6 45 7 45 8 45 9 45 11 45
Ashland	11.8	6 00 7 00 8 00 9 00 10 00 11 00 12 00 1 00 2 00 3 00 4 00 5 00 6 00 7 00 8 00 9 00 10 00 12 00
South Scituate *	15.4	6 05 7 05 8 05 9 05 10 05 11 05 12 05 1 05 2 05 3 05 4 05 5 05 6 05 7 05 8 05 9 05 10 05 12 05
Richmond *	15.6	6 07 7 07 8 07 9 07 10 07 11 07 12 07 1 07 2 07 3 07 4 07 5 07 6 07 7 07 8 07 9 07 10 07 12 07
Power-House	17.1	6 15 7 15 8 15 9 15 10 15 11 15 12 15 1 15 2 15 3 15 4 15 5 15 6 15 7 15 8 15 9 15 10 15 12 15
Rockland	18.1	6 20 7 20 8 20 9 20 10 20 11 20 12 20 1 20 2 20 3 20 4 20 5 20 6 20 7 20 8 20 9 20 10 20 12 20
Clayville	19.0	6 25 7 25 8 25 9 25 10 25 11 25 12 25 1 25 2 25 3 25 4 25 5 25 6 25 7 25 8 25 9 25 10 25 12 25
Foster Center *	21.6	6 35 7 35 8 35 9 35 10 35 11 35 12 35 1 35 2 35 3 35 4 35 5 35 6 35 7 35 8 35
North Foster *	25.4	6 50 7 50 8 50 9 50 10 50 11 50 12 50 1 50 2 50 3 50 4 50 5 50 6 50 7 50 8 50
East Killingly *	29.4	7 00 8 00 9 00 10 00 11 00 12 00 1 00 2 00 3 00 4 00 5 00 6 00 7 00 8 00 9 00
Elmville *	32.8	7 22 8 22 9 22 10 22 11 22 12 22 1 22 2 22 3 22 4 22 5 22 6 22 7 22 8 22 9 22
Elmville *	0.0	7 23 8 23 9 23 10 23 11 23 12 23 1 23 2 23 3 23 4 23 5 23 6 23 7 23 8 23 9 23
Danville *	1.5	7 30 8 30 9 30 10 30 11 30 12 30 1 30 2 30 3 30 4 30 5 30 6 30 7 30 8 30 9 30
Wildwood Park *	2.5	7 37 8 37 9 37 10 37 11 37 12 37 1 37 2 37 3 37 4 37 5 37 6 37 7 37 8 37 9 37
Putnam ****	7.4	8 00 9 00 10 00 11 00 12 00 1 00 2 00 3 00 4 00 5 00 6 00 7 00 8 00 9 00 10 00
Webster *****	18.7	9 00 10 00 11 00 12 00 1 00 2 00 3 00 4 00 5 00 6 00 7 00 8 00 9 00 10 00 11 00
Worcester	36.8	10 30 11 30 12 30 1 30 2 30 3 30 4 30 5 30 6 30 7 30 8 30 9 30 10 30
Danielson	34.9	7 30 8 30 9 30 10 30 11 30 12 30 1 30 2 30 3 30 4 30 5 30 6 30 7 30 8 30 9 30

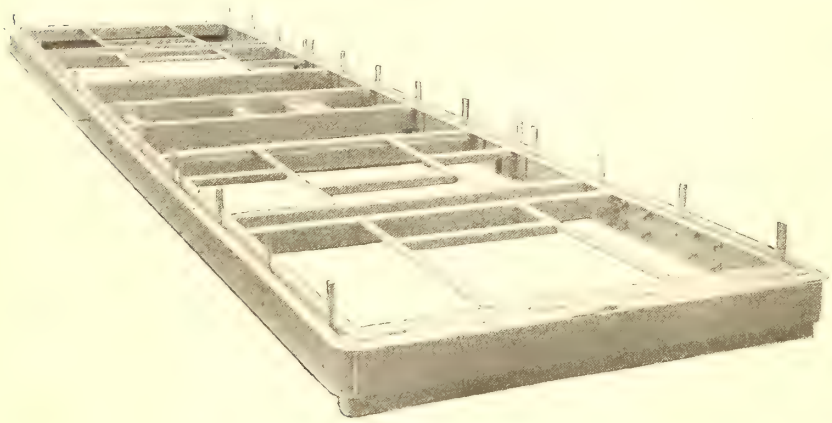
PORTION OF TIME-TABLE—PROVIDENCE & DANIELSON RAILWAY

asterisk next to the station after leaving which an additional nickel is required for passage. A portion of the time-table is reproduced herewith, from which the plan followed can easily be understood. In addition, on the last page of the time-table, a table is published showing the fares, distances and time required between Providence and the principal cities along the route.

One of the most expensive bridges ever constructed by an electric railway company has been contracted for by the Toledo Urban & Interurban Railway Company. The bridge will span the Maumee River between Maumee and Perrysburg. It will be 1430 ft. long, and will be built of steel with stone and concrete piers. The contract was awarded to the American Bridge Company, and the price will be $280,000. The company will lease the right to use the bridge to other interurban roads entering the city from the south.

A STEEL CHANNEL BOTTOM FOR CITY CARS

A type of car bottom construction which is finding very extensive use but about which very little has been said, is that which is known as the steel channel car-bottom construction of the St. Louis Car Company. The peculiar feature of this bottom is the opportunity that it gives for a very low car body in city service without interfering with the strength of the car by cutting down the strength of the sills. One of these bottoms under construction is illustrated by the accompanying engraving. This particular bottom is one of an order for the Louisville Railway. Similar construction has been employed on the standard cars with which the Chicago City Railway Company is gradually equipping its lines, and also under the new cars of the St. Louis & Suburban Railway. These, however, are only two of the most notable and extensive car orders in which this type of bottom has been employed.



STEEL CHANNEL BOTTOM FRAME FOR CITY CARS

In this bottom the longitudinal strength is obtained entirely by the two channel steel side sills. Sufficient strength is obtained in these so that there is no necessity for the usual heavy longitudinal timbers under the middle, and, consequently, there is a certain amount of room saved for the turning of the trucks which would not otherwise be available.

A NEW CABLE BRACKET FRAME

G. M. Gest, of Cincinnati and New York, who has invented many valuable specialties for use in conduit construction, has recently placed on the market the cable bracket frame illustrated herewith. This frame is made of galvanized angle-iron, and is supplied at top and bottom with anchors which are built in the wall with the frame itself. The face of the frame is flush with the wall, and therefore takes up no room in the manhole.



CABLE FRAME

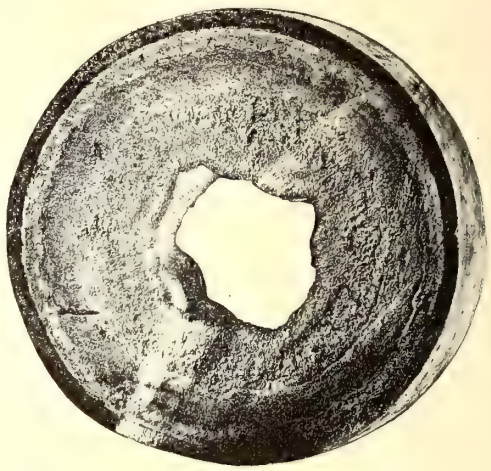
The galvanized cast-iron cable bracket is secured to the frame by means of a galvanized T-head bolt with a special nut so designed that the bracket is removed by being lifted straight up. By means of the special nut the bracket can be adjusted to any angle, and as the slot in the frame is unobstructed from top to bottom the bracket can be adjusted to any height desired.

The frames are made in the following lengths: Twelve ins., 24 ins., 30 ins., 36 ins., 42 ins., and the brackets are made in three sizes, single, double and triple. Longer frames than the above are made to special order. The brackets and bolts are removable at any time, and very little time is required to change from a single bracket to a double or triple type. As all parts are heavily galvanized they will last as long as the conduit system itself.

SCALE IN BOILER TUBES

Although the accumulation of scale in boiler tubes may appreciably affect the cost of generating power, the importance of keeping the tubes clean is often overlooked.

The accompanying cut illustrates one of 215 tubes in the boilers of a street railway company in the South. The water used was very bad and scale actually accumulated to the thickness of an inch. As the operating conditions prevented the plant being shut down for any extended length of time the company was at a loss how to have the tubes rapidly cleaned. Its attention was called, however, to the "Weinland" mechanical cleaner, made by the Lagonda Manufacturing Company, of Springfield, Ohio, and in a very short time after the cleaner was adopted all the tubes were thoroughly cleaned without injury to any of them and with very little trouble or expense.



SECTION OF SCALE CHOKED PIPE

WIND-BREAKS FOR HIGH SPEED INTERURBAN CARS

After a series of practical experiments the Pacific Electric Railway Company, of Los Angeles, Cal., has decided to put wind-breaks on all of its long-distance cars. The experiments were made on the company's Long Beach division, between Los Angeles and the ocean. Four different shaped wind-breaks were tried. The one adopted will resemble the cow-catcher of a locomotive. The base of the structure will be on a level with the floor of the car. From this point the knife-like edge extends upward at an angle of 45 degs. to the top of the car. The minor portions of the sides are rounded off in a convex curve to the sides of the car. The forward part of the structure will be constructed of glass, and it may be feasible to have the motorman sit in this hood, where he may control his car undisturbed.

To drive at a speed of 60 miles an hour a car equipped with this wind-break it took 220 hp. Without the hood the same car, with its flat front, required 290 hp to attain the same speed. This is a saving of about 24 per cent of energy. At a speed of 50 miles an hour the test with and without the hood registered 137 hp and 170 hp, respectively. At one time the car attained a speed of 68 miles an hour.

These experiments were made against a stiff ocean breeze. R. S. Masson, consulting electrical engineer of the company, under whose directions the tests were made, says that the use of the wind-break on all long-distance cars is an assured fact in the light of such practical and satisfactory results.

MORE SEMI-CONVERTIBLE CARS FOR PHILADELPHIA SUBURBS

The J. G. Brill Company has recently finished a number of fine cars for the Philadelphia, Bristol & Trenton Street Railway Company, to be used for the present on the 9-mile division between Bristol and Morrisville. Later the cars will run to Torresdale, 7 miles south of Bristol. At Croydon this railway runs over a ¾-mile elevated structure, as the company has not yet been permitted to lay surface rails in that section. The lines extend for most of the distance over private way. The service is distinctly interurban, for which this type of car is particularly suited, having all the features for comfort and convenience for summer as well as winter use. They are substantially constructed for carrying heavy loads at fair speeds. Many cars of this type are now in operation on electric railways between towns near Philadelphia.

The car illustrated is of the size most largely used. The



SEMI-CONVERTIBLE CAR FOR BRISTOL, PA.

length over end panels is 30 ft. 8 ins.; length over vestibules, 40 ft. 1 in.; from panels over end panels, 4 ft. 8½ ins.; width over sills, 7 ft. 10½ ins.; width over posts at belt, 8 ft. 2 ins.; sweep of posts, 1¾ ins.; from center to center of posts, 2 ft. 8 ins.; height from track over trolley board, 12 ft. 1½ ins. The corner posts are 3¾ ins. thick, and the side posts 3¼ ins. Side sills, of long-leaf yellow pine, are 4 ins. x 7¾ ins., plated on the inside with ⅜-in. x 12-in. steel, to which plates the posts are securely bolted. End sills are 5¼ ins. x 6⅞ ins. The interiors are finished in natural-color cherry, and the ceilings are three-ply birch, handsomely decorated. Entrance to the vestibules is from either side, the doors folding against the corner posts of the car. The vestibule windows are each composed of one light and drop into pockets. The car windows are raised into roof pockets by means of trunnions at the sash corners moving in grooves entirely of metal.

Each car is furnished with angle-iron bumpers, radial drawbars, "Dumpit" sand-boxes, track scrapers, "Dedenda" gongs and ratchet brake handles, all of the builder's make. The trucks are Brill 27-G with 4-ft. wheel base, 33-in. wheels, and equipped with 50-hp motors, two per car.

FURTHER DEVELOPMENTS IN RICHMOND STRIKE

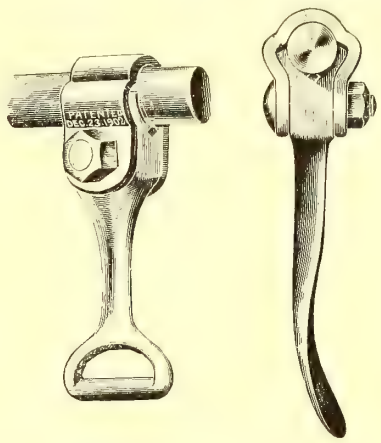
The continued presence of militia in Richmond and Manchester, and the determination of the authorities to preserve order, has had a very quieting effect on the strikers in both cities. Cars are running on the lines of the Virginia Passenger & Power Company, and are being well patronized. The strike sympathizers have taken to cowardly tactics by placing obstructions on the tracks and throwing missiles at cars during the night, but the watchfulness of the military sentinels has prevented serious damage.

Under the general laws of Virginia, railway companies have the right to arm their motormen outside of city limits. The Virginia Passenger & Power Company has taken advantage of this right and has furnished each motorman and conductor with a shotgun and buckshot-filled shells. These guns are placed in special racks from which they can be quickly taken for use.

At present most of the trouble is confined to Manchester, one man having been killed and another wounded there on July 4. In Richmond all is so quiet that part of the soldiers may be withdrawn at any moment.

IMPROVEMENT IN REGISTER ROD HANDLES

An improved register rod handle has been recently placed on the market by C. O. Oberg & Company, of Boston, Mass.



TWO TYPES OF REGISTER ROD HANDLE

The present practice is to have an eye or hole at one end of the handle through which the rod passes. The rod and handle are supposed to be held in rigid relation by means of a set screw. The fact is, however, that the eye stretches and the set screw becomes worn or broken from continued tightening, thus making it incapable of holding the handle rigid on the bar. This necessitates the replacing of the old handle. The only way to get a new one on is to loosen all the handles on the bar and remove the rod from its bearings and connections with the register. This, of course, involves considerable trouble and expense.

The new handle, two types of which are shown herewith, will do away with all these objectionable features. It may be put on or removed without disconnecting the rod from the register or from its bearings, none of the other handles has to be removed, and the operation of the register is not disturbed. It cannot get loose, even if worked both ways, on account of the powerful grip it has, and the hardened steel key which is set in the composition and which is pressed into the steel rod when the bolt is tightened up.

The manufacturer states that these handles are made in any desired shape, that they cost about the same as the old style, and are much cheaper than the square rod handles.

TAG SYSTEM FOR PACKAGES.

The interurban lines operating into Indianapolis have adopted the tag system in their freight business. Tickets are being sold to the farmers and others along the lines, and when a package is to be shipped by express the shipper merely consults his schedule of rates and attaches to his package a ticket that will carry the package to its destination. A 5-gal. can of milk is carried to the city for 10 cents and is returned for 5 cents.

FINANCIAL INTELLIGENCE

Wall Street, July 8, 1903.

The Money Market

In spite of the fact that bank reserves are still far below the level of the season, a distinctly easier feeling is apparent over the money outlook compared with a month or even two weeks ago. Belief is gradually growing that liquidation in stocks has been so thorough that whatever needs may arise later on in the money market will be met without serious disturbance in speculative circles. There are no great demands upon bank credit, such as pressed so heavily upon surplus reserve last summer and the summer before. This in itself is a matter of incalculable importance. Then, again, we occupy an immensely better position in the international exchanges as compared with twelve months ago. European loans have been repaid on an enormous scale, estimates of the amount paid off reaching as high as $200,000,000. This means a decided change from the condition last autumn, when affairs being at a crisis here Europe was not only unwilling to lend us more, but was refusing to renew accommodations already existing. Beyond any reasonable doubt we shall be able this season, should necessity arise, to borrow freely in the foreign markets, importing gold where it is needed to sustain domestic bank reserves. These two circumstances—the absence of new borrowing on the one hand and greater capacity for obtaining assistance from abroad on the other hand—are the two essential respects in which the present situation is reassuring as compared with a year ago. It is of less moment whether or not our local banks are able to strengthen their position materially between now and the harvest time. Exports of gold continue—$2,800,000 more has gone out to Paris during the past week. Besides this, the currency inflow from the interior has slackened perceptibly. Arrivals of new gold from the Klondike and one or two scattered consignments from Australia will serve to help out in a measure, but the main hope during the next six weeks for adding to surplus reserves lies in a probable reduction of the loan account. Such reduction, it is expected, will occur from the paying off of the $40,000,000 Pennsylvania loan and from the similar return of credits in one or two other syndicate enterprises. Call money, after a temporary rise to 10 per cent during the period of the first of July settlements, has now returned to a normal level. Time money, meanwhile, is rather easier, with sixty-day loans made at 3½ per cent, and six months money offered more freely by the banks at 4¾ per cent.

The Stock Market

The general stock market has scarcely changed at all during the past two weeks. Operations for the rise continue to be held in check by the uncertainty of the crops, by the necessity already alluded to of strengthening bank reserves, and by the knowledge that the assimilation of undigested securities has not yet gone as far as it ought to be. On the other hand, short selling and bear manipulation are equally restrained by the evidence that genuine liquidation is over and by many proofs that stock prices are so low that any further decline would bring in plenty of investment buying. With these limits imposed on either side the market is naturally dull and narrow with trading confined to professional operators who take first one side and then the other, whichever for the moment seems to present the best opportunity for profits. Prices have fluctuated within a very small range, and from present indications they are likely to continue in this rut for some time longer. The thing now most anxiously awaited is definite news from the crops. In former years experience has shown that a moderate advance is not improbable in the summer despite the money uncertainties of the autumn close at hand. But such movements are, of course, entirely dependent upon good news from the harvest regions. The latest crop reports have been decidedly encouraging. Great improvement has been made in the condition of corn in particular since the middle of last month, and with all due allowance for the fact that the crop has had a late start and will be unusually liable to frost damage, the present outlook is for at least an average yield. Spring wheat indications, except in a few localities, are highly favorable, and taken together with an exceptionally large yield of wheat now assured, make it entirely probable that the total production will be one of the largest on record.

The local traction stocks are still governed pretty wholly by the course of the general market. Reports of largely increased earnings on the Brooklyn Rapid Transit system, owing to the large volume of the summer traffic on the road, are receiving some attention. There is reason to believe that a new pool has been formed to operate in the stock, bidding up the price where general conditions permit and giving support on occasions of weakness. The other traction stocks have been very quiet. Investment buying is still noticeable from time to time in Manhattan Elevated, but several attempts which have been made by speculators to mark up the price have not met with much success.

Philadelphia

No very important changes have occurred in Philadelphia stocks during the two weeks period, nor is there any particular news. It is announced that the recent assessment on Rapid Transit stock has been fully collected, and the money will be devoted at once to the subway, extensions, and other contemplated improvements on the system. Rapid Transit shares in the market after getting down to 10¼, rallied to 11. Union Traction held steady around 45, while Philadelphia Traction sold at 95⅞, the lowest of the season, and later at 96. Philadelphia Company common recovered sharply from 41¾ to 42½, on signs of investment buying. The preferred changed hands throughout at the one figure, 47. Other transactions of minor importance included American Railways at 45, Easton Electric at 15, United Traction of Pittsburg preferred at 50 and Consolidated Traction of New Jersey between 66½ and 67½.

Chicago

Trading in the Chicago specialities is at a standstill and there seems to be no prospect of any real improvement until the everlasting traction question is out of the way. There are no new developments in the controversy over franchise renewals between the city authorities and the companies. Officials of the City Railway declare that they are perfectly willing to do the fair thing with the city, but they insist that there are vested rights in the property which must be recognized and they do not intend to be prevented from getting what is essential to continue their business. City Railway shares are down again from 199½ to 195, and Union Traction is weak at 4 to 4½. Sales are reported in West Chicago at 62, Southside Elevated at 99, Metropolitan common at 23¼ to 23, the preferred at 67¼ and Lake Street on a rising scale from 4½ to 5¼. Traffic of the South Side Company for the six months ending June showed an increase of about 6 per cent over last year. It is said that the Aurora, Elgin & Chicago line, which is an offshoot of the Metropolitan, has increased its earning capacity more than 50 per cent since the opening of the Elgin branch. The current daily earnings of this branch are figured out as being at the rate of $500,000 annually.

Other Traction Securities

In the Boston market the leading stocks as a rule have improved, but on very light dealings. Elevated shares recovered 5 points from 140 to 145, Massachusetts Electric common rose from 26 to 27 and back to 26½, the preferred rose from 83 to 84, West End common from 89 to 91, but the preferred, after rallying 2 points from 109 to 111, lost the value of its gain. Prices are a trifle better in the Baltimore market, but business is too slow to give the movement any significance. United Railways stock is up from 11¼ to 11⅝, the income bonds from 64⅜ to 64¾ and the general 4's from 92¾ to 93¼. Other sales include Newport News & Old Point Comfort 5's at 100, City & Suburban 5's at 112¼ and 112, City Passenger 5's at 105½, Traction Consolidated 5's at 101 and 101¼, and Petersburg 5's at 114⅛. Transactions on the New York curb market for the fortnight have been quite unimportant. They comprise sales of New Orleans preferred at 43¼ and 43, the 4½ per cent bonds at 85½ and 85¼, American Light & Traction preferred between 96½ and 97, St. Louis Transit and 72, Washington Traction preferred at 38⅝, the 4 per cent at 22 and 21⅝, United Railways of St. Louis preferred at 72⅛ and 72, Washington Traction preferred at 38⅝, the 4 per cent bonds at 74½, and Brooklyn Rapid Transit 4s at 81.

Iron and Steel

The report of the United States Steel Corporation issued last night for the quarter and half year ending June 30, makes a much more satisfactory exhibit than had been looked for. Although comparison is made with the most flourishing period of the company's business a year ago, net earnings for the last three months show a decrease of only 3 per cent. This goes to prove that the popular idea of the recent reaction in the iron trade has been very much exaggerated. The very large orders for steel rails aggregating 250,000 tons from the Western railroads alone during

the past ten days have given a tone of increasing confidence to the whole iron industry. A good trade is also reported in structural steel, and in tin plate and tubes the current tonnage is very heavy. An undercurrent of improvement is also visible in the pig iron market, partly owing to the strike in the Southern foundries, which, promising to curtail production considerably, may perhaps bring in the long-awaited buying movement. Quotations are as follows: Bessemer pig iron $19.85, Bessemer steel $29.50, steel rails $28.

Metals

Quotations for the leading metals are as follows: Copper 14 cents, tin 28 cents, lead 4⅛ cents and spelter 6⅛ cents.

Security Quotations

The following table shows the present bid quotations for the leading traction stocks, and the active bonds, as compared with last week:

	Closing Bid June 23	July 7
American Railways	45	44½
Aurora, Elgin & Chicago	a24½	17
Boston Elevated	a142	143
Brooklyn Rapid Transit	75¾	75⅞
Chicago City	195	190
Chicago Union Traction (common)	3½	4
Chicago Union Traction (preferred)	30	30
Cleveland Electric	*70	73¼
Columbus (common)	102	105½
Columbus (preferred)	105	102
Consolidated Traction of New Jersey	67	66½
Consolidated Traction of New Jersey 5s	105	105
Detroit United	72⅝	73½
Electric People's Traction (Philadelphia) 4s	99	99
Elgin, Aurora & Southern	a49	a48
Lake Shore Electric	10	a13½
Lake Street Elevated	5	5¼
Manhattan Railway	136	136¾
Massachusetts Electric Cos. (common)	26	26
Massachusetts Elec. Cos. (preferred)	82	83
Metropolitan Elevated, Chicago (common)	23	24
Metropolitan Elevated, Chicago (preferred)	66	67
Metropolitan Street	124	122½
New Orleans Railways (common)	11½	—
New Orleans Railways (preferred)	42	43
North American	85	85½
Northern Ohio Traction & Light	a22	21
Northwestern Elevated, Chicago (common)	21	21
Philadelphia Rapid Transit	11	†16½
Philadelphia Traction	96	96
St. Louis Transit (common)	24¼	23
South Side Elevated (Chicago)	*98	97
Syracuse Rapid Transit	26	24
Syracuse Rapid Transit (preferred)	70	76
Third Avenue	113	115
Toledo Railway & Light	25½	25½
Twin City, Minneapolis (common)	95⅞	98½
Union Traction (Philadelphia)	45	44¾
United Railways, St. Louis (preferred)	72¾	72

a Asked. * Ex.-dividend. † $10 Paid.

CHICAGO ELEVATED REORGANIZATION PLAN

It is officially announced that the Lake Street Elevated Securities Committee had received sufficient deposits of stock to warrant it in proceeding with its reorganization plan. It is known that in the main this plan provides for an assessment on the stock, the retirement of the present 5 per cent bond issue with a 4 per cent issue, and the giving of the stock in a new company in return for whatever assessment is made on the present stock issue of $1,000,000. The plan, whenever presented, will be backed adequately by interests represented by Blair & Company, of New York. In fact, it substantially will be underwritten before it is presented.

J. B. Dennis, of Blair & Company, was in conference on July 7 with Lake Street and Northwestern Elevated officials. The decision to go ahead with the consideration of the reorganization plan resulted immediately from Mr. Dennis's presence in Chicago. The protective committee appointed by the stockholders is busy securing stock, and thinks it will be able to get a majority. This may or may not complicate matters from the Reorganization Committee's standpoint.

Mr. Dennis is quoted as saying the Ravenswood extension of the Northwestern Elevated would be actively taken up as soon as the ordinance is passed by the City Council. It is not expected that building operations can begin before next spring.

CLEVELAND RAILWAY CONSOLIDATION

The stockholders of the Cleveland Electric Railway Company have formally ratified the agreement of consolidation between that company and the Cleveland City Railway Company. It was voted to increase the capital stock from $13,000,000 to $23,400,000 in order to purchase outright the Cleveland City Railway Company's lines. Universal transfers have already been granted. Officers have been elected as follows: Horace E. Andrews, president; Christopher F. Emery, vice-president; George Russell, treasurer; John Ehrhart, assistant treasurer; H. J. Davies, secretary; John J. Stanley, general manager; George C. Mulhern, general superintendent. The chairman of the board of directors is Senator Hanna.

TRACTION AND LIGHT CONSOLIDATION IN COLUMBUS, OHIO

As stated in the STREET RAILWAY JOURNAL for June 27, the Columbus Railway & Lighting Company has taken over the Columbus Railway Company. It will also control the Columbus Edison Company. The new company has now perfected its organization by the election of officers and directors.

Robert E. Sheldon has resigned as president and director of the Columbus Railway Company and is succeeded by his son, Butler Sheldon. E. K. Stewart has resigned as first vice-president, treasurer and general manager, and his son, Frank T. Stewart, has been elected as vice-president and treasurer, to succeed him. The office of general manager has been abolished. Mr. Sheldon, Sr., and Mr. Stewart, Sr., were elected to the same offices in the Columbus Railway & Light Company, or the company which recently took over the holdings of the Columbus Railway Company, and the Columbus Edison Company's properties.

The board of directors of the Columbus Railway & Light Company, as reorganized, will be as follows: Robert E. Sheldon, E. K. Stewart, Theodore Rhoades, Frederick Sinks, Clarance Clark, Emil Keisewetter and C. H. Lindenberg.

The minor officers of the Columbus Railway Company will hold similar positions with the holding company, and the former will practically pass out of existance, with the exception of a few officers who will retain titles in the Columbus Railway Company.

OPENING OF NEW CLUB-HOUSE FOR BROOKLYN STREET RAILWAY MEN

The new clubhouse which the Brooklyn Rapid Transit Company has built for its employees was formally opened on July 7. This building, which was described in the STREET RAILWAY JOURNAL for Dec. 13, 1902, contains a gymnasium, entertainment hall, billiard room, bowling alleys, baths, etc. There will also be classes in mathematics, mechanics and electricity. A skeleton car will be used for purposes of instruction in the school.

John F. Calderwood, vice-president and general manager of the Brooklyn Rapid Transit Company, in a very neat speech presented the building to its board of managers in the name of the company. In response to Mr. Calderwood's address, George F. Wolfram, a motorman, accepted the gift on behalf of the rank and file. Mr. Wolfram made a strong appeal to the men to join the Brooklyn Rapid Transit Sick and Death Benefit Association and told of the many advantages thereby gained, the association having paid out during the first six months $1.25 for every $1.00 paid in.

T. J. Nicholl, vice-president and general manager of the Rochester Railway Company, who organized the first Y. M. C. A. street railway branch in America, related the great improvement which had taken place in the character of the men since his company had opened the branch.

T. M. Dudley, secretary of the Young Men's Christian Association, spoke of the good work which has been done by that organization. He was followed by T. F. Moore, secretary of the International Committee who said that the Brooklyn Rapid Transit Company had placed the management of the club house in the hands of the Y. M. C. A. because it felt that the experience of that organization in such work would prove of the utmost benefit to railway employees.

This club house will be open to all employees of the Brooklyn Rapid Transit Company. The yearly dues for membership in the Sick and Death Benefit Association are $6, and the annual payment of $2 additional will entitle members to all the educational, social and athletic privileges enjoyed by similar Y. M. C. A. branches, but which usually cost $10 to $15 per year.

The spirit of this first meeting was so cordial as to leave no room for doubt that the opening of this building presages a new and happier era for the officials and men of the Brooklyn Rapid Transit Company.

STREET RAILWAY LEGISLATION IN CONNECTICUT

The session of the General Assembly of Connecticut, recently brought to a close, saw not less than fifty special electric railway resolutions passed, while four general statutes bearing on street railways were enacted. In addition to this large special legislation the session was especially significant because of the persistent attempt that was made to stifle electric railway building by amending the general railroad law of the State. The progress of this struggle between the street railway and steam interests was reviewed from time to time during its progress in the STREET RAILWAY JOURNAL, the ultimate failure of the attempt being noted only a few weeks since.

Thirteen new street railway companies, most of them getting franchises for intertown lines, were incorporated. Perhaps the most important charter which was granted was the one authorizing the Groton & Stonington Street Railway Company to build an electric railway from New London to the Rhode Island boundary, where connections will be made for Westerly and Watch Hill. The capital stock of the company is $600,000. The Norwich, Mystic & Westerly Street Railway Company, another ambitious project in New London County, has rights to build in Norwich, Preston, Ledyard, Stonington and North Stonington, and to run over into the State of Rhode Island. The maximum capitalization of the company is $700,000.

Two new projects, which lie wholly within New Haven County, are important because they cover connecting links for trunk lines of street railway. One of them is embodied in the resolution incorporating the Wallingford Tramway Company with a franchise to build from the Meriden system at Montowese, in the town of North Haven. The road will be the connecting link from Naugatuck south through the Naugatuck Valley to the town of Seymour. The construction of the link will put Waterbury in connection with New Haven, Bridgeport and Ansonia. The company will be allied with the Connecticut Railway & Lighting Company, and will probably be controlled by that company. The maximum capital stock which the company is authorized to issue is $1,000,000. Franchises for two other street railways which concern Naugatuck Valley, and which will traverse the boundary line between New Haven and Litchfield Counties are embodied in resolutions creating the Woodbury & Seymour Street Railway Company and the Woodbury & Middleburg Street Railway Company. The former corporation, capitalized at $400,000, grants a privilege for a road in the towns of Woodbury, Southbury, Oxford and Seymour. The latter company, which has a capital stock of $200,000, will operate in Woodbury, Middlebury and Waterbury, and will reach Lake Quassapaug, a summer resort in Middlebury.

In the geographical distribution of new electric railway companies, Middlesex County gets two. One of them, the Moodus & East Hampton Tramway Company, is chartered to build a line from East Haddam to the village of East Hampton, and thence to the Lake Pocotopaug, in the town of Chatham. It has a maximum capitalization of $300,000. The other is the Middletown & Middlefield Traction Company, which will have a capital stock of $150,000 and which will operate a suburban line in Middletown and Middlefield.

Other new corporations are the Crystal Lake Railway Company, chartered with a capitalization of $150,000 to build a line in the towns of Summers and Enfield; the Voluntown & Jewett City Street Railway Company, authorized to issue $100,000 capital and to operate in Voluntown and Griswold and the borough of Jewett City; the Plainville & Farmington Tramway Company, capitalized at $50,000 and chartered to build a line in the two towns mentioned in the title; the Branford Railroad Company, which has a capital of $50,000, and which will build from Pine Orchard to the Branford driving park, and the Pawcatuck Street Railway Company, which is incorporated with a capital of $50,000, to construct a line in the town of Stonington.

Much of the other special legislation consisted of granting additional privileges and franchises to existing street railway companies. Nearly all of the prominent companies obtained new charter rights, and the authorized extensions to present systems represent scores of miles in the aggregate. Many of these franchises will not be utilized for a considerable time, but they are essential to the schemes of ultimate expansion. Another class of special trolley resolutions provided for a two-year extension of the life of the trolley franchises which have been granted but which have not yet been used. Many corporations which were chartered by previous legislatures, but which have not yet organized, are given until July 1, 1903, to begin work. A large project in the southwestern section of the State is embodied in a resolution authorizing the Greenwich Tramway Company to merge with other street railway corporations in Connecticut and New York. The name of the consolidated corporation is to be the New York & Stamford Street Railway Company, and it is authorized to issue capital stock to an amount not exceeding $2,000,000.

IMPROVEMENTS IN JERSEY CITY AND NEWARK

The Public Service Corporation of Jersey City and Newark has already commenced on a number of important improvements in its service and rolling stock, which will add greatly to the facilities possessed for handling traffic.

Among these are considerable additions to its rolling stock. An order for twenty-five semi-convertible cars has already been placed with the J. G. Brill Company, and the company is getting out specifications for twenty-five half open and closed cars and for 100 standard closed cars with 30-ft. bodies. The closed cars and the semi-convertible cars will be equipped with a modified Detroit platform, that is with a 6-ft. platform with dividing rail. As the cars are double-enders this platform will of course be at both ends. The company has also ordered 1200 tons of rail, principally for renewals.

Included in the new construction which the company will build is a new line from Paterson to Ridgewood. This line will be from 5½ to 6 miles in length, the greater part of which distance will be over a private right of way.

BOSTON & WORCESTER LINE IN REGULAR OPERATION

The Boston & Worcester Street Railway Company opened its line for operation between Boston and Worcester, Mass., July 1, and had all the traffic it could handle. It is the longest single electric railway in New England, and operates on the fastest time schedule. The cars have not been able to keep up to the schedule of two hours and fifteen minutes for the forty-four miles, but there is no reason to think that the schedule will be found too fast when a few temporary difficulties have been overcome. The time table posted by the company provides that cars leave Park Square, Boston, for Worcester at 6:15 a. m., and every thirty minutes until 9:45 p. m.; two later cars run only to the Wellesley Hill car house. The cars leave Worcester at 6:30 a. m., and every thirty minutes until 9:30 p. m. for Boston, at 10 and 10:30 p. m for Wellesley Hills and 11 and 11:30 p. m. for Westboro. Cars running only to South Framingham from Boston enter the subway but the longer through cars are too large to go in. Details of the construction of this line, together with a map of the route, were given in the STREET RAILWAY JOURNAL of Oct. 4, 1902.

AN AGREEMENT BETWEEN NEW ORLEANS COMPANY AND ITS EMPLOYEES

An agreement as to wages and conditions of service has just been entered into by the New Orleans Railways Company and its employees, which dates from July 1, 1903, and is binding until July 1, 1905. The agreement is the result of negotiations extending over a period of many weeks, and while in some of its provisions it seems most liberal the period of uncertainty as to unexpected action by the men is removed, and the signature is obtained of the representatives of the men to an agreement that if repudiated will bring into disrepute the whole labor organization.

In the first place the union is recognized, and in addition provision is made that any man expelled from the union by a majority vote shall be discharged by the company, if the request is properly made by the association. In the classification of employees and rates of wages, no changes have been made. In the case of the pitmen, however, there is a reduction of one hour in the working day. Other classes of barnmen get the benefit of every other Sunday off with pay. Overtime for motormen and conductors is to be paid for at the rate of thirty cents per hour, while all other employees who work overtime are to receive time and a half. For runs of five hours or less the pay is to be thirty cents per hour, while runs of over five hours and under seven and one-half hours are to be paid for at the rate of $1.50. Runs over seven and one-half hours are to be paid for at the rate of twenty cents per hour.

A section of the agreement that seems to be loosely constructed says that "no motorman or conductor shall be compelled to work overtime, except in extreme cases." This section further "applies to extra as well as regular men, while said extra men are on duty as regulars."

The general style of uniform is to be decided by the company, but it is provided that the men shall be allowed to purchase their uniforms in the open market.

A regular schedule of time allowances, for which pay is to be received by the men at twenty cents per hour, is provided where the men return their cars to the end of a line at a considerable distance from the car house. Free transportation is provided for con-

ductors and motormen in uniform. In accident cases employees are to be paid for the time used in looking up evidence, and suspended employees are to be paid for the period of suspension if true cases are not brought against them. A working and an extra board are to be provided at each car house, and the extra board is to be worked according to seniority. Except in cases of emergency, all changes in schedules are to be posted forty-eight hours before going into effect.

Section 15 of the agreement says: "There shall be no sympathetic strike, so-called, and there shall be no strike of any kind for any cause or any grievance not arising from a grievance of the employees of the railways company, and there shall be no strike pending any matters admitting arbitration under this agreement. In order to carry out the intention of this provision, all employees shall, unless waived by the railways company, give the railways company forty-eight hours notice of their intention to resign and leave the employ of the railways company, and without the consent of the railways company not more than twenty-five conductors and twenty-five motormen shall resign from the service of the railways company within any twenty-four hours, resignations to take effect in order in which application therefor shall be made in writing to the railways company."

Except in cases of irregularities in registering fares or transfers, any employee having a grievance against the company is to have the right to appeal to the association for an adjustment of the grievance or reinstatement where discharge has resulted. If the association and the company cannot agree, then the question is to be submitted to a board of arbitration consisting of three members, one selected by the association, one by the company, and the other by the two already selected. The decision of this board is to be binding. In the case of discharge for irregularities in fares or transfers the accredited officer of the association is to be permitted to plead the case of the employee.

ROUTE OF NEW TUNNEL IN BOSTON

The Rapid Transit Commission of Boston has voted on the proposed route of the new tunnel through the heart of the business section of the city. The route selected is the one known as the May Place-Devonshire Street-Union Street route, and provides from a point between Oak and Nassau Streets, to a point under Union Street near Haymarket Square, having stations in the vicinity of Summer Street and State Street, and such other stations, if any, as may hereafter be determined upon. It is to be a two-track tunnel, for the use of elevated cars or trains, as provided for in chapter 534, acts of 1902.

Under the special act authorizing the construction of a tunnel to facilitate local transit in Boston, it was provided that after a route had been determined it should be submitted to the Boston Elevated Railway Company, and if it dissented, it had three days to remonstrate to the railroad commissioners, and the finding of the latter would be a finality. The fact that the elevated people have been in consultation with the transit commissioners while the route was under consideration leads to the belief that it is entirely satisfactory and that the Railroad Commissioners will not be called in.

The southerly incline of the new tunnel begins at May Place, but no connection with the elevated structure on Castle Street is shown. This part of the work is entirely in the hands of the railway company, and it may unite the elevated and underground lines according to its own ideas. The incline will slope down to below the foundations of all intersecting buildings, until it reaches Bedford Street, where it follows the line of Kingston, Otis, Devonshire and Union Streets to its termination near Haymarket Square. The tunnel comes to a dead end at Union and Merrimac Streets, as the commission has not as yet determined on an extension from that point. It will not, however, connect with the present subway at Haymarket Square. Provision has been made for a station in the vicinity of Summer Street, and another near the Old State House. At the latter point the new subway will pass under the East Boston tunnel, being connected with it by flights of stairs or possibly elevators.

The length of the new line is 1 1-13 miles, and it is practically free of sharp curves and will be more suited than the old subway for the elevated trains. With the new tunnel in operation the present connection between the elevated structure at Pleasant Street and the subway will be discontinued, and the subway's whole length be given up to surface cars. The change will involve a heavy expenditure, as will also that at Causeway Street. Giving the old subway up entirely to surface cars will mean much in handling various suburban lines, as they can be run through to northerly and southerly points and avoid the changes now required at Scollay Square and Park Street.

The Transit Commission opened bids on July 7 for the construction of the section of the East Boston tunnel, between the westerly end of the Old State House and Scollay Square, at which point it will connect at grade with the existing Tremont Street subway. This will be known as section "F" while under construction. Eight bids were received, ranging from $121,500 to $229,170. The bids were: Metropolitan Contracting Company, $229,170; H. P. Nawn, $217,755; James J. Coughlan, $191,365; Jones & Meehan, $188,200; Shailer, Dunfee & Taylor, $174,200; E. W. Everson & Company, $158,600; Patrick McGovern, $150,475; Coleman Brothers, $121,500.

From the stipulations contained in the contract form, it is evident that the East Boston tunnel will not be ready for use this year. The contractor will have until Dec. 20, in which to complete section F, and this will not include the laying of track. By that time, however, all the other sections should be ready for use, and the work rushed to completion. Most of the work has been done in contract time, or a little better. The delay on the harbor section was due in part to the change in route after the contract for that section had been awarded, and work begun on lines intending to carry it through Fleet Street and Hanover Street.

ELEVATED SHOPS BURNED IN NEW YORK

Three shops of the Manhattan Railway Company, of New York, were totally destroyed, with their contents, by a fire which broke out about 4 p. m. on July 4. The shops are situated in a block bounded by Lexington and Park Avenues, Ninety-Eighth and Ninety-Ninth Streets, and there are several of them, all numbered. Flames were first discovered in shop No. 2, known as the workshop. An alarm was turned in at once, but by the time the firemen got to work the flames had eaten their way to shop No. 1, known as the storage shop. To the rear of No. 1 is No. 3, known as the mills and carpenter shop. In it was from seven thousand to ten thousand feet of lumber.

The fire was confined to these three shops, though there was danger at one time that the paint shop would also be ignited. It contained hundreds of gallons of oil and other inflammable material In shop No. 1 were stored fifteen new motor cars, and in the storage shop twenty passenger cars. These burned so fiercely that the firemen confined their efforts to saving the other shops, and to preventing the flames from spreading to the barns of the Interurban Street Railway Company, on the other side of Ninety-Ninth Street.

According to an official of the company the damage is between $100,000 and $150,000, the principal loss being fifteen motor cars, valued by the company at $6,000 apiece, and twenty passenger cars, all of which are a total loss.

TROLLEY EXCURSION FROM SARATOGA TO GLENS FALLS

The Hudson Valley Railway Company opened its line from Saratoga to Glens Falls last week with a special excursion for the members of the American Society of Mechanical Engineers and their guests. For some time the lines of the Hudson Valley system have been in operation from Waterford, connecting there from Albany and Troy to Mechanicville, Schuylerville, Fort Edward, Glens Falls, Caldwell and Warrensburg, with a branch from Mechanicville to Round Lake, Ballston and Saratoga. The Saratoga Lake road is a part of the combination. The new line from Saratoga to Glens Falls opens a second route between Glens Falls and Mechanicville. The extension northward from Saratoga follows the route of the old Mount McGregor Railroad as far as Wilton.

The party of mechanical engineers went to Glens Falls as the guests of President E. L. Eshley, of the Hudson River Power Company, to inspect the new dam across the Hudson at Spiers Falls, about ten miles southwest of Glens Falls. This dam will be finished next autumn at a cost of between $2,000,000 and $3,000,000. Electric power will be supplied to Glens Falls, Sandy Hill and Fort Edward, and it is presumed that power will also be transmitted to Schenectady for the use of the General Electric Company, to supplement that now furnished from Mechanicville. It is also possible that the United Traction Company will take power from Spiers Falls for the Albany and Troy street railway system.

BRAZILIAN STEAM RAILROAD CONTEMPLATES CHANGING TO ELECTRIC TRACTION

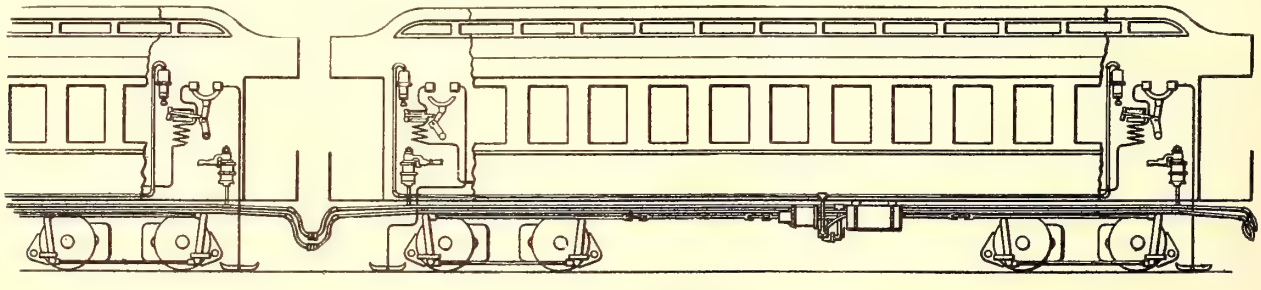
The Companhia Trilhos Urbanos do Recife a Olinda e Beberibe at Pernambuco, Brazil, which operates a steam railroad about 12 miles long, desires to change its system to electric traction. Bento Tagalhaes, manager of this company, states that he wishes to receive full information on this subject from railway contractors and manufacturers.

WORK OF FINANCING THE NASHVILLE COMPANY

The total issue of stock of the Nashville Railway & Light Company, as the successors to the old company is known, will be $6,000,000, divided into $3,500,000 common and $1,500,000 preferred. Of this only $5,000,000 will be put upon the market. The bond issue will be the same, $6,000,000. A treasury reserve of $1,000,000 of bonds, $500,000 of common stock and $500,000 preferred stock, $2,000,000 in all, will be set aside for the purpose of making future improvements and purchasing other electric lines and properties. The bonds bear 5 per cent interest. By this plan there will be a total issue of $12,000,000 stocks and bonds, but only $10,000,000 securities will be placed upon the market. The plan provides that $1,800,000 shall be spent now upon improvements of the Nashville system and properties. Of this amount over $600,000 has already been expended. The reorganization of the Nashville Railway Company into the Nashville Railway & Light Company is made noteworthy by the fact that nine cities are represented among the underwriters, Birmingham, Atlanta, New Orleans, Baltimore, Richmond, New York, Boston and London being the home cities of the banking firms and individuals who have underwritten the issue. Despite the fact that a number of interurban lines are projected near Nashville, it is the general impression that the reorganized company will carry out on an extended scale the development of suburban and interurban lines.

TROLLEY EXCURSION FOR NEWSPAPER MEN

The Trenton & New Brunswick Railroad Company, through Superintendent E. T. Wagenhals, tendered an outing to the newspaper men of Trenton and New Brunswick on June 24. Twenty-six were in the party altogether. A special car, the "Bound Brook," was used for the occasion, and it was gaily illuminated inside and out with electric lights. The party started from Trenton and arrived in New Brunswick at 8:43. A banquet was spread for the guests, and a return was begun at 10:33. On the home run the distance between Milltown Junction and the Fair Grounds, 24 miles, was covered in 44 minutes, and for more than half of the distance the speed exceeded 50 m. p. h. It was the first event of the kind that has ever been held by an electric railway company in that section of the State, and the most remarkable coincidence in connection with it was that the mystic "13" appeared in just thirteen occasions that evening. The local cars in which the scribes traveled from the City Hall, Trenton, to the Fair Grounds, run every 13 minutes, and it took 13 minutes to make the run. On the car that left 13 minutes before 7 there were 13 people altogether, and on the 7 o'clock car there were 13 of the party going upon the trip. Thirteen of the men were newspaper writers and 13 were not. Superintendent Wagenhals had 13 lights upon the side of the car. One of the newspaper men, for a joke, rang up 13 fares on the register. There were 13 at Superintendent Wagenhals' table, and the thirteenth man was a coroner. There were 13 speeches made and the car left 13 minutes behind the schedule previously arranged upon the return trip. Lastly, the time made was 13 minutes better than the schedule. Everybody arrived home safe before midnight.



PATENT NO. 721,814

STREET RAILWAY PATENTS.

UNITED STATES PATENTS ISSUED JUNE 23, 1903

731,455. Electric Brake; Ernest R. Hill, Winkinsburg, Pa. App. filed Dec. 29, 1899. The motor generates braking current and the field and armature are connected in separate circuits when the braking action is required, so that the reaction of the field will not affect the armature current.

731,508. Street Car Fender; Henry P. Schneider, Peoria, Ill. App. filed Oct. 10, 1902. Details of construction of a fender provided with pneumatic or other cushions to prevent injury to a person coming in contact therewith.

731,606. Trolley Pole Controller; John J. O'Donnell, Aylmer, Canada. App. filed Sept. 22, 1902. Details of a spring drum adapted to take up slack trolley cord.

731,806. Railroad Transfer Table; August Nelson and Frank X. Herrmann, Manitowoc, Wis. App. filed Oct. 18, 1902. A reciprocatory transfer table provided with a cylinder having its axis arranged in the plane of movement of the table, a piston disposed in the cylinder, a cross-head connected with the piston, cross-head guides, a bar connecting the cross-head with the platform, a plurality of laterally yielding bolts carried by the table and guides or recesses for the reception of said bolts.

731,814. Combined Power and Brake System; William B. Potter and Clarence D. Clark, Schenectady, N. Y. App. filed Oct. 31, 1900. A train system comprising vehicles equipped with propelling motors and with an air brake system, engineer's valves located at any desired points along the train, circuit breakers in the several motor circuits, a plunger adjacent to each circuit breaker, and operatively connected with the air brake system and means whereby each plunger will cause its corresponding circuit breaking device to open the motor circuit only in case current is flowing therein when the brakes are actuated.

731,952. Device for Operating Street Railway Switches; Elias Robbins, Pittsburg, Pa. App. filed Jan. 2, 1903. A series of spring arms are arranged on the end of a shaft, which is spring mounted adjacent to the rail and means for rotating and depressing the shaft whereby the spring arms will engage and move the switch tongue.

731,954. Trolley Finder; Guy T. Roberts, San Diego, Cal. App. filed Feb. 24, 1903. Details.

732,009. Circuit Breaker Operating System; William B. Potter, Schenectady, N. Y. App. filed Oct. 31, 1900. Relates to the invention described in patent 731,814.

732,011. Street Railway Switch; James E. Scott, Louisville, Ky. App. filed Jan. 27, 1903. Details.

732,144. Trolley; John H. Walker, Lexington, Ky. App. filed March 14, 1902. The trolley harp and hub are so constructed as to afford good contact and lubrication.

732,145. Trolley; John H. Walker; Lexington, Ky. App. filed Nov. 20, 1902. A modification of the preceding patent.

732,157. Electric Railway; Arthur H. Bedworth, Boston, Mass. App. filed Nov. 13, 1902. When a car enters a block on a single track railway, it cuts off current from a short section of the track in the block ahead, thereby preventing other cars entering the block from the opposite direction.

732,272. Signaling System; Harold G. Brown, Melrose, Mass. App. filed Oct. 10, 1902. In railway systems in which direct current is used for both power and signal operation, the object is to prevent the return current in the rail from operating the signal system when a part of the circuit of the latter includes the rail.

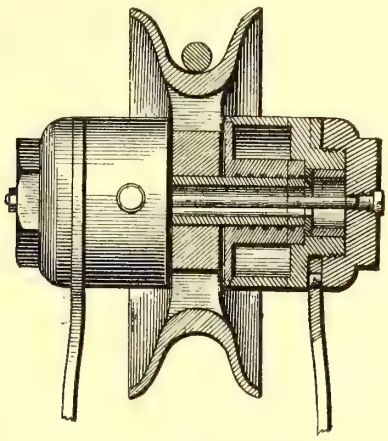
732,325. Rail Sander; James C. Thompson, Wilkinsburg, Pa. App filed March 10, 1903. Relates to mechanism for applying sand both in front and behind the wheels of a car.

732,495. Trolley; George E. Allen, Pittsburg, and George Zimmer, Allegheny, Pa. App. filed April 15, 1903. Details of an arrangement for retaining the trolley wheel on the wire.

732,512. Electric Railway; Edward C. Boynton, Newburgh, N. Y. App. filed March 5, 1903. The current for the engine in a train or switching yard, is carried by overhead rails extending across all of the tracks, the locomotive carrying a shoe long enough to bridge from one rail to anther, thereby receiving current at all times without the necessity of overhead switches.

732,559. Electric Signal; George F. Hilton, St. Augustine, Ill. App. filed July 21, 1902. A signal to indicate the approach of trains wherein an electric bell is placed in circuit with a bond, one terminal of which is insulated from the rail but mechanically connected therewith by the car wheel.

732,598. Clips; Louis Steinberger, Brooklyn, N. Y. App. filed Sept. 12, 1902. The connection between the clip and the ear which



PATENT NO. 732,144

holds the trolley wire is more or less yielding to provide for strains brought upon the ear by the trolley wheel.

732,599. Turnbuckle Strain; Louis Steinberger, New York, N. Y. App. filed Feb. 24, 1903. Details.

732,600. Emergency Car Brake; William B. Storch and Valentin Storch, Knoxville, Pa. App. filed March 6, 1903. Heavy metallic shoes adapted to be thrown under the car axles and lift the car wheels from the track.

732,636. Track Sanding Apparatus; John C. Hooper, Baltimore, Md. App. filed Feb. 18, 1903. A track sanding apparatus provided with means by which the act of disconnecting the sand discharge tube from its casing automatically closes the sand box, so that the sand is prevented from leaking therefrom while the sand discharge tube is undergoing repairs.

PERSONAL MENTION

MR. W. B. POTTER, chief engineer of the railway department of the General Electric Company, has just returned from an European trip of about three months.

MR. EBEN WHITE LOTHROP, of the engineering staff of Messrs. Stone & Webster, Boston, was married June 24, to Miss Bessie Holbrook Fox, of Duxbury, Mass.

MR. THEODORE WENTZ, of Findlay, Ohio, manager of the Toledo, Fostoria & Findlay Railway Company, has tendered his resignation, which has been accepted.

MR. T. C. RODERICK, formerly superintendent of the Owensboro City Railroad Company, has accepted the position of superintendent of the Indianapolis, Shelbyville & Southeastern Traction Company, of Indianapolis, Ind.

MR. DANIEL J. KANE has been appointed acting superintendent of transportation of the Milford & Uxbridge Street Railway, of Milford, Mass. Mr. Kane has been car despatcher for the company, and has been connected with Milford street railways for seven years.

MR. JAMES COFFIELD WARREN, JR., the representative in New York City of the Ohio Brass Company, of Mansfield, Ohio, was married at Norfolk, Va., on June 24, to Miss Martha Helen Grant, of Norfolk, Va., daughter of Mrs. Vernon Carvick Grant. The ceremony took place at five in the afternoon, at the home of the bride. Mr. and Mrs. Warren will make their home in New York.

MR. E. B. GUNN, superintendent of the Richmond Street & Interurban Railway Company, of Richmond, Ind., has been appointed as successor to Mr. R. K. Howard, superintendent of the Dayton, Springfield & Urbana Railway, of Dayton, Ohio, who recently resigned on account of his health and who will leave shortly for the West, where he will spend a year or so in traveling. Mr. Gunn has been connected with the interurban business in Indiana for several years. In appointing Mr. Gunn as successor to Mr. Howard there will be a few changes made in the officials. Mr. Howard was general superintendent of the Dayton, Springfield & Urbana branch of the Appleyard syndicate only, while Mr. Gunn will assume the general superintendency of the Dayton, Springfield & Urbana and the Columbus, London & Springfield Railroads. Mr. Thomas, now superintendent of the Columbus, London & Springfield, has been given a similar position with the Central Market Street Railway in Columbus.

MR. H. M. LITTELL, of New York, has just accepted the position of general manager of the Rapid Transit Company, of Chattanooga, Tenn. Mr. Littell was president of the American Street Railway Association in 1896-1897, and has been prominently identified with the street railway industry, having been general manager of important companies in Cincinnati, New Orleans, Brooklyn and New York. He has recently been making his residence in New York City, and has been acting in an advisory capacity in street railway matters for well-known banking firms.

MR. ROYAL H. HOLBROOK, who has been acting as engineer during the reconstruction of the property of the People's Gas & Electric Company, of Burlington, Ia., has resigned from that company to become chief engineer of the Everett Pulp & Paper Company at Everett, Wash. Mr. Holbrook has been engaged at Burlington for about a year past, previous to which time he was superintendent of the Ottumwa Traction & Light Company. He is well known as an engineer in Iowa, and it is with regret that his street railway friends see him leave this field.

MR. A. L. SCOTT has given up his position as general manager of the Fort Wayne Traction Company, Fort Wayne, Ind., which he has held for five years, to become assistant to Mr. George F. McCulloch, president of the Union Traction Company, of Indiana. He will be associated with Mr. McCulloch in the general offices of the company in Indianapolis. When Mr. McCulloch came to Fort Wayne to purchase the Fort Wayne Traction Company, he evidently realized that Mr. Scott was a thorough and able street railway manager. He left Mr. Scott in charge of the Fort Wayne system only until he could promote him to a position where he would be of greater value. Mr. Scott's new position will put him in close touch with all of the Union Traction Company's interests.

ASSISTANT GENERAL SUPERINTENDENT HENRY E. REYNOLDS, of the Old Colony Street Railway Company, who has just been promoted to that office from that of superintendent of division No. 1 of that system, has been connected with the street railways making up the system since 1884, when he entered the employ of the Brockton Street Railway Company as a conductor, at the age of seventeen years. After running on that railway as conductor two months, he was taken into the office as a clerk, and on account of his recognized ability as a street railway man, was successively promoted to the positions of book-keeper, assistant treasurer and treasurer. His services in these various positions of trust covered a period of seventeen years. When the street railway lines were consolidated as the Old Colony Street Railway Company, he was assigned, March 1, 1901, to division No. 1, as superintendent, with headquarters at Quincy, which position he had held until his promotion as assistant general superintendent of the entire system, a position which his long experience and ability are believed well to qualify him to fill. Mr. Reynolds will have direct supervision of the Quincy, Brockton & West Roxbury divisions, with headquarters at Brockton.

MR. SAMUEL M. KENNARD, has resigned as president of the St. Louis & Suburban Railway, of St. Louis, Mo., and will probably be succeeded by Mr. Julius S. Walsh, president of the Mississippi Valley Trust Company, the Terminal Railroad Association, the Union Electric Lighting Company, and numerous other big corporations. It is understood that Mr. Julius S. Walsh, Jr., will be made vice-president, succeeding his father in that position. Mr. Kennard's resignation was tendered on June 24, and accepted in a communication from the board of directors, signed by the secretary, June 29. Mr. Kennard, in his letter of resignation, stated that he could not, in justice to himself and other organizations with which he is connected, retain the presidency of the Suburban beyond the expiration of his first year of service, which ended July 7. He added that he would be pleased to remain in the executive committee, and that after his return, about Sept. 1, from the East, would render every service possible. Mr. Kennard succeeded Mr. Charles H. Turner as president of the Suburban Company, and it was under his administration that the company was refinanced and the system practicaly rebuilt. The board adopted resolutions, a copy of which was sent to Mr. Kennard, setting forth that it accepted the resignation with sincere regret, and expressed gratification that Mr. Kennard was to remain on the executive committee. On behalf of the stockholders and directors, a vote of thanks was tendered him for his devotion to the interests of the company, and "for the efficient, intelligent and conscientious service he has rendered during his term of office as president." Mr. Kennard will spend the summer at Magnolia, Mass.

NEWS OF THE WEEK

CONSTRUCTION NOTES

BIRMINGHAM, ALA.—The Birmingham Railway, Light & Power Company has begun work on its line to Glen Iris.

LITTLE ROCK, ARK.—The City Council has granted to the Little Rock Railway & Electric Company a franchise to the streets of the North Side, across the free bridge, the work of construction to begin in thirty days.

LITTLE ROCK, ARK.—The City Council has passed an ordinance granting the Little Rock Electric Street Railway Company a franchise to extend its line across the free bridge over the Arkansas River and through the principal streets of Argenta, known as North Little Rock. The work is to be completed within eighteen months at an estimated cost of $200,000.

LOS ANGELES, CAL.—J. W. Eddy has been granted a franchise for his proposed pavilion, observatory and incline railway, to be built in Griffith Park. Work must be begun within four months and completed in three years. A bond of $2,000 was exacted.

LOS ANGELES, CAL.—Wesley Clark has secured the final passage of the franchise awarding to him the right to build an extension of the Ninth Street Electric Railway. A contract provision will give to the city 2 per cent of the earnings of the entire line after five years. A $10,000 bond was required for the performance of the terms of the franchise.

LOS ANGELES, CAL.—For the sum of $20,000 the City Council has sold to L. C. Brand, for the Los Angeles & Glendale Electric Railway Company, a franchise covering Lake Shore Boulevard, Figueroa, Sixth and other streets to the city limits on the way to Glendale, a distance of about 10 miles. Outside the city limits Mr. Brand holds a private right of way.

LOS ANGELES, CAL.—It is persistently rumored that the Los Angeles Traction Company proposes building an electric railway to Whittier, in competition with a Huntington line, now under construction to that place.

LOS ANGELES, CAL.—Surveys are being made by the Pacific Electric Railway Company from Long Beach along the seashore through Pacific City to Newport Beach. The distance is about 30 miles. It was originally announced that the line from Pacific City to the Long Beach-Los Angeles Road would branch off at Signal Hill above Long Beach, and make a cut through the lowlands for several miles before striking the beach. Now, however, the plans are to start directly from Long Beach and let the entire road run along the coast. This line is the one which is to be extended to Santa Ana and thence to Los Angeles.

LOS ANGELES, CAL.—Work has begun on a Huntington road that is to run between Pasadena and Monrovia, east on Colorado Street, through Lemanda Park. It is expected that the road will be in operation by Sept. 15.

LOS ANGELES, CAL.—The Los Angeles Railway Company has purchased a franchise on Twelfth, Stanford, Fourteenth, Griffith and other streets for $2,500.

LOS ANGELES, CAL.—Beautiful station buildings will be erected by the Pacific Electric Railway Company and the Los Angeles Interurban Railway Company at all points of importance which the Huntington lines are preparing to reach. They will be of the mission style of architecture, and will cost from $500 to $5,000. South Pasadena, at the junction of the Monrovia and Pasadena lines, will be the first equipped. Long Beach, Monrovia and San Gabriel will follow in rapid succession.

PETALUMA, CAL.—Articles of incorporation have been filed by the Petaluma & Santa Rosa Railway Company, which proposes to connect Petaluma, Santa Rosa, Sebastopol and Forestville, all in Sonoma County, by a railway operated either by electricity or steam power. The capital stock of the company is fixed at $1,000,000, of which $40,000 has been already subscribed by the seven directors and incorporators: Frank A. Brush, Alfred D. Bowen, Thomas Archer, Francis Cutting, Charles Towne, L. T. Wagner, Alfred G. Sheath. The City Council of Petaluma has drafted an ordinance giving the Petaluma & Santa Rosa Electric Railway Company a franchise within the city of Petaluma. The franchise is made in the name of Bourke Corbett, of San Francisco.

RIVERSIDE, CAL.—Mr. Huntington's electric railway on Seventh Street, from the Santa Fe station to Main Street, is now in operation.

RIVERSIDE, CAL.—A franchise for a 10-mile trolley line from Riverside to West Riverside and to the east side of Riverside down to Victoria Avenue, has been sold to the Pacific Electric Railway Company for $500. Work on the line will begin at once.

SAN BERNARDINO, CAL.—The directors of the San Bernardino Valley Traction Company have organized a company to control all the traction lines in the valley, comprising those now known as the Traction Company's lines, the electric railways of Redlands and the railway now in course of construction between San Bernardino and Highland. Organization of the new company was completed by the election of the following officers: President, H. H. Fisher, of Redlands; vice-president and general manager, A. C. Denman, Jr., of Redlands; treasurer, E. D. Roberts, of San Bernardino; secretary, W. W. Wilcox, of Cotton; auditor, C. W. A. Cartlidge, of Redlands; traffic manager, K. L. Bernard, of San Bernardino. The company proposes to build a branch line to Rialto as soon as the Highland branch is completed, and to extensively improve Urbita Springs, an already popular pleasure resort.

COLORADO SPRINGS, COL.—The Manitou & Pike's Peak Railway Company has completed surveys and plans and secured the right of way for an extension of its line from the summit of Pike's Peak to Cripple Creek, a distance of 9 miles. The extension will cost approximately $750,000.

HARTFORD, CONN.—Application has been made to the Railroad Commissioners by the Hartford Street Railway Company for an extension of its lines in this city. The Common Council has already given its consent for the extension and the hearing. The first petition asks that the Charter Oak Avenue line be extended from its terminus at Wehasset Street southerly through Huyshope Avenue over to the south line of Masseek Street. The second extension is a siding from Capitol Avenue, near Laurel Street, into the property of the Hartford Dairy Company.

HARTFORD, CONN.—The Manila Electric Railroad & Power Company has been organized under the laws of Connecticut, with an authorized capital stock of $6,000,000, par value of shares $100 each. A holding company of similar name was incorporated in New Jersey last spring, but the present company, formed under the more liberal laws of Connecticut, owns the franchise and rights in Manila. The officers and directors of the company will be announced later.

NAUGATUCK, CONN.—Governor Chamberlain has signed a resolution incorporating the Naugatuck Valley Electric Railway Company. The company has a franchise to build an electric railway from the terminus of the Connecticut Railway & Lighting Company's line in this borough south, through the towns of Beacon Falls and Seymour, where it will connect with the road which the Railway & Lighting Company is building between Ansonia and Seymour. The construction of this line will put Waterbury in connection by electric railway with Ansonia, Derby, New Haven and Bridgeport, and will make a continuous line through the southern half of the Naugatuck Valley. The company has an authorized maximum capitalization of $1,000,000. The incorporators are: George A. Lewis and A. L. Dayton, of Naugatuck; A. D. Warner, of Beacon Falls, and Edmund Day and W. H. H. Wooster, of Derby. Wide powers of merger, sale, purchase and consolidation are conferred by the charter.

REHOBOTH, DEL.—The Commissioners of Sussex County have just granted a franchise to W. C. Lofland, proprietor of the Douglass House on the Atlantic Beach, south of the town, to build an electric railway and erect the lighting plant. The only restrictions are that the work shall be completed not later than Aug. 1, 1904, and that the fare shall not be more than 5 cents a passenger. Mr. Lofland has purchased two lots in town for the electric lighting and power house site. Ex-United States Senator Richard R. Kenney, of Delaware, will be interested with Mr. Lofland in the undertaking, and together they will incorporate a $100,000 company. The electric railway will start at Rehoboth Bay, south of the Douglass House, with a loop in front of the hotel from King Charles Street, and run thence through Rehoboth town, immediately west of the Pennsylvania Railroad depot, to the rear of the Henlopen Hotel, thence along the ocean to Cape Henlopen and on to Lewes, which will be the northern terminus. The total distance will be 9 miles.

ATLANTA, GA.—The Atlanta Interurban Railway Company has been incorporated, with a capital stock of $100,000, to build the proposed electric railway between Atlanta and Marietta. Interested in the company are Georgia Railway & Electric Company interests. The incorporators of the company are: P. S. Arkwright, G. W. Brine, T. K. Glenn, W. H. Glenn, H. N. Hurt, S. E. Simmons, S. J. Bradley, R. E. Cullinane, W. B. Stoval and F. M. Fisk.

CHICAGO, ILL.—The South Side Suburban Railroad Company has been incorporated, with a capital of $50,000, to be constructed from a point in Chicago to boundaries of Cook County. Incorporators and first board of directors: C. J. Ton, C. C. Heisen, F. C. Bendle, C. R. Taylor, Gustav Nelson, all of Chicago.

SPARTA, ILL.—John W. Tweed and his associates, who had in contemplation the construction of an electric railway at Sparta, have abandoned the project for the present at least. The city of Sparta is unwilling to grant concessions that the company could accept.

SPRINGFIELD, ILL.—The articles of incorporation of the Springfield & Southwestern Railroad Company have been filed. The capital stock of the company is $25,000. The incorporators and first board of directors are: J. W. Maunts, G. D. Chaffee, Max Kleeman, T. F. Dove, of Shelbyville, and C. Weekley, Obed; E. D. Kerr, Brunswick, and R. P. Smith, of Moweaqua, all citizens of Shelby County.

SPRINGFIELD, ILL.—Articles of incorporation have been taken out at Springfield by the Macomb, Mount Sterling & Beardstown Railway Company for the completion of its electric railway to pass southerly through McDonough and Schuyler Counties to Mount Sterling in Brown County, with a branch from Macomb to Beardstown. The headquarters of the road will be at Macomb. The incorporators and first board of directors are: C. V. Chandler, W. A. Compton, D. P. Pennywitt, E. I. Humpton and G. V. Chandler, all of Macomb.

ANGOLA, IND.—The Goshen & Indiana Traction Company, incorporated to build a line from Goshen to Angola, Ind., has changed its name to the Northern Indiana Railway Company, and filed a mortgage to the Colonial Trust Company, of Pittsburg, as trustee, to secure $3,500 000 of fifty-year bonds.

EVANSVILLE, IND.—It is said to be the intention of the Evansville & Henderson Traction Company to extend its line to Mount Vernon, Ind. The promoters of the line say as soon as all the surveys are completed they will at once begin construction. They say they will have cars running into Evansville just as soon as possible.

INDIANAPOLIS, IND.—The Indianapolis & Martinsville and the Indianapolis & Plainfield companies announce that they have completed arrangements by which they will become coal-carrying lines. The Vermillion County coal field will be tapped, branches will be shot off to northern Clay County and to the North Vago and the South Park County fields.

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The Rear End of the City Car

An article in our last issue, in which the type of car used in Des Moines, Ia., is described, gives food for some peculiar reflections as to the tendency in recent years on certain roads to modify the rear platform so that it really forms part of the car, or, in some cases, to do away with it entirely, as has been done at Des Moines. Ever since mechanical traction was introduced there has been a tendency to lengthen the rear platform so as to accommodate a large standing load in rush hours and also offer an outdoor ride to smokers and others who prefer standing on an open platform to riding in a closed car. What is known as the "Detroit platform," which is an extra long platform with a division hand railing through it, has been extensively used. In St. Louis, General Manager Dupont, of the St. Louis Transit Company, has gone even further than he did when he introduced the Detroit platform, and now has platforms 7 ft. long, with two sets of hand railings dividing the platform into three divisions for the convenience of the large standing load which these platforms accommodate. That such platforms are liked by a large number of the male passengers is an undoubted fact. From a mechanical standpoint, of course, such a large overhang is not desirable, but mechanical considerations are of secondary importance when questions of convenience and comfort and ability to carry large loads during rush hours are considered.

The European cars, especially those on the Continent, have developed the platform to a greater extent even than in the most extreme Detroit type. The usual rule prohibiting passengers from standing in the car but allowing a certain number on the front and rear platforms, depending on their size, has produced cars which, in many cases of single-truck cars, are almost 50 per cent platform. The result is that these cars carry per square foot nearly as many passengers as in a crowded car of the American type.

The Des Moines car is adapted for conditions of a city where there is no such congestion as in St. Louis. Here the overhanging rear platform has been done away with entirely, and for it there has been substituted a half-open smoking compartment with seats. The entrance is at the side of the car so that there is no annoyance to ladies in passing through the smoking compartment or through a crowd of smokers to get into the car. As a matter of fact the Des Moines idea is merely carrying out the Detroit and St. Louis platform idea a little further and putting in seats. At Denver the side-entrance car has also been adopted. It will be interesting to note in the future just the course of evolution of the side entrance car and the long rear platform and whether the two are worked together into some common form which retains the desirable features of both.

Libel by Implication

The opportunity to stab a street railway company in the dark with the poisoned knife of insinuating slander seems bound to be utilized these days on every possible occasion by the sensational press. This time the Boston Elevated is the victim of one of the meanest innuendoes that recent months have brought to light. A few days ago an electric car, operating some 40 miles or 50 miles from Boston, left the rails while on a trestle, and after a decidedly startling journey along the edge of the structure, came to a stop just in time to avoid pitching off into the street or road below. Here was the chance of one of the yellowest of the Boston papers to set afloat an abominable canard against the elevated. In massive glaring capitals the bulletin board and headlines of this paper informed the gullible public that 200 passengers faced death on an elevated car, and described in thrilling detail how the unfortunate conveyance hung to the structure by its finger tips, while the terror-stricken passengers were hauled out of the death trap which was about to spring. Although the details of the affair were properly placed in regard to the correct geographical location of the accident, when one finally reached the fine print, the impression given in both headlines and bulletin rendered the unoffending elevated road subject to no small amount of unsparing and entirely undeserved criticism. To cap the climax the story closed by stating that the car which had left the rails was of just about the same construction as those in use on the Boston Elevated, and that the heavy trucks had been of little use as an accident preventive.

To characterize properly such contemptible attempts to injure the reputation of a road, which is known as one in which the safety of its passengers is the most vital feature of its operation, would require a list of adjectives that would tran-

scend the limits of those remarks. We believe, however, that calumnies of this kind will revert on the heads of their authors, as after the deception is appreciated the public will naturally look with suspicion on all other statements which emanate from the same source.

The Use of Scrim

One of the weak features of the modern street-car building and of car repairing as well is in the application of canvas to the panels. Canvas, when properly applied to a wooden panel, trebles, or perhaps quadruples, the strength, and accomplishes this result with no appreciable addition to the weight, but when badly put on is of no earthly use. By canvas we mean "scrim," burlap or any of the woven materials used for the purpose. The careless application of any form of the cloth to a panel is actually injurious, because it forms a resting place for dirt and also for moisture.

Canvas, under the action of glue and paint, may undergo a complete change of structure. Some kinds of paint appear to completely destroy its strenth. Then, instead of being a strong, durable material it becomes brittle and quickly decays. Red iron-oxide paints have a peculiarly destructive action. Some of them make canvas brittle as soon as they harden upon it.

When the "scrim" is left with projecting or rough edges, no matter how heavily they may be coated with paint, the threads become very sensitive to both air and moisture. They yield rapidly to the latter, becoming so brittle as to break like sticks. Both air and moisture follow the threads long distances into the body of the cloth under the paint. Even where no threads are left hanging, if the edge is left loose, decay rapidly begins.

The application of canvas to panels is a dirty job; it is hated by woodworkers, and is usually given to the youngest worker or to a man who has the least pull. When ordinary glue is used, little attention is paid to keeping it warm. Often a liquid glue of poor character is considered good enough for the purpose. The foreman usually looks upon this part of the work as a job to be put out of sight as soon as possible. There are a few shops in the country, and only a few, where the value of this part of the work is appreciated. There are still fewer where it is well done. In making repairs the application of the "scrim" or canvas is often merely done in deference to public opinion.

When properly put on the canvas should fit as closely to the surfaces on which it is placed as a coat of paint. The edges should be trimmed smoothly with a sharp chisel and not a thread left projecting. In the shop where this work is better done than in any other in the country, success has been attained by putting it into the hands of one man who was taken from the ranks of the laborers. He was shown "how," given first-class facilities, and had an increase of pay and position, which was stimulating to both pride and pocket. The resulting workmanship justified the pains taken, while the better men were relieved from what is, essentially, a disagreeable task. Canvas put on in this way never parts company with the wood to which it is applied unless it is soaked off. If taken away forcibly the canvas takes a layer of wood with it.

Blood on Train Resistance

Our esteemed correspondent, Mr. Blood, writes mildly to protest against some criticisms we made in the matter of his so-called "rational" formula for train resistance. Now, as we before remarked, a rational formula would be an excellent thing, and we hope Mr. Blood will find one, but he has not yet done so, and from the communication, which it gives us pleasure to print in this issue, we judge that he is not likely to do so. Nothing approximating a rational formula has as yet been presented by anyone, and when sufficient data have accumulated to furnish one it will very probably be too complicated for convenient use, so that for most problems a good empirical simplification of it will be more useful, just as the parabolic formula for wire spans is, in most cases, more useful than the full equation of the catenary.

In the concrete problem before us Mr. Blood takes exception to some of our suggestions in a way that seems to call for a response. *Imprimis*, he questions our hint that the "stern factor" may vary with the length of the train. This was merely thrown out by us as a suggestion, with the introductory word "perhaps." We are willing to acknowledge that the weight of evidence now available tends to show that both head and stern resistance are independent of the length. The remark was intended to call attention to the fact that more complete experiments with actual high-speed electric trains would be of great assistance in determining the relation of air streams to trains, and that at present the construction of a rational formula, in which each term represents exactly a separate factor in the resistance encountered by a moving train, is an extremely difficult undertaking.

As regards the fractional exponent we would merely repeat that it is a concession to the well-known discrepancy between linear formulæ and those in V^2. Like any other fractional exponent it is a useful abbreviation of a series of integral powers, but there is no reason to suppose that it represents any rational relation between speed and train resistance. In dealing with the other terms of his formula Mr. Blood seems to fall again into the very errors that we have been striving to correct. All the recent experiments seem to indicate that the coefficients, A and B, sliding and rolling friction respectively, when taken as constants, do not account for the facts. Mr. Blood furnishes five values for the former and two for the latter. There may or may not be constant terms representing sliding and rolling friction, but they are not Mr. Blood's A and B, the varying values of which speak for themselves. A and B are really aggregations of terms, about which up to the present very little is known save that they vary. A considerable amount of evidence has accumulated tending to show that the track resistance as a whole does vary irregularly with the speed, although purely for convenience the contrary is often assumed, and the whole variation is charged to atmospheric resistance. In the light of practically all the results at very high speed it is now clear that the total track resistance is often singularly small, and that current ideas of its magnitude must be revised. The effect of this knowledge is shown in formulæ like those of Vauclain and Sinclair, where a linear equation with a small absolute term meets the experimental facts in spite of the known existence of an atmospheric term in V^2.

As regards the general form of Mr. Blood's equation, especially the propriety of introducing an exponent of less than two in the "air resistance" term, we believe that a more satisfactory form for general use is that of the Maclaurin type. The chief advantage of the Maclaurin type of formula is that it makes very easy the computation of numerical results by the use of tables of square and cubes, whereas with fractional coefficients logarithms have to be employed. A mathematical consideration of the determined results of train resistance shows that the Maclaurin series, when applied, converges so rapidly that it is useless for practical purposes to carry the ex-

pansion beyond V^2. In other words, if the coefficients be properly selected for this type of equation no practical advantage is secured by the use of a fractional exponent in the third term, as employed by Mr. Blood. On the other hand, such a type of formula has several disadvantages. In the first place, in combination with the first power, it is a form for which there is no mathematical precedent. In this respect it is unlike the Aspinall formula, which is of the recognized $y = a + bx^n$ type. It also has the objection of making the computations more complicated, as stated above, and it differs in form from all other formulæ of the kind in use.

We heartily appreciate the efforts of Mr. Blood to get the train resistance matter on a sounder basis than that furnished by many of the earlier formulæ which have lingered in use. It is extraordinary that some of these, long discredited by experiment, are still solemnly quoted as authorities. Mr. Blood's formula we regard as a useful one, even although as empirical as its predecessors. The real speed-resistance curve is theoretically, and experimentally so far as it has been worked out, a somewhat complicated affair. Now, to obtain working formulæ three courses are open. One can wait for a rational formula which will take into account all the irregularities; one can construct an approximation curve, as Mr. Blood and others have done, more or less correct according to the assumptions, or finally, one can approximate the curve by a series of right lines, giving a set of linear equations. We incline to the last process in the present state of data on the subject. Meanwhile we need data very badly indeed; in particular, data on the variations of track resistance and on air resistance, the two groups being cleared of mixed factors as far as possible. Then, perhaps, a rational formula to meet all the facts can be constructed.

Conservatism in Railway Building

We feel it necessary to sound a note of warning against the vice of overconfidence in building electric railways. There have been many jibes of late about the promoter of the Hot-Air Line, and perhaps the public is sufficiently acquainted with his devious, not to say crooked, ways. But this is not enough, for there are not a few really rash enterprises undertaken in wholly good faith but with quite insufficient caution. It is no extraordinary thing that such is the case, for the remarkable success achieved by some electric roads and their very evident importance to the public makes them singularly attractive, as a class, to the imagination. Steam railroad building went through exactly such a phase a score of years ago, in the days when the great West was growing with magnificent rapidity. Great it still is and still growing, but the "boom" spirit is less rife and the growth is of a sounder grain. In the last five years the amount of electric railway building has been something startling, and while by no means all the roads have been successful, there have been some very conspicuous examples of prosperity. It would be a thankless and unkind task to draw up a muster roll of the failures, but it would be, we fear, a lengthy one. Most of the roads will sooner or later be put on a sound, paying basis, but the tale of struggles and reorganizations will be a long and strenuous one. It is somewhat instructive to consider the causes of success and failure and thus to get a somewhat clearer view of the perils that beset the path to success and dividends. It is a story not unlike that which was characteristic of the early electric lighting promotion, and from that ancient history some useful parallels may be drawn.

Perhaps the commonest cause of hard luck has been misjudgment of the possibilities of the traffic. This was the efficient cause of most of the failures in steam railroading, and is equally operative in this latter development of electric traction. It does not follow that because an interurban line between two cities of a quarter of a million inhabitants each has proved a money-making enterprise, that a line between two towns of a tenth the size will earn its salt. Perhaps it will but more often it will not. In a regular city road not only is there a larger public to draw upon, but there can safely be reckoned far more rides annually per person. Probably the same ratio is not true for pure interurban traffic, but the general fact is the same. It takes a good many nickels to pay the interest on an investment of a million or so of dollars and to keep the investment intact by taking care of the depreciation. This latter rock is one upon which not a few roads have already gone to pieces, and we fear that it will be the graveyard of many more ere the tale is complete. In this particular large urban roads stand in better case than the rank and file, a point which is not generally appreciated at its full importance. A big tramway system has, perforce, to do more in the way of steady up-keep, and with the present strong tendency of the population toward the larger cities, its income keeps to a certain extent pace with its necessities. Thus it happens that some such road, without having a sinking fund or other formal provision for taking care of depreciation, still manages to hold the property in first-class shape by current expenditures. And when a demand for re-equipment comes it frequently happens that the earning power has so increased that new work can be taken care of by an increase of investment without passing the danger point of inflation.

The smaller roads have no such luck on their side. Less dense traffic means that the fixed charges and depreciation are larger per passenger carried, and what is more important the rate of steady and natural increase in traffic is less than in case of an urban road. Hence it is harder to allow for up-keep properly out of the ordinary receipts, and there is less steady increment to depend upon when extensive changes become necessary. We know of no definite statistics on the subject, but we are inclined to think, too, that the urban road loses less traffic in hard times than one which depends on a less densely populated region. It, therefore, behooves one who plans an electric road to look after the matter of probable traffic much more sharply than is usual. Guessing is as often wrong as right in this particular, and many a road has found itself hard pushed because of too roseate a view of the traffic probabilities. Besides all this the somewhat speculative character that attaches to some projected lines causes a tendency to build on far too small a cash capital, and involves heavy actual burdens due to all kinds of ill-advised credits. From the same source come unskillful engineering and construction, hastily done by contractors who cannot be properly kept in line for lack of funds in hand. More than one road has had to be practically reconstructed by the representatives of its bondholders after the inevitable crash. Built for cash and carefully operated the vast majority of electric roads will pay, but the time for booming schemes has now pretty much gone by. It should not be forgotten, too, that the combination of two or more bad roads does not necessarily make a good system, particularly if the fixed charges are concurrently raised without a corresponding physical improvement in the properties. We are approaching the time when a cautious and sound conservatism should be at the bottom of the electric railway business just as in ordinary railroading. "Electric," as a word to conjure with, has somewhat lost its potency.

THE SYSTEM OF THE NORTHERN TEXAS TRACTION COMPANY

This road consists of an interurban line connecting Dallas and Fort Worth and a system of local lines in Fort Worth and a line in Dallas extending into the business center of the city. The Fort Worth system is a consolidation of three local roads, aggregating 17 miles of track.

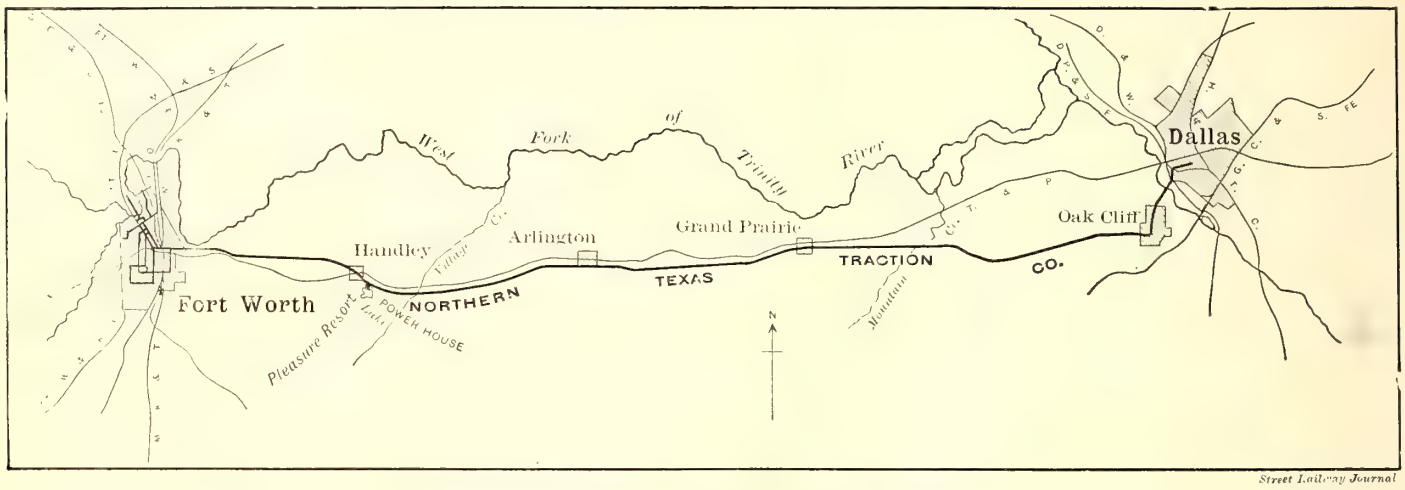
The chief suburb of Dallas is Oak Cliff, which is on the southwest side of Trinity River, and, consequently, as seen by the accompanying map, toward Fort Worth. The Dallas & Oak Cliff Electric Railway Company formerly operated an electric line from the west line of Oak Cliff into the business center of Dallas. This is now part of the Northern Texas property. The roadway is that of the old steam road, and the right of way through Oak Cliff is in the center of an exceptionally wide street; each side of the track being practically a street in itself, though the grade line of the track conforms to that of the street. Between Oak Cliff and Dallas the right of way is private, there being heavy fills through the low ground adjacent to Trinity River. The length of this road is approximately 4 miles. It has double track for the portion over which the interurban cars operate, which is the only portion shown by the map, and in addition a loop for local service is to be built to the west of the main line.

The interurban is approximately 28.5 miles long between the corporation lines of Fort Worth and Oak Cliff, and the run of the interurban in Fort Worth about 1.8 miles, making a total run of the interurban of 34.3 miles. The line in Dallas is being extended, and when completed the run will be approximately 35 miles.

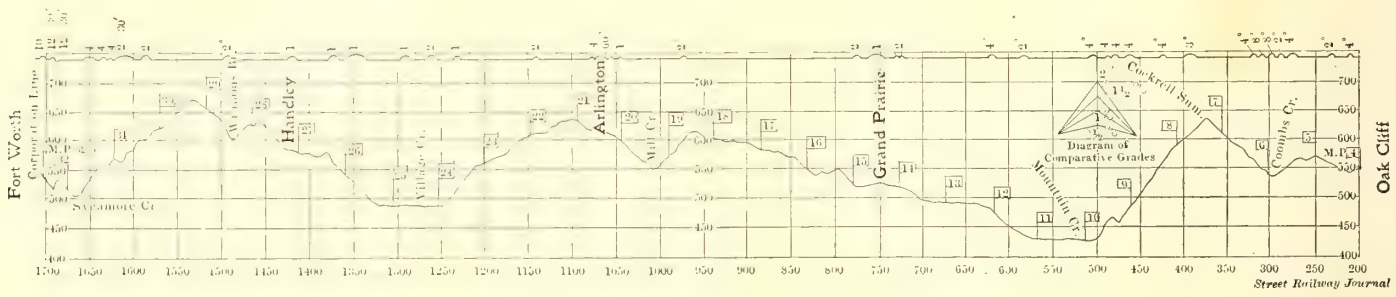
Dallas and Fort Worth are the two largest and most important cities in Northern Texas. Each is a county seat, has a large wholesale and retail business, and also is an important steam railroad center. Only one steam road, however, the Texas & Pacific, connects the two cities, though shortly the Rock Island will also run through both. This new line, owing to its location, will not affect intermediate traffic, but the competition between the interurban and the Texas & Pacific has been very aggressive, especially on the part of the Texas & Pacific, though the interurban has obtained the business.

Dallas is the more important wholesale and retail center, and does a large trade in agricultural instruments, being, it is claimed, the second city in the country in this line. It has also extensive banking and financial interests, as well as being an important social and educational center. Fort Worth is also prominent for features similar to those mentioned above for Dallas, though possibly to a less degree, but it is more important as a railroad center, and especially as a center for live stock interests. The latter have greatly increased since the Northern Texas Traction Company purchased the Fort Worth roads. The Fort Worth Stock Yards Company has erected exceptionally large yards, and both the Swift and Armour Companies have erected large packing houses, including cold storage buildings. In the future, instead of sending cattle north to be fattened and distributed, they will be corn-fed in Texas, and shipped from Fort Worth packing houses.

The towns between Dallas and Fort Worth are small, the residents either doing business in the city or supervising farms in the neighboring country. This section, however, is quite important in the raising and shipping of cotton. In Arlington there are two compress companies, and one making cotton oil, and the shipments of cotton from Arlington are stated to be even greater than from Fort Worth. Grand Prairie also has a cotton compress. The land between Dallas and Fort Worth is a splendid farming country and yearly produces large crops of wheat and cotton, oats and corn. A tendency has recently set in, however, towards the raising of garden truck and poultry, dairy farming, cheese making, etc., the proximity of the city markets and the advantages of the refrigerator-car service on the trunk lines, now made accessible, placing these new and more remunerative interests at the disposal of the farmer. The ground and climate will produce almost any crop, the variable factor being water, and the crops are remarkable when the rainfall is evenly distributed or where water is available for irrigation. The latter has not yet been developed to any considerable extent.



MAP OF NORTHERN TEXAS TRACTION COMPANY



PROFILE MAP OF INTERURBAN LINE

TRACK

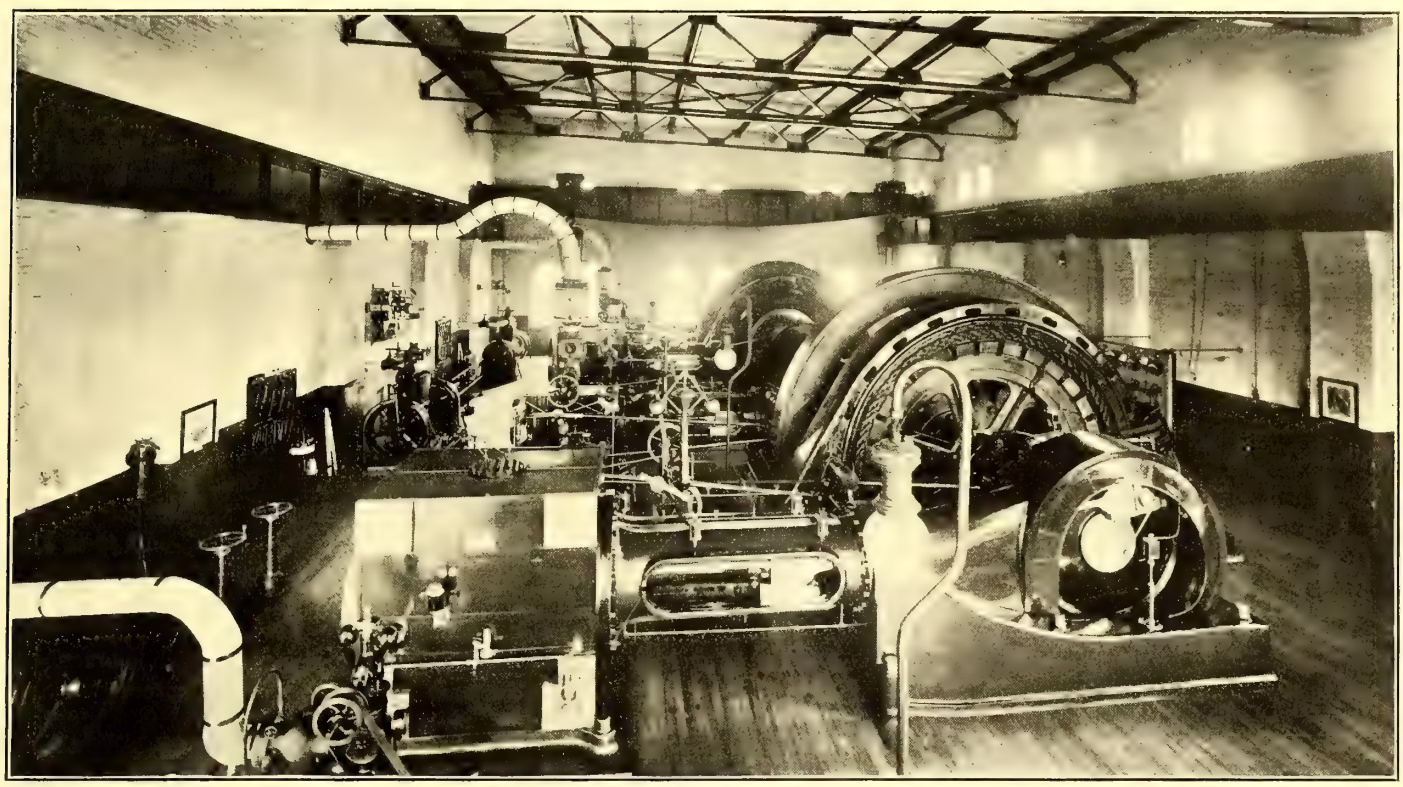
With the exception of short distances, where the line passes through intervening towns, the entire 28.5 miles of interurban road between Fort Worth and Oak Cliff is on its own right of way. This right of way in general is 66 ft. wide, and it has been so obtained that but few sharp curves or heavy grades were necessary, and the stretches of straight track could be made especially long, the majority of the tangents being from 1 mile to 4 miles in length. Outside of the tracks in the terminal cities the curves are 4 degs. or less, with the exception of an undergrade crossing of the line of the Texas & Pacific at Handley, which required curves of considerable less radii at the approaches. In Dallas the interurban road crosses the main lines of two steam railroads at grade, but as the tracks of these two roads adjoin at this point it is practically a single grade crossing. This is the only grade crossing on the road with the exception of three crossings of steam railroad branch lines to warehouses.

the center. At Fort Worth there is a branch track to the Sante Fe Railroad, and at Handley there is a connection to the Texas & Pacific. These two connections with steam railroads very materially facilitate the delivery of fuel and other supplies to the power station and other parts of the line.

GENERAL SYSTEM OF GENERATION AND DISTRIBUTION OF ELECTRICAL ENERGY

The power house is situated at Handley, its location being determined by the ability to obtain water. It was also somewhat affected by the fact that at such point was the most available location for a park, and the development of a lake for the water supply would be a very desirable adjunct to the park. At the same point is located the car house and repair shop and a waiting station for the park business. The latter includes in connection with it the despatcher's and superintendent's offices.

The generators are alternating-current, three-phase direct-connected, there being rotary converters in the power house



INTERIOR OF POWER STATION

The average grade is less than 1 per cent. At the entrance to Fort Worth there is a maximum grade of 3.7 per cent for about 700 ft. The excavations and fills by which this result was obtained necessitated considerable work on many portions of the line, as shown by the views of certain sections reproduced in the illustrations. The roadbed is 16 ft. wide on embankments, with slopes of 1½:1, and in cuts is 20 ft. wide, with slopes of 1:1, except, of course, in rock cuts. There are three steel bridges on the line, one spanning Trinity River, one at Sycamore Creek, and one at Mountain Creek; the latter two being constructed by the King Bridge Company, of Cleveland, Ohio. At other streams pile trestles are employed. Smaller water courses have stone or concrete culverts or extra heavy sewer pipe.

The rail is 70-lb.-T, A. S. C. E. section, 30-ft. lengths, and is jointed by standard six-bolt splice bars. The ties are sawed Southern pine, 6 ins. x 8 ins. x 8 ft., except where special ties are used on switches, bridges, etc. No. 10 spring frogs and 15-ft. split switches with spring connecting rods are used at all turnouts, so that cars can take the siding at high speed. The ballast consists of 8 ins. of gravel under the ties crowned up at

and also in two sub-stations at distant points on the line. One sub-station is placed close to the corporation line of Fort Worth, and the other near the Cockerell Hill Summit, approximately 3 miles from Oak Cliff. The location of the first was governed by the decision that it was undesirable to take high-voltage wires into Fort Worth, and of the second by the fact that it is a reasonable distance from the Dallas end of the line. Furthermore, in the latter case, cars approaching this point in either direction have to climb grades, it being down-grade practically all the way to the Dallas terminus, and there being about 2½ miles of rather heavy up-grade for cars approaching the summit from Fort Worth.

The sizes of the rotaries in the power house and sub-stations No. 1 and No. 2 were based on the predetermination of the momentary maximum load, two rotaries being sufficient for the resident schedule, and two for any probable extra schedule. At the power house one rotary is sufficient for the regular interurban cars on hourly headway, package freight car and the shifting of cars about the car house. In the Cockerell Hill Summit sub-station one rotary is sufficient for interurban cars on hourly headway, a package freight car and the local

traffic between Oak Cliff and Dallas. One rotary in the Fort Worth sub-station is sufficient for interurban cars on hourly headway, package freight car and local traffic in Fort Worth, based on demands at the time the road was planned, but since such time other local lines have been purchased and the requirements greatly increased. Owing to the building of the stock yards and packing houses large passenger cars with four 35-hp motors have been placed on the line thereto, and these cars at times pull heavy trailers. On this line there is a grade of 6 per cent, with a sharp curve on the grade, so that the momentary maximum has greatly exceeded that originally anticipated, measurements on individual cars showing a momentary maximum of 215 amps., whereas previously the cars on this line were small single-truck cars (14 ft. to 16 ft. body), having two 25-hp motors and not hauling trailers. The result is that the momentary maximum at the Fort Worth sub-station is greater than was, or could have been, anticipated, and two rotaries are required for a portion of the regular daily run. This increased momentary maximum also necessitates, or at least makes desirable, the operation of two generators oftener than originally intended, there being a general tendency with all operators to avoid such a high momentary maximum as will throw circuit breakers. Although same may not be injurious to the mechanism, it is annoying to the attendant as well as the motorman, even though the schedule is not injuriously affected. In this connection it should be noted that in the original design it was contemplated that when the requirements should exceed the provision then being made, it might be desirable to add one or more storage batteries, thereby reducing momentary maximums as well as increasing the efficiency of output. If such a battery were installed at Fort Worth the second rotary would seldom have to be operated, and a second generator would less often be required, but it is, for the present, considered preferable to operate under the conditions stated, as the resulting saving in fuel possibly would not yet justify the installation of the battery. If one rotary or one generator should be injured the regular schedule could be maintained with a little more care in the operation of cars, so as to avoid throwing circuit breakers. Moreover, the power house in Fort Worth, formerly used for local service, is still in position, and could be used in case of emergency, providing all the energy needed in Fort Worth. Arrangements are being made for the increase on the local road from Oak Cliff to Dallas, and, when completed, it may be found advisable also to place batteries at the Cockerell Summit sub-station and the power house, or, possibly even better, to add a third generator and rotaries. Decision on these matters is, of course, an engineering problem, which, as is generally the case, includes both financial and technical factors, and the matter is here presented not only on account of its being interesting in itself, but because of its application to the consideration of the tests hereinafter described, and it is again referred to in connection with those tests.



EXAMPLES OF TRACK AND OVERHEAD CONSTRUCTION

POWER STATION

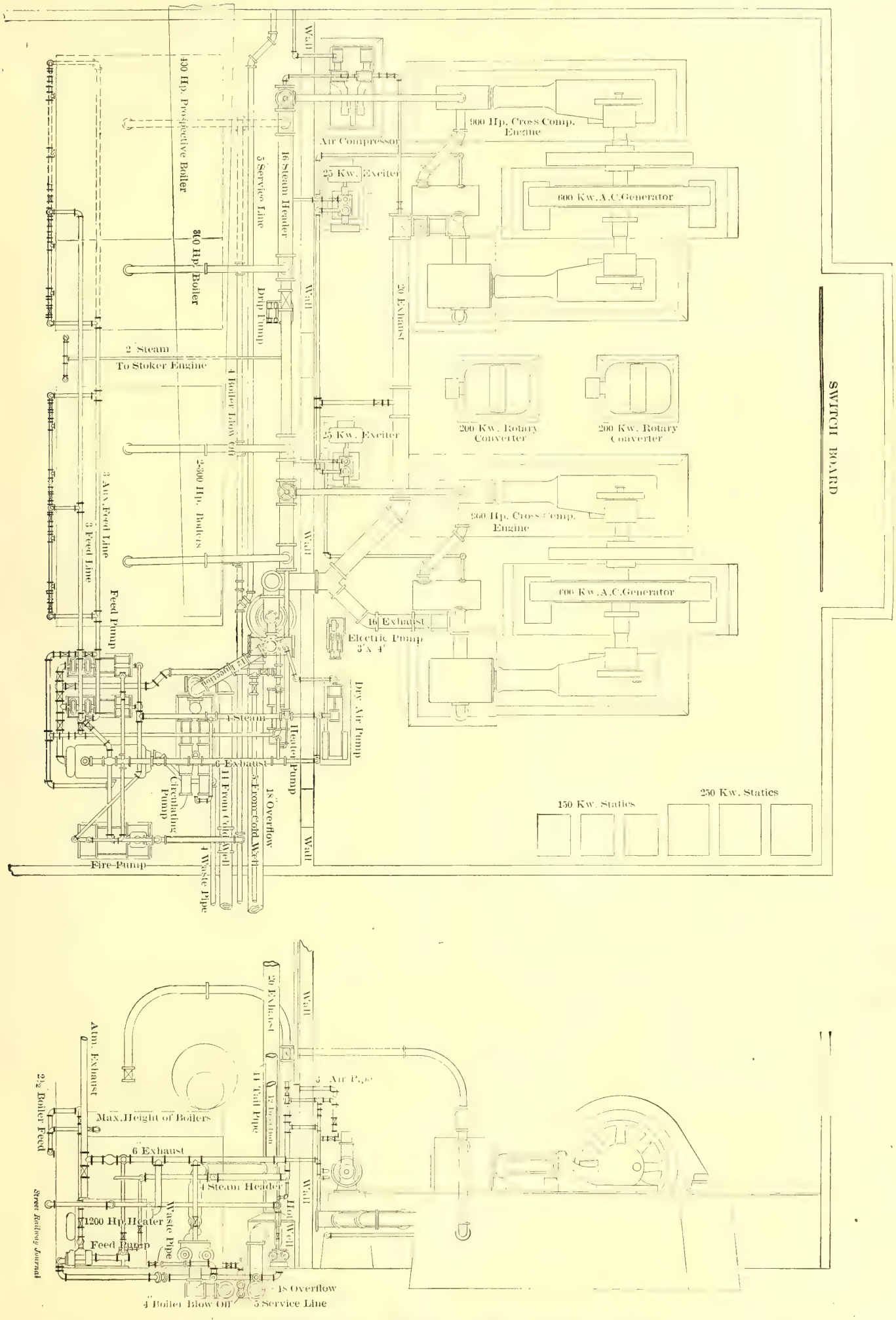
The power station is of brick with steel trusses and gravel roof, having a traveling crane in the engine room. The building was originally designed to be a self-supporting steel structure, but, owing to the difficulty in obtaining steel work in the time desired, the design was changed so that the steel trusses rest on brick pilasters. The building is divided into three general sections. Boiler room, 88 ft. x 50 ft., and 32 ft. high from the floor to the under side of the roof trusses at the lower end. The engine room is 53 ft. x 88 ft., and 24 ft. high from the engine floor to the under side of the roof trusses at the lowest point. A room for the static transformers, which is practically an addition to the main building, and is a fireproof structure, is 55 ft. 9 ins. long over all and 12 ft. wide, the statics being in the lower portion. Above them is a gallery, and above the gallery the high-voltage switches and the high-voltage lightning arresters. In a portion of this addition, which is separated from the remainder by a brick wall, is the toilet room.



CAR HOUSE AND POWER STATION

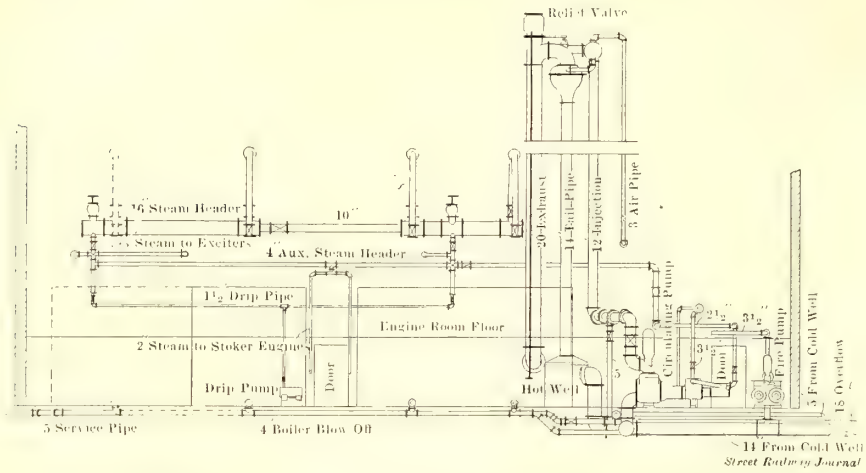
CAR HOUSE AND OTHER BUILDINGS

The car house is a brick structure, consisting practically of two buildings divided by a fire wall; the larger portion is used for car storage, 208 ft. long by 40 ft. It has three tracks, and



PLAN AND ELEVATION OF STEAM PIPING, HANDLEY POWER STATION

is of sufficient size for twelve interurban cars. The rear portion has a cinder floor, and the front portion, 72 ft. long, has washing down and inspection pits under the entire floor. The



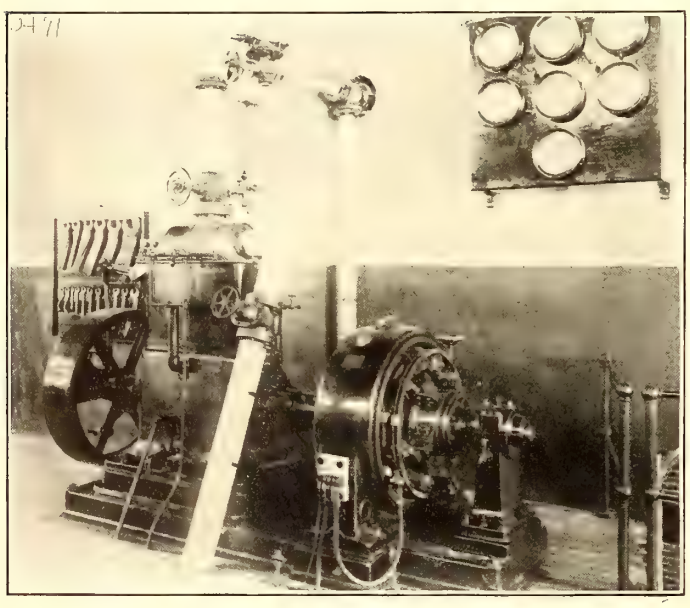
ARRANGEMENT OF AUXILIARIES IN POWER STATIONS

smaller portion of the building consists of a repair shop, 143 ft. 4 ins. x 24 ft., and a stock room, 15 ft. 4 ins. x 24 ft.

The repair shop is of sufficient size for two interurban cars, and has a pit 92 ft. long, and an inclined runway from the bottom of the pit up to the floor level. The repair shop has two 3-ton jib cranes and a complete equipment of tools, including two lathes, a wheel press, a couple of drill presses, a shaper, a forge, etc., operated by a direct-current motor.

About 400 ft. from the power house is the passenger station for the park. This is a frame building with a long covered platform, and contains waiting rooms for men and for women, a baggage room, superintendent's office and despatcher's office, all of these being on the ground floor.

In the second story of the waiting station is a suite of apartments for the general manager, which consists of a bed room, bath room, and a room which, for any but an official of an



EXCITER SET IN POWER STATION

electric road, might be termed a lounging room, but, as in this case the general manager is also the second vice-president and the local executive officer, such designation would possibly be a misnomer. There is also a balcony connected with these rooms, which commands a view of the track, power house, car house and park. The general manager being a bachelor, the above rooms were considered sufficient for his lodging, and it was not considered necessary to make any provision for his board. Consequently he is able, without disturbing domestic arrangements, to take his meals at Dallas or Fort Worth, or at such intermediate point as he may happen to be, and at such time as most convenient. This condition may be of value for the efficient supervision of operation, and, consequently, satisfactory to the president of the company, though possibly not to the President of the United States.

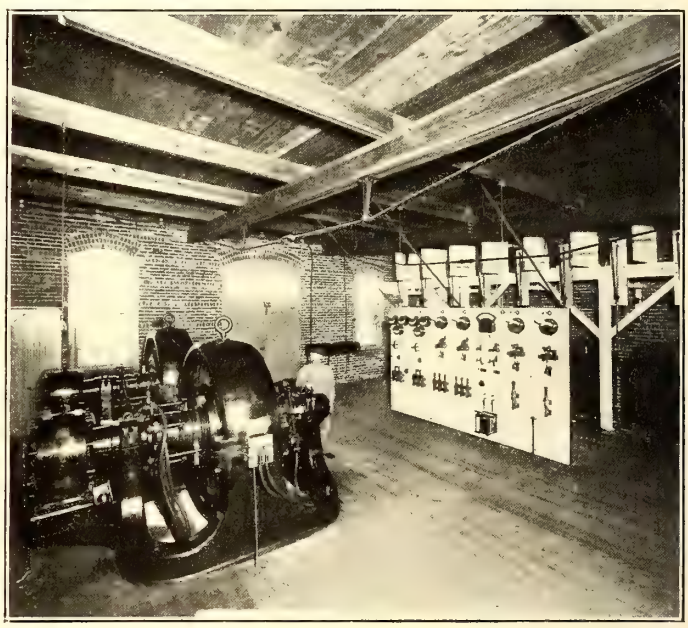
The sub-stations are brick structures with gravel roof, 37 ft. x 33 ft. Near the Cockerell Summit sub-station is a residence for the attendant. This is a frame structure, and is shown in one of the illustrations.

The buildings were erected by William Bryce, of Fort Worth, the structural steel and crane being furnished by the Browning Engineering Company, of Cleveland, Ohio.

MECHANICAL AND ELECTRICAL EQUIPMENT

The boiler equipment consists of four 300-hp Stirling boilers. Each boiler has a heating surface of 3000 sq. ft.

It was originally intended to use coal for fuel, and the design included a brick stack, stokers and coal feeding by gravity from the coal bins into the stokers. After this design was com-



INTERIOR OF SUB-STATION

pleted the Beaumont oil fields were developed, and it was decided to use oil, but also to make provision for using coal in case the price of oil should be increased to such an amount as to make coal more economical. This is now the condition and coal is being used.

The modified design omitted the coal bins, provided individual stacks for the boilers and a fan system of forced draft, the setting of the furnaces being as shown by the accompanying illustration. The stacks are sufficiently high to give a draft that will prevent undue pressure within the boilers and the forcing of gases out through the boiler settings.

Outside the building and approximately 200 ft. distant are provided three large oil tanks, the oil flowing into same from oil-tank cars by gravity. The oil-burning system was provided by A. M. Lockett & Company, New Orleans, and duplicate pumping sets were provided, each set consisting of two duplex pumps, 3 ins. x 2¾ ins. x 3 ins., pumping oil from the tanks and supplying the oil burners. Each boiler was equipped with six No. 2 Reid burners and necessary steam connections for atomizing the oil. These burners are shown by the accom-

panying drawing. A Worthington meter was also provided for measuring the oil.

Owing, as before stated, to the increased price of oil, its use has been discontinued, the oil burners removed and the brick work on the grate bars removed, and coal is now fired by hand.

The engines are two C. & G. Cooper Company cross-compound condensing Corliss engines. The cylinder dimensions are 22 ins. and 44 ins., with 48-in. stroke, and the speed is 100 r. p. m. The rating is 900 ihp at 150 lbs. steam and 26-in. vacuum.

Each cylinder is provided with a Phœnix automatic oil pump and a hand oil pump. Tanks are placed in the upper portion of the boiler room, and from them oil is fed by gravity to all bearings. After being passed through a cross filter it is pumped back to the tanks. The exciter engines are Westinghouse junior, direct-connected to 30-kw Westinghouse exciters.

The piping and auxiliaries were furnished by the Best Manufacturing Company, of Pittsburg, and the auxiliaries are as follows: One 20-in. Worthington elevated injector condenser with a 12-in., 17-in. x 22-in. x 15-in. Worthington compound-circulating pump, and one 8-in. x 16-in. x 12-in. Worthington rotating dry vacuum pump. The boiler feed pumps are two 10-in. x 6-in. x 12-in. duplex Dean outside end-packed pumps. There is also a Worthington duplex, 6 ins. x 7½ ins. x 6 ins., which draws from either the cold well or the hot well,



A STRAIGHT ROCK CUT

and discharges into the feed-water heater, which is a 1200-hp Cochran make. There is also a 16-in. x 9-in. x 12-in. duplex Dean underwriter's pump, discharging into the fire line, with connections to the various buildings on the grounds. The cold water supply is obtained from either one of two cold wells adjacent to the building. One is fed by gravity from the lake, and the other is fed from deep well pumps, the overflow passing into the first well and out to the lake. The lake water is not desirable for boiler feed, and the water from the deep-well system is used. This being the case the low-service pump nominally feeds cold water to the heater, but it is also



WORK CAR AND CREW

connected to the condenser hot well. The piping is so cross connected that either or both feed pumps can feed the boilers or one can draw from either the hot well or the cold well and discharge into the heater, thereby acting as reserve for the low-service pump. Also the fire-pump discharge line is cross connected to the feed-pump discharge and to the condenser injector line. The low-service feed water and fire pumps are provided with Fisher automatic governors, and there is a Worthington hot-water meter in the boiler-feed line.

All the high-pressure pipe is extra heavy with long radius bends. Flange fitttings are used for all pipe 3 ins. and over; the gate valves are Best's, and the globe valves, Jenkins Brothers. The pipe covering was furnished by the Philip Carey Manufacturing Company, 85 per cent magnesia being used on the high-pressure steam lines, and asbestos magnesia on low-pressure steam and on hot water lines. The lines to the main engines have vertical live steam Cochran separators.

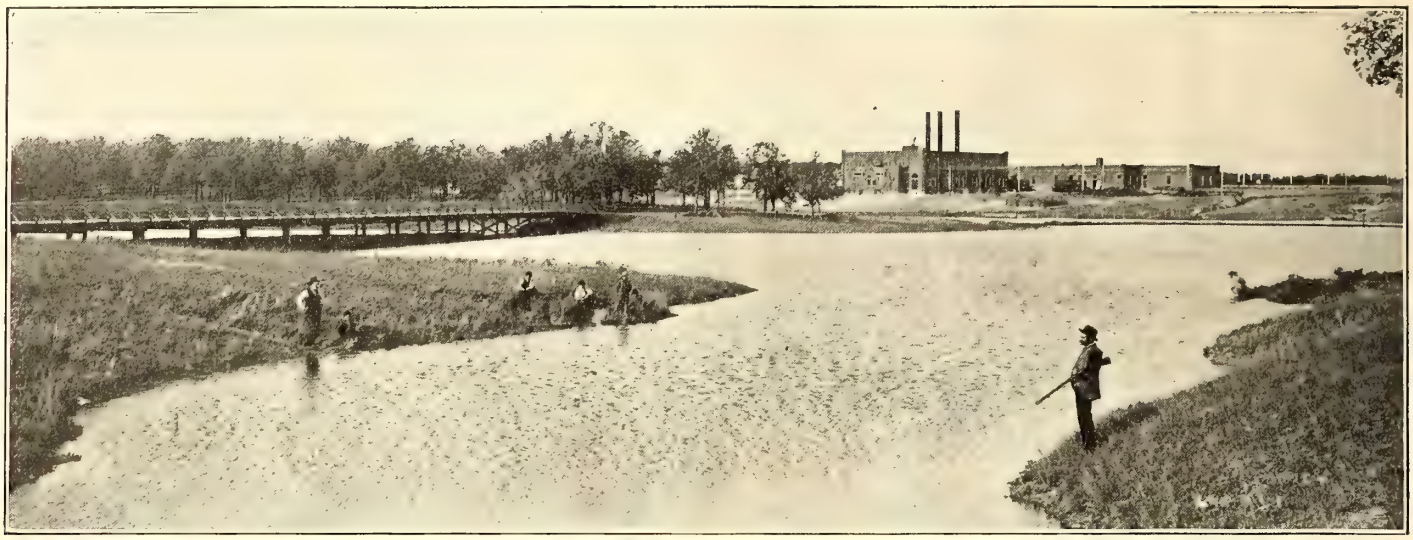
The general piping scheme consists of long-sweep bends from the boilers to the upper side of the header, and the connections to the main engines are also taken from the top of the header. The header is divided into two sections, each 16 ins. in diameter, and they have a 10-in. intermediate connection with a valve between. All high-pressure drips are drained by the Holly system, and, in addition, there is an auxiliary steam header below the main header, and steam to the pumps is obtained from this auxiliary header, the result being that in case of the Holly system being unable to act with sufficient rapidity or repairs being needed, the header drains to the pumps where water in the steam will not cause accident. A direct drain to atmosphere is provided for emergency.

As above stated, the boiler feed is obtained from deep-well pumps, but because of the cost of fuel it was desirable to operate condensing. On the ground selected there was a grove of considerable size, which was desirable for a park, and there were few obtainable places between Dallas and Fort Worth which had trees. Near the grove was a small valley, through which was the bed of a stream, where at some seasons there was merely the bed, and at other times a considerable stream. At a convenient point a dam was constructed, and a beautiful lake produced, the water from which is used for the condensers. The lake is supplied partly by the stream, partly by surface drainage from the adjacent land, and, to some extent, by the overflow from the deep-well pumps.

In the engine room is an Ingersoll-Sergeant air compressor for supplying the storage air-brake system on the passenger cars. Connection is also made to the car house for cleaning the

cars, and in the power house for cleaning electrical equipment with compressed air.

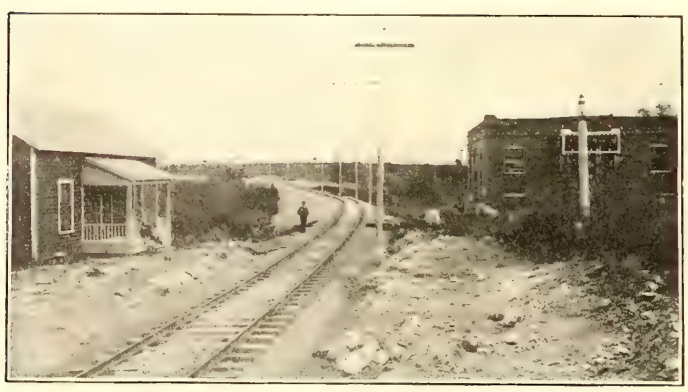
The electrical equipment was supplied by the Westinghouse Electric & Manufacturing Company. The generators are two 600-kw, alternating-current 25-cycle, 400-volt, direct connected to the Corliss engines, and also two 30-kw, 125-volt, direct-current exciters, direct-connected to the Westinghouse junior engines, either of the latter being sufficient to excite both alternating-current generators. These exciters also furnish current for the lighting of the power house, car house, waiting room and park.



POWER STATION, PARK AND ARTIFICIAL LAKE

In the power house are two 250-kw rotary converters and seven 200-kw step-up static transformers, one being an extra, the transmission voltage being 15,000. The switchboard has a complete equipment of controlling and indicating apparatus, and also recording wattmeters for registering the output of generators, exciters and rotaries.

Cockerell Hill (sub-station No. 1) has two 400-kw rotary converters and six static transformers. At Fort Worth (sub-station No. 2) there are two 300-kw rotary converters and six static transformers.



SUB-STATION AND ATTENDANT'S DWELLING

A view of a sub-station presented herewith shows the high-voltage lines entering the building, and the barrels shown on the left of this picture were used as water rheostats when making tests. The switchboards of the sub-station have recording wattmeters.

LINE WORK

The contractor was the Electrical Installation Company, of Chicago, which furnished all the material except the wire. The brackets, hangers, etc., or what is generally termed "overhead material," was obtained from the Ohio Brass Company, and the high-voltage insulators are of glass, manufactured by Locke. Bracket construction was installed on private right of way and cross suspension in the terminal cities and in intermediate towns.

The poles are 35-ft. Idaho cedar, with 100-ft. spacing on straight line. Above the bracket are two cross arms, carrying the high-tension transmission. On the outer side of the upper cross arm is placed one of the three-phase high-tension wires, and on the outer side of the lower cross arm the other two high-tension wires. At present the trolley feeder wire, or wires, are on the inside of the lower cross-arm, this provision being made because it was considered that later it might be desired to run another set of high-tension wires, and at such time the feeders could be dropped onto brackets placed on the side of the pole. This contemplated condition has not yet arisen. The high-tension wires are transposed.

The telephone line is placed on brackets outside of the pole, slightly below the level of the bracket arm, and transposed. Double trolley wire is used, it being of the figure 8 type and 2-0 B. & S. gage. The feeder wires and the high-tension wires are aluminum cable.

ROLLING STOCK

The rolling stock for the interurban road consists of eight standard passenger cars, one private parlor car, "Sagamore," one package freight car and one work car. All of the above are motor driven, the general dimensions and equipment being as follows: The parlor car "Sagamore" is 59 ft. 6 ins. over all, 8 ft. 5 ins. wide, is equipped with four Westinghouse No. 6 motors, and weighs, complete with equipment, 31 tons. The standard interurban closed passenger cars measure 44 ft. 5 in. over all, and have a width of 8 ft. 4 ins. These cars are equipped with four Westinghouse No. 56 motors, and weigh, complete, 25.4 tons. The interurban express car has a length of 40 ft. over all, and is 8 ft. 4 ins. wide.

There are also three fifteen-bench open passenger trail cars and a number of flat cars. The city cars are varied in size, character and make.

All the interurban cars, with the exception of the work car, were built by the G. C. Kuhlman Car Company. McGuire trucks are used, except for the trailer cars, which have Brill trucks. The work car was built in the shops of the Northern Texas Traction Company.

All the motor cars have Christensen air brakes. The standard passenger cars have stored air; the package freight, parlor car and work car have motor-driven compressors. The seats are Hale & Kilburn, and the registers New Haven. Arc headlights are used and Consolidated Car Heating Company's electric heaters.

OPERATION, PLEASURE PARK, ETC.

The schedule time between termini is 85 minutes one way and 95 minutes the other, and cars are ordinarily run on hourly headway. The package freight car is run regularly and as necessary to provide the required service, and material is delivered to and from the cars in Dallas and Fort Worth by the William McVeigh Express Company.

The artificial lake at Handley is about 25 acres in area, and



PARLOR CAR



INTERIOR OF PARLOR CAR

has been named "Lake Erie." On the shore is a beautiful grove, and a handsome dancing pavilion, with restaurant, has been erected. This building is arranged so as to be admirably adapted for the use of conventions, public and private entertainments by clubs or individuals, and special provision can be made with the general passenger agent of the road for the accommodation of parties wishing to secure these privileges. The lake is also surrounded by several hundred acres of forest and field, which is reserved by the railway company for picnic parties, and forms an especially attractive spot for encampments of a military or religious nature, and the free use of which is given by the company. The lake provides opportunity for boating and other aquatic sports, and ample room for athletic games, such as baseball, football and golf has been made in the park. This pleasure resort is reached only by the cars of the company and is situated about 7 miles from Fort Worth. There is excellent hunting and fishing along the route of the railway, and sportsmen are in the habit of leaving cars at one point, where, if unsuccessful, they can board the next car and try their luck at a point many miles distant. Much ingenuity has been shown by the management in attracting traffic, and special inducements have been offered to nearly every class of patronage.



INTERIOR OF INTERURBAN CAR



STANDARD INTERURBAN CAR

TESTS ON POWER-STATION APPARATUS

Complete power house and sub-station efficiency tests have been made by E. P. Roberts & Company, with the object of ascertaining whether or not the apparatus was in accordance with the contract, and the detailed data and results are not included in this article, but merely such results as are considered of general interest.

From the foregoing description it will be noted that arrangements were made to burn either oil or coal, and tests were made using each, the results being given below. The length of the run was rather short for boiler tests, more especially when using coal, but these special tests were made to obtain only approximate comparative values and not for exact efficiency.

Owing to the gradually increasing cost of oil since the plant was started it has now been found more economical to burn coal, and the tests were made in order to ascertain when it would pay to change from oil to coal.

TESTS WITH COAL AND OIL, MADE UNDER OPERATING CONDITIONS IN JANUARY, 1903

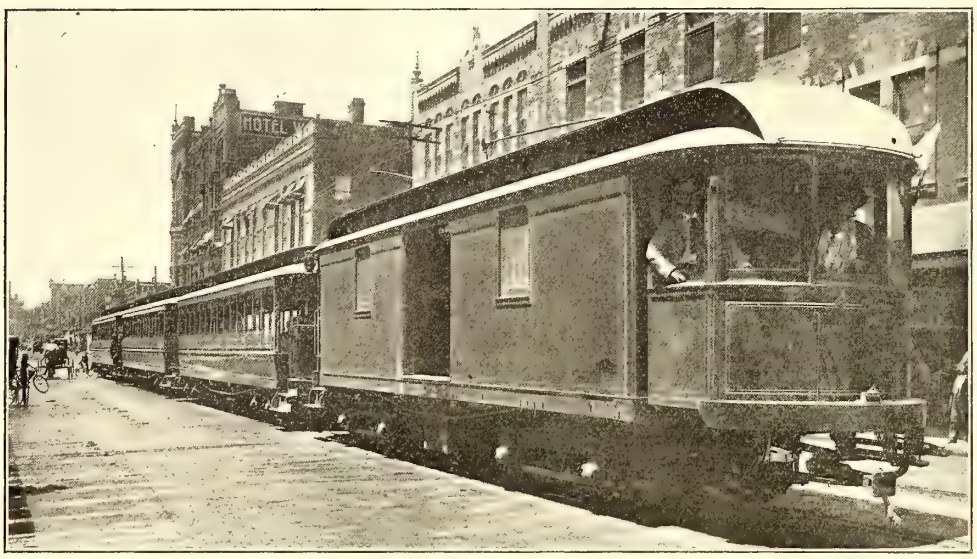
	Test with Beaumont Oil	Test with Coal
Duration of test	7 hrs.	6 hrs.
Heating surface of one boiler	3000	3000
Grate " " " "	.....	60
Steam pressure	139 lbs.	136 lbs.
Draft pressure in inches of water	0.4	.....
Temperature of stack	497° F.	.....
Feed water per lb. of fuel actual	14.2 lbs.	8.2 lbs.
" " " " from and at 212° F.	15.4 lbs.	9.0 lbs.
Steam used by oil burners	11.7 per cent	.....
Efficiency of boiler	77 per cent	.....

It will be noted from the above that 1 lb. of coal equals .66 lbs. of oil, based on steam obtained for use, exclusive of amount used by oil burners. During the month of November, 1902, the run was made entirely on oil. During the month of April, 1903, entirely on coal, and the comparative value based on kilowatt output was 1 to .67, or practically the same figure.

The agreement between the two above stated figures is closer than it was reasonable to anticipate, as the kilowatt output in April was greater than in November, but on the other hand

only one generator was operated in November, and in April two were often in use. The condition of greater output was, of course, in favor of economy, but the operation of two generators operating on lighter average load than one was against economy. Nevertheless, apparently, the conditions were such that the one about offset the other. Consequently the results of actual operation checked the pre-determined figures obtained by test.

The coal per kilowatt-hour in April was 5.8 lbs., which, considering the character of the coal and especially the low ratio of average load to rated load, was a very satisfactory performance. The power above considered includes both the alternating-current delivery and the direct current of the exciter generators. The latter, moreover, is considerably in excess of the amount needed for excitation, as the exciter generators also furnish current for all the lights in the power house, car house, office building and waiting station, and also outside lights, including those in the adjacent park. The total kilowatt-hours of the exciters was 14,645, and the amount needed for excitation was probably 9000 or less, and on the basis that it was 9000, the coal per kilowatt alternating current was 5.97 lbs.



TRAIN WITH OPEN PASSENGER TRAILERS

The accompanying table gives the result of a test made Dec. 31, 1902, and also the record obtained from the log for the entire month of April, 1903, and it will be noted that the efficiency from alternating-current generator to direct current delivered at sub-station switchboards was practically the same. These tables are not in every respect strictly comparative, as the record on Dec. 31 was obtained during the time of heaviest run and operating one generator only, whereas the run for the month includes the light runs in the early morning and late at night, which reduces the average. As a matter of fact, however, during the heavy hours the average per hour was greater than for a single day's run, to such an extent as to generally necessitate the operation of both engines, and in the Fort Worth sub-station (sub-station No. 2) the operation of both rotaries. This increased load was due to the extension of business in Fort Worth to a greater extent than originally expected, caused mainly by the building of large stock yards and the consequent necessity of providing large cars for the run to same. An additional line in Fort Worth was also purchased. The increased load was, however, mainly due to the large cars above noted, which operate for a portion of the run on a 6 per cent grade, and during the rush hours also haul trailers, consequently not only increasing the average load but especially the momentary maximum, tests made on such cars showing momentary current up to 215 amps.

TEST OF EFFICIENCY OF ALTERNATORS AND ROTARIES

	During test Dec. 31, 1902.	Entire month of April, 1903.
Average load of generator recorded by A. C. Wattmeter	595.7 kw	* 547 kw
Average load of P. H. rotary D. C. Wattmeter	98.5 kw	108.3 kw
Average load of S. S. No. 1 rotary D. C. Wattmeter	173.1 kw	150.4 kw
Average load of S. S. No. 2 rotary D. C. Wattmeter	222.0 kw	† 191.6 kw
Combined efficiency of rotaries, statics and transmission lines	82.9 per cent	82.3 per cent

* During greater part of time two generators were in use.
† During greater part of time two rotaries were in use.

It is impracticable to give all the details relative to the different conditions at the time of the test, but the above is stated in order to show the danger of making comparisons or drawing conclusions other than those to which attention is directly called.

The April record showed the alternating-current kilowatt-hours and the direct-current kilowatt-hours in each sub-station, and calculating the ratio of average to rated load of static transformers and rotary converters, and using the figures stated as the probable efficiencies at such loads, the following result is obtained:

Output of generators	547 kw
Input of P. H. rotaries at 86 per cent efficiency	126 kw
Input step-up transformers	421 kw
Output of statics 96.5 per cent efficiency	406 kw
Input S. S. No. 1 rotary at 88 per cent efficiency	171 kw
Input S. S. No. 2 rotary at 88 per cent efficiency	218 kw
Input S. S. No. 1 step-down transformers at 96 per cent efficiency	178 kw
Input S. S. No. 2 step-down transformers at 97 per cent efficiency	225 kw
Total input of statics in S. S.	403 kw

This would give the efficiency of transmission line as 99 per cent.

The calculated transmission line losses for the above average loads is as follows:

Calculated line loss to S. S. No. 1	1.5 per cent
" " " " " 2	1.25 "

This makes a close check, although indicating the probability of the efficiency of some of the apparatus being slightly less than the figures used, but the difference is so small as not to have any material value.

It should also be noted that both at the test made on Dec. 31 and the record for the month of April the power house rotary had much less output than the sub-stations No. 1 and No. 2. Consequently by far the greater portion of the energy passed over the high-voltage transmission lines, and, in this connection, the location of the power house and the sub-stations should also be noted on the profile. The power house location was determined by the ability to obtain water. The Fort Worth sub-station was located approximately at the corporation line in order to avoid the necessity of taking high-voltage wires into the city, and the location of sub-station No. 2 at Cockerell Summit, near Oak Cliff, was based largely upon the long grade on the Fort Worth side of Cockerell Summit.

The size of the rotaries in the power house was based upon the number of regular cars which would be in operation on

this section, together with the necessary provision for a package freight car and for shifting cars in the car house, also, as in all cases, making allowance for curves and grades shown by the profile. It was assumed that when operating on hourly schedule one rotary would be sufficient, both being required only when cars are operated on more frequent headway, either for through traffic or in trains to the park, open trailers being provided to make up such trains, hauled either by motor passenger cars, the package freight car or the work car.

The size of the rotaries in sub-station No. 1 was determined principally by the large momentary maximum caused by the fact that cars approaching this sub-station, both from the east and west, travel up-grade, also making allowance for the probability of considerable increase of local service between Oak Cliff and Dallas.

The size of the rotaries in sub-station No. 2 was determined by the provision for the interurban cars and the requirements of the local road in Fort Worth, as it existed when the plant was designed. As elsewhere stated the requirements of the local road have been very materially increased, not only as to the average, but also, and especially, as to the momentary maximum due to placing large cars on the road to the new stock yard, which cars climb a steep grade and haul large trailers.

The following combined efficiencies were calculated from the data obtained during the efficiency tests, one engine and generator being in operation, and the two rotaries in the power house operating on a water rheostat, the engine and generator being at rated load and the rotaries being 8 per cent overload:

Combined efficiency of engine and generator (excitation not included)	86.4	per cent
Combined efficiency of engine and generator (excitation included)	85.1	"
Combined efficiency of engines, generators, wiring, inductance coils and rotaries in power house	76.6	"

OFFICERS AND ENGINEERS

The road was constructed under the general financial management of George T. Bishop and John Sherwin, both of Cleveland, Ohio, acting as syndicate managers, Mr. Bishop later being elected president of the company. F. M. Haines, second vice-president and general manager, was also civil engineer for the road. W. A. Kappler is auditor, and C. A. Taylor secretary and treasurer. D. H. Lavenberg is superintendent of the interurban and Oak Cliff divisions, and Mr. O'Hara is superintendent of the Fort Worth division. W. C. Forbes is general passenger and ticket agent.

E. P. Roberts & Company, consulting engineers, of Cleveland, Ohio, had charge of the mechanical and electrical engineering and of the buildings, with the exception of the terminal station at Dallas, which was designed by Searles & Hirsch, architects, of Cleveland, Ohio. The resident engineer for E. P. Roberts & Company, when the work was commenced, was C. F. Fredericks, who had the supervision when the overhead line work was started and until most of it was erected, after which Bret Harter was resident engineer.

William Barclay Parsons, chief engineer of the New York Rapid Transit Commission, says that if the contractor, John B. McDonald, has further labor or other troubles between now and Jan. 1, all hope of having the rapid transit subway in running order by that time will vanish. He states that for some weeks the work has been practically at a standstill, and now that the troubles have been partially settled difficulty is experienced in getting the workmen together where needed, many of them having left the city for other work. This view is borne out by the fact that the amount of money drawn from the city for May for work done was but $300,000, whereas under normal conditions the withdrawal for the month should have reached nearly $1,000,000.

A REVIEW OF STREET RAILWAY LEGISLATION IN MASSACHUSETTS DURING THE RECENT SESSION

The Massachusetts Legislature of 1903 this year referred to its committee on street railways seventy matters, and, as is the usual case, a number of other measures of interest to street railway operators were referred to different committees. The street railway committee of this year had as its Senate chairman Hon. Herbert E. Fletcher, of Westford, who acted in the same capacity a year ago, while its House chairman was Representative Louis A. Frothingham, of Boston, who, although new to the committee this year, proved a very efficient member. The remaining members were Senators Carlton F. How, of Haverhill; George K. Tufts, of New Marlboro, and William T. A. Fitzgerald, chairman of the Democratic city committee of Boston, with Representatives Hunt, of Worcester; Quinlan, of Boston; Chace, of Fall River; Warner, of Northampton (who acted as clerk); Hill, of Stoneham; Entwistle, of Framingham; Callender, of Boston; Castle, of Methuen; Dempsey, of Millbury, and Beck, of Chelsea.

As has been the case for many years a large number of associations of individuals petitioned for charters to enable them to construct new street railways. Among these petitions was one for a line through the hill country of Western Massachusetts, the title being the Huntington & Westfield River Railway Company, with a connecting line for which a special charter was asked between Shelburne Falls and Ashfield. Another ambitious petition was for a cross-country line between Fitchburg and Lowell, with a branch extending to Nashua, N. H., the name of the company to be the Fitchburg, Nashua & Lowell Street Railway Company. Other petitions were for charters for the Danvers & Malden Street Railway Company, the Lee & Winsted Street Railway Company, the Concord & Chelmsford Street Railway Company, the Sandwich, Hyannis & Chatham Street Railway Company, and the South Shore Street Railway Company. The earliest charter bill reported was for the South Shore Company, which was to operate in Bristol County and vicinity. This was reported in the House April 15, took its readings and reached the Governor April 28. On May 4 Governor Bates sent in a veto of this bill, founded on the ground that the general law at present makes ample provision for the organization of new street railway companies, and that the General Court is, therefore, not justified in passing a special act unless it gives special privileges, which he failed to discover in this measure. The result of the veto was the recall from the Governor's hands of measures which had subsequently reached him for the incorporation of the Danvers & Malden, and Lee & Winsted roads, and a holding up of several of the other charter bills. The veto of the South Shore measure was sustained on May 8 by a vote of 4 in favor to 170 against passing the bill despite the objections of His Excellency, the vote being taken in the House. An earnest effort was made to push through the Fitchburg, Nashua & Lowell bill to enactment, but after passing the House it was defeated in the Senate on the ground that the bill contained nothing that might not have been secured under general laws, while Senator Fletcher, who lives on the line of the proposed railway, further argued that the Lowell & Fitchburg Street Railway Company had already secured locations between the two cities under general laws, and two competing roads could not live in the territory. The bills granting charters to the Huntington & Westfield River and the Shelburne Falls & Ashfield Companies (designed for rather peculiar conditions and in a sparsely settled country, and, therefore, containing special provisions), were enacted.

A very important proposition made this year, as hitherto, contemplated broad extensions of the powers of various street railway companies as to the transportation of merchandise and freight. Spencer Borden and others asked a charter as the

Fall River Electric Freight Railway Company, with the right to construct an extensive system in that city, and the Old Colony Street Railway Company met this petition by one asking that it might have the right to transport freight in Fall River and vicinity, a privilege which could have been easily availed of by the construction of a few spur tracks connecting with its present system. One of the earliest bills to be reported on these freight carrying petitions was to permit the Fitchburg & Leominster Street Railway Company to act as a common carrier. This took all its readings in both branches, reached the Governor March 2, and was vetoed March 6, on the ground that if these privileges were to be extended it should be done by the Railroad Commissioners after hearing and careful examination. The veto was sustained by a vote of 177 to 2. Meanwhile the street railway committee took immediate action in the direction of passing a general law giving the Railroad Commissioners authority to grant freight carrying privileges after notice and hearing. The bill, which was founded on the petition of the Marlboro & Westboro Company that it might act as a common carrier, was drawn in consultation with the Governor, and gives the Railroad Board wide powers as to granting of privileges. The Fall River Freight Company petition was adversely reported, as were also all the other common carrier petitions which had been pending, including those of the Worcester & Holden, the Worcester & Northern, the Norfolk & Western Company, a charter for a freight railway company in Chelsea, the petition of W. A. Twombley and others that they might carry on an express business on street railways, and the Norton & Taunton Company. The earliest street railway charters granted in Massachusetts gave freight carrying privileges, the Lynn & Boston road being a case in point, its right to do this having passed into the hands of the Boston & Northern Company; but it has never been exercised further than in the transportation of street railway supplies.

As is usual a number of bills were offered for the compulsory use of automatic fenders, these going over to the next General Court, in accordance with the committee's recommendation. An attempt was made to secure a law to prevent the overcrowding of street cars, an odd provision in one of the petitions being that there should always be accommodations in these cars for all the women who ride. This was adversely reported, and the report was accepted without ceremony. A bill looking to the adoption of new types of fenders on street railway cars was sent over to the next General Court, in accordance with the committee's recommendation.

Another attempt was made to change the law as to street railway waiting rooms so as to transfer the power of compelling the establishment of such stations from the hands of the Railroad Commissioners, except upon appeal, to local authorities. The committee reported against this bill, but the House substituted the measure for the adverse report, and it passed that body, being rejected by the Senate.

A law was considered giving conductors of street railway cars additional power to keep therefrom newsboys and others of immature years, the measure not affecting the rights of news companies to have boys in their employ board the cars. It was rejected on its final stage enactment.

On the recommendation of the auditor of accounts a bill was passed repealing the provision in the street railway act which provides that a fee of $20 shall accompany the annual report of every street railway corporation to the Board of Railroad Commissioners, this being on the theory that the money is paid in another way.

A bill to make compulsory the use of automatic brakes, taken from the files of last year, was adversely reported and the report was accepted.

On the recommendation of the Railroad Commissioners a bill was passed to provide that a street railway company shall equip its cars when in use, unless propelled by horse-power, with such fenders and wheel guards, brakes and emergency tools in such cases as may be required by the board, and the board may from time to time modify its requirements.

In accordance with the recommendation of the Governor and with a petition of Representative Arthur P. Sleeper, of Natick, the street railway committee reported a bill which was enacted relative to the speed of cars and use of tracks of street railway companies, to make the requirements of local authorities subject to the approval, revision or alteration of the Board of Railroad Commissioners. Section 40 of Chapter 112 of the Revised Laws, as amended, reading as follows: "The Board of Aldermen and the Selectmen shall, from time to time, establish such regulations as to the rate of speed and as to the mode of use of the tracks within their city or town as the interest and convenience of the public may require, and subject to the approval, revision or alteration of the Board of Railroad Commissioners; and a street railway company whose servants or agents wilfully or negligently violate any such regulation shall forfeit not more than $500 for each offense."

On the initiative of Senator Fletcher a law was passed making the provision of the steam railroad act as to immediate notice of accidents apply also to street railway corporations, the effect being to provide that every railroad and street railway corporation shall give immediate notice of an accident on its road which results in a loss of life to the medical examiner of the county who resides nearest to the place of accident, and shall also within twenty-four hours give notice to the Railroad Commissioners of any such accident or of any accident of the description of accidents of which the board may require notice to be given, the provision being subject to a penalty of $100.

Early in the year the Waltham Street Railway Company, which had been endeavoring to secure certain locations through petitions to the Railroad Commissioners, asked legislation to permit it to build and operate in Newton, Wellesley, Weston, Lincoln and Concord. There were some very exciting hearings on this subject, but before the committee decided upon a report it was understood that the road, which has not yet been put in operation, had passed into new hands, and that a majority, at least, of its owners did not desire the extensions which had been asked, and which were ardently opposed by roads already in the territory or having pending petitions for locations. A majority of the committee, however, voted to report a bill, which was promptly rejected by the House.

A bill to authorize the Conway Street Railway Company to purchase the property, franchises, etc., of the Conway Electric Light & Power Company was favorably reported and approved by the Governor.

The Cape Cod Street Railway Company asked extended powers to construct and operate in Falmouth, Bourne, Mashpee, Barnstable and Yarmouth, act as common carrier, maintain wharves, docks, etc., doubtless on the theory that these privileges could be obtained under the general law as amended this year. The bill was adversely reported and rejected.

The Boston, Quincy & Fall River Bicycle Railway Company came in with a petition asking that it be given another year in which to build its road and also for freight carrying privileges. The committee cut out the freight carrying provision and reported favorably the bill, which took all its readings until it reached the enactment stage in the Senate, where it was rejected. E. Moody Boynton, the promoter of the scheme, will, therefore, be compelled to commence work of construction between now and December 31, or his charter will lapse.

A bill to provide for the transportation of letter carriers on street railways was introduced, adversely reported, and the report accepted.

A bill was reported reviving the charter of the Lowell, Acton & Maynard Street Railway Company and extending the time for its construction. A similar bill was passed legalizing the or-

ganizing of the Essex County Street Railway Company, and giving it further time to build. Additional time was given the Rutland Street Railway Company for construction and operation, and the Providence & Fall River Company was given authority to contract with connecting companies for the transportation of passengers and freight, this exception from the adopted policy being based on the fact that much of its location is outside the bounds of the Commonwealth.

Many hearings of this committee were in joint session with the railroad committee. One of the most important bills so considered was to permit railroad and street railway companies to purchase stock in other such companies having locations in their territory. This matter came in on the petition of William H. Coolidge, general counsel of the Boston & Maine Railroad. The committees jointly reported in favor of the measure, but with Senator Fitzgerald and Representatives Dempsey, Beck, Callender, Hill, Entwistle, Warner, Quinlan and Hunt dissenting. The Senate tabled the bill on April 22. Here it remained for many weeks and finally it was taken from the table and on motion of Senator Fletcher referred to the next General Court, his explanation being that it was too far-reaching a measure to be passed without more mature consideration.

Another bill considered by the two committees sitting jointly was also on Mr. Coolidge's petition and contemplated legislation relative to the establishment of railroad corporations and a consolidation, revision or codification of the laws relating to railroads and street railways. The two committees reported adversely on this petition without dissenters on March 30. The report was tabled in the Senate. There it stayed until the very close of the session, when the report was accepted.

Another petition of Mr. Coolidge was heard by the street railway committee and contemplated an amendment to the present law as to the extension of tracks of existing street railway companies into other cities and towns, the bill authorizing the Railroad Commissioners to decide whether public convenience and necessity require extensions into other cities and towns. This measure was adversely reported and tabled by the Senate April 16. It eventually was taken from the table and the report was accepted.

Quite early in the year the Amesbury & Hampton, Haverhill & Plaistow, Haverhill & Southern New Hampshire, Lawrence & Methuen, and Lowell & Pelham Companies asked authority to consolidate under the name of the Northern Massachusetts Street Railway Company, this scheme being understood to contemplate the final consolidation of the group of thirteen Southern New Hampshire street railway companies, many of them with termini in Massachusetts under the name of the Exeter & Hampton Street Railway Company. No sooner had the matter reached the point of a hearing when charges were made that a system of financiering, unsual to Massachusetts, had been adopted by the owners of the roads, and an order was passed requesting an investigation and report by the Railroad Commissioners upon the subject. This report was later submitted and tabled in the House, being finally filed. Soon after the committee favorably reported the bill, which passed the Senate and took its place in the House calendar. Eventually it was engrossed in concurrence and it was approved by the Governor June 3.

One of the most important bills which came in on petition was that for a charter for the Concord & Chelmsford Street Railway Company. In that measure, which was favorably reported, was a section as to the powers of the Selectmen to take land for street railway purposes, and the committee eliminated the section and reported a general bill to authorize Aldermen and Selectmen to empower street railway companies to take land for certain purposes. This bill provides that if a company applies to a local board with a statement that public convenience and necessity requires that certain land or interest in land be taken by the company in its work of construction to avoid dangerous curves or grades existing in highways in which it has received locations, and the board finds in favor of the petitioner after public notice and hearing, the company may apply to the Railroad Commissioners for a certificate that public necessity and convenience and for approval of the adjudication of the Aldermen or Selectmen as to the necessity or reasons for taking land or rights in such city or town in which such adjudication has been obtained. If the Railroad Commissioners grant the certificate as prayed for the petitioner may take the land or rights by eminent domain. This measure, popularly called the "eminent domain" bill, was the cause of long discussions, and did not reach enactment until the very close of the session. The House amended it by adding a referendum, but this later came out. The bill finally got into a conference committee on the question of amendments, and this committee recommended that the House concur with the Senate in striking out a requirement for approval of local voters, and that the Senate agree to strike out the section permitting railroad companies to run electric cars in streets without the consent of local authorities.

The street railway committee sat jointly with the committee on towns on a petition that the town of Dover may lay out special town ways for the use of street railways, and the bill was favorably reported and passed.

In joint session with the committee on metropolitan affairs the question of a metropolitan parks highway, to be constructed through the metropolitan parks system, was considered. A measure was finally reported authorizing the metropolitan park commissioners to investigate and report to the General Court on this measure.

One of the last measures to be considered was a bill to incorporate the Sandwich, Hyannis & Chatham Street Railway Company, which was opposed by many legislators on the ground that it gave the company extraordinary powers which could not be obtained under general laws. The route was largely upon a State highway, and crossed a bridge which was originally built to bear the weight of ordinary vehicles, but not electric cars. It was claimed that the company was seeking to avoid the supervision by the State Highway Commissioners, which would be imperative under general laws, and also the responsibility for reconstructing the bridge. After long consideration the bill was amended so as to eliminate these features and make the measure conform to the general laws, and it was passed, the principal gain to the company being in a saving of time in preliminary proceedings.

A large number of stringent employers' liability bills were introduced, tending to change the laws as to prima facie evidence in cases of injuries to employees of transportation companies, etc. Finally, all were reported with a recommendation for a special committee to be appointed by the Governor to revise the laws concerning the relations between employees and employers. This resolve, founded upon fifteen petitions and bills, was approved by the Governor May 4.

The pipe calkers at work on the Rapid Transit Subway in New York city are on strike, despite their agreement with the association. Though only twenty-four men are out the strike is said to delay matters seriously in the subway. The strike was ordered in spite of the fact that the standing committees of the Central Federated Union and the Rapid Transit Contractors' Association at a joint meeting decided that the subcontractors in paying $3 a day were paying the prevailing rate of wages. The advance from $3 to $3.50 a day is therefore held to be 50 cents a day over the prevailing rate. This is said to be the first violation of the agreement between the Rapid Transit committee of the Central Federated Union and the Rapid Transit Contractors' Association since the agreement was made over two years ago.

HOME-MADE AUTOMATIC STARTER FOR AUTOMATIC AIR COMPRESSOR

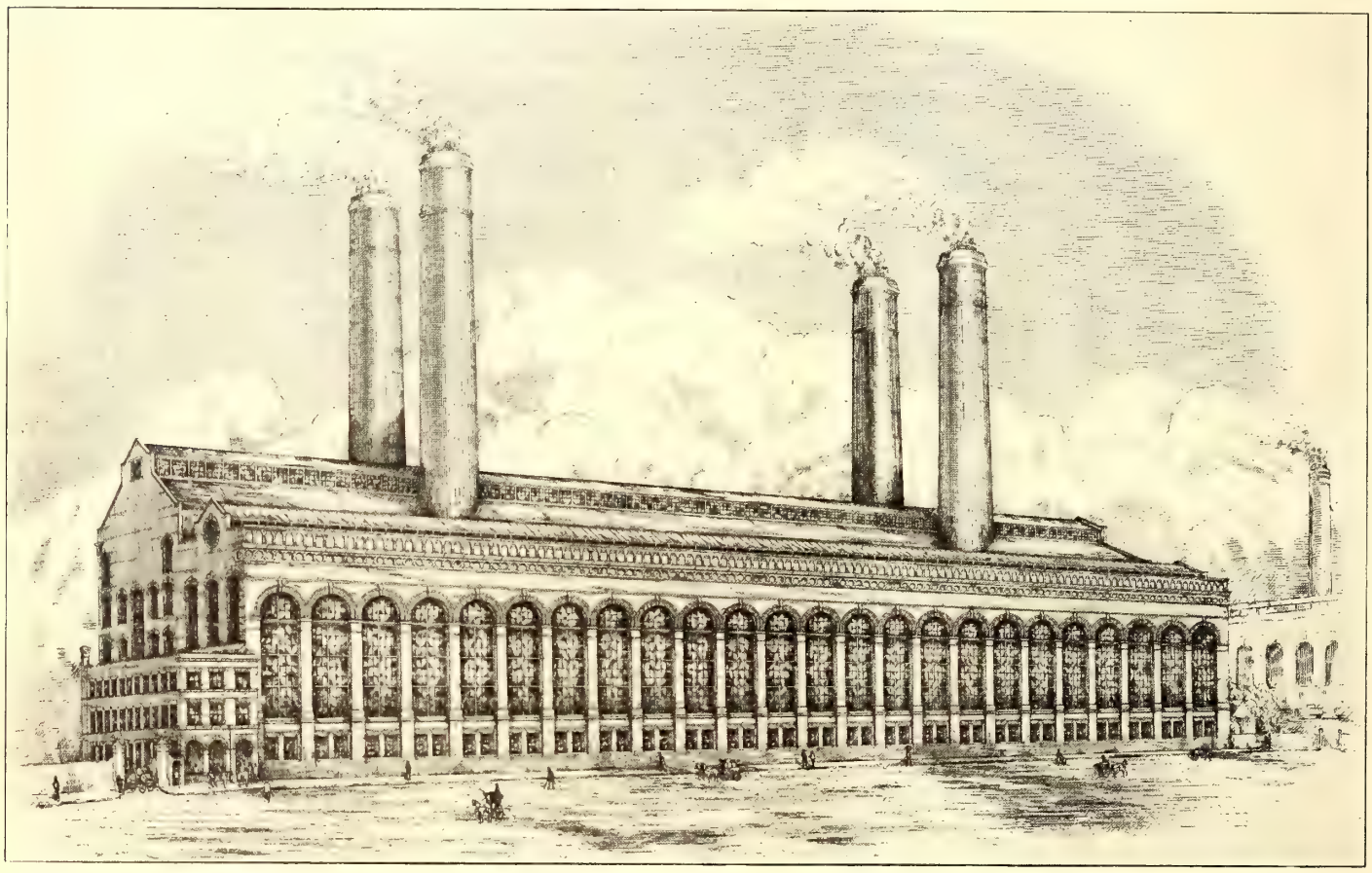
The St. Louis Transit Company has a large air compressor at its shops to supply air to compressed-air tools and for cleaning. This compressor is driven by an old D-62 generator run as a motor. It is provided with an automatic starter which is of interest, as it affords a means of automatically starting and stopping this large motor so as to keep the air pressure constant, which is very satisfactory and perfectly capable of handling a large volume of current. The shunt fields of this motor are connected permanently to the 500-volt constant-potential railway circuit. The armature is started through a rheostat. The cutting out of the rheostat is accomplished by contactors, such as are used on the General Electric Company's type-M system of train control. Each contactor is controlled by its own magnet, as is well known. The only function of the automatic governor, which is controlled by the air compressor, is to close the armature circuit. When the motor is idle, of course, all the type-M contactors which cut out or short circuit the rheostat are on open circuit. The magnet coils of these contactors are connected in shunt around the terminals of the motor. Of course, in starting the motor with all the resistance in circuit the voltage across the motor terminals is low, and as the motor speeds up this voltage automatically rises. The weights on the contactor magnets are adjusted so that as soon as the motor armature speeds up a little, with a corresponding rise of voltage, one of the contactor magnets pulls up its contacts and short circuits one section of the resistance. When the motor speeds up a little more, and the voltage across its terminal rises again, another contactor magnet draws up its contacts and short circuits another section of the resistance. Thus the various sections of the resistance are short circuited, one by one, by the contactors as the speed and voltage of the motor armature rise, until finally all of the resistance is short circuited. The arrangement works admirably and is extremely simple.

POWER STATION FOR THE UNDERGROUND ELECTRIC RAILWAYS COMPANY OF LONDON

The work on the electrical equipment of the Yerkes underground railway system in London is being carried forward rapidly under the supervision of G. F. Chapman, chief engineer. Particulars were published in a recent issue of the cars and third-rail system adopted, and views are given herewith of the immense power station which is now being erected on the Thames.

The site of the station comprises 3.67 acres of land with a water frontage on the Thames and on Chelsea Creek of 1100 ft. and a frontage on Lots Road, Chelsea, of 824 ft.

The building is 453.5 ft. x 175 ft. and 140 ft. in height from the ground floor to the peak of the roof. The office building adjoining on the east measures 81 ft. x 25 ft., and will have three floors, the lower of which forms the machine shops. The main building will have a self-supporting steel frame, weighing about 5800 tons. There will be four chimneys, each 19 ft. internal diameter and 275 ft. high; the foundations for these chimneys are 42 ft. sq. and 34 ft. 6 ins. below the ground floor level. There are 2200 cu. yds. of concrete in each foundation.



LOTS ROAD ELEVATION—CHELSEA GENERATING STATION. UNDERGROUND ELECTRIC RAILWAYS COMPANY OF LONDON, LTD.

The capacity of the building at normal load is 57,000 kw. On this basis the cubic feet per kilowatt (including office building) is 139, and the square feet per kilowatt is 1.36.

The steel frame of the building will be closed in with brick and terra cotta; the roof and most of the floors will be concrete. In general details the building will be considered as a factory for the production of a commodity, and there will be no ornamental features.

The south side of the building will contain eighty water-tube boilers arranged two stories high and carried directly on the steel frame of the building. Each boiler has 5212 sq. ft. of heating surface and 672 sq. ft. of superheating surface. The boilers will be piped in groups of eight, each group supplying the steam for one electric generating set and one feed pump, there being no steam connections between the several groups

except that a supplemental header at the east end of the building is connected to two groups. This header supplies the exciter engines, air compressors, house pump, etc. Chain grate stokers will be used under each boiler, and will have 83 sq. ft. of surface.

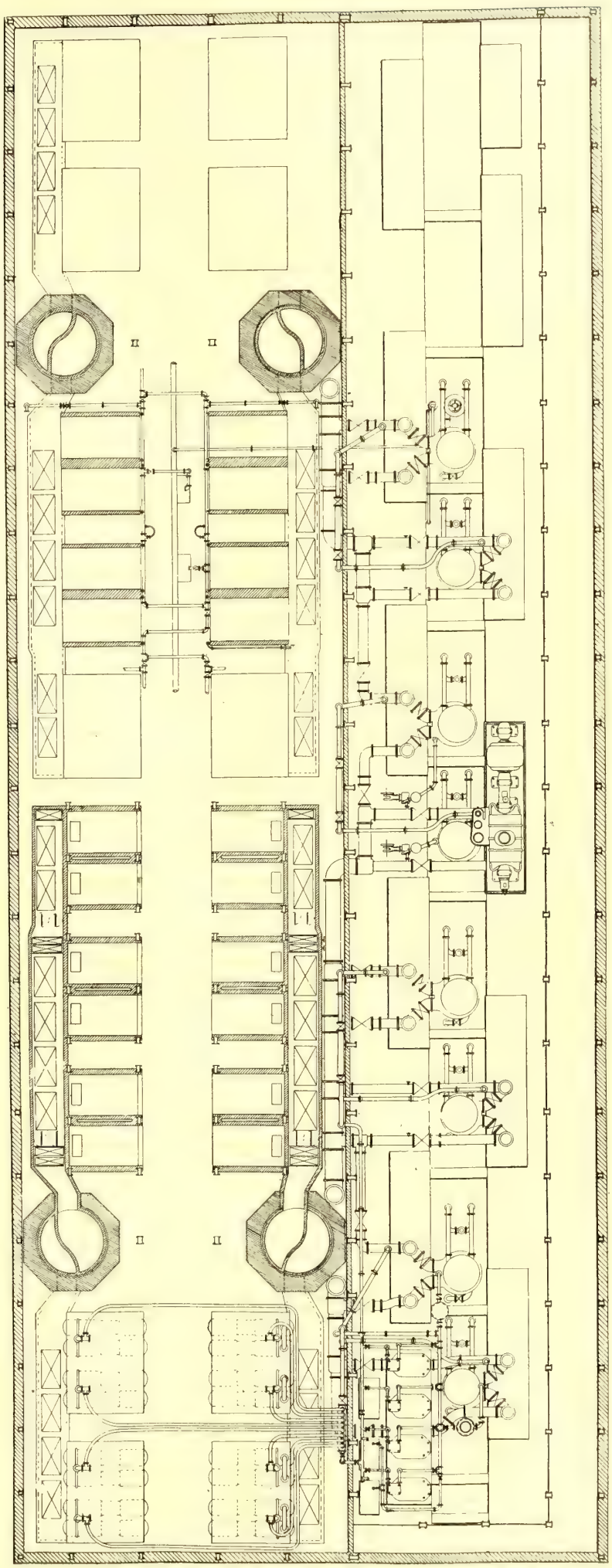
Economizers with tubes, 10 ft. long and placed wider apart than the usual practice, are grouped behind the boilers, with the customary by-pass flues; 1540 sq. ft. of heating surface is provided for each boiler. The boiler feeders are placed on the ground floor and supply ring mains on both the boiler room floors.

The main generating sets consist each of a Westinghouse horizontal steam turbine running at 1000 r. p. m., and a three-phase generator, wound for 11,000 volts 33 1-3 cycles. There will be ten such sets, with floor space for one of half the size. The normal rating of each generator is 5500 kw, but they will carry an overload of 50 per cent for two hours at practically the same steam consumption per kilowatt-hour. There will be in addition four 125-kw, 125-volt steam-driven exciter sets, running at 375 r. p. m.

The condensing system consists of vertical condensers each with 15,000 sq. ft. of cooling surface, and located in pits between the engine foundations. The circulating water is supplied by 66-in. pipes laid to the edges of the channel of the Thames. Each condenser has a 20-in. centrifugal pump; the duty of this pump is simply to overcome the friction of the pipes, as the system is arranged on the syphonic principle, the top of the condensers being within 29 ft. of minimum low tide, and the circuit is closed. The intake and discharge mains are arranged for reversible flow. The condensers are designed to work on the dry vacuum principle, the air pump and the water pump being separate. All the condenser pumps are electrically driven.

The switchboard is carried on three gallery floors extending across the north side of the engine room with returns across the east end. All high-tension switches will be motor operated, and the feeder system extending to the twenty-three sub-stations will be in duplicate. A line of sixty-four ducts is being constructed to carry these feeders to the nearest point on the District Railway at Earl's Court.

Coal will be received on lighters in a tidal basin at the east end of the station, or by rail at an unloading point of the West London Extension Railway on the opposite side of Chelsea Creek. For unloading barge coal the basin is spanned by two traveling cranes, each working a 1-ton grab; the coal is weighed in the tower at one end of each of these cranes and dropped onto a belt conveyor, thence by duplicate inclined elevators, 140 ft. high, to the top of the building. Rail coal will be taken from a hopper under the coal wagons by an inclined elevator to the top of the building at the opposite end. The distribution over the bunkers is by duplicate belt conveyors, so arranged that the direction of travel of both belts can be reversed so as to handle coal coming in at either end. The storage capacity of the bunkers is 15,000 tons. The daily consumption will reach 800 tons, and six of the largest river barges can be placed in the basin at each tide.



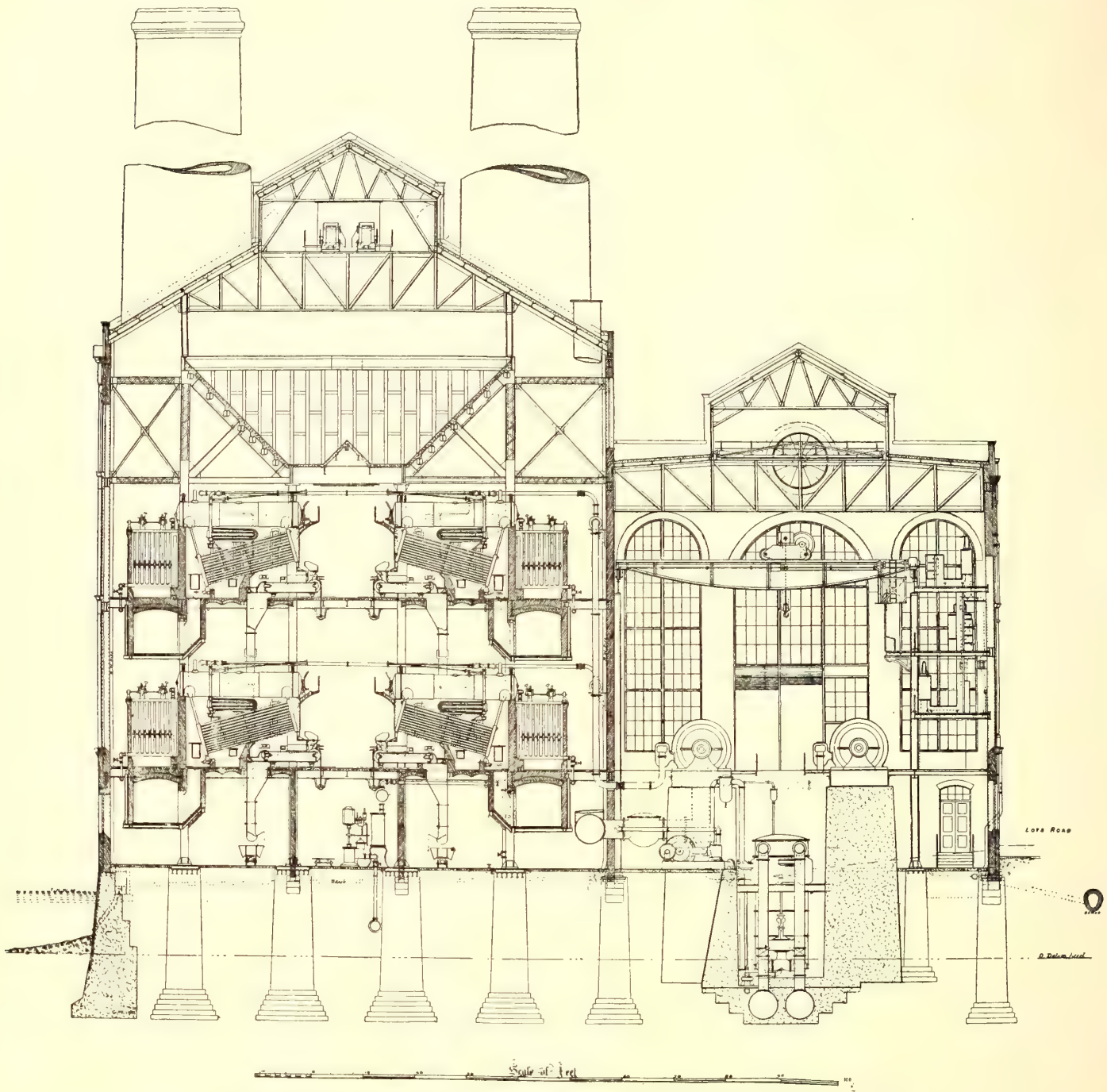
PLAN OF CHELSEA GENERATING STATION, UNDERGROUND ELECTRIC RAILWAYS COMPANY OF LONDON, LTD.

Ashes will be removed by an industrial railway worked by a storage battery locomotive; two lines of rails will be laid under the ash hoppers on the ground floor. The ashes will drop into self-dumping buckets, to be unloaded into barges by pneumatic hoists on the dock wall at the west end of the premises or stored in an adjoining bin if no barge is available.

The capstans, barge basin gate mechanism and many of the large valves in the building will be worked by pneumatic motors.

The electric motors on the traveling cranes over the engines, as well as those on the oil switches, will be direct current, 125 volts. All other motors will be three-phase 220 volts; most of the lighting will be on the latter circuit.

It is expected that a portion of the plant will be in working order by the latter part of 1904.



CROSS SECTION THROUGH ENGINE AND BOILER ROOMS, CHELSEA STATION

It is announced that a sub-commission of the Royal Commission on London Street Traffic will go to the United States in the Autumn to study the street railroad systems of the principal cities there.

THE ELECTRIC RAILWAYS ON LONG ISLAND

For a territory so closely contiguous to New York it is indeed remarkable that there has not been greater development of the electric railway on Long Island. Of course, there is a boom on now that the Pennsylvania Railroad, as owner of the Long Island Railroad, has so greatly improved the service of its lines on the island, and since the construction by that company of its proposed tunnel and the tunnel to be built by the city between New York and Brooklyn is assured. Up to the time of the development of these projects, however, the only electric railways on the island worthy of mention were those operated by the New York & Queens County Railway and the Brooklyn Rapid Transit Company, whose lines extend from Long Island City and Brooklyn respectively.

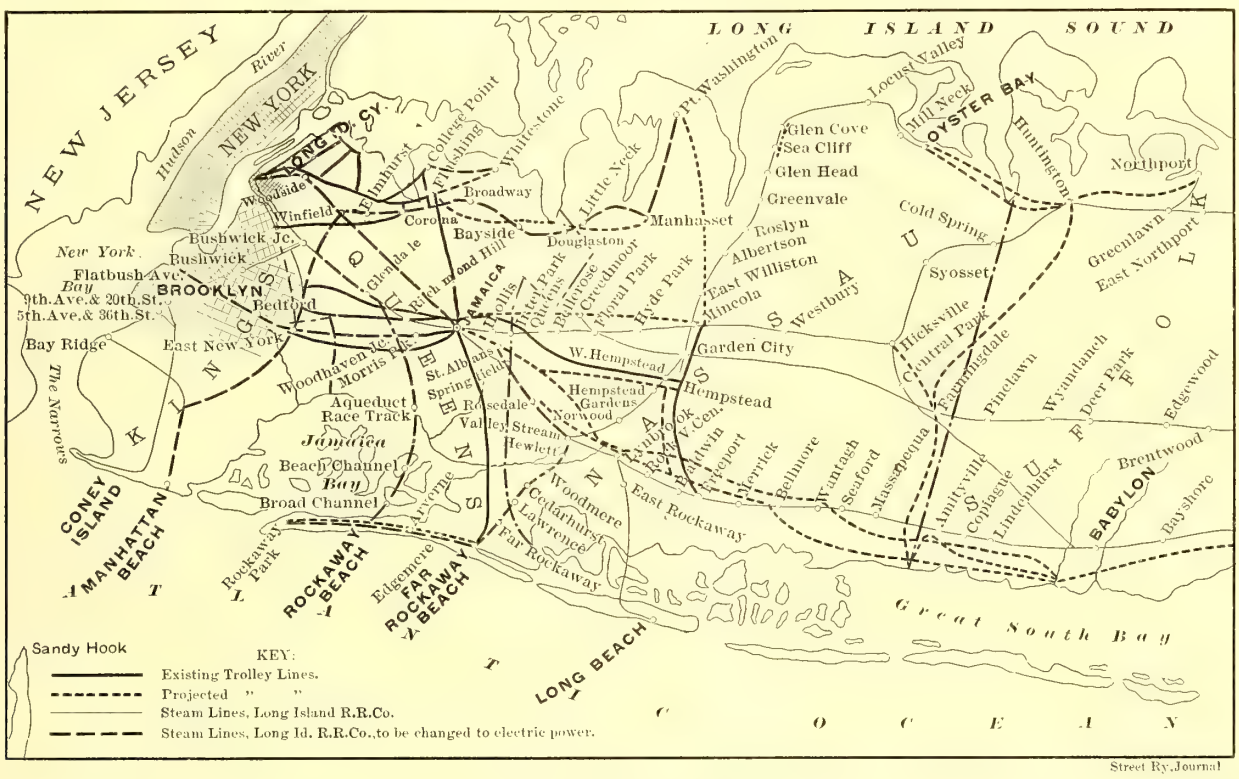
At the present time there are about 140 miles of electric railway in operation on the island outside of Brooklyn Borough. Of the above named the New York & Queens County system has 74½ miles, the New York & Long Island Traction Company, 16 miles; the Long Island Electric Railroad, 19; the

Brooklyn Rapid Transit Company, 20; the Ocean Electric, 8; the Huntington Railroad, 3; the Northport, 2½.

The New York & Queens County's lines extend from the East River ferries, at the foot of Borden Avenue, Long Island City, to Astoria, Steinway and North Beach, by way of Ravenswood, and between the same terminals by way of Dutch Kills; a line from the ferries to Flushing and College Point by way of Elmhurst, and another between the same points, a more direct line, over Jackson Avenue; a line from the ferries to Calvary Cemetery, Newtown, and another from Flushing to Jamaica. The company has franchises from Flushing to Whitestone and Willetts Point, and from Flushing to Bay Side and Manhasset, and has promised soon to construct these lines.

The Long Island Electric Railroad Company operates a line from Queens to Jamaica, from Jamaica to Far Rockaway, and from Jamaica to the terminus of the Kings County Elevated line at a point near Rosedale, and it has made an application for a franchise for an extension through South Jamaica, in Queens Borough, to the Brooklyn line at the terminus of the Kings County Elevated Railroad. It has also applied for a franchise for an extension from the Queens Village through Jamaica and thence to the Brooklyn line, not far from the line of the Long Island Railroad. It has a franchise for building a line over the Jericho Turnpike from Mineola to Jamaica.

The company has also applied for franchises for the building of a line from Freeport to Babylon. The completion of this line in connection with the one now under construction from Freeport to Rockville Center and the Queens Borough line, would form a continuous line 31 miles in length from Babylon to the terminus of the Kings County Elevated line of the Brooklyn Rapid Transit Company, and with the other proposed lines would give three parallel east and west routes through



MAP OF WESTERN END OF LONG ISLAND, SHOWING EXISTING AND PROPOSED ELECTRIC RAILWAYS OUTSIDE OF THOSE IN BROOKLYN

Railroad at Liberty Avenue and Crescent Street, Brooklyn. At Far Rockaway the lines of the company connect with the Long Island Railroad, which operates in summer an electric service between that place and Rockaway Park, thus making possible a trip entirely by electric railway from the City Hall, New York, to Rockaway Beach, a popular summer resort that ranks with Coney Island for its attractions.

The Brooklyn Rapid Transit Company operates, of course, in Brooklyn, also from East New York to Jamaica, on Myrtle Avenue from Brooklyn to Richmond Hill, from Ridgewood to Flushing and North Beach, and from Brooklyn to Maspeth, Newtown, Corona and North Beach. The company also has franchises for several other lines in the town of Newtown. It was over part of this company's line between Brooklyn and Jamaica that the Jamaica & Brooklyn Railroad operated electric cars under the Van Depoele system as early as Jan. 1, 1888.

Of the systems now in operation the New York & Long Island Traction Company, operating between Freeport and Mineola, by way of Hempstead, a distance of 9 miles, and a line between Hempstead and Queens, a distance of 7 miles, probably has in contemplation more construction work than any other company on the island. The company is now building a line from Freeport to Rockville Center and the Queens County a large portion of Nassau County and traversing an important section of Queens. The company gets its power from the Roslyn Light, Heat & Power Company's plant, but has under construction a power house of its own at Rockville Center. At Queens the company's lines will connect with the New York & Queens County Railway, thus completing electric railway connections with Long Island City, Brooklyn and New York. This system was described in detail in the STREET RAILWAY JOURNAL for June 26, 1902.

The electric railway between Far Rockaway and Rockaway Park, to which reference has already been made, is operated by the Ocean Electric Railroad, a subsidiary company of the Long Island Railroad. This line is to be extended next fall to Valley Stream and Mineola. The grading for a second track to Valley Stream is already finished, and the ties are laid along the line. Upon the completion of this work the motive power of the line between Far Rockaway and Mineola—now a steam railroad—will be changed to electricity.

Of the companies that have as yet done nothing in the way of actual construction work probably the most pretentious is the South Shore Traction Company, recently incorporated. The company is capitalized at $2,000,000, and it proposes to build about 60 miles of line in Suffolk County and Nassau

County, extending from Jamaica through Rockville Center, Hempstead, Babylon, Amityville, Islip, Patchogue and Brook Haven. Interested in this company are R. E. Lee Slingluff, of Baltimore; Charles H. Davis, of Petersburg, Va., and James F. Heyward, formerly general manager of the City & Suburban Railway, of Baltimore, Md. The company now has a right of way from Brook Haven west to the Nassau County line, with the exception of Babylon village, and has been granted a franchise through that portion of Babylon Town outside of the limits of the two incorporated villages of Babylon and Amityville. Oyster Bay, the home of President Roosevelt, has granted the necessary franchises in that town, and an application is now pending before the Nassau Board of Supervisors and the Hempstead Town Board. Franchises will also be asked for through the incorporated villages of Freeport and Rockville Center. The company has bought the Patchogue Electric Light Company's plant, the East Islip Electric Company's plant and franchises for lighting covering the whole town. It has also an option on the Amityville Electric Light Company's plant. The company will lay its line almost altogether over a private right of way, except in the villages.

There has long been in contemplation an electric railway between Patchogue and Port Jefferson, and at one time a company known as the Patchogue & Port Jefferson Traction Company is actually said to have begun work on the line. This was in 1897 or 1898, but the project has recently been revived. Now it is said an entire private right of way has been secured for the line, and that its construction is assured. The road will be 15 miles long.

A project for which franchises have been partly secured is the Huntington & Amityville Cross Island Railroad, in which Harry A. Hanbury, Robert A. Sharkey and other prominent Brooklyn politicians are interested. The company proposes to build from Huntington railroad station through Melville and Farmingdale to Amityville. It has secured franchises in the towns of Huntington, Oyster Bay and Babylon for the building of its entire line up to a short stretch of country road in Farmingdale.

A company is being formed to build a road on the north fork of the island, to run from Riverhead to Greenport. This road is to be built entirely by local capital. John H. Perkins is the most active promoter of the enterprise.

Of the projects that have as yet attained nothing like tangible shape may be mentioned plans to connect Farmingdale and Hicksville, Mineola and Port Washington and Oyster Bay and Northport. These are merely in the preliminary stages of promotion. As far as can be learned nothing has even been done toward securing franchises for them.

At Huntington and Northport the Long Island Railroad has built short lines that extend from the railroad stations at these places through the villages, and the company plans to build similar lines at Sea Cliff and Glen Cove, with a line between these towns.

The lines at Huntington and Northport, furnishing as they do a ready means of transit in these villages, have proved very popular with the residents, and the fact that more of them are to be built by the company also proves that they are creators of traffic. In passing, it might be well to mention that the Long Island Company plans to equip for electric operation by the third-rail system more than 70 miles of line. The names and the mileage of these lines follow: Long Island City to Manhattan Beach, 16.10 miles; Glendale Junction to Rockaway Park, 10.31 miles; Hammels to Valley Stream, 8.37 miles; Long Island City to Port Washington, 18.18 miles; Whitestone Junction to Whitestone Landing, 4.78 miles; Glendale Junction to Rockaway Junction, 4.34 miles; Flatbush Avenue (Brooklyn) to Jamaica, 9.63 miles.

As stated in the article, "The Passenger Traffic Problem of Greater New York, III—Brooklyn," by W. W. Wheatly, 1903, the present plan is to operate all trains on these lines by the multiple-unit system. The trains from the six lines first named will probably run to Manhattan by way of Long Island City and the Thirty-Fourth Street tunnel. The trains from Jamaica, by way of Flatbush Avenue, will probably run to the Battery or the City Hall, in Manhattan, by way of the Interborough Rapid Transit Company's tunnel.

In all there are projected or under construction on Long Island at this time nearly 250 miles of new line in Queens County, Nassau County and Suffolk County, which do not include Brooklyn, in Kings County.

POWER STATION TEST OF THE UNION TRACTION COMPANY OF INDIANA

Under the title of "Central Station Economies" Professor W. E. Goldsborough and P. E. Fansler presented a paper at the recent meeting at Niagara Falls of the American Institute of Electrical Engineers, summing up the results of some tests made under their direction by the students in the electrical engineering course at Purdue University. The station is provided with eight Babcock & Wilcox water-tube boilers, rated at 400 hp each, the principal dimensions of which are: Number of tubes, 102; arrangement, 16 wide and 12 high; size of tubes, 4 ins. diameter; two drums, 3 ft. diameter 16 ft. long; O. H. steel, tensile strength, 56,000 lbs.; steam pressure (rated), 160 lbs.

ENGINE ROOM

There are at present in the engine room three cross-compound Corliss automatic cut-off condensing engines, with a maximum capacity of 2000 hp each, and space for a fourth unit of the same size. These engines are built under a guarantee of less than 1 per cent speed variation from no load to full load, with an instantaneous variation not greater than 2 per cent in any case. The economy guarantee is that the maximum steam consumption of engine, jackets, air-pump and reheating coils, when under normal steam and vacuum conditions, shall not exceed on an average the equivalent of 14½ lbs. of dry steam per indicated horse-power per hour, when the engine and pump under a constant load are together indicating 1500 hp.

The general dimensions of the main engines are: Diameter of cylinders, 26 ins. and 50 ins.; length of stroke, 48 ins.; speed, 100 r. p. m.; diameter of balance fly-wheel, 18 ft.; weight, 120,000 lbs.; diameter of shaft at middle, 24 ins.; dimensions of main bearings, 22 ins. x 58 ins.; crank pin, 8½ ins. x 8½ ins.; cross-head pin, 7 ins. x 8½ ins.; length of connecting rod, center to center, 12 ft. An improved Rites inertia-type governor gives a cut-off variable from zero to three-fourths stroke. Connected to the low-pressure cylinders of the compound engines are jet condensers, the condensed steam and condensing water from which is allowed to escape into a private sewer. However, special connections are made at all joints and at the separators in order that the water in the steam pipes may be drained into the Holly system and returned to the boilers to be evaporated.

Direct connected to each of the three engines is a 1000-kw three-phase generator with rotating fields, separately excited, designed for 100 r. p. m. With thirty-two poles this gives 1600 cycles per minute. Each generator has a normal capacity of 1600 amps. in each of the three phases, the full-load voltage being 400.

A summary of the boiler tests is given in Table I.

In explanation of this data it might be said that Item 4 is an assumption owing to the fact that it was thought no dependence could be placed upon the determinations of the moisture in the coal, made from the samples taken, inasmuch as when dumped upon the floor the coal was in a relatively dry condition on account of having been stored over the boilers for

a considerable number of hours previous to its being used. It was impossible, however, to seal up the samples at once, and consequently they had ample opportunity to absorb a considerable amount of moisture.

Owing to the fact that Item 27, which shows the equivalent water evaporated per pound of combustible from and at 212 degs. is rather high, it is thought that the actual amount of moisture in the coal was less rather than greater than the assumed value of 6 per cent. If the extreme condition is assumed and the coal taken to be dry when fired into the boilers, Item 27 will be reduced from 12.30 lbs. evaporated per pound of combustible, to 11.65 lbs. evaporated per pound of combustible, which is more nearly in accordance with the claims of the builders of the boilers.

Results reported by the Babcock & Wilcox Company indicate an average performance of 11.4 lbs. of water evaporated from and at 212 degs. per pound of combustible; the test figures, therefore, indicate an excellent performance. There are but few reports of boilers showing a maximum evaporation above 12 lbs. of water evaporated per pound of combustible from and at 212 degs., and 12.5 lbs. is about the highest evaporation that can be obtained from high-grade steam fuels. A few reports have shown as high a maximum as 13.25 lbs. of water evaporated per pound of combustible, but it is safe to say that an average record made during three days' test at Anderson, Ind., of 12.3 lbs. evaporated per pound of combustible from and at 212 degs. is an excellent showing under conditions of variable load.

Recent tests upon electric street railway properties show an economy somewhat less than this. For instance, a test made of the Oshkosh Electric Railway System about one year ago

TABLE I.—RESULTS OF BOILER TESTS

No.	QUANTITY	April 17	April 18	April 19	Total
1	Date of trial	April 17	April 18	April 19	Total
2	Duration of trial	24 Hrs.	24 Hrs.	24 Hrs.	72 Hrs.
3	Weight coal as fired	144.500	145 000	146,000	435,500
4	Moisture in coal	6 p.c.	6 p.c.	6 p.c.	6 p.c.
5	Total weight dry coal	135,800	136,300	137 200	409,300
6	Total ash and refuse	16,460	16,540	16,640	49,640
7	Per cent ash and refuse	11.4	11.4	11 4	11.4
8	Total combustible	119,340	119,760	120,560	359,660
9	Dry coal per hour	5,650	5,700	5,730	5,690
10	Dry coal per sq. ft. grate per hour	14.25	14.40	14.48	14.39
11	Total water to boiler	1,242,000	1,256,600	1,256,600	3,755,200
12	Water actually evaporated	1,229,700	1,244,000	1,244,000	3,717,700
13	Equivalent from and at 212°	1,487,000	1,505,000	1,505,000	4,497,700
14	Water per hour, cor.	51,200	52,000	52,000	51,700
15	Equivalent evap. per hour	62,000	62,800	62,200	62,400
16	Equivalent per sq. ft. grate	157	158	158	157.8
17	Average steam pressure	137.7	141.5	139.4	139 5
18	Temp. feed entering boiler	88.7	88.5	88.6	88.6
19	Moisture in steam	99 p.c.	99 p.c.	99 p.c.	99 p.c.
20	H.P. developed	1,800	1,820	1,820	1,805
21	Builders' rated h.p	2,400	2,400	2,400	2,400
22	Per cent b.r.h.p. devel	75 0	75.8	75.8	75 3
23	Water evap. per lb. coal	8.51	8.58	8.52	8.53
24	Equiv. evap. per lb. coal	10.21	10 30	10.22	10.24
25	Equiv. evap. per lb. dry coal	10.86	10.96	10.89	10.90
26	Equiv. evap. per lb. combustible	12.27	12.36	12.29	12.30
27	Calorific value coal	12,500	12,500	12,500	12,500
28	Calorific value combustible	14,100	14,100	14,100	14,100
29	Efficiency boiler based on coal	79.1	79.7	81.1	79.6
30	Efficiency boiler based on combustible	83.0	84.6	84 3	84.3
31	Economy feed water heater	6 15	6.20	6.23	6.19
32	Cost per ton of 2000	$1.35	$1.35	$1.35	$1.35
33	Cost of coal required to evaporate 1000 lbs. of water from and at 212°	$.0655	$.0651	$.0657	$.0654

by Professor Swenson, of Wisconsin University, and some of his students show the boiler plant to have developed an economic evaporation of 10.6 lbs. of water per pound of combustible from and at 212 degs. F. The boilers in this case were of Babcock & Wilcox manufacture.

An elaborate test was made in May, 1898, by the students of the Massachusetts Institute of Technology on the Harvard power station of the Boston Elevated Railway Company. This station is equipped with six Babcock & Wilcox water-tube boilers, developing a total capacity of 3000 hp. The report shows that 11.3 lbs. of water were evaporated from and at 212 degs. per pound of combustible, there being 1 per cent of moisture in the coal and 5.9 per cent of ashes and clinkers. Other points of comparison are that in the Harvard test the average boiler pressure was 168 lbs. against 158 lbs. at Anderson. The average temperature of feed water entering the boilers was 209 degs. F. at Harvard against 191 degs. F. at Anderson, and the heat gained in heaters and economizers as compared to the total heat acquired was 7.6 per cent at Harvard against 6.2 per cent at Anderson. The Harvard test offers the best comparison with the Anderson tests of any that has come to the attention of the authors, and the Anderson tests show the boilers to have developed a higher economy.

In Table II results are recorded which show the economy of the station in terms of the coal and water required to develop an indicated horse-power-hour and a kilowatt-hour for the different days and for the whole test. It must be remembered that the results here recorded include the steam used by the auxiliaries. The average coal consumption per indicated horse-power per hour is 2.85 lbs. The best economy was developed on the 19th, when an average of but 2.65 lbs. of coal was required in developing one indicated horse-power. This is probably due to the fact that the load was heavy and quite steady for a number of hours on the afternoon of the 19th.

The high value of 3.01 lbs. of coal per indicated horse-power per hour shown on the 18th inst. comes from the fact that on the 18th the variations in the load were heavy, and there was no balancing period of heavy load during the latter part of the day. In other words, the fires had to be built up to carry the heavy load at 5 o'clock, while immediately after 5 o'clock the load fell off. On the 19th the period of heavy load extended on until 9 o'clock, beginning as early as 2 o'clock in the afternoon.

The weights of water required to develop an indicated horse-power, as given in the table, vary from 22.6 lbs. on the 19th to 23.9 lbs. on the 17th. These values are high, even though they include the steam used by the auxiliaries.

In approximating the actual coal and water economy of the engines and generators the assumption has been made that the auxiliaries require 15 per cent of the steam generated. It is not believed that this percentage is too high, in view of the fact that a considerable amount of power is developed by relatively small engines in operating the crushing and conveying machinery, the automatic stokers, pumps, etc.

A great deal of data is not available as to the amount of power which auxiliaries consume. Results recently published by C. D. Taite and R. S. Doune* give a comparison between steam and electrically operated auxiliaries in central stations, and show that electrically-operated auxiliaries require from 6.5 per cent to 8.5 per cent of the total power generated, whereas steam-driven auxiliaries require upwards of twice this amount.

The records in Table III show that on April 19 an indicated horse-power-hour was developed with an expenditure of 2.25 lbs. of coal; and the average for the three days shows that an indicated horse-power-hour was developed by 2.42 lbs. of coal. The average of seven tests of compound condensing Corliss, Greene, McIntosh and Seymour and simple-valve motion compound engines reported by Professor R. C. Car-

TABLE II.—RESULTS OF TESTS MAKING NO ALLOWANCE FOR STEAM USED BY AUXILIARIES. TOTAL COAL AND WATER IS CHARGED TO ENGINES AND DYNAMOS OF MAIN GENERATING SETS

Date Apr.	Coal Fired Lbs.	Boiler Water Lbs.	I. H. P. Hours Developed	Lbs. Coal Per I. H. P. Per Hour	Lbs. Water Per I. H. P. Per Hour	Kw-H Developed	Lbs. Coal Per Kw Per Hour	Lbs Water Per Kw Per Hour
17	144500	1229700	51300	2.82	23.9	33600	4 38	37.2
18	145000	1244000	48000	3.01	25.9	32200	4.50	38.6
19	146000	1244000	55000	2.65	22.6	36700	3 98	33.9
3 days	435500	3717700	153820	2.85	24.25	101900	4.28	36.8

penter, of Cornell University, in a paper read at the Cornell meeting of the New York Street Railway Association, 1899, is

* A paper presented at a meeting of the British Institution of Electrical Engineers, April 7, 1903.

2.6 lbs. of coal per indicated horse-power per hour. The lowest value reported by him is 1.8 lbs. of coal per indicated horse-power per hour, and the highest 4.06 lbs. of coal per indicated horse-power per hour. The low value was developed by an engine of 2000-hp capacity and the high value of an engine of 825-hp capacity. By comparison with these results the performance developed by the engines at Anderson is very creditable.

As regards steam economy Table III shows the best performance of the Anderson engines to have been on April 19, when they developed an average economy of 19.7 lbs. of water per indicated horse-power per hour. On this day the average indicated horse-power of each engine was 1230, and the maximum horse-power developed 1690. The engines were, therefore, on the average, working under but 60 per cent of their maximum capacity. Under these conditions an economy of 19.7 lbs. of water per indicated horse-power per hour is not so bad, and in fact may be taken as representing creditable performance. The average of the tests reported by Professor Carpenter was 18.8 lbs. per indicated horse-power per hour. The 2000-hp engine before referred to developed an indicated horse-power on 14.5 lbs. of steam, while the 825-hp engine required 22.7 lbs. of steam. Unfortunately, the condition of loading is not specified in these cases so that the comparison fails in some particulars.

In the case of the test on the Harvard station previously mentioned of engines made by E. P. Allis Company, each of which have a nominal capacity of 1800 hp, the engines are shown to have developed an indicated horse-power with a consumption of between 14 lbs. and 15 lbs. of water. The different results being for different days. This is a high economy for street railway work. Unfortunately, no curves or other data is given from which any determination of the character of the variations in the load upon the Harvard station during the tests can be made. On May 10 the Harvard test record shows the engines to have developed an indicated horse-power on 14.05 lbs. of steam when the engines were under an

Table III.—Results of Tests Figured on the Assumption That 15 Per Cent of the Steam Generated Was Used by the Auxiliaries

Date, April	Lbs. Coal Per I. H. P. Per Hour	Lbs. Water Per I. H. P. Per Hour	Lbs. Coal Per Kw Per Hour	Lbs. Water Per Kw Per Hour
17	2.40	19.23	3.72	31.6
18	2.56	22.0	3.82	32.8
19	2.25	19.7	3.38	28.8
3 days	2.42	20.61	3.64	31.3

average load amounting to only 72 per cent of their normal rating. This performance is better than anything reported by Professor Carpenter, and shows a performance 29 per cent better than that of the Rice & Sargent Corliss engines in the Anderson station. In operating efficiency, however, the machinery in the Anderson station seems to be the equal of that in the Harvard station, as both average 90 per cent with the percentage of loading in favor of the Harvard station.

FRICTION TESTS

Table IV gives the results of a special friction test run on engine No. 2 on the morning of the 19th, after all cars had ceased running. Ten readings were taken after the operators in every sub-station had been instructed to disconnect the direct-current leads of the rotaries, leaving them running free. The power indicated then was that used in engine friction, generator losses, transformer and transmission losses, and that required to run all the rotary converters in the system.

The operators were next telephoned to throw off the rotaries, leaving the transformers only on the line, and ten more readings were taken. The difference in the indicated power between these first two conditions is that required to run the rotaries.

The generator switches were then opened, and ten readings taken on "no load," with normal field excitation. The difference between the power indicated under conditions No. 2 and No. 3 is that lost in the transformers and the high-tension transmission lines.

Next, the field circuit of the generator was opened, and the engine ran free; ten readings being taken under these conditions. The power developed in this final set of readings is that consumed in overcoming the friction of the generating unit, and may be considered constant at all loads. The difference in the power under conditions No. 3 and No. 4 gives the hysteresis and eddy current losses.

The engine and generator friction loss of 64.2 horse-power is only 3.2 per cent of the maximum capacity of the engine and only 5 per cent of the average power developed by the engine during the test. Including, as it does, the friction in both engine and generator, this is a low value.

Table IV.—Special Test

	Hp	Kw
Average power developed under conditions No. 1	341.4 or	254.5
" " " " " " 2	199.4 or	148.8
" " " " " " 3	100.5 or	74.8
" " " " " " 4	64.2 or	47.9
Power required to run the rotaries	142.0 or	105.9
Power lost in transformers and transmission	98.9 or	74.0
Power lost in hysteresis and eddy currents	36.3 or	26.9
Friction loss in engine and generator	64.2 or	47.9

Table V contains a tabulation of the results which show the thermal efficiency of the plant. From this table the authors find that the efficiency of the furnaces and boilers is 79.6 per cent, i. e., 79.6 per cent of the total heat in the coal as fired is delivered by the boilers to the engines in the steam. The average thermal efficiency of conversion between the boilers and engine cylinders is 9.11 per cent, i. e., 9.11 per cent of all the heat delivered in the form of steam by the boilers is converted into work in the cylinders of the main engines. This value of 9.11 per cent credits against the engines the steam used in the auxiliaries. If we follow out the assumption that 15 per cent of the steam delivered by the boilers is consumed by the auxiliaries, the thermal efficiency of the engines works out to be 10.7 per cent. The total average thermal efficiency of the plant is 7.25 per cent from the coal pile up to the engine cylinders and the total average thermal efficiency of the plant from

Table V.—Station Efficiencies

No.	Quantity	April 17	April 18	April 19	Total
1	Coal burned, pounds	144,500	145,000	146,000	435,500
2	Water evap. from 11.45° C	1,229,700	1,244,400	1,244,400	3,717,700
3	Water evap. per lb. coal	8.51	8.58	8.52	8.53
4	Equiv. evap. per lb. coal	10.21	10.30	10.22	10.24
5	Efficiency furnace and boiler	79.1	79.7	81.1	79.6
6	I. H. P. from area curve	51,300	48,000	55,000	153,820
7	Thermal efficiency engine	9.14	8.55	9.65	9.11
8	Total thermal efficiency	7.23	6.82	7.82	7.25
9	Kw-h from area curve	29,200	29,500	34,450	93,150
10	Kw-h from wattmeter	33,000	32,200	36,700	101,900
11	Error (W. M. as standard)	11.5 p. c.	8.4 p. c.	6.9 p. c.	9.1 p. c.
12	Efficiency engines, ratio areas	87.2	90.0	90.5	89.2
13	Efficiency engines, average instantaneous efficiencies	86.1	89.4	89.1	88.2
14	Total thermal efficiency	6.23	6.08	6.96	6.39

the coal pile to the switchboard, i. e., the ratio of the energy delivered by the generators to the total heat in the coal, is 6.39 per cent. Although it is frequently stated that the thermal efficiency of the steam engine at a maximum is about 25 per cent, it is improbable that any engine of this class working under these conditions will convert more than 12 per cent of the heat of the coal into work. The thermal efficiency of 6.39 per cent up to and including the switchboard shows high economy as compared with other stations of a similar character.

The total thermal efficiency of the Harrison Street station of the Chicago Edison Company has been estimated to be 4.5 per cent, while the thermal efficiency of the generating station of the Blue Island Chicago Storage Battery road was found to be 5.5 per cent.

The Anderson power plant of the Union Traction Company uses Indiana block coal for developing power. It is delivered at a cost of $1.35 per ton. On the basis of this figure the cost of

developing a kilowatt-hour is as shown in Table VI. The cost of developing a kilowatt-hour may be taken as the final

TABLE VI.—COSTS

	April 17	April 18	April 19	Total
Cost coal per kw-h	$.00295	$.00304	$.00269	$.00288
Kw-h per pound coal	.229	.222	.251	.234
Cost coal to evaporate 1000 pounds of water from and at 212°	.0655	.0651	.0657	.0654

estimate of the efficiency of any station, as the aim and end is to develop as much power as possible per unit of cost.

A RATIONAL TRAIN RESISTANCE FORMULA

Boston, July 8, 1903.

EDITORS STREET RAILWAY JOURNAL:

Your number of June 27 contains an editorial on the paper I presented at Saratoga. It presents points and opinions which I believe would not have been stated in the form which they are given if the matter had been given attention it deserves. I should like to present the following on this subject:

The editorial charges the formula presented by me with being "about as far from being free of empiricism as it could well be," yet the points further on do not warrant such statement. Again, the editorial states that "Mr. Blood is obviously right in making a strong plea for the rational formula," but later on states, "to our mind the best formulæ are simple ones * * * and deliberately empirical." It would seem that these statements are at variance.

In my formula No. 8, which is as follows:

$$R = A + BM + \left(C + \frac{D}{T}\right)M_n$$

it is stated that D openly groups a pair of terms arguing that such grouping is empirical. I would state that such is not the case, as the variables of the two terms are the same, and simply placing them together, giving the head and stern in one term instead of two, is perfectly rational. Of course, grouping the side resistance term with the term for head and stern resistance would be empirical after it were known that the variables of the two terms were not of identical functions. We do not know this at the present time, and it is a mooted question. Until it is known that they are different, we are as rational as we can be by assuming that they are the same and drawing the formula on that basis.

In my formula it will be noticed that a side resistance term, of which C is the coefficient, is proportional to the length or weight of the train, inasmuch as the resistance per ton is independent of the length or weight of the train. The statement that the stern factor D is proportional to the length of the train is entirely new, and it would seem that a statement of this nature being so far from natural observation, would require evidence to support it. At the same time it is presented "that whatever else D may be, it is not a function of the weight of the train." This is in accord with common opinion, and most the formulæ now show this relation. My formula, by placing the weight in the denominator, makes the resistance per ton inversely as the weight, and consequently makes the total resistance independent of the weight. It is certain that the cross-section and shape of the front of the train has a bearing on the coefficient D, and the several values of the coefficient D, under paragraph nine of my paper, show that this coefficient varies for different cross-sections.

I quote as follows: "The presence of T is purely empirical and merely serves to take account of various errors and omissions in the assumptions, which it does more or less well, according to the skill with which the constants are made to fit the experimental data." This statement is totally wrong, as any well-informed person on train resistance will acknowledge. The presence of T in the denominator of any formula giving the resistance in pounds per ton, makes that factor in which it appears of such nature that the total resistance given in pounds is independent of the weight.

The statement that the fractional exponent of the higher term is a well determined fact is not in accord with existing opinions. One reason for presenting this paper was to obtain a discussion on this point. It is believed by the writer that best results will be obtained by a fractional exponent. At the same time this is not acknowledged to a large extent and would necessarily bear much discussion before it could be considered "as a well determined fact."

Some few remarks in your editorial make it appear that the definition of a rational formula at the beginning is not followed. It is stated that it is "quite certain that A varies with the speed." This would be contrary to the hypothesis, for A is that portion of the train resistance which is independent of the speed. A rational train resistance formula is made up usually of three terms, one term which associates all forms of resistance which are independent of the speed. The largest portion of this resistance is a journal friction. The second factor is taken as the one in which the resistance varies as the first power of the speed, and all portions of the resistance varying as the first power of the speed are associated together. The track friction is the largest portion of this first power resistance. The third term of the resistance formula is taken as varying with a power of the speed higher than the first power, and has usually been taken as the second power. This is largely the air resistance. Now, the statement that it is quite certain that A varies with the speed is contrary to the definition of a rational formula and contrary also to experimenting. It has been definitely determined, if anything has been definitely determined, that there is a portion of the train resistance which is independent of the speed. Of course, the initial or starting resistance is not to be considered. It is known that it takes more power to start the train than it does to run it at an infinitely small speed.

A statement that B is not strictly a lineal function of speed is at variance with common opinion, although one eminent experimenter on this subject thinks that possibly there is another term in the train resistance formula which will vary as the power of the speed less than the first power. There is no reason for making a statement that B is not strictly a lineal function on the basis of any published results. It is, of course, known that the track is not a uniform rigid plane. If it were perfectly uniform and perfectly rigid the first power term would practically be eliminated. The fact that the first power term plays an important part is on account of the fact that the track is not rigid.

The statement that the air resistance varies with the length of the train but not with the weight is apparently contradictory, as trains are usually constructed so that the length is proportional to the weight. Of course, if the coefficients of the formula were calculated on the basis of length with a train of extremely light cars it would not apply to another train of cars built on an entirely different construction with different relation of weight and length. At the same time, for a given train, the weight is proportional to the length, and with coefficients properly chosen it is just as accurate to use the weight factor as the length factor.

It is, of course, true, that the track and axle resistance varies with the number and load of trucks, the condition of the roadbed, track and bearings, and it is just these various factors which it is attempted to rationalize by separating out the various coefficients in such manner that the proper coefficient for each feature of resistance may be placed in its proper relation in the formula.

The final recommendation is that a set of simple and empirical formulæ is the best. As against this I present that a single rational formula with a set of coefficients for different conditions is much better and more simple than any set of em-

pirical formulæ. An empirical formula is of necessity based on experiment and has no method of taking into account new or extraordinary conditions, whereas a rational formula with a set of coefficients can be made to represent new and unknown conditions.

The aim of a rational formula is to present the variables of the train resistance in such shape that they will be in accord with the actual conditions, relying on the choice of coefficients to give accuracy in accord with the present detail conditions. It would seem clear that the simplest possible method of arriving at given resistance would be this, and that a set of empirical formulæ would require in addition a system to know when and where such formula was appliable.

My paper was written to obtain discussion on the third or air resistance term. I believe that this term should have an exponent greater than one and less than two. I believe also that the coefficient should be sum of two coefficients, one of which is independent of the weight and one of which has a weight or length factor in the denominator.

In this connection I would like to state that my referring to C. O. Mailloux as an advocate of empirical formula is not in accord with his views on the subject and that he is an advocate of a rational formula. John Balch Blood.

REINFORCED CAR SILLS

Brooklyn, July 9, 1903.

Editors Street Railway Journal:

The article on "Reinforced Sills" in your issue of June 5 omits mention of two excellent methods, perhaps the most widely used, of which I enclose sketches.

Fig. 1 shows a flat steel plate on the outside of sill and projecting below bottom of sill. The added depth gives much greater strength than a plate of the same weight and no deeper than the sill, without the disadvantages of a plate extending above the sill, as in Mr. Carpenter's Fig. 4. If bolts be run through plate, sill and knees attached to the cross-timbers, no tie-rods and no other bolts through sill and plate will be necessary.

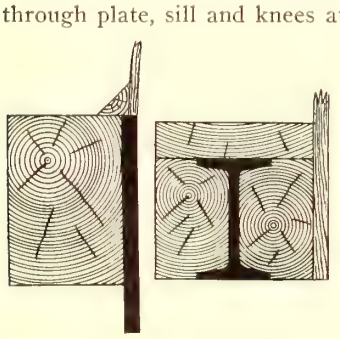


FIG. 1 FIG. 2

The reinforcement shown in Fig. 2 is specially adapted to cars with flush platforms, in which the intermediate I's can extend clear through to the bumper. The I-beams are braced together at end-sills, bolsters, needle-beams and by tie-rods, thus having the advantage of a steel framing, while the wood fillers make possible the use of wooden floor bridges (less expensive than all-steel framing), and the tie-rod and bolt-heads being sunk into the outer filler there need be no projecting heads on the outside of sill.

Both of these methods have been used largely and with satisfaction by the largest street railway systems in this country.

Construction.

REPORT ON NEW YORK CITY STREET RAILWAYS

Report of the Board of Railroad Commissioners of New York State on the status of the New York city street railway companies was rendered June 30, 1903, and contains some interesting statistics on the different properties. The report is the result of a special investigation on the part of the Board of Railroad Commissioners and its experts during January and February of this year, as described in the Street Railway Journal at that time. Recommendations have been made from time to time to the several companies, and steps were taken to ascertain that they were carried into effect.

The Board states that in this investigation it has acted not only upon the many suggestions offered by the Merchants' Association and other organizations and citizens of New York, but has consulted some of the ablest experts in transportation matters in the country. While the result has to some extent been gratifying, the Commissioners believe that further improvement can be made, and will continue their efforts to bring it about.

Since the hearing in January the Board investigated the methods employed by the different railroad companies in Greater New York in keeping the records of the movements of cars and trains, with a view to suggesting such improvements as would give the Board at the earliest possible moment the detailed information and data necessary for its own action in suggesting further changes. The power supply also received attention, and the Board is of the opinion that this matter is of the greatest importance; from the report of operations, which is herewith submitted, it is evident to the Board that in most cases provision for additional power should be made at once, and companies whose power will be inadequate in a year from the date of this report have been urged to make such provision. This matter is at present being investigated by the electrical expert of the Board, and a report on the power conditions of each company will be submitted by him later, when the Board will issue a supplementary report on this subject.

OPERATION

There has been an improvement on all of the lines. More cars are being moved, and there is now greater regularity in operating them. The matter of increased service during rush hours is still under investigation. As soon as it can be demonstrated that it is practical and that more trains can be operated with safety, orders will be issued to increase the number. As to the surface roads, the tables herewith submitted will show an improvement, and as subway construction progresses and conditions in the streets become more normal we believe a marked change for the better will be shown. The Board expresses its thanks to the Police Department and Street Department for their co-operation in trying to better the condition under which surface cars run. As a result of their efforts more cars are run on the Interborough lines, and reports show a decrease of causes of detention of cars.

CAR EQUIPMENT

The matter of equipment has been gone into in a most thorough manner. Construction of cars used on the elevated lines has been investigated as well as the methods of repairs, with a view to adding to their strength and safety.

The new cars ordered by the Board for elevated service have nearly all been received and are in service. The new closed cars ordered by the Board to be used by the Interurban will have a different style of ventilation, similar to that used in steam roads. The ventilators are so arranged that the air will be drawn outward rather than in, as is done at times under present arrangements, and it is believed that under the new scheme cars can be ventilated in extreme cold weather without having a direct draught upon any of the passengers. The grab handle on the bell shaft has been remodeled so as to be about 7 ins. nearer the conductor. This enables him to stand in the middle of the car and ring up fares without interfering with passengers.

The Board has ordered that hereafter companies in their reports to the Board of equipments shall report only such as are actually fit for service.

SPITTING ON CAR FLOORS

The Board calls attention to the good effects accomplished by the notices carried in the cars and to the enforcement of the law against violations of this ordinance. There is believed to be but little evidence of violation.

FIRE PREVENTION

The Board has investigated the construction of cars of the Manhattan Elevated line and finds the floors and bottoms of all cars covered with one-eighth asbestos board, which is treated with a highly insulated compound, also a special asbestos cloth tape designed and manufactured for the purpose of forming the wires into cables. Also that the single wires are carried from the cables to the connections on the apparatus, the braided asbestos being used, and at connection a braided asbestos sleeve embraces and covers all such connections. Each car before being put into service is subject to a test. All of the electrical apparatus and wiring are tested with 2000 volts alternate current for a period of from two to four seconds.

IMPROVEMENTS ON THE METROPOLITAN AND UNION

Eighty-Sixth Street line is being rapidly completed, and it is anticipated that the line will be complete and in operation July 20. Material for the Thirty-Fourth Street line is now on hand, and this will be changed from storage battery to underground electricity, and the work pushed to an early completion. The Kingsbridge power house has recently been completed and the company will now have ample power for several years.

The company has in preparation an increase in transfer system, and it is anticipated that this will be put into operation at an early date. Work on the changing of the Fourteenth Street line and several other downtown cross-town lines to underground electricity is promised as soon as the Thirty-Fourth Street line is completed.

The Union Company has recently constructed a sub-station at West Farms, which is substantially completed and equipped, and when operated to its full capacity will enable it to operate at least a hundred additional cars. Plans have also been prepared for two new sub-stations, and when these are completed the company will be able to double its car capacity upon its Yonkers and Mount Vernon divisions.

The necessary electrical machinery for both of these stations is now in course of construction by the Westinghouse Company, and it is expected that both of these stations will be in operation before Jan. 1 next.

The company has also recently built a new car house on 138th Street, with a storage capacity of 100 cars, and is now engaged in building another on the Bronx River Road with a capacity of 200 cars. It is also relaying a number of miles of track with 9-in. girder rails. Improvements are being made on 138th Street, west of Rider Avenue, and when the street improvements under way are completed it will enable it to operate cars from 135th Street and Eighth Avenue, in the Borough of Manhattan, to Tremont, Fordham and West Farms, in the Borough of the Bronx, doing away with the present inconvenient and undesirable change of cars at 138th Street and Third Avenue.

The rebuilding of the Tremont Avenue line from Third Avenue to Boston Avenue has just been completed, a distance of 4800 ft. of double track. One hundred new electrical equipments and trucks and fifty open cars have been recently added to the system.

IMPROVEMENTS ON THE BROOKLYN RAPID TRANSIT

Ninety-five new cars received this year and twenty-five are now promised by June 22, 1903. Until quite recently the company has been handicapped from lack of proper car repair shops, and the Board recently visited the new car shops at Thirty-Ninth Street and found them complete. Inspection was made of the manner of repairing cars, and the Board heartily approves of the improvement that is being made to strengthen those used on the elevated.

Several months ago the Board called the attention of the company to the danger from fire in the floor system. It at once took steps to guard against this danger by ordering that 4½ ins. of mineral wool be placed under the floors of all cars operated on the elevated. This is well under way, and about one-fifth of those in the elevated service have already been changed. This in addition to the ninety-five new cars which have been so constructed. All elevated cars are being equipped with fire extinguishers.

During the past year over 100 worn-out cars have been destroyed. Since Jan. 1, 1903, 1833 surface cars have been painted. The Board has ordered that this work be continued, and that the elevated cars be painted as early as practicable.

The Board has called the attention of the company to the need of having clearly legible signs reading, "Smoking on Five Rear Seats Only," placed in each car in which smoking is allowed. They are now being put in and in such a manner as to allow of their being read from any part of the car.

The Brooklyn Rapid Transit Company has been for several years seriously handicapped for want of power. This has to some extent been overcome, but the Board will insist upon additional power being provided so as to meet the requirements of rapidly growing traffic of the company. The Board has examined the contracts for the erection of power house and supply equipment, and believes that the company is using every possible effort to secure an early completion of plants. Strikes and other causes have occasioned serious and expensive delay.

TABLE I.—STATISTICS OF TRAFFIC FOR ALL ELECTRIC LINES IN NEW YORK CITY

Road	Passengers Carried (Including Transfers)								Car Miles in 1903			
	February		March		April		May		February	March	April	May
	1902	1903	1902	1903	1902	1903	1902	1903				
Manhattan	17,718,831	19,969,943	20,675,616	23,042,060	20,096,043	22,974,934	20,121,544	22,679,788	4,392,348	5,054,556	5,045,191	5,153,600
Interurban	37,862,765	40,127,983	43,992,730	46,217,524	44,100,999	47,260 303	47,132,850	49,967,987	4,524,480	5,266,470	5,202,766	5,347,005
Union	1,978,122	2,318,415	2,591,485	2,848,833	3,020,080	3,268,335	4,041,385	4,455,755	506,509	594,193	586,465	683,661
Brooklyn R. T	20,334,575	22,160,457	24,646,752	26,217,555	24,960,564	27,546,652	27,831,626	30,609,884	3,732,158	4,315,915	4,344,677	4,842,290
Coney Island & Brooklyn	2,063,264	2,278,277	2,569,595	2,723,592	2,848,667	3,023,465	3,579,688	3,984,551	380,885	435,244	457,600	586,636
New York & North Shore	79,400	104,942	134,304	145,812	153,047	188,381	193,877	241,990	41,473	48,176	53,153	63,615
New York & Queens County	619 831	800,172	900,946	1,040,025	1,008,624	1,164,213	1,328,203	1,534,259	216,614	256,235	258,953	300,578
Staten Island Midland	100,154	148,328	156,698	194,526	170,546	217,824	254,398	289,289	64,529	74,282	74,472	92,718
Richmond Light & R. R	202.490	266,293	299,640	322,874	328,752	350.688	427,197	428,164	78,302	89,738	89,209	100,116
Total	80,959,432	88,174,810	95,967,716	102,752,801	96,687,322	105,990,795	104,910,768	113,495,658	13,937,298	16,134,809	16,112,786	17,170,219

TABLE II.—GREATEST NUMBER OF PASSENGERS CARRIED IN ONE DAY DURING FIRST FOUR MONTHS OF 1903

Road	Date	Passengers Carried
Manhattan	April	917,060
Interurban	May 9	1,790,464
Brooklyn R. T	May 30	1,217,369

TABLE III.—STATISTICS OF EMPLOYEES AND CARS IN SERVICE FIRST FOUR MONTHS OF 1903

Road	Employees				Cars in Service			
	Feb.	Mar.	Apl.	May	Feb.	Mar.	Apl.	May
Manhattan	1,599	1,633	1,643	1,602	1,152	----	----	1,512
Interurban	5,873	5,861	5,895	6,188	1,987	2,017	2,021	2,021
Union	----	----	----	----	117	117	163	210
Brooklyn R. T	8,433	8,394	8,758	9,502	1,549	1,609	1,690	1,744
Coney Island & Brooklyn	506	506	554	628	144	147	154	178
New York & North Shore	----	----	----	----	7	7	7	10
New York & Queens County	227	252	269	276	----	----	----	----

PRIVATE CAR FOR AUBURN & SYRACUSE RAILWAY

The Auburn & Syracuse Electric Railroad Company, of Syracuse, N. Y., has purchased from the G. C. Kuhlman Car Company the handsome private car which the latter company exhibited at the Detroit convention. The car, which has been

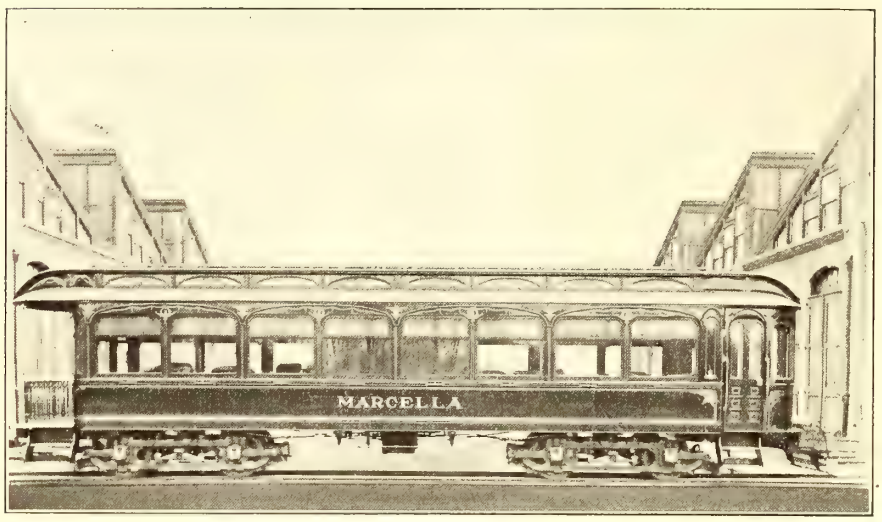


FIG. 1.—EXTERIOR OF PRIVATE CAR

named "Marcella," has been pronounced one of the finest ever built for electric traction.

Fig. 1 shows the exterior of the car. The principal dimensions are as follows: Length over all, 47 ft. 2 ins.; width over sills, 8 ft. 6 ins.; height from under sill to top of roof, 9 ft. 5 ins.; height from top of floor to head lining, 8 ft. 7 ins. The car is constructed according to the Kuhlman standard, having side sills of yellow pine, 4¾ ins. x 7¾ ins., faced with steel plates, 7 ins. x ⅝ in., and sills of white oak, 7¾ ins. sq.; intermediate cross sills are of white oak, 3¾ ins. x 7⅞ ins.; two intermediate longitudinal sills, made of 5-in. steel I-beams filled with yellow pine; cross sills of ⅝-in. tie-rods, with turn buckle on each rod, placed between intermediate sills; two needle beams of white oak, 4¾ ins. x 6 ins., each reinforced with M. C. B. under-truss. The end sills at rear end of car body are faced on outside with 7-in. x ¼-in. steel plates, bent around corners of car and bolted to main side sills. The end longitudinal intermediate sills, also corner sills, where they join under sills are all reinforced with ⅝-in. x 5-in. wrought iron angle corners, securely bolted in place under side and intermediate sills. This makes a very strong bottom. The body framing of the car and roof are along the same substantial construction.

The inside finish is of Mexican mahogany. The panelling between windows is curved, and the panelling at the corners of the car is all bent work. The ceiling is of Empire style, decorated in green tint with relief mouldings in gold. The globe fixtures and individual lamp fixtures are of carved gold-plated solid bronze. The globes and shades are of silver etched glass, Empire design. The lamps on individual fixtures are of ground glass.

As shown in Fig. 2 the front end of the car has an observation room on the left-hand side, occupying a little more than half of the vestibule, the other half being used as the motorman's cab.

The stateroom, which is illustrated in Fig. 3, is in the center of the car. It has a length of two windows, contains a bed and a complete toilet equipment, including a shower bath.

The rear platform of the car can be used as an observation platform, having a circular railing, with heavy gates on both sides, made of heavy, fancy wrought iron grill work. The base of the railing, dash cap, all hinges and locks for gates, together with hood stancheons and hood brackets, are all of heavy polished bronze. All glass is French plate, tastefully embossed. The window sash is equipped with Edwards' sash balance. The car is covered with green velvet carpet, and has movable cane chairs with leather and plush seats. It is equipped with the mahogany writing desk shown in Fig. 2, and a mahogany buffet with leaded glass windows, partitions below for ice-box, and a place for storing the good things so essential on private cars. This buffet is shown in Fig. 4.

On the whole, this car is a veritable palace on wheels, and the Syracuse Company is to be congratulated for having so fine a speciment of rolling stock.



FIG. 2.—OBSERVATION ROOM AND MOTORMAN'S CAB

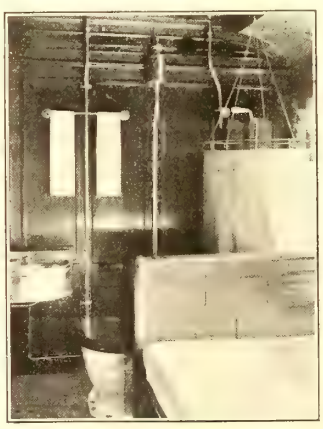


FIG. 3.—STATEROOM



FIG. 4.—BUFFET AND REAR SECTION

THREE-WIRE TREBLE-GUARD BLOCK SIGNAL SYSTEM

Many electric interurban railways have in the past been deterred from installing block signal systems owing to the great expense usually involved. To overcome this difficulty W. D. Marks, of New York, has devised an electric block signal system which he believes to be both cheap and efficient.

This system consists of three wires stretched alongside the track, the lengths of which are determined by the length of the blocks established. Semaphores are connected in parallel to one side of this three-wire system together with white lights, which indicate safety when the current is on that side. To the other side are connected bells and red lights in series or parallel, which indicate danger when the current is on that side.

The polarity of the three wires is determined by means of a commutator box having two polarities, which are reversed each time the commutator is moved one step by the mechanical or electrical action of a car passing over the commutator box,

or making contact with a third rail or wire to the box for the length of the block, thus causing the current to flow first on one side and then on the other side of the three-wire system, operating in this manner the sounding and visible devices connected to them. In the cheapest form a key commutator box is moved by means of a key carried by the conductor, who stops the car for this purpose.

To understand the mode of operation it is assumed that a vacant track is equipped with two-pole commutator boxes connected to the three-wire system, which in turn has semaphores, lights and bells attached to its two sides. On turning the current on at the station it will be necessary to adjust the commutators so that the semaphore side of the three-wire system has current flowing from wire to wire. The semaphores will then show safety by being pendant and the white lights will burn. The bells and red lights on the other side will also corroboratively indicate safety by the bells remaining silent and the lamps unlit, since no current is flowing on that side. Thus, one set of signals will verify the indications of the other set. When a third rail or wire is used it is obvious that it is no longer a "track instrument" system, being similar in its action to systems used on steam roads.

If the current is cut off at the station the horizontal position of the semaphores will indicate danger, the bells will remain silent and both red and white lights will be out. These contrary signals show that either no current is flowing through the system or that it has broken down through some external cause.

Putting the current on at the station again, assume a car to pass over the first commutator box. Its action will be such as to reverse the polarity of the two wires leading forward and

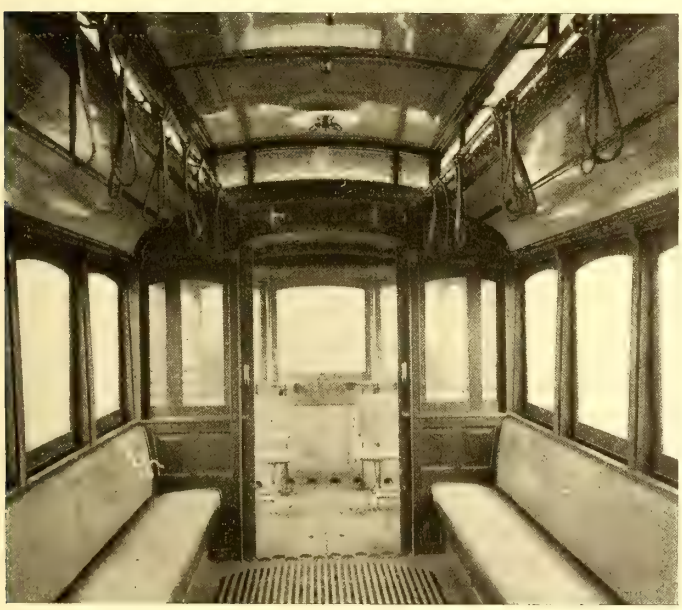


FIG. 2.—INTERIOR OF CAR, SHOWING ARRANGEMENT OF SEATS

passing out of the box. The wire assumed positive becomes negative, and the wire assumed negative becomes positive, but the middle wire remains negative since it branches back from the negative side of box No. 2, one block ahead. The result is that the semaphores which have been at safety (pendant) go to danger (horizontal) at box No. 1 and the near side of box No. 2, the white lights are extinguished, the red lights light up and the bells in the bell box and at all road crossings begin to ring. When the car reaches commutator box No. 2 it reverses the polarity of its commutator and sets the danger signals ahead as before, reversing simultaneously the polarity of the middle wire, which extends backward one block, and showing safety in the block behind which it has just left.

This simple and cheap arrangement is obviously for single-track railways. For double track guarding the rear, only a single long wire is required for each track. The Marks system lends itself to an absolute block system, cutting off current or throwing switches or brake trips. This system is also adapted for passing any number of cars on switches.



FIG. 1.—COMBINATION OPEN AND CLOSED CAR FOR SEATTLE

COMBINATION TYPE CAR FOR SEATTLE & RENTON RAILWAY

The combination open and closed car shown in Fig. 1 is a type lately built by the American Car Company, of St. Louis, for the Seattle & Renton Railway Company. Renton is about 12 miles south of Seattle, and at the lower end of Lake Washington, which is connected with Admiralty Inlet. The line runs over the peninsula—between the lake and inlet—through a fine and populous country, and as the winters are mild this form of car is suitable for service during the entire year. "Eureka" maximum traction trucks are used, as the grades are heavy in places, and the towns along the route too frequent to make high-speed service desirable. The trucks carry the car body low, and thus facilitate ingress and egress. This form of car has extra firmness imparted to the upper structure on account of body ends being set well in. The platforms, it will be seen, are not dropped, and therefore the sills and stringers extend from crown piece to crown piece. The side sills are 4¾ ins. x 7 ins., and plated with ½-in. x 7-in. steel. The sash in the vestibules, the ends and the sides are arranged to drop into pockets. The open portions are protected by curtains, which may be drawn to the floor. Guard rails are permanently fastened between the corner posts of the car and the side posts, and folding gates hinged against the vestibule posts. Double sliding doors are provided in the ends. The interiors are finished in cherry, natural color, and the open parts in ash. The ceilings are birch, handsomely decorated. As shown in Fig. 2, in the closed compartment, the spring cane seats are placed longitudinally, while reversible back ash slat seats are used in the open parts.

The length of car over end panels is 16 ft. 8 ins.; length over vestibules, 32 ft. 2¾ ins.; from end panels over vestibules, 7 ft. 9⅜ ins.; width over sills, 7 ft. 5½ ins.; width over posts at belt, 8 ft. 2 ins.; sweep of posts, 6⅛ ins. of closed compartment and 5¾ ins. of open; from center to center of posts, 3 ft. 3 ins.; thickness of corner posts, 3⅝ ins.; of side posts of open part, 2¾ ins.; of closed, 2¼ ins. The "Eureka" maximum traction trucks have 4-ft. wheel base, 33-in. drivers and 20-in. pony wheels, and are equipped with 35-hp motors.

FINANCIAL INTELLIGENCE

Wall Street, July 15, 1903.

The Money Market

Higher rates for time loans are the principal development in the money market of the week. There seems to be still a good deal of confusion over the exact position of the market for the longer maturities. This is due to the fact that lower rates are quoted regular bank customers for small borrowings than to some of the larger corporations which are applying for heavy accommodations. It is operations of the latter sort which constitute the principal source of demand at the present time. Several railroad companies which are in need of funds for improvements and other purposes, and which are afraid, owing to the disturbed condition in the investment market, to attempt to float any new securities, have had recourse to the expedient of borrowing what they need from the banks. The remarkable part of these transactions is the exceedingly stiff rates exerted from the borrowing companies. The Burlington Railroad has just announced a loan of $5,000,000, secured for six months, on which it has to pay an interest and commission amounting to 6 per cent. There are rumors of negotiations by the New York Central for a much larger amount on the same terms, and it is also not improbable that a similar method of financing will be resorted to by the Atchison. All this means a new complication of serious import for the monetary future. The Pennsylvania Railroad will pay off its $40,000,000 probably during the next few weeks. This had been counted upon to strengthen considerably local bank resources. But if, as now appears, the capital thus returned to the market is to be taken out again right away by other corporations, the outlook is by no means as promising as it seemed to be a short while ago. The extremely heavy liquidation still in progress in the Stock Exchange is bound to help the situation materially. Yet, even thus considering, the low state of bank reserves will not be sufficient. Our market must, evidently, draw heavily upon Europe to meet the needs of the coming autumn, and upon our ability to do this easily depends very largely the future movement of the money market. If the crop output is as abundant as is now indicated it will signify that we shall be able to draw freely from abroad without having to bid excessive premiums for money. Much depends, therefore, upon the crops coming out as well as is now anticipated. As for the immediate position of the banks, the principal source of drain during the past two months, which has been the gold exports, is now removed. Sterling exchange has fallen another three-quarters of a cent in the pound, and is now well below the level at which gold could be exported at a profit. Currency is still moving inward from the interior, and new gold is arriving from Alaska. The chances are, accordingly, that within the five weeks or so which remain before the harvest demands set in, the banks will be able to add a substantial sum to their reserves. Time money is quoted at 4 per cent for sixty to ninety days, and 5½ to 6 per cent for six months. Call money ranges between 3½ and 4 per cent.

The Stock Market

The stock market continues its downward rush, and there is seemingly as much uncertainty as at any time as to when bottom is likely to be reached. Nearly the entire active lists has fallen below the previous low prices established early in June, and, as a whole, may be said to be at the very lowest of the year. In fact, some of the standard issues are below where they were selling three years ago, before the great boom in Wall Stret values began. No one any longer attempts to reason out any connection between market quotations and general financial and business conditions. The two movements are more clearly distinct from each other than at any stage of the decline. Measured by ordinary investment standards, stocks are selling far below their real merits, but investment capital is timid, because of the absence of initiative from powerful financial interests, and because of the fear that even though prices are below real values they may go still lower. Consequently, what Wall Street calls the buying power is exceptionally weak, and the aggresive and daring bear partly has things all its own way. Of course there will be an end sooner or later, and a more or less violent recovery will be due in order to restore equalization, but no one care to say just how far off this limit really is. The principal factor making for the decline is the situation already described in the money market. If corporations of high rank are unable to borrow for less than 6 per cent it is only natural that investors in securities should look for approximately a similar return in their money. Selling of the high grade investment stocks during the last few days, such as Lackawanna, Consolidated Gas, Northwestern and Pullman Palace Car, has reflected this view more clearly than anything else. The higher priced securities, indeed, have suffered more severely than the low-grade stocks all through the market. The culmination will not come until the investment process, now at work so slowly, absorbs the floating market supply. Many good judges feel that this end is near at hand, but few have the courage to make this a prediction.

Philadelphia

The investment group of traction stocks have held very firmly during the week; the speculative group have declined. In the first category comes Union Traction, which has sold throughout at the one figure, 45, and Philadelphia Traction, which has remained without changing at 96. Among the speculative favorites Philadelphia Company common shares dropped 2 points under rather heavy liquidation, from 42⅜ to 40⅜; the preferred lost a point, from 47 to 46; American Railways dropped from 45½ to 45, and Rapid Transit sold off to 16 (equal to 11 with the recent $5 assessment deducted from the market price). Other minor transactions for the week include Pittsburg Traction preferred at 51 to 50, Railways General at 3½, and Consolidated Traction of New Jersey at 67¼ to 67. The trading, except in Philadelphia Company securities, has been too light to be significant. In the case of Philadelphia Company the selling represents liquidation by speculators who have been more or less confirmed by the fall in the general market.

Chicago

Some new low prices for the season have been established among the Chicago traction stocks during the week. City Railway broke 10 points to 185, and West Chicago lost 1½ points to 60. Both of these are low records. Union Traction common, on the other hand, was comparatively steady. It fell at one time to 4 but rallied to 4½. South Side Elevated sold at 99, and later at 99¾. Lake Street at 5⅜ to 5½, Metropolitan common from 24½ to 22, and the preferred at 67. What is considered reliable authority says that the final details of the South Side Elevated increase in capital stock are being pushed vigorously. The fact that it is growing late in the season and that the delivery of material is becoming more difficult is said to be forcing the company to immediate action.

General Manager Roach, of the Union Traction Company, has submitted plans for improving the service to Judge Grosscup which it is believed will involve the expenditure of at least $1,000,000. It is not known just what the plans are, but it is the general opinion that cars from the outlying districts will be brought nearer the heart of the city by electricity instead of by cable, in case the court approves of the plan, and will allow the company to borrow the money for that purpose. In a long communication to the receivers of the Union Traction Company on Friday last Judge Grosscup practically upheld the validity of the ninety-nine-year act claimed by the traction lines of this city.

Other Traction Securities

The Boston specialties, in common with the general market tendency, have sold down to almost their low points of the year. Elevated shares fell 3 points, from 144 to 141; Massachusetts Electric common dropped from 26½ to 25, the preferred from 83⅞ to 82½, West End common from 90½ to 89⅞, and the preferred from 110 to 109½. There was no news of a special nature to account for any of these declines. United Railway of Baltimore income bonds lost a point, from 64⅜ to 63⅜—the latter figure being close to the year's low record. The stock of the company fluctuated between 11 and 11½, and the 4 per cent mortgage bonds, after rising to 93⅝, fell to 92⅞. Other Baltimore sales for the week include City and Suburban 5s at 112, Knoxville Traction 5s at 100, and Petersburg Class B 5s at 124. On the New York curb the traction specialties, as a rule, have been rather neglected during the week. St. Louis Transit (about 1500 shares) changed hands between 23¼ and 23⅝, and other sales comprised American Light and Traction common at 70, the preferred at 96¾ to 95¾, New

Orleans 4½s at 85⅛ to 84⅞, Brooklyn City Railroad at 236, Brooklyn Rapid Transit 4s at 80¾ to 80, and Interborough Rapid Transit at 103 and 102½. Twin City Rapid Transit shares on the New York Stock Exchange sold up at one time during the week as high as 101, or 14 points above their recent low record. Subsequently they yielded sharply in sympathy with the general market. North American stock yesterday broke to 81½ on the forced liquidation of a small holding, but recovered almost immediately to 85.

Security Quotations

The following table shows the present bid quotations for the leading traction stocks, and the active bonds, as compared with last week:

	Closing Bid	
	July 7	July 14
American Railways	44½	45
Aurora, Elgin & Chicago	17	a17½
Boston Elevated	143	140
Brooklyn Rapid Transit	57⅝	52⅜
Chicago City	190	185
Chicago Union Traction (common)	4	4
Chicago Union Traction (preferred)	30	30
Cleveland Electric	73¼	74
Columbus (common)	105½	104
Columbus (preferred)	102	102
Consolidated Traction of New Jersey	66½	66
Consolidated Traction of New Jersey 5s	105	105
Detroit United	73½	65
Electric People's Traction (Philadelphia) 4s	99	..
Elgin, Aurora & Southern	a48	a48
Lake Shore Electric	a13½	a14
Lake Street Elevated	5¼	5½
Manhattan Railway	136¾	132
Massachusetts Electric Cos. (common)	26	24½
Massachusetts Electric. Cos. (preferred)	83	82
Metropolitan Elevated, Chicago (common)	24	20
Metropolitan Elevated, Chicago (preferred)	67	66
Metropolitan Street	122½	118¾
New Orleans (common)	—	12
New Orleans Railways (preferred)	43	42
North American	85½	85
Northern Ohio Traction & Light	21	21
Northwestern Elevated, Chicago (common)	21	21
Philadelphia Rapid Transit	†16½	15
Philadelphia Traction	96	96
St. Louis Transit (common)	23	20½
South Side Elevated (Chicago)	97	99
Syracuse Rapid Transit	24	25
Syracuse Transit (preferred)	76	73
Third Avenue	115	112
Toledo Railway & Light	25½	20
Twin City, Minneapolis (common)	98½	96⅜
Union Traction (Philadelphia)	44¾	44¾
United Railways, St. Louis (preferred)	72	71

a Asked. * Ex-dividend. † $10 Paid.

Iron and Steel

Further reductions in both iron and steel prices have been announced during the past week. Cuts of 50 cents to $1 a ton went into effect last Thursday on the standard grades of foundry iron, while Bessemer pig iron and steel are each off $1 a ton. Consumption in the lower branches of the industry has at length failed to meet the pace set by producers. In most lines of steel and steel manufactures the situation still is very strong. But it is an open question at the moment whether the enormous demand for the higher products, such as rails and structural material will eventually serve to harden the rest of the iron market, or whether the weakness in pig iron will be the dominating factor. Quotations are as follows: Bessemer pig, $18.85; Bessemer steel, $28; steel rails, $28.

Metals

Quotations of the leading metals are as follows: Copper, 14 cents; tin, 27¼ cents; lead, 4⅛ cents; spelter, 5¾ cents.

THE RICHMOND CAR STRIKE

The cars of the Richmond Passenger & Power Company are now running as usual, and carrying many passengers. While there are still some disturbances from time to time, they are decreasing in frequency and violence. Several hundred troops have been withdrawn, but the remainder will be kept until the authorities feel sure that the rioters have been effectually quelled.

CHICAGO UNION TRACTION MATTERS

Judge Grosscup has issued some orders and recommendations to the receivers of the Chicago Union Traction Company which will have an important bearing on the policy of the receivers as regards extensions and as regards franchise renewals. He has granted permission to the receivers to issue certificates in place of the floating indebtedness to the amount of $4,108,000, and he has further ordered improvements made to the amount of $580,000. This will be expended on increase in equipment, and the placing of trolley wires over some of the outlying cable lines to relieve congestion, and so permit more cars to be operated around the down town cable loops. Of the $580,000, about $480,000 is for purchase of new equipment, and $100,000 for equipping the cable lines with electricity.

POLICY TOWARD THE NINETY-NINE YEAR ACT.

Since the arguments presented before Judge Grosscup, June 18, he has had under consideration the probable rights of the companies under the ninety-nine-year act. The results of his consideration of the matter are embodied in the form of instructions and recommendations to the receivers issued July 10. While the conclusions reached by Judge Grosscup are not the final settlement of the controversy, nevertheless the opinion carries great weight, and will govern the policy of the receivers as well restrict the action of the city government. Judge Grosscup's recommendations are as follows:

"It is not my purpose now to announce any final judgment upon the questions raised and discussed. The absence of full discussion on the part of those who are said to believe the ninety-nine-year act to be invalid and inapplicable, makes final judgment at this time inopportune. Nor shall I take any step toward requiring the city to intervene to test the validity and scope of the act. I have not given up the belief that the railway companies and the city will ultimately, in spirit of fair play, get together upon a basis just alike to both, and without the delay of protracted litigation.

"My purpose, therefore, in this communication, after a preliminary statement of the general legal situation, is to give you such instructions in the matter of continuance of your possession of the street railway properties when the 30th of July arrives, and of immediate expenditure of money for the improvement of the system, as will, in my judgment, adequately conserve the property rights of the companies, while requiring them to fulfill their obligations to the public.

"Chicago's initial street car ordinance was passed by the City Council Aug. 16, 1858. The city then had a population of about 95,000, and the purpose of the ordinance was to install a street car service by granting to certain persons therein named, and to others to be associated with them, authority to lay tracks in certain streets, and to operate their railway system in the manner and upon conditions therein named. A period of twenty-five years was fixed for the life of the ordinance.

"But it turned out that at that time there was no State law authorizing municipalities to make such grants. Thereupon, Feb. 15, 1859, the State Legislature, instead of passing a general law conferring authority upon municipalities, proceeded to deal concretely with the Chicago street railway problem by incorporating the Chicago City Railway Company and the North Chicago Railway Company, with authority to maintain and operate their railways—with all necessary and convenient tracks, side tracks and appendages—in and over such streets as the City Council had already set apart or should thereafter set apart for such purpose, leaving it to the City Council and the companies to fix, by contract, the manner, terms, and conditions of such occupancy.

"The grant embodied in this act was for a period of twenty-five years. Supplementary to this, the Legislature, Feb. 21, 1861, created the Chicago West Division Railway Company, conferring upon it like powers and upon like conditions; the duration of the grant being also for twenty-five years.

"Feb. 6, 1865, the so-called ninety-nine-year act was passed. Its manifest purpose was to extend the period of the grants previously mentioned from twenty-five years to ninety-nine years. In express terms it provided that 'all contracts, stipulations, licenses, and undertakings entered into between the Common Council and any one of said corporations respecting the location, use, or exclusion of railways in or upon the streets or any of them, should be continued in force during the life of such act.' Other langauge of similar significance is used.

"It may be a matter of legitimate difference of opinion whether the Legislature meant to confine the legislative grant thus given to the streets named in the act, or meant to include, as well, the streets that must prospectively, in the natural evolution of a street railway system, come into additional use. However that may be, the legislative grant, when rightly interpreted, controls; any ordinance of the city to the contrary notwithstanding; for, under the constitution of 1848 the State, in the matter of control of streets, was the original depository of power, the municipalities having no power except such as was conferred by the State, and exercising that only as the arm of the State.

"Two questions then are presented: Are the granting acts of the Legislature constitutional; and, does their grant of rights to the occupancy of the streets reach not only those actually named in the acts and put into use at the time, but those also that prospectively were seen to be needful to the natural evolution of a street railway system?

"The constitutional points—so far as I have been able to dig any out—do not merit space for statement, much less for discussion. Upon that phase of the matter my judgment is at rest. But what is to be regarded as the legitimate scope of the legislative grants—what streets now used must be held to be in use under the grants thus obtained—is a matter of greater difficulty.

"The legislative grants, whatever their origin, are the existing law of the land. They constitute the contract between the people of the State and the railway companies. They have been the accepted basis for tens of thousands of transactions by people who never heard of the Legislature of 1865. To set them aside now, either covertly or openly, or to deprive them of their full meaning and effect, would be a judicial invasion of contract and a breach of public faith as reprehensible as the repudiation of some undoubted but unpopular public debt. There is no way left, then, to approach the interpretation of these grants other than as one would approach any plainly written contract between disputing parties.

"The legislative grants, taken together, look to the installation of a railway system in the city of Chicago, and, to that end, grant to the railway companies, for the period of ninety-nine years, the right to occupy certain streets, leaving to the city, by contract with the companies, the manner and conditions of such occupancy. Thus, when the companies entered into occupation under these grants, the underlying right of their occupancy was from the State, the manner of its exercise only being governed by the ordinances of the city. The State was the grantor, the city the supervisor. Now, while the power of the city over the exercise of the grant thus obtained from the State was made ample, it remained, and remains, a subservient power. Its function is to promote the uses of the grant; it cannot be made a means to defeat the grant; for the rights of both the city and the companies, under these legislative grants, are substantial rights, and the courts are bound to see that the substance of both is preserved. So much for the streets actually named in the legislative grants and entered upon by the companies at that time. This brings me to the streets subsequently occupied by the companies.

"There is much in the view that the Legislature had in mind in enacting the grants a street railway system, adequate not only to the then present but to the future needs of the city; that the natural growth of the city was foreseen, and a corresponding expansion of railway facilities forestalled; that the grants were meant to cover the branches and twigs as well as the trunks of a growing system.

"In this view the legislative grants were, when passed, already executed and vested as to the streets named in the grants, and though in fieri, as to streets not named, naturally falling in course of the city's growth under the system are none the less effective as vested grants when the new streets are occupied. In this view, too, the ordinances of the city, subsequent to the legislative grants, are to be held to be not independent city grants, but ordinances in execution of the legislative grants, and as such have the effect not of giving right of occupancy, but of prescribing the manner of such occupancy.

"However, I do not mean now to commit my judgment to this view of the legislative grants. I think it forceful enough to guide my action as conservator of this property always upon the understanding that it is open for further discussion on any joining of issues that will finally settle this controversy.

"I will go further. It is within the power of the court to compel the companies to accept any reasonable arrangement that does not involve confiscation of property rights. I am ready, in the interest of a just settlement of these street railway difficulties, to exercise that power.

"There has grown up in the public mind a good deal of confusion respecting the purpose of a waiver by the companies of the ninety-nine-year act and the character such waiver should take. Undoubtedly many think that the surrender of these legislative grants should be without condition and without compensation. On the other hand, there has grown up in the minds of some parties interested in the railway companies the belief that no concessions whatever can be made without the consent of every bondholder as well as the consent of the companies.

"Both of these views are, in my judgment, too rigid and too far reaching. The city can have no real interest in seizing, either by brute force or by superior advantage, that which lawfully belong to the companies, at least until the owner is fully compensated. I am sure the Mayor and a majority of the Aldermen entertain no such project.

"On the other hand, the bondholders, though interested in the legislative grants, are so interested to the extent only that such grants are part security for their debt. Any equivalent security—any arrangement, for instance, whereby the cash value of the unexpired term of the grants should be substituted for the grants themselves, as pledge to the debt—would meet the just claims of the bondholders. This leaves us, then, free to look about for such adjustment as will give to the city all it may fairly ask, without confiscation of property or invasion of vested rights. Fortunately, as I view it, such an adjustment is at hand.

"The feature of the so-called waiver of the ninety-nine-year act that really interests the city lies in the fact that the continuance of title to the companies under the legislative grants may interfere with the city's projects looking to municipal ownership and independently of municipal ownership, to the maintainance of a supervisory and warning hand over the character of service to be given.

"Indeed, so long as the companies have title under the legislation grants, municipal ownership may be impossible. Title to the streets having come from legislative grants and for street railway purposes, it is at least doubtful if the city could constitutionally obtain, even by act of the Legislature, the right to occupy by eminent domain the streets thus covered. Hitherto, eminent domain has been used, not to change the personnel of ownership, but the character of use. It is doubtful, also, if the so-called Mueller law even purports to convey such power. In this state of affairs, unless there be a surrender by the company of its title under the legislative grants, the city might find itself, even when actually ready for municipal ownership, at a complete standstill.

"But aside from municipal ownership, a surrender of title under the legislative grants is desirable to give the city the warning hand. Should the companies enter upon a new period, knowing that the city could not terminate the grant even at the end of twenty years, there might be temptation to disregard such claim for good services as the city has a right to demand.

"But all this can be accomplished by a full surrender, by the companies, of title under the legislative grants, accompanied with a stipulation either to assess presently the value of the unexpired term, or to make such assessment at the end of the new grant. If the grant is not to be renewed no legal difficulty need entangle such an arrangement.

"The right of the companies to occupy and their right to be compensated for a quit claim of such occupancy are distinct legal rights. The former can be surrendered in consideration, or part consideration, of the latter. When so separated, the right of payment becomes a claim against the city, secured possibly by a lien on the title surrendered, but is no longer tied up with the title surrendered. The title, except for purposes of lien, would become extinct; and there would be no payment adjudged until after judicial determination of the validity and scope of the legislative grants. For my own part, I cannot see why this is not a simple and effective way out of present complications.

LET PROSPERITY PAY THE OBLIGATION.

"Conscious of what this generation is doing for the reclamation of the streets of this city from the prairie and the marsh—trying heroically to make of it a finished and compact city—I can see no business or moral objection to leaving it to the next generation to discharge whatever money obligations these legislative grants may impose upon the city. The obligation is theirs as much as ours; we stand in need now, much more than will they, of money to put into actual improvement of street facilities, and the chances are many to few that the obligation will never mature; for, confronted with certain loss of the use of the streets unless good service is given it is almost certain that the companies will fulfill their obligations to the public and thus earn a renewal of the leases."

The court delivered to the receivers the following orders:

1. To suffer no interference with your possession of any of the streets named in the legislative grants, or occupied by the companies named in the legislative grants, or their successors, under ordinances of the city, which, in the view I have outlined, are to be treated as subservient to the legislative grants. Any attempted interference you will report immediately to me.

2. To pledge to the city, if the city wishes negotiation, the co-operation of the court to bring about a settlement on the lines indicated, or such other lines as will observe existing contract rights.

3. Since the receivership began eighty-five cars have been added to the regular service. These were old cars taken from the barns, quickly repaired and repainted, and though in some instances incongrous at this season, have added something to the comfort of the public. The report of the general manager, submitted to me July 8, 1903, shows that upon an expenditure of about $480,000, 100 new double-truck electric motor cars, each capable of seating comfortably more than fifty people, can be added. The general manager also reports that for something less than $100,000 he can equip electrically certain portions of the cable lines, so that cars on outlying lines may be brought electrically much nearer the business center, and, transferred as trailers to cable trains, bring their occupants into the business district without change of cars. This would add to the convenience of the public, and to the capacity of the companies' carrying facilities.

I instruct you to procure the equipment indicated.

TO CONNECT THE TUNNEL WITH ELEVATED RAILROAD IN NEW YORK

The plans to connect the rapid transit subway with the Manhattan Elevated system at 149th Street, New York, so that through express trains can be run from West Farms to the City Hall over the Second Avenue line, have been indorsed by the subway committee of the Rapid Transit Commission, which has ordered a favorable report on the entire matter to be made this week at the meeting of the commission. It also has been decided to favor the proposition to extend the rapid transit subway down Broadway from Forty-second Street to Union Square and thus connect the system by a short cut at that point.

The rapid transit subway comes to the surface just north of 149th Street, near Westchester Avenue, and from that point on runs as an elevated line. It is projected to connect this elevated line at once with the Manhattan Elevated so that through express trains from the Bronx to City Hall can be run by late in the fall and take care of all the through travel to City Hall. Either the Third or the Second Avenue lines could be used, but it is desired to use the Second Avenue line, and thus keep all through traffic off of the Third Avenue elevated. This scheme includes the proposition to widen the Second Avenue line by 6 ft. from Chatham Square to 129th Street, so that three tracks can be used, and to build a double-decked station at Chatham Square so that neither the Second nor the Third Avenue line will interfere one with the other. Real estate experts are already working on the probable cost of the enterprise in the matter of damage to property, and if this is not deemed to be too great the Second Avenue project will be taken up in all its features. Otherwise it will go to the Third Avenue, which already is a three-tracked affair. The double-decker arrangement is a part of the terminal plans submitted to the Board of Estimate and Apportionment over a week ago by Bridge Commissioner Lindenthal.

In addition to this project the sub-committee has considered the proposed plans for a cut-off from Forty-second Street down Broadway to Union Square for a subway extension. At the meeting of the commission this week it will be reported favorably on the findings of Controller Grout and of William Barclay Parsons, the chief engineer of the Rapid Transit Commission. For the time being at least it has been decided to abandon the extension of the subway down Broadway from Forty-second Street to the Battery, and Union Square alone now will be the objective point, thus cutting off the elbow at Forty-second Street and Fourth Avenue.

If the commission favors the plan proposed by the sub-committee it will include the construction of the short-cut with a station at Thirty-fourth Street, from which shuttle trains will be run to the Pennsylvania Railroad station. This is an acceptance of the Interborough Company's offer in separate terms from those presented at the time of the entering of bids for the Brooklyn tunnel. At that time the offer of the Interborough interests was to build the Brooklyn tunnel for $2,000,000 as a flat proposition or for $3,000,000 if the cut-off at Forty-second Street to Union Square be given for $100,000. The former bid was accepted for the Brooklyn tunnel, and now plans and specifications will be prepared for the Forty-second Street cut-off. It is said by William Barclay Parsons that it will be nearly a year before bids can be advertised for on this work, but the scheme has been taken up with favor in its initial stages, and will be reported to the board this week.

THE BRIDGEPORT STRIKE DECLARED OFF

The strike of the employees of the Connecticut Railway & Lighting Company, which has been in progress in Bridgeport and the surrounding suburban towns for two months, petered out July 11, when, after a fight among themselves, the strikers divided and a large majority of them returned to work as individuals. The meeting was productive of heated discussions. Personalities were indulged in, and one faction says that the ballot-box was stuffed. The fight, so report says, was occasioned over the vote on a motion that the strikers should return to work as individuals if the Connecticut Railway & Lighting Company would promise to take back all of the old men. According to the best information obtainable 75 per cent of the strikers voted for calling the strike off. The president of the union held that the action was unconstitutional, in that a majority vote of all members in good standing was necessary to declare the strike off. A large number refused to abide by his decision, saying that the majority vote of those present should be decisive. The public is patronizing the cars, and the company has won a complete victory over the strikers.

The strike went into effect on May 15, because of the refusal of the company to grant the demands of the men for a flat scale of $2.25 for a day of ten hours, a rearrangement of schedules, and recognition of the union. To these demands the company offered a counter-proposition embodying a slight increase in wages and a new schedule, but this was not satisfactory to the men.

AN IMPORTANT DECISION IN CALIFORNIA

The street railway companies of California have won a victory in the Supreme Court, for it has been decided in a test case that companies, when operating in two or more counties, must be assessed by the State Board of Equalization and not by the local authorities.

The decision that has been handed down is the result of an attempt by the tax collector of San Francisco to secure the taxes on the property of the San Francisco & San Mateo Street Railway Company. The company refused to settle and instituted a civil suit to compel the tax collector to desist. The case was in the Superior Court for a long time, but was finally decided in favor of the municipal official. An appeal was then taken to the Supreme Court in order that the legal rights of the contestants might be finally determined.

The one question involved was whether under the State constitution the franchises, rails, machinery and rolling stock of street railroads operated in two or more counties should be assessed by the State Board of Equalization or by the the local officials. On all other points of the dispute the contestants waived argument and submitted the case on the understanding that this one question of jurisdiction be decided.

The attorneys for the corporation cited section 10 article XIII. of the constitution as authority for their stand in the matter. This provision declares that all railroads operating in more than one county of California shall be assessed by the State Board of Equalization. It is decreed that the counties shall receive taxes in proportion to the number of miles of track in their respective territories. The purpose of the provision was to make the work of assessment simpler and more accurate in the case of the big steam railroads. It all happened before the long-distance electric railways were constructed or even contemplated.

The case merely resolved itself into the question of what the term "railroads" means in the constitutional provision cited. To decide the question the record of the debates in the Legislature over the passage of the measure were called for and considered. It was shown that the kind of railroads at which the legislation was aimed was not specified, and hence the term is deemed general in its application by the Supreme Court. It is held that the motive power makes no difference in any case. Even if the electric railways were unknown, that does not alter the effect of the law. Accordingly the judgment of the trial court is reversed and a new hearing is ordered.

PAWTUCKET STREET RAILWAY

The Rhode Island Company, which controls the street railway, electric light and power systems of Providence, Pawtucket, Central Falls and vicinity, has announced that it will expend $1,004,070 in the reconstruction of the street railway system at Pawtucket. This sum includes the cost of laying about thirty-two miles of standard gage tracks and installment of new rolling stock. Over the questions of compensation for grants and franchise requirements, the city has for years so persistently refused to treat the company with anything like fairness that to-day it suffers from an antiquated car service of five or six bench cars, operated over narrow gage tracks. Recently the differences were adjusted, however.

STREET RAILWAY PATENTS.

UNITED STATES PATENTS ISSUED JULY 7, 1903

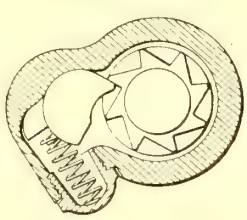
[This department is conducted by W. A. Rosenbaum, patent attorney, Room No. 1203-7 Nassau-Beekman Building, New York.]

732,882. Bogie or Truck for Tramway Cars, Railway Carriages, or the Like; Andrew S. Nelson, Albert Stewart and Thomas J. Foster, Motherwell, Scotland. App. filed Dec. 13, 1902. Relates to means for adjusting the brake to take up wear and for distribution of pressure upon the wheels.

732,914. Brake for Electric or Other Tram Cars or Vehicles; Giles Atherton, Stockport, England. A track brake whose shoe consists of a composition of rubber; also means for adjusting the shoe so as to take up wear.

732,967. Trolley Pole; Ernest Schlicker, Pittsburg, Pa. App. filed Feb. 21, 1903. Details.

733,015. Trolley; Arthur S. Deem, Reading, Pa. App. filed July 9, 1901. A trolley comprising duplicate contact wheels mounted in a frame pivoted in the trolley harp and carrying a pair of fingers capable of being thrown over the wire to retain the trolley in place.



PATENT NO. 733,185

733,048. Fender for Cars; William Johnston, Millersburg, Ohio. App. filed Aug. 30, 1902. A tilting netting frame mounted on a supporting frame, pivotally connected to a car truck independent of the car body, said tilting frame adapted to elevate a person falling thereon above the track.

733,185. Brake Handle; James Grady, New York, N. Y. App. filed Feb. 19, 1903. The upper end of the brake shaft is provided with ratchet teeth, and the base of the handle, which is made hollow, fits thereon, surrounding the teeth.

733,252. Motor Control System; William O. Mundy, Schenectady, N. Y. App. filed Jan. 2, 1902. The arrangements are such, in a multiple unit system, that the operation of the circuit controlling switches in all operations of the master controller will depend upon the proper operation of the reversing switch.

733,271. Electric Brake; William B. Potter, Schenectady, N. Y. App. filed Jan. 30, 1901. Current from an auxiliary source can be thrown into the braking circuit of the motors to hold the brakes after the motor has ceased to rotate.

PERSONAL MENTION

MR. SETH BARHAM has resigned as superintendent and purchasing agent of the Kickapoo Transit Company, of Springfield, Mo., to engage in the lumber business in Kansas City. Mr. Barham will be succeeded by Mr. Jeremiah Fenton, late postmaster of Springfield.

MR. GEORGE A. SAWYER, who has been general freight and passenger agent of the Cincinnati, Georgetown & Portsmouth Railroad, of Cincinnati, O., has been appointed general manager of freight and express traffic of the Union Traction Company, of Indiana.

MR. CHARLES HATHAWAY, of Cleveland, O., the oldest street railway builder in the United States, is dead of pneumonia. He was the father-in-law of Mr. F. DeHaas Robinson, the baseball magnate, and former treasurer of the Cleveland Electric Railway. Mr. Hathaway was eighty-four years of age.

MR. LOUIS McFERRAN has been appointed assistant manager and auditor of the Fort Wayne & Southwestern Traction Company, of Fort Wayne, Ind., to succeed Mr. B. R. Stephens. Mr. McFerran was formerly in the Erie offices at Huntington, and he has had much experience in clerical work.

MR. CHARLES S. THRASHER, formerly auditor of the Cincinnati, Hamilton & Dayton Traction Company, of Hamilton, Ohio, and more recently auditor of the Western Ohio Railway at Lima, has been appointed general manager of the New York & Long Island Traction Company, of Mineola, N. Y.

MR. R. H. MYERS, who for seven months past has been connected with the Sandusky & Southwestern Electric Railroad, of Sandusky, Ohio, has been promoted to the position of general superintendent of the company, to succeed Mr. W. H. Wyke, who is looking after the business connected with the bonding of the road.

MR. GEORGE H. GIBSON has resigned as manager of the advertising and publication department of the B. F. Sturtevant Company, of Boston, Mass., to accept an appointment with the International Steam Pump Company, of New York City. Mr. Gibson was formerly connected with the Westinghouse Companies' Publishing Department, of Pittsburg, Pa., and was for two years a member of the editorial staff of the Engineering News, of New York.

MR. JOHN MAHANEY, who for many years has been connected with the St. Louis Transit Company, as superintendent of the second division, has resigned his position to become auditor of the St. Louis & Suburban Railway Company. On July 8 he was presented with a silver tea service by the employees of his former division. Mr. Mahaney's division included the Cherokee, Tower Grove and Jefferson Avenue lines, and was one of the most important in the operating department of the system. Charles Turner, superintendent of the Olive Street division, is slated to succeed Mr. Mahaney. These changes will go into effect at once.

MR. THOMAS CHALMERS, one of the founders of the Fraser & Chalmers Company, of Chicago, now merged into the Allis-Chalmers Company, died at Chicago on Tuesday, July 14. Mr. Chalmers was born in Dronley, near Dundee, Scotland, in 1816. He followed the trade of a machinist at the age of fourteen in Scotland and England, and came to this country in 1843. After settling in a farming site near Lockport he walked to Chicago and sought employment as a machinist in 1844. Later he was employed by Mr. P. W. Gates and was associated with him in business for thirty years. In 1855 he assisted in forming the firm of Gates, Warner, Chalmers & Fraser. In 1871 the firm of Fraser & Chalmers was organized. In 1901 Mr. Thomas Chalmers withdrew from active participation in the business.

MR. A. M. MATTICE, chief engineer of the Westinghouse Electric & Manufacturing Company, has just been appointed chief engineer of the Westinghouse Machine Works, but will continue his connection with the Electric & Manufacturing Company in the capacity of consulting engineer. Mr. B. G. Lamme has been appointed acting chief engineer for the Electric & Manufacturing Company. Mr. Mattice was graduated from the Naval Academy, of the class of 1874, and for a considerable period after graduation acted as assistant to the engineer-in-chief of the navy. After leaving the naval service he made a study of the application of electricity to power purposes, and as chief assistant of Mr. E. D. Leavitt, of Cambridgeport, Mass., chief engineer of the Calumet & Hecla copper mines, supervised the application of electric power to a number of the Michigan copper mines. He was appointed chief engineer of the Westinghouse Electric & Manufacturing Company about twenty months ago.

Mr. Lamme has been identified with the Westinghouse Company for a long time as its chief designer. He was graduated from the Ohio State University in the mechanical engineering course in 1888, and soon after entered the employment of the Westinghouse Electric Company. He has designed a great deal of the power apparatus of this company, including the early No. 3 railway motor; the 1500-kw generators installed in Philadelphia, the 5000-hp generators at Niagara, the 5000-kw generators and the 1500-kw rotaries for the Manhattan Railway.

MR. L. D. MATHES has been appointed general manager of the Union Electric Company, of Dubuque, Ia., to succeed Mr. F. L. Dame, resigned, who has become connected with the General Electric Company. Mr. Mathes formerly was general superintendent of the Trenton & New Brunswick Railroad, and before his connection with that company was general superintendent of the Norfolk & Atlantic Terminal Company, of Norfolk, Va. Mr. Mathes is thirty-two years of age, and was educated at the University of Tennessee. His first mechanical experience was in the shops of the Memphis & Charleston Railroad, at Memphis, Tenn. He soon abandoned the steam railroad field, however, and joined the forces of the Edison General Electric Company. With that company, its successor, the General Electric Company, and with the Westinghouse Electric Company, he engaged for five years in the construction, equipment and operation of electric railways in various parts of the country. Mr. Mathes, deciding then to take up the operating side, accepted an important position with the construction department of the Buffalo & Niagara Falls Electric Railway, at the time of its construction one of the most pretentious of electric railway undertakings. Later he was appointed superintendent of the Norfolk & Ocean View Railway, and by his economical management succeeded in placing the road in so substantial a financial position that it was taken out of the hands of the receiver, and transferred to its original owners. Mr. Mathes was connected with this company two and one-half years. After a short connection as general superintendent with the Charleston & Seashore Railroad, of Charleston, S. C., he accepted the position of general superintendent of the Norfolk & Atlantic Terminal Company, which does an immense freight and pleasure business. As manager of the Union Electric Company Mr. Mathes will be called upon to solve the trying questions of a combined street railway, electric lighting and power system, but he is well fitted by his varied experience for the duties that will evolve upon him.

MR. W. W. MILLER, of New York, who, as first vice-president of the New Orleans Railway Company, of New Orleans, La., has been in active charge of the affairs of that company since last March, and who now returns to New York, after having turned over to Mr. E. C. Foster, formerly general manager of the Massachusetts Electric Companies, the management of the property in his dual capacity of president and manager of the company, is a native of Washington, D. C. He was born in that city on May 14, 1870, and is a son of William J. Miller, who, for many years, was one of the leaders of the bar of the District of Columbia. Mr. Miller first attended school at the Sisters of the Holy Cross in Washington, D. C., where he went for about four years; after that he attended the public schools, passing through the common school and high school. He did not take an undergraduate course at college, but immediately upon finishing at the high school started in on a law course at the National University in Washington, D. C., and after the required two years' course took the degree of LL.B. in the spring of 1890. He remained another year in the law school, taking the post-graduate course, and gained the degree of LL.M. the following spring. When admitted to the bar he was just twenty-one years old. It seems that he had long been determined to go to New York to enter upon his professional career. His parents were very much averse to this, for it was expected that he would take a position with the law firm of which his father was a member. It was in April, 1891, that Mr. Miller arrived in New York, and immediately, through his own efforts, he secured a position with Messrs. Hornblower, Byrne & Taylor, prominent lawyers. Three years after entering the firm's employ Mr. Miller became a partner. At present the firm consists of five members, Messrs. Hornblower, Taylor, Byrne, Miller and Potter, and the office force consists of about thirty persons. The National University at Washington has conferred on Mr. Miller the honorary degree of LL.D., and in 1900 Princeton University conferred on him the honorary degree of A. M. In addition to his professional duties Mr. Miller is also a trustee in many large corporations. Beside his legal connections and the position he holds with the New Orleans Company, may be mentioned the fact that he is vice-president of the Lake Street Elevated Railroad, of Chicago.

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Noise Reduction on the Boston Elevated

It is gratifying to note that considerable success is attending the efforts of the Boston Elevated Railway Company to reduce the noise which is more or less inseparable from the operation of its trains. Although we are not aware that any apparatus has been devised that is capable of checking the estimate of 25 per cent reduction in two years which a Boston editor recently gave as the measure of diminution accomplished, there is no doubt that the management has obtained noteworthy results in dealing with this trying problem.

Few railway systems in America have given anything like the attention to the noise question which it has received, and is still getting, in Boston. Doubtless the attitude of abutting property owners has been a powerful stimulus to the company to employ every means at hand to lessen the sound of its elevated cars, but whatever the cause the results are a public benefit of no small value. The use of a leather link in the contact-shoe support has contributed materially to the reduction of noise, but perhaps the greatest success has been attained through the grinding of the car wheels to remove flat spots. The inspection of car equipments, air brakes, trucks and motors with the adjustment of loose parts in view is another factor which is being carefully applied toward the problem's solution. For some time records of the exact speed of the trains at every point on the elevated division have been in the company's possession, these figures being obtained from the readings of a magnetogenerator, calibrated in terms of speed and belted to a drum mounted on the car axle. No item of information bearing upon the noise question has been knowingly slighted.

"Jim Crow" Legislation Unpopular in the South

The enactment of the "Jim Crow" laws in several Southern States was a mistake, and the impracticability of enforcing these measures was pointed out at the time, as they imposed restrictions and unnecessary expense upon the operating companies without affording relief to the community; in fact, instead of regulating the evil complained of, they aggravated the annoyance and discomfort of the traveling public. Now, that the Supreme Court of Tennessee has declared the law invalid because of a technical defect, it is evident that public sentiment will not favor any attempt to re-enact the measure. Commenting editorially upon the decision the Memphis "Scimitar" says: "Whatever the reason, the decision will be welcomed in Memphis, where it is realized that the people who ride in street cars would be put to serious inconvenience and annoyance if such a law were in force." The "Commercial Appeal" says that the law was conceived under circumstances "which had best not be related at this time," that it was "almost surreptitiously hurried through the Senate of the last General Assembly," and rejoices that it is now declared "invalid, illogical, unjust and unconstitutional." It seems to be the general sentiment wherever an attempt has been made to comply with the law that it is impractical and incapable of enforcement. These expressions do not mean that there is any change in public sentiment in the South on the general subject of the distinctions that must be observed with relation to the color line. It is pointed out that it is one thing to be forced to travel for hours or days with negroes on railway trains and quite another to ride with them for a few minutes on a street car. The railroads find no difficulty in complying with the "Jim Crow" law, but, as was proved in New Orleans and Memphis with the street railroads, it is almost an impossibility. The decision will be welcome relief to the operating companies, and it is to be hoped that this is the end of Jim Crow legislation, so far as street railways are concerned.

The Life of Franchises

The subject of the proper length of franchises is one which is now agitating municipal councils and street railway companies in several of the Western cities. Franchises for the use of streets, which were granted a number of years ago, are now expiring in certain cities, and the conditions upon which they will be extended and the life to be given their renewal are subjects of serious discussion. To most Eastern railway managers the discussion on this topic seems somewhat incomprehensible, as does the claim of a recent writer on railway finances that a sinking fund should be established by every street railway company to cover the loss caused by the lapse of its franchise when

the period for which it has been granted has expired. Most of the street railway franchises in the Atlantic States, outside of Massachusetts, are of the so-called perpetual kind, although not all of them, while those in Massachusetts are revokable if the railway company does not supply the service to which the municipal authorities and the railroad commissioners consider the public is entitled.

Theoretically both the perpetual franchises and the revokable franchises are unsatisfactory when viewed from the standpoints of both company and public. Theoretically the perpetual franchise offers no protection to the city, because the railway company, being secure in its use of the streets, can pay for this privilege an inadequate compensation and can furnish an inadequate service. On the other hand, the revocable franchise seems to offer no protection to the railway company. It would appear prima facie a most unbusiness like proposition for a street railway company to make a large investment in irremovable property like track and power stations on the basis of a franchise which can be revoked at a moment's notice.

As we have said, neither of these plans seems theoretically desirable. Practically neither of them has the serious objections which theory would indicate. Companies with perpetual franchises in New York and other Eastern States have found that although the franchise is perpetual in name its title does not prevent either a rigorous supervision of all details of operation by the State railroad commissioners or an enforced increase in the compensation paid for the use of the streets to the State or municipal authorities. Whether or not the State, as a final resort, has the power to declare such a franchise void or not is of little moment if it can, through its commissioners, compel the operation of additional cars if they should consider the public needs require an additional service, can specify the speed and compel use of safety appliances, or through legislative enactment can regulate the fares or increase the returns paid to the city and State for the use of the streets. On the other hand the revokable franchise, as in force in Massachusetts, possesses little danger to the railway companies, provided the power is never invoked except in extreme cases, where the welfare of the public is absolutely at stake. Massachusetts is famous, however, for the high intelligence of its administrative officers, and we doubt whether the plan followed in that State could be satisfactorily enforced elsewhere, but the New York plan of perpetual franchises, which is theoretically the other extreme, is practically on the same basis and is equally satisfactory from the public point of view.

We do not mean to say that such arbitrary power vested in legislatures or State boards always has or always will give absolute satisfactory results, even in the States mentioned. There has been and will be abuse of this power, but the courts are always the final resort, and can be appealed to in case of any serious injustice. Any plan of this kind involving constant inspection and occasional interference with the railway company by the authorities may not be the most perfect form of government, but we believe that on the whole the "perpetual" form of franchise will be found to be much more satisfactory to the public than where, as in many of the Western States, the franchise is granted for a predetermined set of years. It may be taken for granted that even with a limited franchise the court would not sustain an effort on the part of the city authorities to transfer the franchise at the end of the term under such conditions as to amount to practical confiscation of the property of the operating company. But even if this is so, the fact that the franchise is nominally limited to a short term introduces into the minds of capitalists an element of uncertainty as to the future of the property which cannot but be detrimental to the service, especially during the few years preceding the termination of the franchise in question.

Needless Franchise Restrictions

The Rapid Transit Commission of New York, at the dictation of Mayor Low, has caused to be inserted in the franchise of the Hudson & Manhattan Railroad Company a number of provisions that might hamper the projectors of an enterprise less favorably situated, although it is said that the conditions under which the proposed North River tunnel is to be built will enable the company to accept the ordinance in the amended form, and that the restrictions will not affect this particular enterprise. Aside from the present case, and in view of the fact that the Mayor announced his intention of insisting upon similar provisions in all franchises for public service corporations hereafter, the effect of such a policy must be viewed with apprehension by those who are dependent upon similar enterprises for the development of their business, as, for instance, owners of real estate and merchants in outlying districts. Any movement tending to hamper or obstruct the completion and extension of transportation facilities is a serious menace to this class of investors, and the policy of imposing severe restrictions and oppressive regulations must result in the abandonment of many projects from which the entire community would reap substantial benefit.

Mayor Low insists that all transportation franchises hereafter shall contain a clause giving the city closer supervision over the operation of the plant, enabling the city, through its officers, to regulate the service and determine how the needs of the several sections may best be served. These are practical operating problems, and neither Mayor Low nor his advisers can consistently claim to be possessed of sufficient knowledge to enable them to speak intelligently, not to say authoritatively, upon the subject. The only redress left to the companies is through an appeal to the courts to relieve them of the oppression which corrupt or incompetent city officials might attempt to inflict. The history of New York's municipal government does not inspire confidence, and the chapter that is being furnished by the present administration is not a record of brilliant achievements or a consistent, well-defined policy; therefore, those who have given this subject earnest consideration are justified in withholding approval from the proposal to intrust such important matters to politicians and pedants.

Interurban Service

The Institute papers on electric railway subjects have been presented in whole or substance in these columns. That by Mr. Armstrong on high-speed electric railway problems, which was printed in our issue of July 4, is one of the most suggestive and useful contributions to technical literature that we have seen for many a day. It deals very directly, in particular, with one of the most troublesome questions that confronts the engineer—the effect of stops on schedule speeds and the requirements for motor capacity. By drawing up curves, based on a standard motor for interurban work and showing output per ton-mile and schedule speed, as related to the stops per mile, Mr. Armstrong makes it at once possible to ascertain the requirements for any given schedule and to assign the limits of possible speed and number of stops at least approximately. The only criticism that we should make on his results are that they are based on a set of coasting experiments, which we think assigned an excessive value to the resistances, but this has at least the merit of being an error of conservatism likely to lead

to safe values for the other quantities. Three sets of curves are given, for one car, two cars and trains of eight or more cars respectively, so that comparisons can be quickly made to determine the most suitable service under given conditions. Perhaps the most striking feature of the paper is displayed in the relations of these curves, showing, as they do, in the most striking manner the immense saving in the energy required at high speeds, due to operating even short trains in place of single cars. The operation of single cars has been rather a fetish in electric railroading, but with the expansion of interurban service has come a half-unconscious recognition of ordinary railway precedents, so that most of the roads which attempt what would be called high speed from the ordinary railway standpoint, do so with trains rather than single cars.

Another most instructive result which appears in Mr. Armstrong's curves is the violent way in which frequent stops make themselves felt when high speed is attempted. With single cars and a maximum of 60 m. p. h., one stop per mile brings the schedule speed down to a little less than half that figure, while two stops per mile reduces the schedule to little more than 20 m. p. h. It becomes then perfectly evident that in order to secure quick running time for suburban work the stops must be infrequent, and this is true even when the maximum speed is as great as 75 m. p. h., which, with one stop per mile, brings the schedule to 28 m. p. h. Hence, electric roads to compete with ordinary suburban roads must follow suburban practice and stop at as few stations as traffic permits. In other words, this condition implies a distinct class of suburban and interurban electric roads differing from other railroads only in motive power. We have many times alluded to the gradual evolution of such a class. Of its usefulness and of the general advantage of the electric motive power there is no manner of doubt, but such roads are in no sense ordinary tramways and must have the same sort of terminal facilities as other railways to gain the full advantage of their operating schedules. They belong to a complete rapid transit system, rather than to the class of surface tramways. Suburban roads of more modest speed are quite a different matter. A maximum speed of 30 m. p. h. allows a schedule of 22 m. p. h. with one stop per mile, and of 14 m. p. h. with three stops per mile, and equipments of this sort can readily be fitted to work over tramway track at tramway speeds in the urban part of the run, while the faster equipments involve many difficulties and some dangers in working at greatly reduced speeds, and do best when equipped with regular railway running gear and operating on regular railway track.

The duplex evolution of the interurban road, therefore, comes about very naturally, and is likely to continue, with fewer and fewer transition types as time goes on. The railway type will steadily tend to running trains, and the tramway type will adhere to single cars. Another convenient use of Mr. Armstrong's curves lies in predetermining schedules on a long line. For instance, with a maximum speed of 45 m. p. h. and stops every 2 miles on the open part of the route, the schedule speed would be about 33 m. p. h., while with three stops per mile in the suburban districts the schedule would have to be cut to about 16 m. p. h. These figures do not vary greatly in operating a train, but the energy per ton-mile does vary immensely, and the relation of this energy to operating expense can be readily determined. Mr. Armstrong goes through a computation of this kind, and shows that for a schedule of 40 m. p. h., and stops every 4 miles, it would pay to run two-car trains, even at a considerably increased first cost in the sub-station equipment. His point as to the difference in traffic as between a car every half-hour and two cars every hour, seems to us a little fine-drawn, since the capacity is the same, and a road which could not fill the cars under either condition would hardly be a paying proposition. The computation shows, however, the serious effect of sub-station costs in a most pointed fashion. The development of the larger electric traction seems to us to depend on the abolition of these costly sub-stations with rotaries, or at least upon a great reduction in sub-station expenses. Much of the substance of Mr. Armstrong's paper is not unfamiliar to electric railway engineers, but it is exceedingly well put, and will repay careful reading and preservation for reference. The exactitude of the absolute results, of course, depend on the original train resistance data, but the relative results are sound to a reasonable degree of approximation, and they are certainly in most convenient form.

Compensation for Franchises

One of the subjects upon which representatives of the Chicago City Railway Company and the city officials have been unable to agree is the amount of compensation to be paid for the new franchises and the form this compensation is to take. The Mayor and his adherents demand that the traction companies waive their claims under the ninety-nine-year franchise act, and make other concessions without any assurance whatever from the city even as to what may be expected in return. The companies, on the other hand, consistently maintain that these are matters for negotiation; that in relinquishing any rights or privileges they possess assurance must be had from the city of equivalent compensation in return. This attitude is in line with Judge Grosscup's opinion on the proper policy to be pursued by the receivers for the Union Traction Company, and it is manifestly so fair and logical that we believe it will be generally accepted by the conservative element of the community.

Already conflicting interests are at war over the form which the proposed compensation is to take. Property owners along the streets occupied by the railways have set up the claim that the license, tax or fee of whatever form exacted from the operating companies should be expended in paving and repairing the roadway along the route, but this is not popular with the great mass of patrons of the street cars who do not own real estate or at least have no investments which would be benefited by this plan. Some of the newspapers, recognizing this condition, have taken up the advocacy of a reduction of fare as an alternative, but this does not produce any enthusiasm, as there is no general demand of this kind on the part of the people. What the city really needs is improved service, which can only be procured at the expenditure of vast sums for modern equipment and construction throughout the entire city. It would seem, therefore, that the logical solution of the problem would be co-operation between the city and the owners of the railway lines, which would enable the management to place within reach of the community, with the least possible delay, a thoroughly modern service such as the city of Chicago is entitled to and which it must have if its industrial progress is to be encouraged and assisted. The companies have already shown that they stand ready to perform their part if the city will do likewise. The interests of the entire community would best be served by the adoption of a plan that would recognize the fundamental principle that the mission of street railways is to provide transportation facilities for the people, and that the men who build and operate these roads are entitled to a fair return upon their investment and adequate compensation for their services.

THE FIRST THIRD-RAIL ROAD IN SWITZERLAND

BY HENRI SOMACH

The first third-rail electric railway in Switzerland was put in operation recently and extends from Fribourg to Morat, near Neuchatel. It is 22.4 km in length and forms a part of the regular railroad system of Switzerland; in fact, the southern section of the line, 21.4 km (13.3 miles) in length, was until recently operated by steam. The change from steam to electricity was decided upon partly owing to the cheapness of electric power in Switzerland, but principally because the cost of operation by steam was very high, owing to the heavy grades encountered.

A profile of the line shows a large number of heavy grades for steam line. The difference in elevation between the termini, Fribourg and Anet, is only 195 m (640 ft.), but the maximum grade is 3 per cent, and there is one grade of 2 per cent for a length of 3.7 km (2.3 miles).

After deciding upon the adoption of electricity the question of direct-current or three-phase motors was carefully considered, and the former was finally adopted, in spite of the fact that an 8000-volt, three-phase station belonging to the canton of Fribourg was to furnish the power. The principal reasons which led to the selection of direct current were as follows:

(1) The direct-current system permits the utilization in the sub-stations of storage batteries to equalize the load and thus avoid sudden changes of load in the power station.

(2) These batteries also act as a reserve in the case of momentary interruption to the primary circuit.

(3) The automatic regulation of direct-current series motors is very desirable on grades where they reduce speed with an increase in load. On the other hand three-phase motors, which run at a constant speed, would have to be designed of sufficient capacity to maintain this speed on the steepest grade on the line, and this would require much larger motors than if direct current was used.

(4) A third rail contact is better for large currents than an overhead trolley; moreover, the use of the three-phase system introduces complications in the overhead work, especially at stations, switches and crossings.

The overhead system is used at both terminal and at certain intermediate stations, and current is taken by a bow trolley. Elsewhere the third rail is used, protected by wooden guards at points where there would be danger of accidental contact with it.



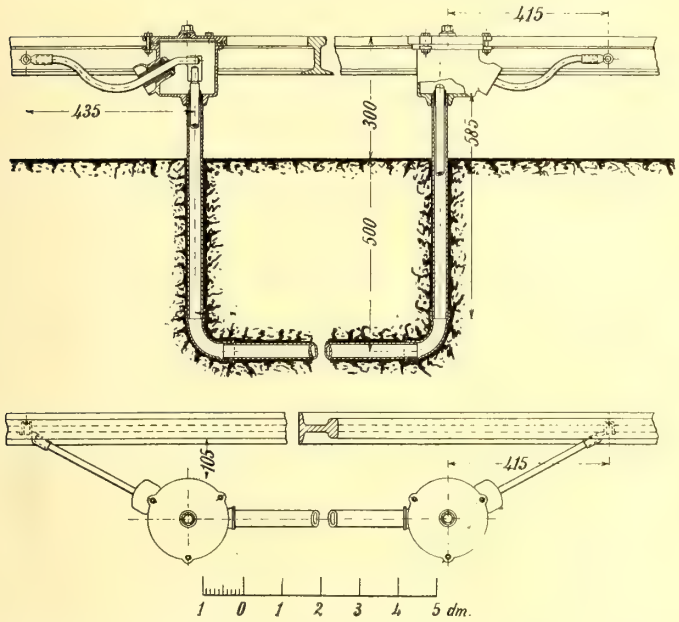
GRADE CROSSING WHERE THIRD RAIL IS CHANGED FROM ONE SIDE TO THE OTHER TO SECURE A SHORT BREAK

The third rail itself is a T-rail, weighing 25 kg per meter (50 lbs. per yard), and is laid in lengths of 20 m (65.8 ft.).



ELECTRIC FREIGHT TRAIN IN STATION AT MORAT

The conductivity is 0.13 ohms per meter length and per square millimeter, and it is bonded with copper bonds of 100 sq. mm section (No. 0000). The rail is mounted on special insulators, as shown on page 116, composed of a casting, on which is an Ambroin insulator, which in turn carries a casting for holding the third rail. A disc of lineoleum is placed between the insu-



PLAN AND SECTION OF METHOD OF ELECTRICALLY CONNECTING THIRD RAIL AROUND BREAKS

lator and the upper casting to reduce the shock of the blows on the insulator. The insulators are carried on special ties placed between the regular ties and spaced 4 m (13 ft.) apart. The top of the third rail is 135 mm (5⅜ ins.) above the top of



INTERIOR OF MOTORMAN'S COMPARTMENT, SHOWING CONTROLLING APPARATUS

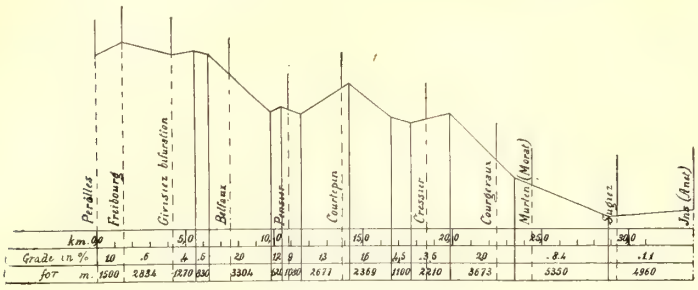


SUB-STATION AND PASSENGER STATION AT PENSIER, SHOWING A POINT WHERE CHANGE IS MADE FROM THIRD RAIL TO OVERHEAD WIRE



APPARATUS FOR SETTING THIRD RAIL IN POSITION

the track rail and 660 mm (26 ins.) from the gage line. Expansion joints are located every 100 m (305 ft.), where about 15 cm (6 ins.) have been left between the ends of the rails. As



PROFILE OF LINE

the third rail is held in the insulators by gravity only it is anchored to prevent it creeping by means of two steel wires 6 mm (¼ in.) in diameter. These anchor wires are connected with the third rail and also to cross ties, and insulation from earth is secured by two strain insulators. The third rail is carried on one side or the other of the track, depending on local conditions.

The motor cars are furnished with four shoes, two at each end, and the distance between the two shoes on each side is 14.5 m (47½ ft.).

The usual composition of a train is one double-truck motor car, one six-wheel trail car and three four-wheel trail cars.

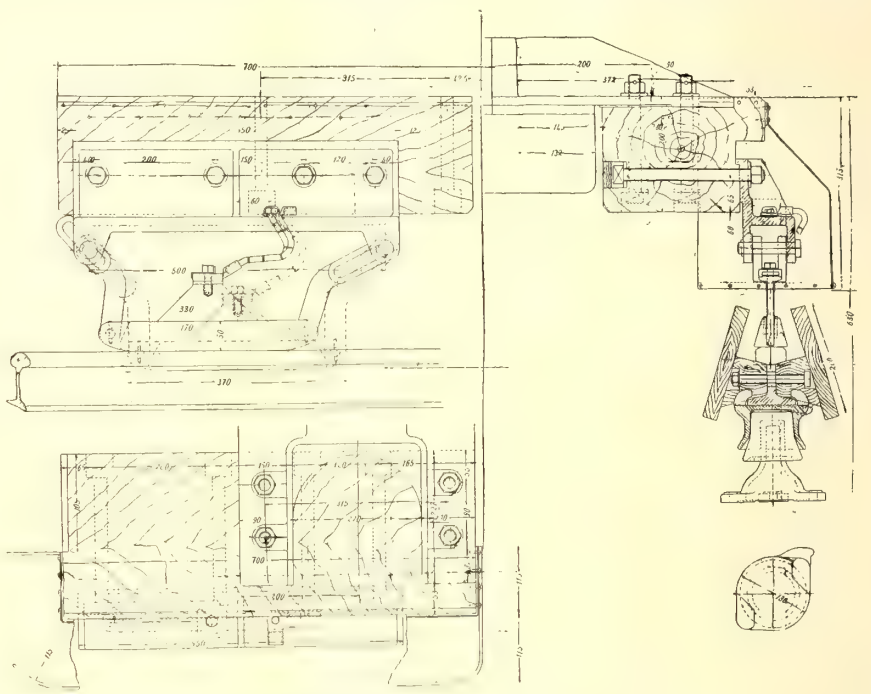
The speed of a train of 70 tons on a 3 per cent grade is 23 km (14½ miles) an hour, and on a level is 35 km (22 miles) an hour. The dimensions of the motor cars are as follows:

Length over all, 17.3 m (56 ft. 9 ins.).
Length of body, 16.2 m (53 ft. 3 ins.).
Total width, 3.035 m (11 ft. 3 ins.).
Truck base, 11.5 m (37 ft. 9 ins.).
Wheel base, 2.6 m (8 ft. 6 ins.).
Weight of motor car, 33 tons (72,600 lbs.).

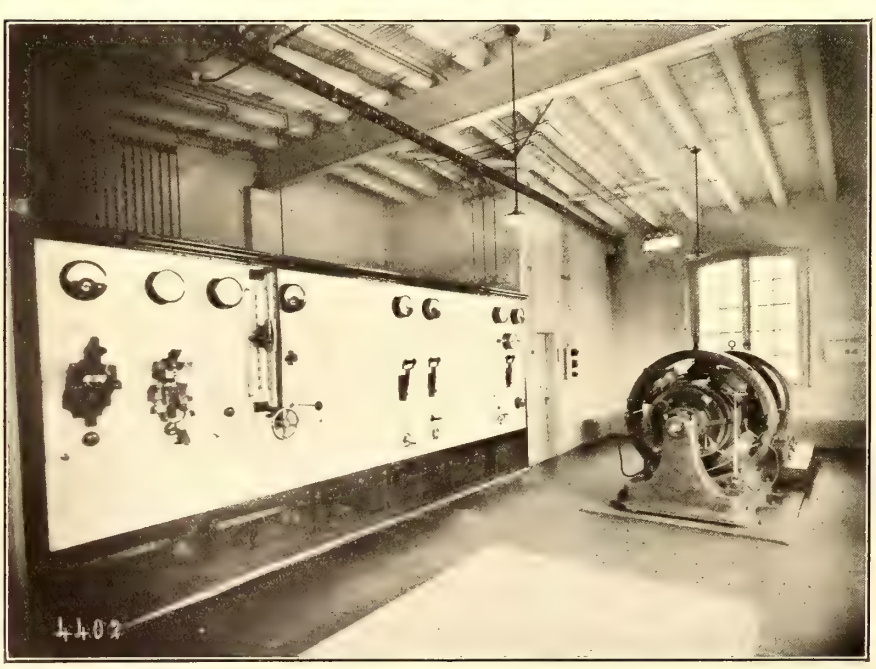
The motor cars seat forty-eight passengers, and have a baggage compartment and motorman's compartment. They are equipped with three brakes, viz., a Westinghouse air brake, a hand brake and an electric brake, also with an air whistle. The electric braking is secured by operating the motor as generators through a resistance.

Each motor car is equipped with two Oerlikon motors of type TM-20 and of 150 hp each. They operate at 750 volts, with two series parallel controllers. The shoe is of malleable steel and has a somewhat novel suspension, as shown herewith. When operating with the bow the motorman cuts off the circuit from the shoe by means of a special switch, and when the bow trolley can be lowered by means of a small winch operated by the motor.

As has already been stated the road takes current from an 8000-volt, three-phase circuit. To transform this to direct current there are two sub-stations, one at Pensier, 11 km from Fribourg, and the other at Morat, 24.5 km. The daily traffic consists of 10 trains, of 70 tons each, each way during 18 hours of the day. This requires the output for a sub-station to be that to operate only one train at a time. Each sub-station contains a storage battery set consisting of 400 cells, with a capacity of 207 amp.-hours. The power necessary to operate a train on the steepest grade is a maximum of 240 hp, and this power, as will be seen, is largely supplied by the battery.



DETAILS OF THIRD RAIL AND CONTACT-SHOE



INTERIOR OF MORAT SUB-STATION

The other electrical apparatus used in the sub-station consists of a synchronous motor, direct coupled to a direct-current generator of 100 kw, wound for 800 volts direct current, and running at 500 r. p. m.; also a direct-current exciter of 30 volts and 180 amps. The synchronous motors have a capacity of 135 kw, and are operated directly from the three-phase circuit at 8000 volts. The switchboard in each sub-station consists of six panels with two in reserve. As for the battery, it can be divided into two sections connected in parallel; after discharging the two halves are connected in series. In this way it is not necessary to use boosters.

The entire construction of the road, with the exception of the track and biuldings, was carried out by the Oerlikon Machine Company of Oerlikon, near Zürich, Switzerland. The operation has been most satisfactory from a financial as well as from an electrical and mechanical standpoint.

OPERATION OF ELECTRIC CARS IN CRIPPLE CREEK DISTRICT

The electric railway operated by the Colorado Springs & Cripple Creek District Railway Company, in the Cripple Creek District of Colorado, has many interesting features which distinguish it from other electric roads. The main line of the Colorado Springs & Cripple Creek District Railway is a steam road, and is popularly known as the "Short Line." It runs from Colorado Springs up the mountains to Summit, which has an elevation of 10,000 ft. above sea level, and then descends to Cripple Creek and Victor, respectively 45.8 miles and 44.6 miles from Colorado Springs. This line is renowned for its grand scenery and bold engineering, and is exceedingly well patronized by tourists as well as by local passengers.

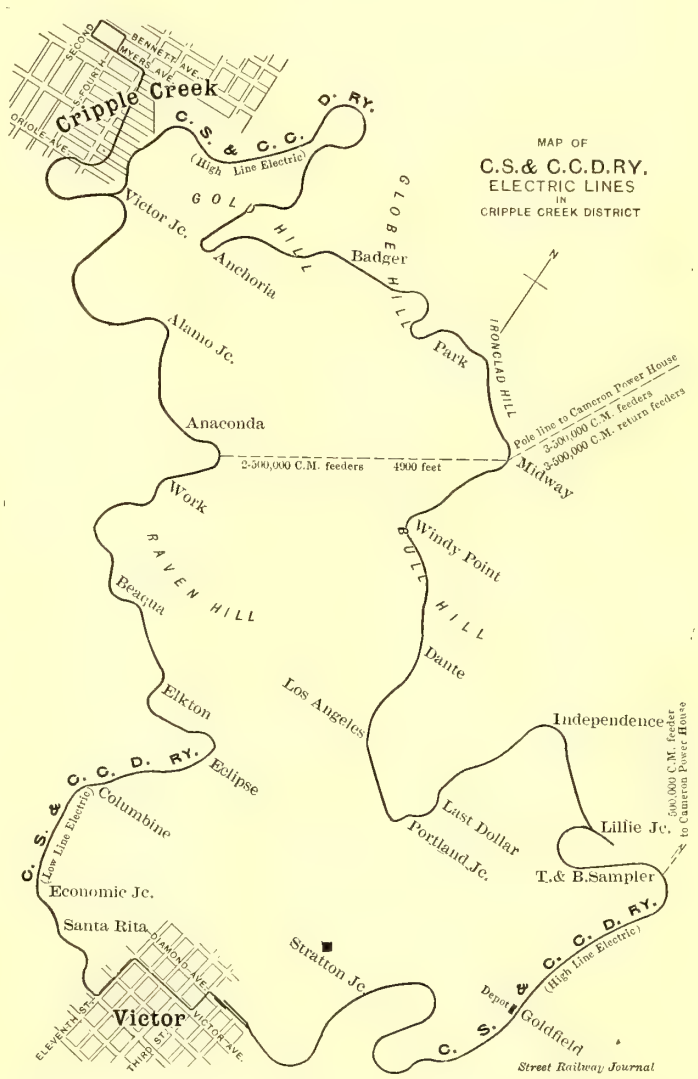
The electric part of the system operates entirely within what is familiarly spoken of as the Cripple Creek District, and reaches all the principal mines and camps of this famous gold-mining district. The road consists of two lines, known as the "High Line" and the "Low Line." Both have Victor and Cripple Creek as their terminal points, and at Cripple Creek the cars of the two lines pass around a loop in the center of the business district and use the same track to Victor Junction, a distance of 1.1 miles. In Victor, up to very recently, the terminal points of the two lines have been about four blocks apart, but franchise rights have lately been obtained to connect the lines, as shown on the accompanying map. This connection will now allow the company to run the cars over on one line and back on the other if desired. The map shows the routes of the two lines as altered recently. The sharp curves are necessitated by the variations in elevation and also on account of the situation of the mines which the road reaches.

The Low Line is considerably shorter than the High Line, and as the grades are easier the cars are geared for 22.5 m. p. h., and the distance of 5.6 miles is regularly made in the schedule time of 27 minutes. On the High Line the cars are geared for only 12.6 miles an hour, on account of the heavy grades, for they reach 10 per cent in places, and the schedule time for the run of 9.9 miles between Victor and Cripple Creek is 55 minutes. The motor cars used on both lines are equipped with four General Electric 57 motors, rated at 52½ hp each.

The Low Line cars in making the run from Cripple Creek to Victor pass by Pointer, Anaconda, Beaqua, Elkton, Eclipse, Columbine and Santa Rita, around Raven Hill and over Beacon Hill, from which elevation a magnificent view is obtained of several mining towns, the Saugre de Cristo range, Mt. Pisgah, Black Horse Hill, etc. On the High Line, Midway, Independence and Goldfield are passed, and Bull Hill is surmounted at an altitude of 10,500 ft. At Windy Point and Midway the cars pass just below Altman, the highest incorporated town in the world, over 11,000 ft. above the sea level.

The passengers on these cars are principally miners, who work in the various mines and live in Victor, Cripple Creek or Goldfield. As they work principally on 8-hour shifts they afford a substantial and regular traffic. As both lines are exceptional for their scenery and for the famous gold mining district through which they pass, they are well patronized by tourists. The morning train from Colorado Springs gives a wait of 2½ hours in the District, allowing visitors ample time to make the trip over both electric lines and return to Colorado Springs for dinner. A fare of 10 cents is charged on the Low Line and 20 cents on the High Line, and "circle tour" tickets are sold for 25 cents. There is a strong competition with two steam roads for passenger traffic between cities in the District, but the electric cars capture the bulk of the business.

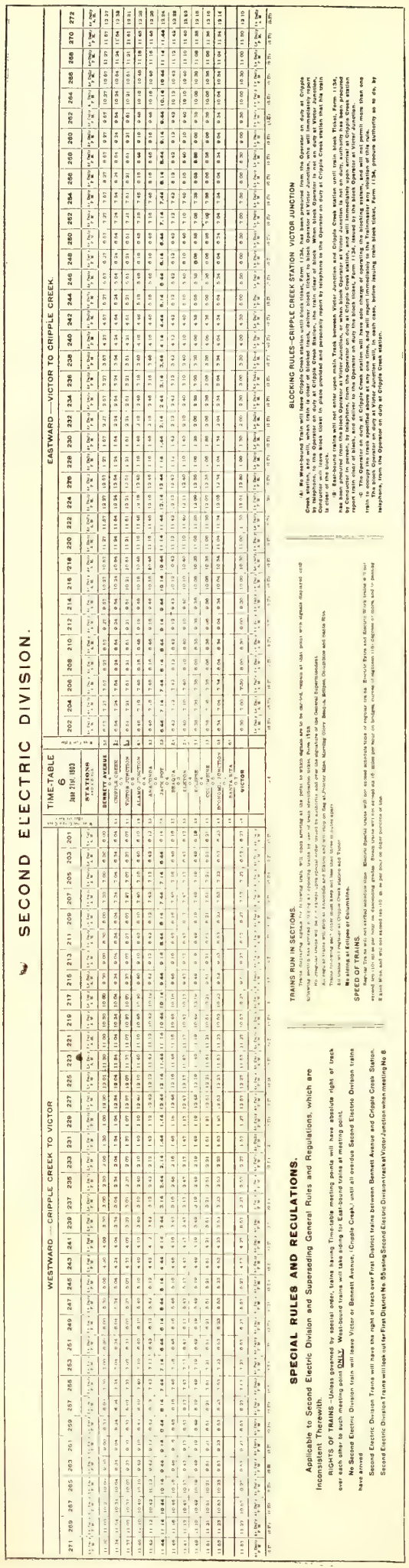
Power for the operation of the electric divisions is supplied from two power houses. One of these is located at Lake Moraine, on Pike's Peak, and is equipped with a water-wheel, driving a 250-hp alternator. The current is transmitted a distance of 8 miles to the town of Cameron, where a steam plant is located. This latter plant is equipped with a 250-hp railway generator and transformers and rotary converter for the high-tension line. From Cameron a feeder line at 600 volts is carried to Midway, the nearest point on the High Line. The line consists of three 500,000-circ. mil cables. A 500,000-circ. mil feeder is also carried by a separate pole line to a point on the High Line, between Goldfield and Independence. The Low Line is fed by a line carried across country from Midway to Anaconda, a distance of 4900 ft. This line consists of two 500,000-circ. mil cables. From the two points on the High Line and from Anaconda on the Low Line the feeder lines are carried along on the trolley poles to the tapping-in points. The two roads are thus interconnected electrically, and from



Midway back to Cameron there are run three 500,000-circ. mil return cables, ground return not being depended upon.

On the Low Line there are operated thirty-six cars a day each way, beginning at 6:00 a. m. and running every 30 minutes until midnight. The High Line cars run on an hourly schedule from 5:15 a. m. to 3:10 a. m., with extra cars around 8:00 a. m. and 4 p. m., when the shifts of miners change. Twenty-four cars are operated each way during the 22 hours.

As parts of both tracks are used by the steam trains of the Colorado Springs & Cripple Creek District Railway for both passenger and freight service, all cars, electric as well as steam, are operated strictly under a despatching system from the Colorado Springs office. The despatching is done by telegraph, with registering stations at Cripple Creek depot, Bennett Avenue (Cripple Creek), Victor, Portland Junction, Vindicator Junction and High Line Junction. Between Cripple Creek Station and Victor Junction, a distance of 0.7 mile, both lines of electric cars and the steam passenger trains use the



SAMPLE PAGE OF TIME-TABLE ISSUED FOR THE USE OF EMPLOYEES OF THE COLORADO SPRINGS & CRIPPLE CREEK DISTRICT RAILWAY COMPANY

same track, and all cars are operated on a block system from Cripple Creek station, the operator at Victor Junction receiving his orders over a telephone line.

For the guidance of employees elaborate time-tables are published, one comprising only the Low Line electric cars and the other the High Line electric and the steam trains. A reproduction of one of these is given herewith. Following are some of the rules and instructions printed on these time-tables for governing electric cars:

No. 55 will take siding on second electric division track when meeting No. 8 at Victor Junction. Switch at High Line Junction will be left set, and locked for electric line.

Second electric division trains will have the right of track over first district trains between Bennett Avenue and Cripple Creek station.

All electric trains change numbers at High Line Junction.

East-bound electric trains will not leave Victor until all overdue West-bound electric trains have arrived.

No train will exceed a speed of 10 miles per hour through city limits of Goldfield.

All electric trains will stop at Goldfield station, and will stop, on signal, at T. & B. Samples, Independence Avenue, and Twelfth Street, Goldfield, Stratton Junction and Hollywood.

All electric trains will stop at Independence, and will stop on signal at Last Dollar.

Regular trains will not exceed schedule time. Irregular trains will not exceed schedule time of regular trains.

Trains following each other must keep not less than five minuets apart.

Electric trains, before crossing steam line or entering thereon, shall be brought to a full stop with motor car not less than 30 ft., nor more than 60 ft. from the crossing, and will not proceed until the conductor has gone ahead to the crossing, and ascertained that no steam line trains are approaching from either direction, when he will signal the motorman to come ahead.

Conductors and motormen of electric trains will be held responsible for accidents with steam line trains at grade crossings.

Second electric division trains will look out for first district No. 55, using second electric division track at Victor Junction when meeting No. 8.

With these rules, which are strictly adhered to by all employees, the electric cars are run in between the steam trains without any friction, and since the opening of the electric division, over four years ago, no serious accidents have occurred. The immediate supervision of the electric trains is controlled by E. E. Hartman, with headquarters at Cripple Creek, while the general management of the cars is in the hands of F. C. Smith, general superintendent; C. W. King, trainmaster, and R. R. Norton, chief despatcher, with offices at Colorado Springs.

THE OPERATION OF THE RATEAU STEAM TURBINE

In the Street Railway Journal for April 18 an extended description was published of the Rateau turbine, as constructed at the Oerlikon Machine Works in Switzerland. The following discussion of the theory and operation of the machine has been especially prepared for this paper by Professor A. Rateau, of Paris. For the practical details of its construction the reader is referred to the former description. These turbines, it might be added, are also being built in France by Sautter, Harlé & Company, but their form does not differ materially from those built by the Oerlikon works.

Before giving any figures on efficiency it is desirable to define exactly the meaning of the term as used by Professor Rateau. It is too frequently the practice in tests of this kind to state the steam consumption per kilowatt-hour without giving the figures for the initial pressure of the steam and of the exhaust. This method of describing the performance of a machine is no more satisfactory than would be that of giving for the equivalent of the output of a hydraulic turbine only the quantity of the water used without the height from which it falls.

In his turbine tests Rateau determined the efficiency from the ratio of the real steam consumption to the theoretical con-

sumption of an ideal perfect machine. The theoretical steam consumption is defined as corresponding to the maximum work which the steam can produce under the conditions under which it is delivered to the machine, by expanding adiabatically and without losses from the initial pressure P to the exhaust pressure p. Professor Rateau worked out the theoretical consumption, and his diagrams showing results under different conditions prove the well-known fact of the importance in economical operation, of having as perfect a vacuum as possible in the condenser. This may be shown from the following example: If a machine using saturated steam at a pressure of 15 kg per cm² (213 lbs. per square inch) exhausts into free air, the theoretical steam consumption is 5.84 kg (12.85) per horse-power-hour. If, however, the same machine be provided with a condenser which reduces the exhaust pressure to 0.10 kg (27 ins.), the theoretical steam consumption is only 3.55 kg (7.82 lbs.), i. e., 39.3 per cent smaller than before.

The relation may be expressed by means of the following simple empirical formula, which is sufficiently accurate:

$$K = 0.85 + \frac{6.95 - 0.92 \log P}{\log P - \log p}$$

in which K is the consumption in kilograms per metric horse-power-hour, P the initial and p the exhaust pressure, both in kilograms per square centimeter, and log is the common logarithm.

Following are the results of some tests of a turbo-generator of 540 electric horse-power, which is one of a group of three similar machines made in the Sautter-Harlé works for the Penarroya mines in Spain, where they have just been installed. Each set consists of two turbines of high and low pressure, and two direct-coupled direct-current dynamos, giving each at normal load 830 amps. at 220 volts. The normal speed is 2250 r. p. m. These turbines operate condensing, with "ejector" condensers of the Rateau type. The boilers supplied steam under an absolute pressure of 11 kg to 16 kg per cm² (working pressure of 140 lbs. to 210 lbs.), maintained at the turbines by a reducing valve at 11 kg per cm² (140 lbs. per square inch) as maximum. The consumption and the efficiencies are given in the following table:

TESTS OF RATEAU TURBINES

	¼ Full Load	½ Full Load	Full Load	Over-load	Overload at 2,400 r. p. m.
Electric horse-power at the brushes	135	259	525	627	641
Absolute pressure in kilograms { at gage	3.25	5.4	9.6	11.0	11.0
per centimetre² { of exhaust	0.0877	0.094	0.115	0.128	0.128
Working pressure at gage in lbs. per sq. in	31.	61.	121	141	141
Absolute pressure in lbs. per sq. in. of exhaust	1.247	1.34	1,64	1.82	1.82
Theoretical consumption in kilograms per horse-power-hour for a perfect machine	4.95	4.43	4.00	3.95	3.93
Theoretical consumption in lbs	10.91	9.77	8.82	8.71	8.71
Actual consumpt'n in kg. per h.-p.-h. at the brushes	9.66	8.16	7.14	6.95	6.74
" " " lbs " " "	21.3	18.0	15.74	15.31	14.86
Combined efficiency of generating set	0.513	0.540	0.560	0.569	0 586

This table shows that the combined efficiency, i. e., that of turbine and dynamo together, varies between 51 per cent and 58.6 per cent, while the steam consumptions per electric horse-power-hour may be as low as 6.74 kg, or 14.86 lbs. Also, that the combined efficiency of the turbo-generator is practically constant, the variations being not more than 8 per cent between overload and one-quarter full load.

The efficiencies of turbines when a high vacuum is used suggested to Professor Rateau the possibility of utilizing by their means the exhaust of steam from engines running at intermittent load, such as steam hammers, mine hauling and rolling mill machinery. When reciprocating machines are used for such purposes neither compounding nor condensing can usually be employed, and the efficiency is therefore rather low. In such cases to secure a continuous flow of steam to the turbine Rateau uses an apparatus which he calls a "regenerative accumulator of steam;" it consists of sheet iron cylinders, containing a series of cast-iron plates, which condense the steam on its arrival from the prime mover and allow it to vaporize when the exhaust from the first machine stops. The pressure of the exhaust steam is nearly constant, and equal to about 0.20 kg (3 lbs.). An adjustable valve, regulated by hand, permits a variation within certain limits of the steam pressure from the accumulator; in general this pressure is 1.3 kg to 1.4 kg, or from 2.8 lbs. to 5.2 lbs.

A very interesting application of this principle has been made at the Bruay mines at Pas-de Calais. The exhaust steam of the hoisting machine is fed to a turbo-generator of 300 hp. The test showed a production of 1 ehp per hour at the terminals of the generator, with a steam consumption of 18 kg (39.68 lbs.); the steam being admitted at atmospheric pressure and the vacuum in the condenser being 63 cm (24.8 ins.) of mercury, hence, relatively bad. This figure Professor Rateau believes could be reduced to 13 kg (28 lbs.) per electric horse-power-hour with a better vacuum in the condenser, which is perfectly obtainable in practice. It will be noted that under these conditions the low-pressure generating set performs about three times as much useful work per pound of steam as the hoisting machine, even with a steam consumption of 18 kg per hour, viz., 30.68 lbs. against 100 lbs., the ordinary figure for a simple non-condensing hoisting engine.

VIEWS ON THE NOSE SUSPENSION

One of the correspondents of this paper, in talking recently with Mr. Olds, superintendent of rolling stock of the Milwaukee Electric Railroad & Light Company, brought out some interesting practical points on motor suspension.

Mr. Olds does not believe in the nose suspension where the nose is located in the center of the motor frame. His objection to this method is that in supporting the motor at three points the reaction between the pinion and the gear tends to shift the motor out of horizontal alignment. The practical result is this: Instead of having the teeth of the pinion and gear wear parallel to the axis, the tipping of the motor around a third point of suspension, due to the thrust caused by the reaction between the pinion and its gear, shows plainly in the character of the wear on the gear teeth, which become wider in the middle than at the ends.

Mr. Olds supports his motor practically with a rigid support in line with the bearing at the pinion end of the motor. The commutator end of the motor is supported between an upper and lower spring, which take half the weight of the motor to bring them in line with the rigid bearing. This is certainly a sound mechanical principle and reduces the friction and increases the life of the pinion and gear, which should be operated in alignment. The flexible nose suspension was originally devised for the purpose of allowing the motor a little headway, so that the inertia of the armature in conjunction with its torque could be used to overcome the static friction in starting the car.

With the increased torques of the modern motor this flexible suspension is not necessary in order to move the car when on the first point of the controller when the resistances are properly adjusted.

Senator Henry Cabot Lodge is one of eighteen prominent residents of Nahant, Mass., who have organized a company to build an electric railway along the side of the isthmus connecting Nahant and Lynn. The company has a capitalization of $30,000, and the projectors of the new line will have an early hearing.

MILFORD STREET RAILWAY SYSTEM

The street railway system centering in Milford, Mass., offers many points of interest, both from an engineering standpoint and on account of the peculiar situation in reference to the territory covered and the steam roads in that section. The former



ENTRANCE TO LAKE NIPMUC PARK, ON LINE UTILIZING STORAGE BATTERY AS AUXILIARY

will be considered chiefly in this article, but to understand the problem fully a general statement of local conditions will be necessary.

The district served lies within the limits of a triangle formed by the cities of Boston, Providence and Worcester. There are five lines running out of Milford to the towns of Medway, South Framingham, Hopkinton, North Grafton and Uxbridge. The line from South Framingham, through Milford to Uxbridge, and the line from North Grafton, through Milford to Medway, form two diagonals which cross this triangle and give two connections between the Boston & Albany Railroad on the north, and the New York, New Haven & Hartford Railroad on the south. This fact has given rise to the phrase "Across the Triangle" as an advertising catch word. The Boston & Albany also has a branch line from South Framingham to Milford, and has been obliged to reduce its fares to street railway rates in order to retain any of its former business.

There are two parks on the system, one near Mendon, known as Nipmuc Park, on the Uxbridge line, which draws from Milford, Hopedale and Uxbridge, and the other known as Waushakum Park, near South Framingham, which draws from the latter town and the small villages lying between it and Milford.

The railway is operated by direct current, and has storage battery auxiliaries on two lines and a 10,000-volt alternating current transmission line fed by an inverted rotary at the power station on the third.

The power station is well situated in the center of the system, and is on a steam railway siding. It is equipped with five return tubular, horizontal hand-fired boilers, aggregating 700 hp. The generating machinery aggregates 1150 kw in three units, as follows: A 600-kw Westinghouse generator, compound wound, direct-connected to a cross-compound, 1000-hp steam engine; a 325-kw General Electric unit, direct-connected to a 700-hp simple engine, and a 225-kw General Electric direct-connected to a 500-hp simple engine. The engines are condensing and take steam at 120 lbs. pressure. The station also operates for the Milford Electric Light Company 150 kw of alternating-current machinery. The 225-kw dynamo is connected up so that it may be used either as a railway generator or as a line booster.

The rolling stock of the system comprises forty passenger cars and several plows and freight cars. There are eleven four-motor equipments, the remainder being two-motor equipments. Some of the heaviest cars are 41 ft. long and weigh 20 tons each.

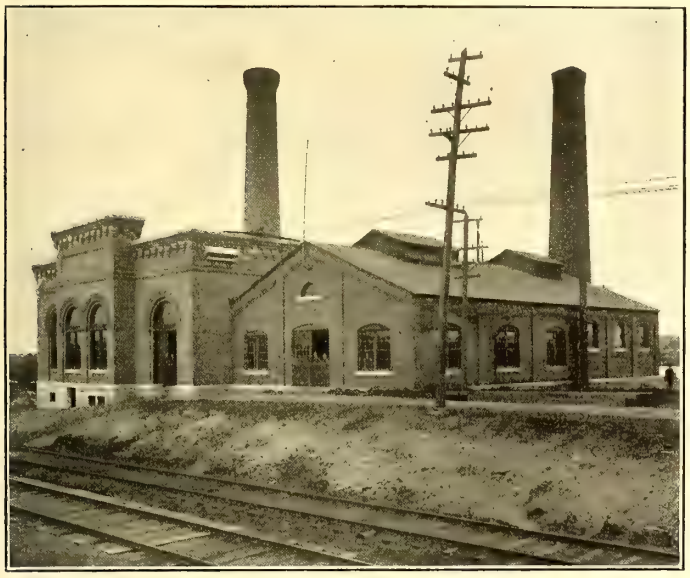
The longest line operated covers 16 miles, and runs to North Grafton. It was formerly a steam road and has a private right of way throughout. High speed is maintained, and an hourly service is operated under ordinary conditions. The farther end of this line is fed from a rotary located in the passenger station at Grafton Center. Alternating current is transmitted over three No. 6 aluminum wires at 10,000 volts pressure, from an inverted rotary at the station, taking current from the direct-current bus-bars. The other two long lines on the system are operated with storage batteries, furnished by the Electric Storage Battery Company, and this feature of the installation will be discussed here, as the results obtained are significant.

The Milford & South Framingham line, the longest of these on which the storage battery is utilized, has 12 miles of track in all, with a long, steep hill about 3 miles from the South Framingham end. Formerly the power for the last 3 miles of this branch was supplied at a fixed rental from a local power station belonging to another road in South Framingham, as it was impossible to keep up steady voltage at the end of the line when depending entirely upon the Milford station. The storage battery on this line is at Gouch's Corner, about 8¾ miles from the main power station. It enables the road to



POPULAR PARK RESORT

operate the entire line from its own generating plant, thus cutting off the expenditure for rented power, and effecting a saving of about $1,200 per year. The resistance of the circuit between the power station and this battery is approximately 1 ohm, and the average load on the line is sufficient to cause an average drop of 50 volts to 75 volts. The number of cells installed in the battery, 240, balances an average voltage of approximately 500 at that point.

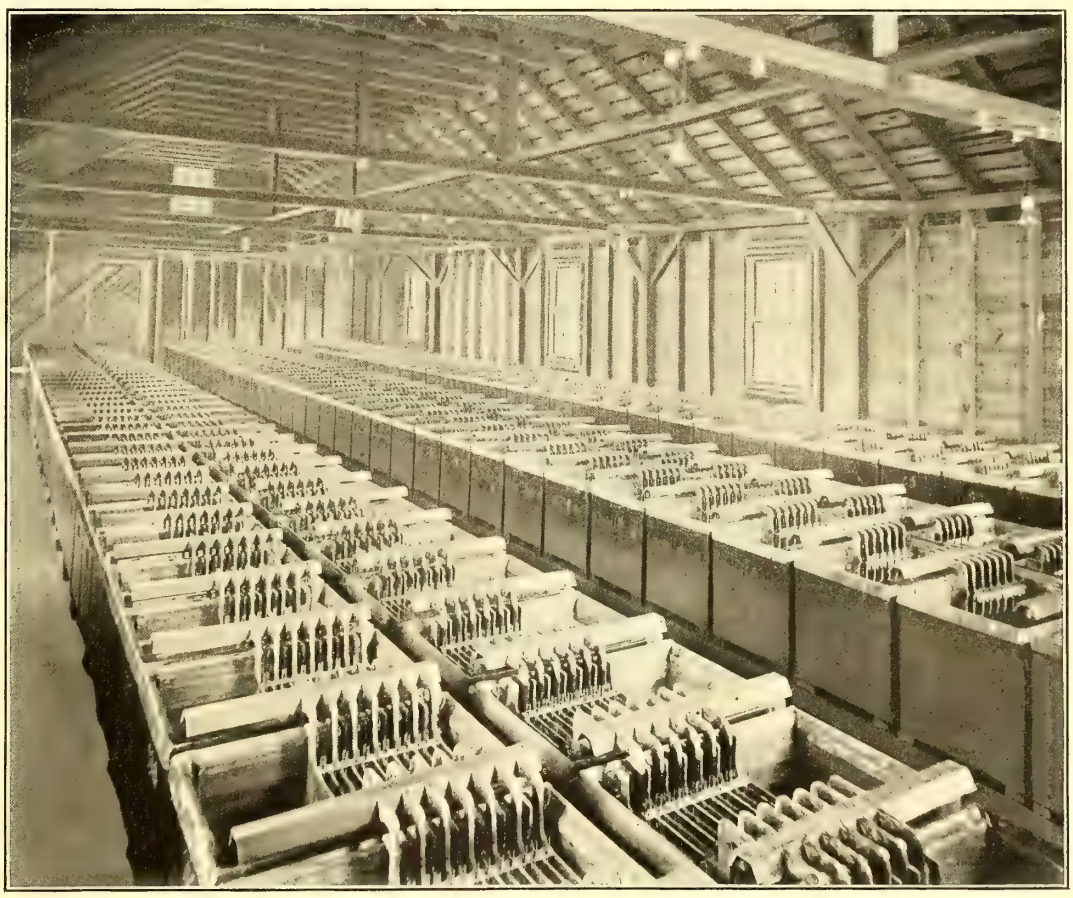


MAIN POWER HOUSE



STORAGE-BATTERY HOUSE

Each cell consists of a hard wood tank lined with lead and mounted on four insulators, which in turn are carried on wooden stringers, resting on vitrified bricks. The tanks contain thirteen plates, of the size known as type F, measuring 11 ins. x 10½ ins., but are made large enough to receive nineteen plates, so that the battery can be increased 50 per cent in capacity by the simple addition of more plates in each cell, an operation which can be accomplished, if necessary, without taking the battery from service. The battery is rated for a discharge of 240 amps. at the hour rate. The house is of wood with a shingle roof, and is unfinished on the inside. In the front portion is a small space cut off and sheathed, to form a room for the switchboard which controls the battery. The switchboard is of marble and carries a circuit breaker, ammeter, voltmeter and single-pole, single-throw, quick-break knife switch. A recording voltmeter keeps a continuous record of the battery voltage.



INTERIOR OF A STORAGE-BATTERY HOUSE

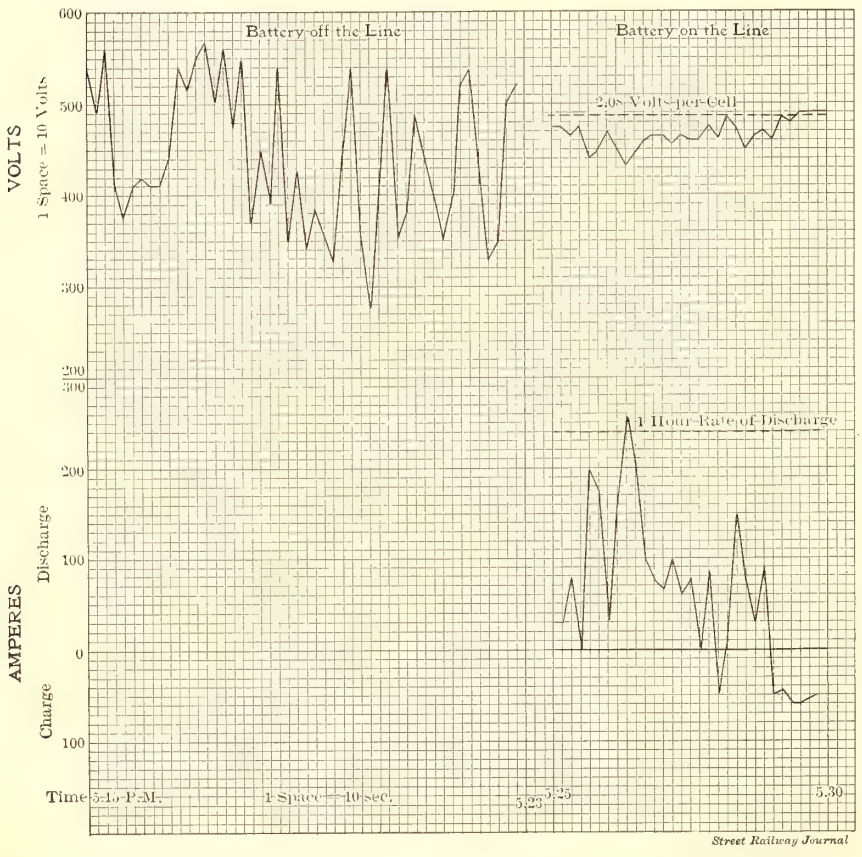
The plant has been in operation two years, and in that time the momentary discharges have frequently reached and even exceeded the hour rating. The manner in which this auxiliary improves the operation of the road will be readily understood from the following considerations: When the battery is discharging momentarily at its hour rate, 240 amps., the potential will drop about 40 volts below the average, reaching a minimum of 460. If the 240 amps. given by the battery had been supplied by the power house over the feeder and track resistance of 1 ohm, it is evident that the drop would have been 240 volts greater, reaching a minimum of 220 volts. Without the battery it will therefore be seen the line voltage would fall to 220 volts, while with it the voltage is maintained at 460 under the same conditions of load demand. If the demand came from a car farther out on the line the voltage at the

car would, of course, be lower still, this being governed by the drop in the circuit between the battery and the car, yet without the battery it might be as low as 175 volts or 150 volts.

The second battery is located at Lake Nipmuc Park, near Mendon, on the Milford & Uxbridge branch, 6½ miles from the power station. This branch is very hilly and causes the load to fluctuate widely. This battery is a duplicate of the one at Whitney's Turnout, excepting that it has 234 cells. It has been in commission approximately the same length of time, and operates in the manner already described; the accompanying readings, taken May 7, 1903, show clearly the effect on the line voltage produced by having the battery connected or disconnected. The circuit resistance between the station and this battery is about three-fourths of an ohm.

On very heavy days in summer when there is large travel to the parks the batteries are drawn upon as reserve, thus serving the double purpose of regulating the fluctuations of the line voltage, and to a certain extent relieving the power station of overload. This action is automatic since the extra load drops the average line voltage below the average battery voltage, resulting in a net battery discharge. Seven cars frequently start from one of the parks at the same time, and without the assistance of the battery it would be impossible to move them, owing to the low voltage that would ensue. The readings, heretofore referred to, were taken under conditions of ordinary service, and they show a variation of 295 volts with the battery off the line, the voltage ranging from 275 to 570, whereas, with the battery on the line the variation extended from 430 volts to 490 volts, or only 60 volts.

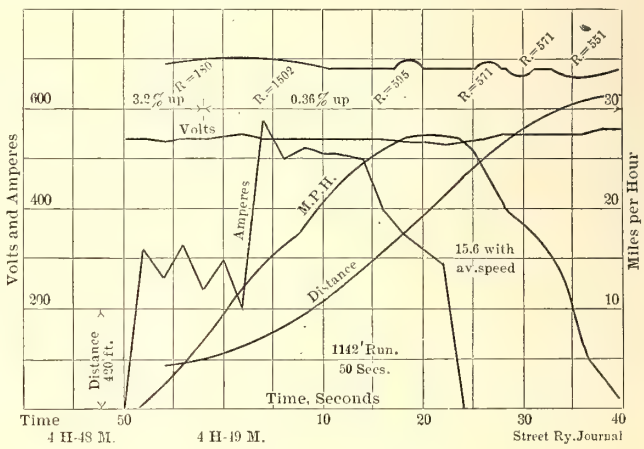
Since the installation of these two batteries two years ago nothing has been spent in renewals, and the attendance has been found to be extremely small, calling merely for the labor required in adding water to the cells to replace vaporization and in changing the charts of the Bristol recording voltmeter once a day. This work is attended to by a man who receives in return a pass on the road. In addition the chief engineer of the company charges 1½ hours of his time per week to the storage batteries for such superintendence as he is called upon to make. This compares favorably with the charge of $14 per week for a regular attendant at the rotary sub-station on the Grafton line, and whatever may be further charged up to this work from the time of the station agent, who takes care of the rotary during one shift. The experience on the Milford system suggests great possibilities for the storage battery in this character of service, and will repay an examination into the financial as well as the engineering aspect of the cases.



EFFECT OF BATTERY OF 234 CELLS AT LAKE NIPMUC PARK, 6½ MILES FROM POWER PLANT

AN ACCELERATION TEST

The study of speed, current and time diagrams in runs made by high-powered car equipments always brings out many interesting points in connection with train movements. In the accompanying diagram is exhibited the results of a test made on a 30-ton car to determine the energy consumption of the equipment in an acceleration run. The car was equipped with two General Electric-55 (160 hp) motors, gear ratio 50 to 21 or 2.38, and operated by the Sprague multiple-unit control. About 63 per cent of the weight was on the drivers. The weight of the car without passengers was 29.9 tons, and the passenger weight was 1.6 tons, total weight 31.5 tons. The run was made on a .36 per cent up-grade, and the current was kept on until close to the application of the brakes. The equipment thus covered the distance of 1005 ft. in practically the fastest time which it could make, 46 seconds from start to stop. Readings were taken every two seconds by a corps of observers stationed on the car, a clock being fitted with a suitably notched wheel for ringing a gong through an electric contact.



ACCELERATION DIAGRAM

Analysis of the diagram shows a maximum current of 520 amps. at 537 volts or 280 kw, this being about 9 kw per ton. The maximum speed was 27.5 m. p. h., and the average speed 14.9. The ratio of average to maximum speed was 54.2 per cent, but the equipment was designed to give the car a maximum speed of from 40 m. p. h. to 45 m. p. h. on a level track with unobstructed running space. The current averaged 340 amps., and was applied 32 seconds, or about 70 per cent of the time, and the average voltage was 540, and the minimum about 537. The ratio of average to maximum current was about 66 per cent. The average power consumption of the car was 183.5 kw, or 246 hp, the ratio of maximum to average being something over 1.5 to 1. The total kilowatt-hours were 1.63, and the kilowatt-hours per car-mile were 8.55, which brought the watt-hours per ton-mile to 272. The energy cost of runs, which contain little or no coasting, is decidedly apparent here.

Considering the speed curve we note that the average rate of acceleration was 1.06 m. p. h. per second, calling for a total accelerating tractive effort of 3040 lbs., or 96.5 lbs. per ton. This rate could probably have been considerably increased if the throttle of the controlling apparatus had been set for a heavier current; 56.5 per cent of the time of the run was acceleration, and 32.6 per cent was occupied in braking. The rate of braking averaged about 1.67 m. p. h. per second, calling for a retarding force of 4800 lbs.

Perhaps the most interesting feature is the excessive energy consumption per car-mile, before noted, 8.55 kw-hours. It is certain that any road which is obliged to operate heavy equipments in short accelerating runs which permit no coasting must look well into its power consumption if it wishes to reduce operating expenses.



SIX MAIL CARS JUST PUT IN SERVICE IN BALTIMORE

UNITED STATES MAIL CARS IN BALTIMORE

As the advantages of electric cars for mail transportation have become more evident to the postal authorities, the use of such cars has correspondingly increased. Among the street railway companies carrying mail is the United Railways & Electric Company, of Baltimore, Md. This company has designed and built in its shops, under the supervision of Superintendent H. H. Adams, a number of special cars for this service. Six cars of this type are illustrated in Fig. 1, and in Fig. 2 the floor plan, side and end elevations are shown.

The principal dimensions of these cars are: Length over bumpers, 26 ft. 6 ins.; length over corner posts, 16 ft. 10¼ ins.; length of platform, 4 ft. 3 ins,; width over sills, 7 ft. 3 ins.

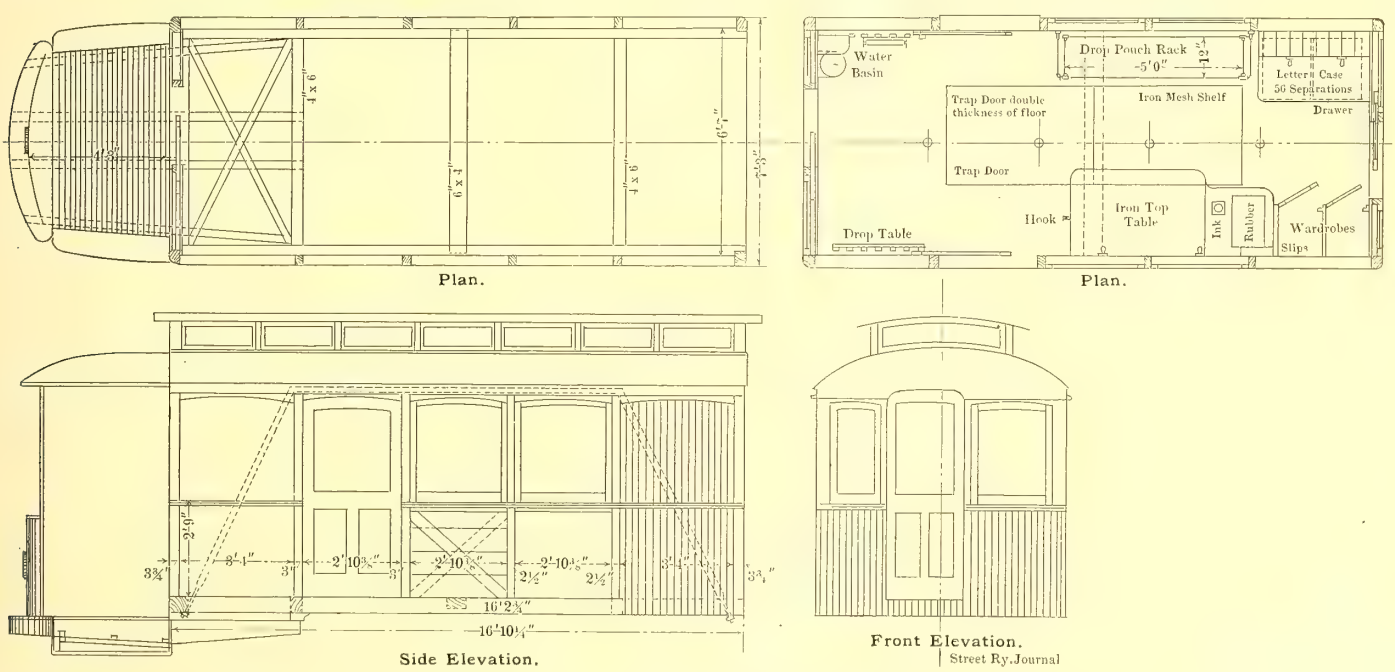
The cars are mounted on Lord Baltimore single trucks, and are equipped with No. 49 Westinghouse motors and K-10 controllers. The average weight of the cars complete is 18,691 lbs.

To enable the mail clerks to enter and leave the cars quickly the end doors are arranged slightly out of center in the opposite direction from the way they are regularly thrown to make the accelerator type of door for passenger service.

The interior furnishing of each car is arranged in accordance with plans submitted by the Post Office Department, and consists of a letter case of fifty-six compartments, a drop rack for holding mail pouches, a sheet-iron covered table for cancelling mail, two wardrobes, a wash basin and a combination cooler and tank. There is also a drop table, used for cancelling parcels, etc.

All the mail cars are painted white, striped in blue. All numbers and lettering are in gold.

No side or hood signs are on the cars, but each car is equipped with a sheet-iron dash sign, giving the route to which it is assigned, with "Through Service" painted on one side, and "Local Service" on the other. The car displays the "Local Service" sign when collections are made from the street boxes, and "Through Service" when it operates between suburban stations, in which latter service it has the right of way over passenger cars.



SIDE AND END ELEVATIONS AND PLAN OF BALTIMORE MAIL CAR

The information and illustrations for this article were furnished by Wm. A. House, second vice-president and general manager of the Baltimore United Railways & Electric Company.

VENTILATING RAILWAY MOTORS

An extensive series of tests are being made on the Camden & Suburban Railway Company's lines to determine the practicability of ventilating and cleaning railway motors while in operation in regular commercial service. The desirability of cleaning motors, and electrical apparatus generally, by forcing air through the motor casings has long been recognized in shop practice, and the plan followed in these investigations really utilizes the same principles, only in this case it is not necessary to depend upon mechanical means for securing sufficient pressure to force the air through the motor casings. Natural draft is used, the air being admitted through a funnel or hood conveniently located on the outside of the car, either in front or above the roof, as may be desired. A pipe leads from this hood to a point underneath the car flooring, where connection is made to the bottom of the motor casing by means of a flexible hose. An aperture is also made in the top of the motor casing to which another pipe is connected, which leads to a funnel-shaped exhaust covered with a wire mesh and secured on the truck at the side of the car. A very strong current of air is produced by this means when the car is in motion.



FIG. 1.—CAMDEN CAR EQUIPPED WITH RAILWAY MOTOR VENTILATOR

The accompanying cuts show a car equipped with this system of motor ventilation, as well as several details of the apparatus. Figs. 1 and 2 illustrate the car now being used for the tests at Camden. It will be noticed that in this equipment the funnel or hood is located on the top of the car, but in other tests the funnel has been placed at other points, above the center of the car, for instance, and in some it has been set in the dashboard (Fig. 3) or secured just below the platform of the motorman's cab. This is a detail which may be determined by local conditions. Fig. 4 shows the truck of the Camden car upon which one of the exhausts is secured, and Fig. 5 is a plan of the piping under the car showing the connections between the motor casings and the pipe leading to the air collector. It will be noticed that both of the motor casings are connected with the air supply, the main pipe going directly to the first motor, and a branch leading to the casing on the rear axle. In the top of each motor case is a vent, from which a pipe is extended to the outside line of the car body. The funnel-shaped hood at the end of this pipe, which serves as an exhaust, is fixed on the car truck in such a position that it will carry off the hot air from the motor casing, even though the supply of air from the collector should be temporarily cut off. Of course, a much larger volume of air is passed through the motor case when the air collector is utilized, as it is intended to be. When thus admitted to the casing air is forced through the parts of the motor, effectually cooling and cleaning it at the same time, and thence out through the top and exhausted as already explained. Ample provision is made for eliminating all danger to the equipment from any moisture that may enter the air collector by inserting drips and valves in the piping through

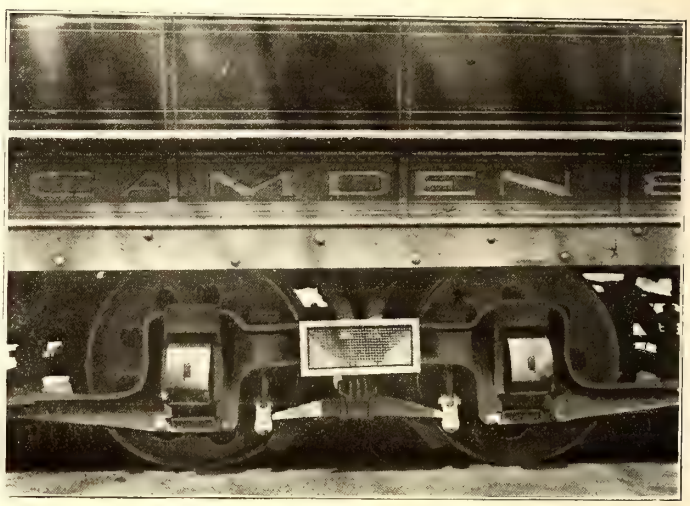


FIG. 4.—EXHAUST ON TRUCK

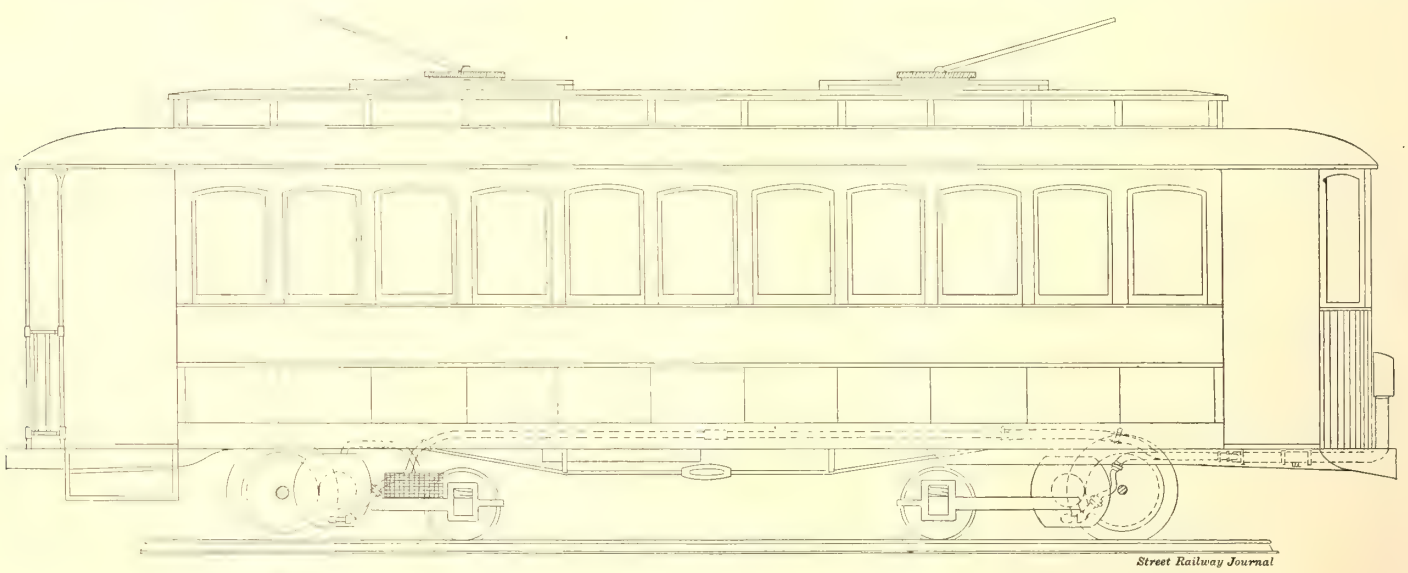


FIG. 3.—SIDE ELEVATION, SHOWING PIPING OF CAR WITH COLLECTOR IN FRONT OF VESTIBULE

which the air must pass before it reaches the motor. The front of the air collector is covered by a screen, which prevents the admission of dust or dirt to the motor case. These collectors also contain valves which work automatically so that the car may be run in either direction and the ventilating system operated without any attention on the part of the employee.

Modifications of this form of ventilator have been used on several roads, and the results of these tests show that the system may be adapted to the special requirements of any street or interurban railroad.

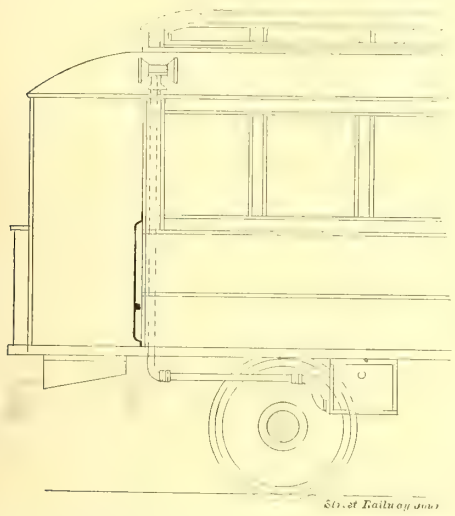


FIG. 2—FRONT OF CAR, SHOWING PIPING CONNECTIONS FOR COLLECTOR ON ROOF

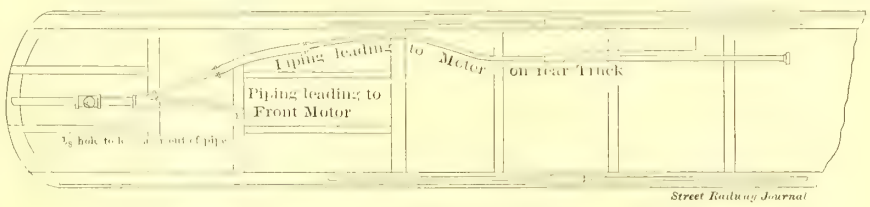


FIG. 5.—PIPING UNDER CAR

and long runs with cars that are overcrowded, are not unusual conditions, especially on the older systems, and it will be readily understood that service of this character means an almost constant overheating of the motors. In some of the newer installations provisions are made for these requirements, but on the older roads the motors may be said to be undergoing a constant baking, which, of course, greatly weakens them, reduces their efficiency and eventually results in breakdowns.

Experiment has shown that cars on which the motors have been kept cool and clean may be continued in service for a longer period without overhauling and repairing the motors than other equipments doing similar work, and that they may also be kept much more regularly in service. The motor has a much longer life where it is properly ventilated, and besides it is always in much better condition.

In the Camden tests a careful examination was made of the motors before the ventilating system was installed, and a record was made of the heat developed ordinarily in the motor cases. This data is presented herewith, showing the temperature of the motor case in the last day's service of a car before the ventilating system was introduced, and also the performance

TEST MADE UNDER CAR NO. 143, OF THE CAMDEN & SUBURBAN RAILWAY COMPANY, SHOWING HEAT DEVELOPED IN MOTOR CASES WITHOUT THE VENTILATING DEVICE

NORMAL TEMPERATURE 48 DEGREES

PLACE	Duration of Test	Motor No. 1	Motor No. 2	Motor No. 3	Motor No. 4
Ferry	5 min.	160	165	165	164
Merchantville	5 "	166	165	166	165
Ferry	5 "	168	169	170	171
Merchantville	5 "	172	171	172	171
Ferry	5 "	174	173	173	173
Merchantville	5 "	175	175	174	178
Ferry	5 "	176	177	176	175
Merchantville	5 "	177	178	178	177
Car house (last trip, making total run 50 miles)	5 "	180	182	181	180

Average temperature ..... 172 degs.
Normal temperature ..... 48 degs.
Excess of heat above normal..... 124 degs.

HEAT TEST MADE UNDER CAR NO. 143, OF THE CAMDEN & SUBURBAN RAILWAY COMPANY, EQUIPPED WITH MOTOR VENTILATING SYSTEM

NORMAL TEMPERATURE 67 DEGREES

PLACE	Duration of Test	Motor No. 1	Motor No. 2	Motor No. 3	Motor No. 4
Ferry	5 min.	100	100	100	90
Merchantville	5 "	100	100	100	87
Ferry	5 "	100	100	101	90
Merchantville	5 "	102	103	102	100
Ferry	5 "	106	105	105	102
Merchantville	5 "	107	108	108	104
Ferry	5 "	110	110	109	106
Merchantville	5 "	102	102	101	104
Car house (last trip, making total run 50 miles)	5 "	107	109	108	110

Average temperature ..... 103 degs.
Normal temperature ..... 67 degs.
Excess of heat above normal..... 36 degs.

COMPARATIVE STATEMENT OF HEAT TESTS MADE UNDER CAR NO. 143 OF THE CAMDEN & SUBURBAN RAILWAY CO.

VENTILATOR NOT IN SERVICE

	Degs.
Average temperature as shown in foregoing table of tests	172
Normal temperature	48
Excess of heat above normal	124

VENTILATOR IN SERVICE

	Degs.
Average temperature as shown in foregoing table of tests	103
Normal temperature	67
Excess of heat above normal	36

SUMMARY

	Degs.
Excess of heat	
Ventilator not in service	124
Ventilator in service	36

Showing a reduction of 88 degs.

The details have been very carefully worked out by Horace B. Rowland, of Philadelphia, who has made a special study of the problems involved, and whose experience is embodied in the system manufactured by the Electric Motor & Generator Ventilating Company.

It may be said in general that all street railway equipments are subject to certain conditions which tend to the overheating of the motors, and consequent deterioration. Frequent starting of crowded cars in city service, sometimes on steep grades, of the same motor on the same car and under practically the same operating conditions the following day when the ventilating system had been installed.

Another feature of the experiments that have been conducted on cars equipped with this system is the economy secured in the amount of current consumed under the favorable conditions maintained when the motors are properly ventilated. It is apparent that where a motor is subjected to such use as is commonly experienced in street railway work a very

high degree of heat is generated, and it is constantly increasing with the length of service until a point is reached where the insulation and bearings are affected, and unless some means is provided for reducing the temperature the equipment will soon be unfit for service.

An installation has been made on the cars of the Camden & Trenton Railway Company at Riverside, N. J., and tests are being made with highly satisfactory results. On this equipment the air collector is placed in front of the dashboard. An elaborate series of heat measurements are being made on this installation, and the results tabulated for reference.

SOME NOTES ON THE OPERATION OF RAILWAY MOTORS IN SERVICE

A paper was presented at the twentieth annual convention of the American Institute of Electrical Engineers, at Niagara Falls, N. Y., June 30, on this subject, by Clarence Renshaw, which will be briefly summarized here. The first part dealt with "The Equivalent Effect of Service Loads," and Part II was devoted to "Tests on an Electric Car in City Service." The author points out that a combination of the speed-time and input curves indicates in general the performance of an equipment of railway motors with reference to its external characteristics, and that judged from these curves only, a given equipment may be perfectly capable of performing a desired service satisfactorily, while in fact it may be entirely unsuited for the work. The three factors which limit the safe loads for a given motor are: First, its commutation; secondly, its mechanical strength, and, thirdly, the temperature rise of the windings. The capacity in regard to the first and second items is usually very much greater than that with reference to the third. As far as commutation and mechanical strength are concerned a railway motor, as a rule, could operate continuously with loads which would completely destroy the windings in a single day or less. It is usually the temperature rise which limits the capacity, and the general tendency is to choose equipments that are too small.

When new motors are first installed the effect of overloads will usually not be apparent at once, as the damage done by abnormal temperatures is, as a rule, not instantaneous but gradual. It is only when a motor has been overloaded sufficiently long to roast coils or make other repairs necessary that trouble is suspected.

The predetermination of the exact temperature rise of the different parts of a railway motor, operating at given loads and under any given service condition, is both difficult and complex. The problem, as a rule, is not, what will be the temperature of the field, or of the armature of such a motor under certain service conditions, but rather, will the temperature of the motor be such as to insure normal life and reasonable repairs? In other words, are the loads carried by the motor within its capacity? Mr. Renshaw presents statistics on "service loads," taken from actual tests on a car of the type ordinarily used in combined city and suburban service, and another car in high-speed interurban service. In each case the figures show a complete operating cycle, including the speed, line voltage and current consumption of the car, as well as the current used by each motor and the voltage at its terminals. The current used by each motor is not merely one-half of that used by the car, since, when the motors are in series, the car current and the motor current are identical.

In the case of the city car the load carried by each motor varies from a maximum input of 95 amps (or about four-thirds of the one-hour rating of the motor) to 23 amps. (or about one-third of this rating). The voltage at the terminals of each motor varies from 80 volts to the rated voltage of 500. Moreover, the load varies through this entire range in less than three-fourths of a minute. For the next one-fourth of a minute, approximately, while the car is coasting and being stopped, the motors carry no load at all and this entire cycle is repeated a little less often than once every minute.

In interurban service the conditions presented are more uniform. The maximum current is 280 amps. per motor and the minimum 77½ amps. The motor voltage varies from 30 volts to 545 volts. For more than half of the entire cycle, however, the current and voltage are quite uniform. The length of the cycle in this case is 6 minutes and 20 seconds, which is pronounced considerably longer than the average cycle on most interurban roads.

The heat losses are next considered by the author, and their bearing on the problem discussed. Owing to the great mass of metal in its frame a motor has a considerable amount of heat-storage capacity. Instead of only a few hundred pounds of copper in the windings to be acted on the temperature of the frame must also be raised; when cooling the entire mass must cool off simultaneously. Owing to this action the temperature rise of the windings of the motor does not fluctuate in accordance with the instantaneous losses but rises at a fairly uniform rate depending on their average value.

In Part II the author takes up the results of a comprehensive series of tests on a car in exceptionally severe city service, showing the actual variation of the loads in all day service. In these tests, the temperature of the field coils of one of the motors was measured in addition to the average loads and the general relation between average load and temperature determined. Complete details in regard to schedule speed, passengers carried, number and duration of stops, etc., were taken also and the tests afford data on a number of minor subjects which have a bearing on the choice of motors for city service. The tests were made under the direction of the writer on a car of the Pittsburg Railways Company. The car was of the single-truck type, approximately 30 ft. long over all. The body was 20 ft. long and had longitudinal seats for twenty-eight people. The equipment consisted of two Westinghouse No. 62 motors with electric brakes of the disc type. The weight of the empty car complete with equipment but without load was approximately 12 tons. The motors were geared for a maximum speed on the level of approximately 26 m. p. h. with 500 volts. The car was run in regular service, carrying passengers. Three observers were needed to take the necessary data. Two of these were located on the front platform with the motorman, and the third on the rear platform with the conductor. The primary object of the tests was to study the temperature attained by the motors in all-day service, particularly the temperature of the field coils.

A small temperature coil consisting of 48 ft. of No. 27 annealed iron wire was calibrated in an oil bath, and an accurate comparison between its resistance and the temperature was obtained. This iron wire was then wound upon two thin wooden strips, and, during the process of winding a field coil for use on one of the motors, these two strips were placed in the interior of the coil, one on each side, about half-way between the center and the outside. Leads were brought out from this iron wire coil and measurements of its resistance, which could thus be taken, gave the temperature of the interior of the field coil. The field coil which had been prepared in this way was placed on one of the motors of the car and the leads from the temperature coil brought to a portable Wheatstone bridge on the front platform. By the use of this arrangement the temperature of the coils could be obtained at any time whether the car was running or standing still and whether the motors were using current or not. During the tests measurements were made every 4 minutes or 5 minutes.

In connection with the temperature of the field coil it was desired to note the root mean square current producing this temperature. In order to avoid the great amount of labor which would have been necessary to calculate this quantity

from the current for an entire day's run of 19 hours or 20 hours it was measured directly as follows:

A street car wattmeter was connected in the field circuit of the motor so that it would measure the watt-hours lost in the field. In adapting the wattmeter for this purpose the large resistance which is ordinarily inserted in series with the armature of the meter when it is used on a 500-volt circuit, was replaced by a smaller resistance suitable for the voltage drop across the field, with maximum current. The wattmeter was, of course, calibrated with this special resistance. When arranged in this way the wattmeter measured the product of I^2, R and T, where I is the current, R the resistance of the field coils and T the total time. The resistance of the iron wire temperature coil at any time, by reference to the comparative test previously made, showed the resistance of the field coil, and the average value of this resistance between any two times could thus easily be found. The time was noted with a watch and hence T and R could be eliminated from the measurement made by the wattmeter, leaving I^2, the square root of which was the quantity desired. In working up the test the root mean square current was calculated in this manner for each single trip between terminals and also for each round trip. Previous tests over the same road had showed the average motor voltage to be about 175 volts, and in the present tests this quantity was not measured. The average line voltage had been found to be about 450 volts.

The observer on the rear platform noted the number, duration and location of stops made by the car, the time of passing prominent points along the route and also the entrance or exit of each passenger.

Five different runs were made with the car equipped as described, three over the Hamilton Avenue line (42,000 ft. long, one way), and two over the Highland Avenue line (36,000 ft. long, one way). For the first 25,000 ft. these two lines coincide. On the Hamilton Avenue line the car was run singly. On the Highland Avenue line a trailer was hauled for one trip in the morning and one trip in the afternoon. In the case of the Hamilton Avenue line starting at a temperature of 25½ degs. C., or 13 degs. C. above the temperature of the air, the temperature of the inside of the field coil rose gradually until at the end of 8 hours it had reached a temperature of 74 degs. C. During the next 8 hours the temperature remained practically constant at this value (maximum rise, 64½ degs. C.). During the following 3 hours, which were late in the evening, the air temperature decreased and the temperature of the field coil decreased with it, reaching a temperature of 70 degs. C. at the end of the last regular trip. Measurements of the temperature were taken also at intervals of 10 minutes while the car was standing idle during the night. The cooling of the motor was interrupted for a short time by the application of current in order to move the car from the yard into the car house. After approximately 4 hours of idleness, at the end of which time the car was made ready to start out on the next day's service, the temperature had fallen from 70 degs. C. to 32 degs. C., the latter point being a little over 20 degs. above the temperature of the air, showing that ordinarily a motor never gets completely "cold." The tests extended over two days' continuous operation, and on the second day the results obtained were practically duplicates of the first.

On the run on Highland Avenue the temperature of the field coil at starting was 18 degs. C. or 5 degs. above the atmosphere. The addition of the trailer for its morning trip caused a much more rapid rise of the temperature than was the case in the run of the Hamilton Avenue car, and a temperature of 60 degs. C. was reached at the end of about three hours. After the removal of the trailer the rise in temperature was more gradual. Had it not been for the addition of the trailer for its evening trip the temperature of the field coil in this case would have remained constant at approximately 75 degs. C., giving a rise approximately the same as in the other case. The addition of the trailer, however, caused a rapid rise to a temperature of 98½ degs. C. When the trailer was again removed and the motor run once more at its normal rate, the temperature fell off gradually to 74 degs. C., that is, a little less than its former temperature. It should be noted that the trailer was on for this afternoon trip only 1½ hours, while about three hours was required after its removal for the motors to cool off to the temperature at which they were before the addition of the trailer, and at which they would probably have remained had the trailer not been added. If the trailer had been left on for additional trips it is evident that the temperature would have reached a much higher value. As the car was not put in service for an early run on the day following this test the cooling continued for a longer time. It was noted that the field coil cooled from a temperature of 71½ degs. C. to a temperature of 25 degs. C. (which latter point was a little over 12 degs. C. above the atmosphere) in about 8 hours.

The two lines on which the tests were made naturally divide themselves into three sections. The first of these is a loop in the downtown or business portion of the city, about a mile in length, where the car is run very slowly and makes frequent stops. On this portion of the road there is great congestion due to the large number of cars, and the movement of any given car over this portion of the route is largely a succession of jerks. The second division is from the end of this loop—High Street to Atwood Street. This portion contains several long, heavy grades, the most important of which, 2½ per cent for 3500 ft. and 4 per cent for 3000 ft., are in the same direction. Comparatively few stops are made on this section. The third portion of the road is from Atwood Street to the outer terminus of the line. On this part of each line the grades are lighter and occur alternately up and down in shorter lengths. There are also few obstructions and a high speed is made. The time required on the first two portions of the road is about the same as that required on the third portion. In order to estimate the relative severity of the service on these different sections the root mean square current was calculated for a number of round trips over each. The average for these trips was 40.5 amps. for the first section, 41.8 amps. for the second section and 45.6 amps. for the third section. The results show that although the average root mean square current for the trips up the heavy grades was 50 amps., the average for the round trips over this section was not materially different from that on the remaining sections and was even less than that on the third section, where the track is most nearly level.

The length of the route over the Hamilton Avenue line is 8½ miles. The running time was in general about 95 minutes for the round trip, making a schedule speed of 10.7 m. p. h. On the Highland Avenue line the distance is 7 1-3 miles and the running time for the round trip was 76 minutes. The schedule speed on this line was thus 11½ m. p. h. In the down-town section of the city about 14 minutes is required to traverse a loop 5500 ft. in length. The schedule speed over this distance is thus approximately 4½ m. p. h. Over the second section of the road, between High Street and Atwood Street, the distance is 11,000 ft., and the schedule speed approximately 11 m. p. h. Over the third section the schedule speed on the Hamilton Avenue line was 11.6 m. p. h., and on the Highland Avenue line 12.35 m. p. h.

The average number of passenger stops per round trip on each route was calculated, and showed a value between four and five stops per mile. It is estimated that the practical stops required at curves and crossings, in addition to the stops for passengers, would make the total number of stops about six per mile. The length of stops varied from zero seconds, that is, a mere slow down, up to about 15 seconds. The average duration of stop for one run was 4 seconds.

The maximum and average passenger loads for each trip of

the respective all-day runs are carefully compiled. The net passenger load was calculated each time a passenger entered or left the car and these net loads were averaged. The average loads were thus figured without any reference to the distance which the passengers were carried. The net passenger load on each trip was plotted, with the distance as a basis, and the average loads were figured also from these curves with reference to the distance traveled as well as to the number of passengers. The results found in this way, however, differ only very slightly from those calculated on the other basis. Most of the passengers were carried over a considerable portion of the route. The car loads while passing over a very short distance, carries almost the entire load about six-tenths of the length of the route and then discharges it gradually. The car carried 457 people during the day on the outbound trips. The number carried on the inbound trips was 499, making a total of 956 in 18¼ hours, or fifty-two and one-half per hour. The average load, as calculated, was twenty-four passengers, or six-sevenths of the seating capacity of the car.

NOTES ON RAILWAY SHOP PRACTICE

Boston, July 18, 1903.

EDITORS STREET RAILWAY JOURNAL:

I have recently had occasion to inspect a number of electric railway shops and power stations in New England, and in the course of my travels naturally ran across a good many praiseworthy features of design as well as some pretty poor layouts. Perhaps some of your readers will be interested in several of the things which appealed to me.

In one large car repair shop the arrangements for handling motors and trucks struck me as admirable. The cars are run into the house from gauntletted tracks connecting with two or three main line spurs, and the machine shop is located on a floor beneath the track level, so that when the repair force desires to overhaul the motor and trucks it is an easy matter to do so. The car bodies are disconnected from the trucks and motor wiring, and then jacketed up over an electrically-driven hydraulic elevator, which quickly lowers the trucks and motors into the machine shop below. The machine shop floor is provided with tracks, and by flexible lead wires connected to the trolley circuit the trucks are self-propelled to any point in the shop where they are wanted. The speed is controlled by an old cast-grid resistance in series with the motors. There is a turntable set in the floor of this shop, which is moved by hand, and which is locked by simply placing an iron bar in each of the girder rails that leads from the turntable out to the main floor. This car house is also well equipped for pit work when it is required. The plan of dropping the trucks to a lower floor works out very well in practical everyday operation, and the elimination of extra work and delays due to cramped quarters is signally complete.

It is gratifying to note that electric railway managers are fast waking up to the importance of providing wholesome conveniences for their employees' sanitary comfort. Not long ago it was thought that proper washing facilities, clean toilet rooms and ventilated metal lockers were things of minor consequence, but observation shows that this attitude is rapidly changing. A great deal remains to be accomplished in this line, as we look over the general run of plants and car shops, but it is safe to say that in many of the larger and newer examples little else is required. Hot and cold water, clean towels, soap, and mirrors, which reflect the images of human beings instead of distorted simian countenances, are to be encountered much more frequently now than in the old horse railroad days, when a nail answered for a comb and all things were used in common felicity.

One of the large city car shops uses an ingenious tire expander in removing or replacing steel tires from and on its rolling stock wheels. The contrivance is composed of two concentric circles of 1½-in. wrought iron pipe, compressed air at 45 lbs. pressure per square inch being supplied to one, and ordinary illuminating gas to the other. Thirty-seven burners project radially into the central space enclosed by the tubes, and when these are lighted a powerful heating effect is produced by the highly oxygenated flames. An old tire, varying in thickness from 1 in. to 1¼ ins., can be expanded off from the wheel in 5 minutes, and a new one expanded on in 8 minutes. The new ones are 3 ins. thick, which accounts for the difference.

While one would naturally expect motor-driven machinery in street railway repair shops, it was something of a surprise to me to find a road using modern types of shunt motors for this work, rather than the antediluvian patterns of street railway motors whose days beneath the cars had long since ended. Here was a 42-in. lathe driven by a 15-hp shunt motor with a speed range of 675 r. p. m. to 925 r. p. m.; there I found four grinders for tires driven by a single motor off a common line shaft, and as a crowning evidence of progress wattmeter records were being taken periodically on the different machines, partly as a check upon the work accomplished and in part for the information of the engineers of the road.

Compressed air hoists, good for raising 6 tons and holding it, electric traveling cranes, as well as hand-operated hoists, pneumatic forges and 600-lb. hammers, all indicated an up-to-date shop superintendent and foreman. In the best planned installations several small machines were usually driven from a common line shaft—such as grinders, shapers, screw cutting machines, etc., rather than from individual motors. In watching lathe work I was struck with the rapidity and depth of cut which the most improved tool steels permit, and the smoking pile of blue steel shavings forcibly illustrated the difference between old and modern methods. These shavings are barreled and sold by the operating company, as well as the worn tires.

On the other hand, in a power station of another road which I visited, I found the boiler room in an indescribably dirty condition, poorly lighted, badly ventilated, with feed pumps nearly strangled in filthy pools of water. In this plant, which is in a large and prosperous city of Massachusetts, the switchboard panels are of various degrees of antiquity; the switches in cases opened upwards, falling closed; the ammeter dials were not definitely calibrated for close readings; the wiring underneath the main floor was in literally fearful shape; the positive switch of a new generator was set out in the floor where the crane chain has already struck it and caused a short circuit, and to cap the esthetic climax the station yard was full enough of old junk to endow a ragman with a fortune.

In one car shop a gasolene torch blazed away the noon hour in quiet celebration, and at the same place the workmen filled their pipes and smoked in peaceful ignorance (?) of a prohibitive sign, which apparently was not in force out of working hours, although it is not recorded that the fire risk absented itself when the 12 o'clock whistle blew.

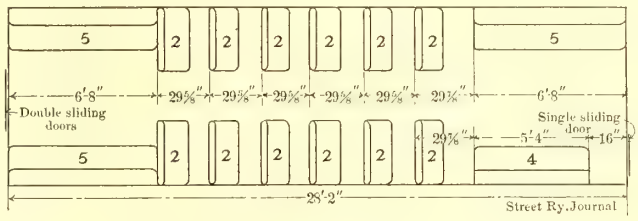
An interesting feature of a prominent car and repair shop's work was found in the card catalogue record of all the motor and equipment troubles daily occurring on the system. Starting with the reports of motormen and inspectors, the performance of a small amount of clerical work in the office resulted in the production of accurate records of all troubles, which papers are growing more valuable year by year to the operating company and to anyone else fortunate enough to see them. Tests on new devices and designs are also filed in the car shop office by card index or loose leaf book.

Thus it will be seen that much improvement has been made in late years and that the tendency is in the direction of systematic work, but there is still a great deal to be done.

ENGINEER.

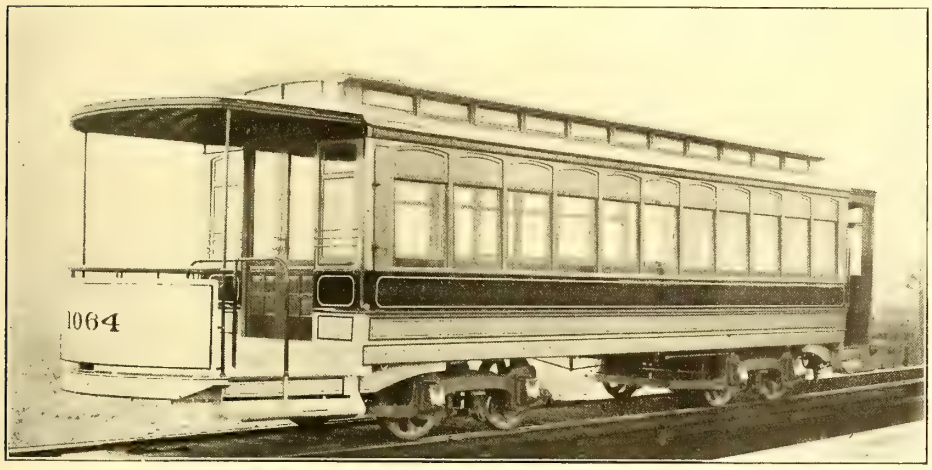
NEW SEMI-CONVERTIBLE CARS FOR DETROIT

The Detroit United Railway is adding 100 new cars for city service which will mark the first introduction on a large scale of double-truck cars for city service in Detroit, and also the first introduction there of a city car which is good for both summer and winter use. Photographs of the interior and exterior of this car and also plans giving dimensions and seating arrangement are here reproduced. The seating arrangement is a combination of cross seats and side seats, the cross-seats being used in the middle of the car and the side seats at the ends, where a wide aisle is desirable. The front platform has a motorman's cab which is entirely shut off from the entrance. The motorman is, therefore, not in the least disturbed by the entrance and exit of passengers from the car by way of the front platform. In this respect it resembles many interurban cars. In the motorman's cab is a stove, arranged like a hot-air furnace, which discharges hot-air into the interior of the car through a register located at the left-hand door, which seats four. The rear platform is of the usual Detroit type, 6½ ft. long, with a railing to prevent those standing on the rear platform from obstructing the passage into the car and for steadying the standing load on the platform. The trucks are 4½-ft. wheel base, known as the No. 47 truck of



PLAN OF SEATING ARRANGEMENT

the St. Louis Car Company, and specially designed for city service requiring a short wheel-base truck. The car is 41 ft. over all and 29 ft. over the corner posts. The width is 8 ft. 1 in. over the sill plates. The floor is 39 ins. from the track.

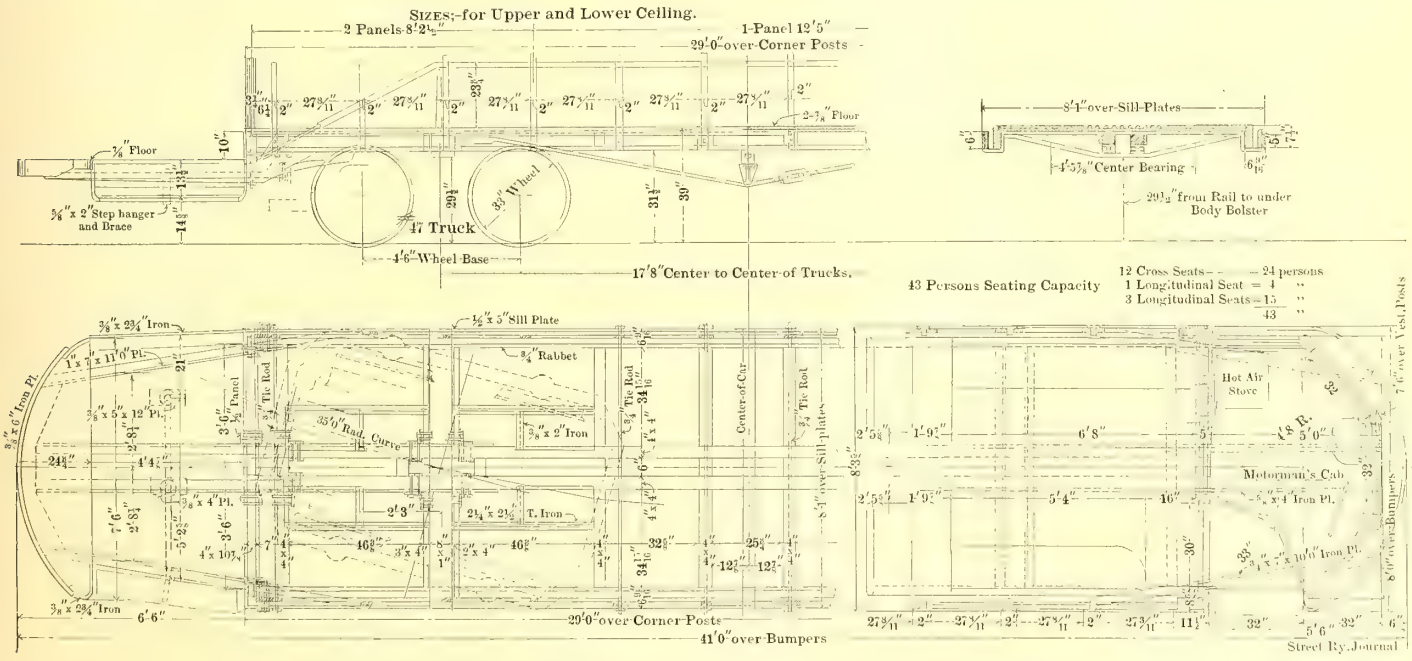




EXTERIOR AND INTERIOR OF CAR

upper corner of the front end of the car, just above the mirror seen in the interior view of the car. The entrance to the rear

The step is 14⅝ ins. from the track and 13½ ins. below the platform; the platform is 10 ins. below the car floor. The



CROSS AND LONGITUDINAL SECTION AND PLAN OF FLOOR FRAMING

of the car is by double sliding doors and to the front of the car by a single sliding door. The side seats at each end of the car will seat five persons, as indicated, except the one next to the finish is in oak and rattan seats. The seating capacity is forty-three persons.

The cars were built by the St. Louis Car Company.

SEMI-CONVERTIBLE CARS FOR ONEIDA

The American Car Company, of St. Louis, recently shipped twelve handsome semi-convertible cars (Brill patent) to the Oneida Railway Company, of Oneida, N. Y. The illustration shows one of three cars built with vestibules at both ends, while the remaining nine have open platforms at the rear. The cars



FIG. 1.—DOUBLE VESTIBULE, SEMI-CONVERTIBLE CAR FOR ONEIDA

include all the features of this well-known type, the ⅜-in. x 12-in. steel sill plate, the extra number of steel car lines, and windows which slide into roof pockets by means of metal grooves. The interiors are richly finished in dark mahogany, handsomely carved and inlaid, and ceilings of decorated birch. There are twenty double seats in each car, with walk-over backs. The seats are 36 ins. long. The monitor decks have a



FIG. 2.—INTERIOR OF SEMI-CONVERTIBLE CAR

clear width of 4 ft. 4 ins. Every other vent is arranged to be opened independently. The lower window sashes measure 25½ ins. x 29⅝ ins., and the upper 16¼ ins. x 29⅝ ins. In the vestibules the sashes are made with one light each, and arranged to drop into pockets.

The length of cars over end panels is 28 ft.; over crown pieces and vestibules, 36 ft. 8½ ins.; from panel over crown piece, 4 ft. 2½ ins. Width over sills, 8 ft., and over posts at belt, 8 ft. 3½ ins.; from center to center of posts, 2 ft. 8 ins. Side sills, of long-leaf yellow pine, are 4 ins. x 7¾ ins., plated on the inside. End sills are of white oak, 4¾ ins. x 6¾ ins. The corner posts are 3¾ ins., and the side posts, 3¼ ins. thick. The trucks are Brill 27-G, equipped with 40-hp motors. The wheel base is 4 ft.; the diameter of wheels, 33 ins., and of axles, 4 ins.

A NEW SYSTEM IN PENNSYLVANIA

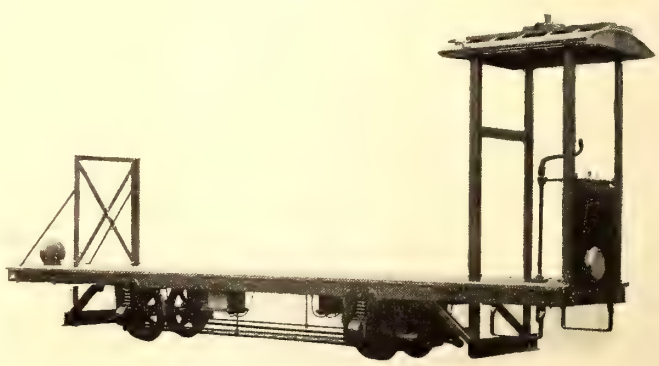
Operations will be commenced Aug. 1 on the Washington & Canonsburg Electric Railway, 15 miles long, connecting Washington and Canonsburg. This line will eventually be the connecting link of a system extending from Pittsburg to Wheeling. The line passes through Oak Grove, Arden, Meadow Lands, Houstonville and McGourren. It is one of the best constructed roads in the country. On the line are a number of steel bridges, and at Houstonville there is a steel viaduct 300 ft. long. The track is laid with 80-lb. rails, laid on oak ties. Instead of following the grade of the hills of Washington County the road has been made almost entirely level, this having been accomplished through the erection of trestles wherever a dip was encountered. This feature of the work cost in the neighborhood of $200,000, and the road complete represents an outlay of about $1,000,000. The power house is located at Meadowlands. It is a substantial brick structure, and the equipment consists of two 400-kw Crocker-Wheeler generators. These are connected direct with two 800-hp Russell engines.

The officials of the company are: Francis J. Torrance, president; Arthur Kennedy, vice-president; W. C. Hagan, secretary and treasurer. The general manager is Robert R. Reed, who has been associated with the Westinghouse Company for a number of years, representing that company in this country and abroad, and in more recent years active in street railway operations in New York city.

AN INTERESTING INDUSTRIAL LOCOMOTIVE

The accompanying cut shows a locomotive and lumber car, two of which have been shipped by the J. G. Brill Company to the Prairie Pebble Phosphate Company, of Mulberry, Fla., for whom they were ordered by the General Electric Company. The economy of operation of electric locomotives for industrial purposes has come to be very generally recognized, and in many places they are displacing steam locomotives. The fact that an ordinary day laborer of moderate intelligence can operate these machines with ease and accuracy is, of course, a great factor in their favor.

For the present these machines are intended for carrying wood, but at any time may be equipped with a second motor and draw-bars for hauling phosphate cars. They have a capacity of two cords of wood, cut in 4-ft. lengths. The length over end sills is 23 ft., and width over sills, 4 ft. The canopy at the forward end is supported by posts, which are 6 ft. 6 ins. high with a space between, 3 ft. x 3 ft. 4 ins. At the rear a strong upright frame is formed by angle-iron posts set through the floor and secured with heavy irons above and below. The locomotives are mounted on gear trucks of the builders' make,



INDUSTRIAL LOCOMOTIVE FOR HAULING AND CARRYING MATERIAL

with wheel base of 10 ft. The wheels are 22 ins. in diameter, and the axles 3 ins. The track gage is 24 ins. A 250-volt motor is used with each locomotive. Total weight of locomotive is 6080 lbs.

LEGAL NOTES.

CHARTERS, FRANCHISES AND ORDINANCES.

ALABAMA.—Street Railways — Nuisance — Injunction—Special Damages.

1. Where a street railway, having a right, by consent of the city, to construct its lines in a certain street, undertakes to lay its tracks in a portion of the street not designated in its charter, an abutting property owner, not suffering any injury, cannot complain.

2. Owners of property abutting on a street, in which it is proposed to lay an electric railway, are not entitled to restrain its construction because of threatened dangers in the ingress and egress to and from their premises, obstruction of the street, noise, dust, and vibration; but if they suffer damages from the operation or construction of the road, they have a remedy at law therefor.

3. In order to entitle owners of property abutting on the street in which it is proposed to lay an electric railway to restrain the construction of the same, it is incumbent on them to show a nuisance in fact, and that they would suffer special injury, different from that sustained by the general public.—(Baker et al. vs. Selma Street & Suburban Ry. Co., 33 S. E. Rep., 685.)

ARKANSAS.—Highways—Construction of Street Car Line—Additional Servitude—Jurisdiction of County Court—Abutting Owner—Contract—Construction by Conduct—Change in Railway System—Right to Damages.

1. Though a county court has general jurisdiction of matters pertaining to public roads, it is without authority to impose an additional servitude on a public highway by granting to a street car company the right to construct its system thereon.

2. A lost contract may properly be interpreted by the conduct of the parties thereunder.

3. By petitioning the county court to permit the extension of a street railway system along a highway beyond the corporate limits of a city, an abutting owner assumed a contractual relation with the company, binding her to permit the erection and operation of its system, which, as then contemplated, was one for horse car service. Afterwards this was changed to an electric system; the situation of the tracks being altered, and poles and wires being erected. Held, that the abutting owner was not precluded by her contract from claiming damages from the change, even though, had the right of way originally been secured by legislative authority, the change would not have imposed an additional servitude on the owner.—(Humphreys vs. Ft. Smith Traction Light & Power Co., 71 S. W. Rep., 662.)

CONNECTICUT.—Street Railways—Paving Streets—Public Authorities — Control — Statutes — Construction—Repeal—Railroad Commissioners—Jurisdiction—Right of Appeal.

1. Pub. Acas 1893, c. 169, sec. 6 (Gen. St. 1902, sec. 3837), provides that every street railway company occupying a public highway shall keep a certain part of the highway in repair to the satisfaction of the authorities of the municipality. By an act of 1901, a prior act of 1895, which authorized an appeal from orders of the local authorities relating to street railway companies to the superior court, or any judge thereof, was repealed; and such act, while providing that most of the matters provided for by the act of 1893 should be within the exclusive jurisdiction of the railroad commissioners, declared that when the local authorities should render any decision with reference to a street railway company as to the highway, etc., the company might appeal to the railroad commissioners. Held, that the power given by the act of 1893 to the municipal authorities to order a street railway company to repair parts of the highway was not abrogated by the act of 1901.

2. The act of 1901 authorized the railroad company, on being denied by the city authorities the right to lay a particular kind of pavement, to appeal from such order to the railroad commissioners.—(City of Hartford vs. Hartford Street Ry. Co., 53 Atlantic Rep., 1010.)

ILLINOIS.—Municipal Improvements—Street Assessment—Superseding of Recommendation—Record Reciting Notice—Railroad Property—Assessment of Benefits—Use for Manufacturing—Fire Protection—Propositions of Law—Refusal to Consider.

1. An ordinance, passed on recommendation of the Board of Improvements, for the paving of four blocks of a street, is not invalidated because the Board had previously recommended paving two of the blocks, and the Council had deferred action on the ordinance introduced accordingly.

2. Under Laws 1897, p. 105, sec. 9, providing that the recommendation of the Board of Local Improvements for the passage of a paving ordinance shall be prima facie evidence of proper preliminary steps, a recital in the Board's record that notices of a public meeting had been mailed pursuant to section 7, requiring such notices to property owners, is sufficient, and the facts relative to the giving of notice to each property owner need not be recited.

3. The fact that leases of railroad property for business and manufacturing purposes may be canceled by the company on six months' notice does not establish that the property is only temporarily devoted to such purposes, so that a paving assessment must be based on benefits accruing to it as railroad property, merely.

4. The fact that the Attorney General may, under General Incorporation Act, c. 32, sec. 5, require a railroad company to sell realty devoted to ordinary business or manufacturing purposes, does not require benefits accruing to the property in view of its ultra vires employment to be excluded in making a paving assessment.

5. The benefit accruing to property from the greater facility with which fire protection can be afforded it is proper for consideration in making a paving assessment.

6. In view of the fact that Laws 1871-72, p. 345, providing for the submission of propositions of law to the court where a jury has been waived, was enacted before Laws 1877, p. 69, creating the Appellate Court, it is error to refuse to pass on such propositions on the theory that the statute applies only to cases which will go for review to the Appellate Court.

7. Where, by exceptions to rulings on the admissibility of testimony, the same questions are preserved for review as are intended to be presented by propositions of law which the court refuses to pass on, such refusal is harmless error.—(Chicago Union Traction Co. et al. vs. City of Chicago, 67 N. E. Rep., 383.)

ILLINOIS.—Street Railways—Transfers—Connecting Lines—Ownership—Legal Title—Beneficial Interest—Evidence—Municipal Regulation of Rates—Reasonableness—Presumption—Proof.

1. Under Revised Code Chicago, section 1723, providing that at any point where the line of a street railway joins, connects, crosses or comes within a distance of 200 feet of any other line owned or operated by the same company any passenger shall be entitled to a transfer entitling him to ride on the connecting line without additional charge, a street railway corporation is required to give transfers if it is the real beneficial owner of both the connecting lines, though the dry legal title to one of them may be in another corporation.

2. Revised Code Chicago, section 1725, provides that any street railway company refusing to give transfers as provided by section 1723 shall be liable to a penalty. Evidence in an action by the city to recover penalties for refusals to give such transfers considered, and held to show that defendant corporation was the real beneficial owner of the connecting lines, and required to give transfers, though the dry legal title to one of the lines was in another corporation.

3. The rate of fare prescribed by a city ordinance limiting the rate of fare to be charged by street railway companies is presumed to be reasonable until its unreasonableness is shown, and the burden of showing the rate to be unreasonable is on the companies.

4. The question of whether the rates prescribed by a city ordinance limiting the fare to be charged by street railway companies are so low as to constitute a deprivation of property without due process of law cannot be determined by a consideration of the earnings of a portion only of the lines of a street railway company, but only by estimating the earnings of the entire line as against the expenses of the entire line.

5. In an action by the city under Revised Code Chicago, section 1723, fixing the fare to be charged by street railway companies, evidence considered, and held insufficient to show that the rate of fare so fixed was so low as to result in a deprivation of property without due process of law.—(Chicago Union Traction Co. vs. City of Chicago, 65 N. E. Rep., 470.)

ILLINOIS.—Municipal Corporations — Street Railways — City Charter—Authority to Regulate Fare—Transfers—Impairing Obligation of Charter—Lease—Waiver—Estoppel—Ordinance—Scope—Application to Future Conditions.

1. The Legislature has power to regulate the charges of common cariers.

2. The Legislature may delegate its power to regulate the charges of common carriers to a municipal corporation.

3. If there is doubt as to whether a municipal charter confers on the municipality the right to regulate the charges of common carriers, that doubt must be resolved in favor of the existence of the power.

4. Under 1 Starr & C. Ann. St. (2d Ed.) pp. 689-715, art. 5, sec. 1 (City and Village Act April 10, 1872), adopted by the city of Chicago as its charter, as well as under former charters (Act Feb. 14, 1851, and Act Feb. 13, 1863), authorizing the city to regulate

and prescribe the compensation of hackmen, cabmen, omnibus drivers, and "all others pursuing a like occupation," the city had power to enact Revised Code Chicago, sections 1723, 1725, limiting the rate of fare to be charged by street railway companies, inasmuch as the phrase "others pursuing a like occupation," when construed ejusdem generis, includes street railway companies.

5. The city of Chicago, having power under its charter (1 Starr & C. Ann. St. [2d Ed.] pp. 689-715, art. 5, sec. 1) to limit the rate of fare to be charged by street railway companies, had also, as a necessary incident thereto, power to enact Revised Code Chicago, sections 1723, 1725, requiring street railway companies to furnish transfer tickets entitling passengers to ride on a connecting line of the same company without the payment of an additional fare.

6. Where city ordinances granted the right to operate street railway lines in the south and west divisions of the city, and provided that the rate of fare for any distance should not exceed 5 cents, the street railway company was not thereby authorized to charge a fare of 5 cents for a ride in one division, and another fare for a ride in the other division, but only to charge a single fare for a ride in both divisions.

7. By incorporating under a general incorporation act, a corporation accepts the provisions of such act as part of its charter.

8. Persons contracting with a corporation are presumed to act with full knowledge of its charter powers.

9. 1 Starr & C. Ann. St. (2d Ed.) p. 1006 (Incorporation Act section 9), provides that, as to corporations organized under that act, the General Assembly should have power to prescribe such regulations as it shall deem advisable. A corporation was organized under this act to construct, own, purchase, acquire, and lease street railways in Chicago. The city charter of Chicago (1 Starr & C. Ann. St. [2d Ed.] pp. 689-715, art. 5, sec. 1) gave the city power to prescribe the rate of fare to be charged by street railway companies. The corporation so organized leased street railway lines from a number of other corporations, which possessed, by contract with the city, embodied in their charters, the right to charge a certain fare, which the city had no right to reduce without their consent. By the terms of the leases the lessee acquired the right to the sole possession, operation, and control of the leased lines. Held that, by leasing the roads with knowledge of the requirement of the lessee's charter that it should be subject to regulation by the General Assembly, the lessors consented to the operation of the leased lines under the provisions of the lessee's charter, and not those of their own, thereby waiving their charter right to charge the fare fixed therein, so that Revised Code Chicago, section 1723, in effect requiring lessee to carry passengers for a smaller fare than lessors were by their charters entitled to charge, did not impair the obligation of those charters as contracts.

10. As the operation of the leased lines by the lessee in accordance with the provisions of the lessors' charters, restricting the power of the city to regulate rates of fare, would be a violation of the requirement of its own charter that it should be subject to regulation by the General Assembly, and hence also by the city under the power delegated in its charter, the lessee was estopped from insisting on the right to operate the leased lines under the lessor's charters.

11. Revised Code Chicago, section 1723, providing that the rate of fare "to be charged" on any street railway for any distance within the city limits shall not exceed 5 cents, and that at any point where a line of street railway does now or shall hereafter join, connect with, cross, or come within a distance of 200 feet of another line belonging to the same owner, any passenger shall be entitled to a transfer, etc., applies not only to companies existing at the time the section was enacted, but to those coming into existence thereafter.

12. In the absence of any showing as to earnings or profits of a street railway company, the court cannot pass on the question as to whether an ordinance regulating the rates of fare to be charged by such companies amounts to a deprivation of property without due process of law.—(Chicago Union Traction Co. vs. City of Chicago (three cases), 65 N. E. Rep., 451.)

ILLINOIS.—Contracts—Construction—Public Policy—Contract to Procure Property Holders' Consents to Construction of Elevated Road—Pleading—Assumpsit—Common Counts.

1. In assumpsit to recover an extra compensation for services rendered in procuring the consents of property holders to the erection of an elevated railroad, evidence held to support a finding that plaintiff's right to extra compensation was conditioned merely on procuring the consents, and not on securing them without compensation.

2. Where a requested instruction stated a correct proposition of law as applied to certain alleged facts, but the court found that the facts did not exist, the refusal of the instruction was not error.

3. Plaintiff contracted to aid in procuring the consents of adjacent property holders to the erection of an elevated railroad loop —such consents being necessary to obtain the passage of an ordinance authorizing the loop; and it was stipulated that he should receive a bonus "in case the company was successful, and his efforts helped in securing the legal amount of frontage." One side of the loop was completed when the contract was made, and ordinances authorizing the construction of the other sides were obtained at different times and in conjunction with various other companies. Held, that the contract could not be construed to make plaintiff's right to receive the bonus conditional on the passage of an ordinance granting the right to build the entire loop, but that he was entitled to the bonus on completion of the loop, though no one ordinance authorized the construction of all of it.

4. A contract to use personal influence to obtain the consents of property holders necessary to enable a City Council to pass an ordinance authorizing the construction of an elevated railroad is not opposed to public policy.

5. In an action on a contract fully executed, so that nothing remains to be done except the payment of money, it is not necessary to declare specially, but a recovery may be had under the common counts in assumpsit.

6. The Appellate Court's finding of fact is conclusive on the Supreme Court.—(Union El. R. Co. vs. Nixon, 65 N. E. Rep., 314.)

ILLINOIS.—Street Railways—City Ordinance—Cleaning Between Tracks—Police Power—Public Burden—Impairment of Contract.

1. A city ordinance required a street railway company to clean, between its rails, all streets occupied by the company, and imposed a penalty for violation of the ordinance. On a prosecution for violation of the ordinance it appeared that, owing to the presence of the tracks, the street, instead of sloping from the center, had a flat crown 16 ft. in width, and that the rails retained dirt in the center of the street, and that, owing to such conditions, it was more difficult and expensive to clean the street. Held, that the ordinance was not void as casting a public burden on the street railway company.

2. The ordinance was not an unreasonable exercise of the police power.

3. An ordinance requiring a street railway company to clean, between its tracks, streets occupied by it, does not violate the rule as to equality and uniformity of legislation.

4. An ordinance requiring a street railway company to clean, between its tracks, streets occupied by it, is not invalid as impairing the obligation of a contract created by the ordinance authorizing the occupation of the streets, since a city cannot, by ordinance, deprive itself of its rightful police power.—(City of Chicago vs. Chicago Union Traction Co., 65 N. E. Rep., 243.)

INDIANA.—Cities — Police Power — Extent—Ordinances—Nuisance—Elevation of Railroad Crossings.

1. The question raised by a demurrer to an alternate writ of mandamus is not whether the relator is, under the facts, entitled to some relief, but whether he is entitled to the specific relief prayed for.

2. Under Burns' Rev. St., sec. 3794 (Indianapolis City Charter, sec. 23), providing that the Common Council shall have power to declare what shall constitute a nuisance, require its abatement, secure the safety of citizens in the running of trains in and through the city, require corporations operating railroads to construct street crossings and viaducts and provide protection against injury to persons from the operation of railroads, require railroad companies to change the location, grade, and crossings of their roads, and to raise or lower their tracks to conform to any grade which may be established, etc., the city has no power to pass an ordinance requiring all railroads operating within the corporate limits to construct elevated tracks over all crossings within a prescribed district, without regard to the conditions or circumstances of any particular crossing.—(State ex rel. City of Indianapolis vs. Indianapolis Union Ry. Co., 66 N. E. Rep., 163.)

INDIANA.—Eminent Domain—Railroads and Electric Railways —Crossings—Proceedings—Injunction—Pleadings—Effect of Appeal—Railroad Law—Application.

1. Burns' Rev. St. 1901, sec. 5468a, cl. 5, gives interurban street railway companies authority to cross any railroad tracks, and requires that, in case the compensation for crossing cannot be settled, the same must be determined by commissioners appointed as under the statute in respect to the taking of lands. This statute (section 5468e) requires the corporation taking the land to file in court "a description of the rights and interests intended to be appropriated." Held, that a complaint for an injunction by a street railway, stating that it was authorized to cross a certain railroad track, and, being unable to agree on compensation, it had filed an instrument of appropriation, that commissioners had fixed the amount, etc., but that said railroad interfered with its rights to cross, was sufficient without setting out the instrument of appropriation or averring that it stated the jurisdictional facts.

2. Burns' Rev. St. 1901, sec. 5468e, in respect to the taking of lands, made applicable to street railways crossing railroads by sec. 5468a, directs that on failure to agree on compensation the court may on application appoint appraisers, and, on the return of their assessment of damages, the amount assessed must be paid to the clerk or tendered to the party in whose favor it is made. The award may be reviewed on exceptions by either party, but it is expressly enacted that notwithstanding such appeal the appropriating company may take possession of the property. Held, that a railroad company that had filed exceptions to proceedings by a street railway to acquire a crossing, and had taken an appeal, had no right to interfere with the street railway and prevent it constructing the crossing.

3. The general railroad law, Burns' Rev. St. sec. 5158a, requiring the question as to whether it is practicable to avoid a grade crossing at the intersection of two railroads, and, if not, the mode of such crossing, to be submitted to the Circuit Court, does not apply to a street or interurban electric railway crossing a railroad, they being governed by Burns' Rev. St. 1901, sec. 5468e, requiring the manner of such crossing to be determined by commissioners in the proceedings to acquire the right of crossing.

4. In proceedings by an interurban electric railway, under the Street Interurban Railway Act of 1901 (Laws 1901, p. 461, c. 207), to acquire a right of crossing a railroad, the report of the commissioners that it should be a grade crossing; that the same shall be a frog crossing constructed of the same weight and kind of rails as are in the tracks of the railroad, and to be of a pattern in general use, and requiring a derailing device so constructed that the electric cars could not be run over the railroad tracks except by connecting the tracks of the electric cars by a lever from the side on which the car was approaching—was sufficiently certain. The provisions of Burns' Rev. St. 1901, sec. 5158b et seq., relate exclusively to interlocking devices to avoid the necessity for stopping trains before passing over the tracks of intersecting railroads, and have nothing to do with condemnation proceedings under the Street and Interurban Railroad Act.

5. The commissioners were not authorized to determine by which of the corporations the expense of establishing the crossing should be paid; the statute fixes that liability upon the company owning the road last constructed, unless otherwise agreed on.—Wabash Ry. Co. vs. Ft. Wayne & S. W. Traction Co., 67 N. E. Rep., 674.)

IOWA.—Highways—Dedication—Street Car Tracks—Municipal Control—Reasonable Exercise—Prior Ordinances—Violation of Contract—Colorable Performance—Statutory Enactment—Franchise—Effect of Purchase.

1. In 1874 property owners along a 66-ft. road dedicated additional land so as to make it 120 ft. in width, and it was afterwards so generally regarded. In 1879 a corporation obtained from the abutting property owners consent that a "street" railway might be built "on and upon said boulevard," and the railway was built along one side of the enlarged street. As a defense to an action by the county to enjoin the company from such use of the road, the company successfully relied on a statute authorizing the construction of such railway on "highways" over 100 ft. in width. The county also refused to accept the dedication of the property owners. Held, that the company's right of way was not derived by grant from the property owners as over private property, since dedication and acceptance of the additional strip by the public was inferable from such circumstances, regardless of the absence of a formal acceptance by the county.

2. An ordinance was passed authorizing a street railway company to lay its tracks on a certain grade and in a certain manner. Six years later, when the repeal of the ordinance was being discussed, the company made its first move under the ordinance. Held, that such action was colorable only, and would not deprive the city of its right of repeal.

3. An ordinance ordered a street railway company to move its tracks from the side of the street to a rock-ballasted, curbed strip 20 ft. wide in the middle of the street, elevated several inches above the 25-ft. driveways on either side. Six years later the city passed a repealing ordinance again ordering the removal to the middle, but also ordering the paving and lowering of the tracks to grade. Held, that the second ordinance was not invalid as a violation of a contract or vested rights, since a city cannot be divested by ordinance or contract of its legislative power to make changes in its streets in the exercise of a reasonable discretion.

4. The burden is not cast upon a city to show that its exercise of legislative power is reasonable.

5. Under the authority of a statute providing that street railway companies might extend their lines into the county over highways 100 ft. or more in width, a company constructed its line out upon such a highway. The highway afterwards became a city street. Held, that the use of the road, as granted by the statute, was subject to the governmental control of the highway, and that hence the company could be compelled by ordinance of the city to move its tracks, the same as any other street railway.

6. A motor line operating a street railway on a certain street purchased the franchise of an electric street railway company calling for an electric line along the same street, and also providing regulations for the construction and maintenance of the tracks. The motor line changed its power to electricity, but continued to occupy the same tracks. Held, that the regulations of the charter applied to the old motor tracks.

7. An ordinance ordered the removal of street car tracks from the side of a street to a strip in the middle 20 ft. wide, to be curbed and rock-ballasted, and elevated several inches above the adjoining 25-ft. driveways. Afterwards a repealing ordinance was passed ordering the tracks to be moved to the middle of the street, but to be constructed at grade, and the ground so occupied to be paved in accordance with the rest of the street. The company was operating under a charter requiring that the car tracks be paved and constructed at grade so as to afford no unnecessary obstruction to travel. Held, that both on general principles and under the charter the repealing ordinance constituted a reasonable exercise of the city's legislative control of its streets. Code, sections 753, 767.—(Snouffer vs. Cedar Rapids & M. City Ry. Co., 92 N. W. Rep., 79.)

IOWA.—Taxation—Street Railway—Mode of Assessment—Appeal from Board of Review—Transcript—Appeal Bond—Failure to File—Effect.

1. Failure to file a transcript of the proceedings of a Board of Review until during the trial of an appeal therefrom does not oust the District Court's jurisdiction of the appeal, jurisdiction being obtained by service of the notice prescribed by Code, sec. 1373.

2. Under Code, sec. 1373, providing that appeal from a Board of Review may be taken by a written notice served on its chairman, an appeal bond is not required.

3. Code, sec. 1343, governing the assessment of street railways, provides that "the lands, buildings, machinery, poles, wires, overhead construction, tracks, conduits and fixtures" shall be assessed in the district where situated, but, where situated partly within and partly without the limits of a town, "such portions of the plant" shall be assessed separately, etc. Held, that while a street railway franchise was not assessable under this section, the portion of the system within a town was, nevertheless, to be assessed as a fractional part of an organized and money-earning whole with allowances for its state of repair, and was not to be resolved for assessment purposes into its component materials, such as rails, spikes, ties, poles, cross-bars, labor of construction, etc.—(City Council of Marion vs. Cedar Rapids & M. C. Ry. Co., 94 N. W. Rep., 501.)

KENTUCKY.—Municipal Corporations—Assessments—Street Improvements—Assessment According to Surface Areas.

1. A city contracted with plaintiff for the improvement of a street, and assessed the cost thereof on abutting property, according to statute, in proportion to superficial areas. Owing to the intersection at an acute angle of another street with that improved, the assessed area of the property across the street from the intersection was 96,250 feet, and that in the intersecting angle was only 11,305 feet. Held, that the assessment, being at the same rate per square foot on each side of the street, was valid.

2. The property across the intersecting street having been previously assessed, and being across a principal street, could not be re-assessed.—(Louisville Ry. Co. vs. Southwestern Alcatraz Asphalt & Construction Co., et al., 74 S. W. Rep., 237.)

MASSACHUSETTS.—Street Railways—Reservation of Space for Tracks—Additional Servitude.

1. St. 1895, p. 109, c. 121, forbidding the granting of any location for the track of any street railway in a certain locality, except in ways in which special space for the use of street railways shall have been reserved prior to the location of the tracks, and except within the limits of such reserved space, and authorizing the Selectmen of the town to lay out such space, is not unconstitutional on the ground that it authorizes the imposition of an additional servitude without compensation.—(Eustis vs. Milton Street Ry. Co. Hollingsworth vs. Same. Whitney vs. Same. Kennedy vs. Same, 67 N. E. Rep., 663.)

MASSACHUSETTS.—Eminent Domain—Elevated Railroads—Statutes—Construction—Abutting Property—Damages—Noise—Concurring Causes—Measure of Damages.

1. St. 1894, p. 764, c. 548, sec. 8, provides that the location of a railway in any public way shall be deemed an additional servitude, and entitle persons having an estate in such way, or any abutting premises, and who are damaged by reason thereof, to recover compensation in the manner provided; and sec. 9 declares that in such a proceeding the findings shall be on the following question: "Has the petitioner's estate been damaged more than it has been benefited by reason of the location or operation of such railway; and,

if so, how much?" Held, that the word "damage," as so used, should be construed to mean special, and not general damage.

2. Where it was found that noise incident to the operation of an elevated street railway was such as to constitute a private nuisance, if it were not authorized, such noise constituted special and peculiar damage to abutting property, for which the owner was entitled to compensation, as authorized by St. 1894, pp. 764, 765, c. 548, sec. 8, 9.

3. Where, in an action for the assessment of damages to abutting property by an elevated street railway, there were other causes of damage connected with the operation of the railway, which, concurrently with noise, produced the damage, it was not necessary, in assessing the damages, to separate the effect produced by the noise alone from the effect of other concurring causes.

4. Where, in a proceeding to assess damages arising from the maintenance of an elevated street railroad, plaintiff owned the fee in a part of the street on which part of the structure was erected, the fact that plaintiff's deed to his abutting property limited his occupation and use to a strip 10 feet in width along the line of the street did not limit plaintiff to a recovery for noise from the operation of the railroad to the difference between the depreciation in value of his property which would be caused by the noise if it existed just beyond its confines and the depreciation caused by the noise in its present location.—(Baker et al. vs. Boston Elevated Ry. Co., 66 N. E. Rep., 711.)

MICHIGAN.—Eminent Domain — Railroads — Condemnation—Jurisdiction—Instructions—Appeal—Review.

1. The court, on appeal, will not review the decision of the trial judge and the jury making the award in proceedings by a railway company for the condemnation of land that the proposed railroad is a public necessity.

2. Where the court in condemnation proceedings by a railway company decided on the issue whether, before the commencement of the proceedings, the company had made a bona fide effort to acquire the land by offering a fair price therefor, that on the evidence offered it was a case for the jury, but that the landowner might later offer additional evidence to perfect his record, the refusal of another judge hearing the case to hear the additional testimony did not oust the court of its jurisdiction to impanel the jury, since the decision of the court that it was a proper case for the jury was a decision that the company had made a bona fide effort to acquire the land necessary as a condition precedent for the impaneling of a jury.

3. Where, in proceedings to condemn land for a railway right of way, the jury viewed the land, and the evidence as to its value was conflicting the court on appeal will not review the action of the jury.

4. An instruction in proceedings to condemn land that railroads are public necessities, and that the taking of land for railroads is taking land for a public use, was not objectionable as removing the question from the jury of the necessity of taking the land for a public use, where other instructions specifically stated that it was for the jury to determine whether it was necessary to take the land for a public use.

5. An instruction in proceedings to condemn land that the jury should pay the land owner what the land was worth was not erroneous as excluding damages for anything on or under the land, as well as the damages resulting to the other land, where other instructions specifically stated that the value of land was what it was worth taking into consideration any injury that might be sustained to the land remaining.

6. Comp. Laws 1897, sec. 6248, providing that within twenty days after the confirmation of the report of the commissioners or jury in proceedings by a railroad company to condemn a right of way either party may appeal from "the appraisal or report of the commissioners or jury," does not authorize an appeal from the allowance of attorney's fee to the owner of the land condemned under the express authority of sec. 6240.—(Detroit & T. Short Line Ry. Co. vs. Hall et al., 94 N. W. Rep., 1065.)

MICHIGAN.—Street Railways—Right of Way—Encroachment on Toll Road—Contract—Adequate Remedy at Law.

1. A contract between a toll road company and an electric railway company operating a single track along one side of the toll road provided that as the railway company desired to construct a second track upon its own adjacent right of way, and desired, when necessary, "to encroach upon" the toll road, therefore such encroachment should be permitted, and, "if at any place it should be necessary to encroach upon the roadbed, the railway company would extend the roadbed, etc. Held, that the purpose of the contract was to enable the railway company to double-track its road, and that necessary encroachment on the roadbed was therein contemplated.

2. A toll road company has an adequate remedy at law for an unnecessary encroachment on the highway by an electric railway company which has a contract authorizing necessary encroachments.—(Detroit & B. Plank Road Co. vs. Oakland Ry. Co., 92 N. W. Rep., 346.)

NEW HAMPSHIRE.—Street Railways—Routes—Establishment—Rights in Street—Obstruction—Special Charter Provisions—Repeal.

1. A street railway company's charter required that its route over the streets of the city should be determined by the Selectmen thereof in like manner as highways are laid out. Pub. St. 1901, c. 45, providing for the establishment of highways, sec. 4, requires that the Selectmen shall make their decisions in writing, and cause the petition and their decision to be filed in the Town Clerk's office and recorded at length on the town records, and declares that their decision shall be of no effect until such section is complied with. Held, that where the Selectmen voted a general location to such street railway company in accordance with a plan, but the hearing of the petition for the laying out of the railway was continued from time to time while the road was being built, such general location, without record thereof, conferred no authority on the company to occupy the streets.

2. Laws 1889, p. 161, c. 178, sec. 2, granting a special charter to a street railway company, and requiring that its route should be laid out and selected by the Selectmen of a town in like manner as highways are laid out, was not repealed by Laws 1895, p. 367, c. 27, providing for the organization of street railway corporations by general law, and declaring that previous charters granted were altered or amended so far as they were inconsistent with such general law.—(Lenoix vs. Dover, S. & R. Street Ry. et al., 54 Atlantic Rep., 1022.)

NEW HAMPSHIRE.—Rural Electric Railway Company.—Charter—Power to Construct Branch Line.

1. Under Laws 1899, chapter 153, section 1, incorporating an electric railway company, and empowering it to construct a railway, with necessary sidings and sidetracks, from a certain point in one town, over and on such highways, bridges, and public and private lands as may be necessary for the public accommodation, in that and three other towns, to some convenient point in the State line, and by section 2 providing that said railway shall be laid out by the Selectmen of said towns as highways are laid out, construction of a rural railway, only, between the termini mentioned, is authorized, and a branch line in one of the towns, for the accommodation of its inhabitants, cannot be constructed; the words "public accommodation" referring to the general public, whose convenience required the road extending through the several towns.—(Attorney-General ex rel. Boston & M. R. R. vs. Derry & P. Electric Ry. Co., 53 Atlantic Rep., 443.)

NEW JERSEY.—Street Railways—Right to Use Streets—Consent of Governing Body of County and Township.

1. Traction Act 1893, section 1 (3 Gen. St. p. 3235), requires a street railway corporation, before using any street or highway, to obtain the consent of the governing body "of the township or county" within which the street or highway used is located; Acts 1894 (3 Gen. St. p. 3247) provides that, in addition to the restrictions prescribed by law, no street railway shall be constructed in any street in any municipality, town, township, village, or borough, without the consent of its governing body; and Act 1896 (P. L. 1896, p. 329) requires the consent of the governing bodies of cities, towns, and villages, and declares that if any board or public authority other than the governing body of such municipality, town, or village shall have control of any of the streets or highways over which the tracks are to be located, the consent of such other body or public authority shall also be obtained. Held, that though, under the act of 1893, the consent of the governing body "of the township or county" only need be obtained, the subsequent acts required the consent of both county and township or other municipality within the territory in which the railway lines were proposed to be built.—(Woodbridge Tp. vs. Raritan Traction Co., 53 Atlantic Rep., 175.)

NEW JERSEY.—Corporations—Powers—Owning Stock—Exchange of Property—Valuation—Injunction.

1. Under Corporation Act, sections 6, 7, making it lawful to form a company to construct and operate railroads, and to hold, purchase, and convey real and personal property out of the State, a New Jersey corporation, with a charter stating its objects to be to own and operate, outside the State, railway properties of all kinds, and to sell and lease the same, and to acquire, by purchase or otherwise, the stock, etc., of other corporations, and sell and dispose of such stock, and providing that "with the consent in writing * * * of the holders of a majority of the stock * * * the directors shall have power to sell or otherwise dispose of the whole property of the corporation," may, on obtaining such consent, exchange its entire property for stock of the purchasing corporation.

2. Such an exchange is not controlled by section 54 of the cor-

poration act, declaring that on the dissolution of a corporation the directors are trustees for the settlement of its affairs, and may sell all or any part of its property for cash, or partly on credit, or take mortgages and bonds for part of the purchase price, though it is intended to divide the stock so received pro rata among the old stockholders and dissolve the corporation.

3. The fact that there is a mortgage on all the property of such corporation, together with "all stocks, bonds, etc., now owned or hereafter acquired" by it, and that the stock, when acquired, will be subject to such mortgage, and cannot be distributed to the stockholders, as contemplated, is not ground for enjoining the exchange.

4. Under 1 Hill's Ann. St. & Codes Wash., secs. 1497, 1500, authorizing corporations to be formed to build and operate railroads, and to purchase, sell, etc., real and personal property, and section 1524, authorizing corporations of other States to "acquire and dispose of all real and personal property convenient to carry into effect its objects," etc., an exchange by a New Jersey corporation, owning a street railway in Washington, of its property for stock in a corporation of the latter State, is valid.

5. Const. Wash., art. 12, sec. 6, declaring that all fictitious increase of stock by a corporation shall be void, does not forbid the issuance of stock in payment for property purchased.

6. Where a corporation issues stock in payment for property purchased, the valuation placed by it on the property and stock, in the absence of fraud, is binding and conclusive, as between the parties, but not on the courts or subsequent creditors.

7. Under Corporation Act 1896, section 51, empowering corporations to purchase the securities of other corporations, and 1 Hill's Ann. St. & Codes Wash., sec. 1506, declaring shares of corporate stock to be personal estate, in the absence of any statute or decision of the Washington courts declaring a contrary public policy in that State a New Jersey court will presume that, in accordance with the rules of comity, a New Jersey corporation may own and vote on shares of stock in a Washington corporation.—(Coler vs. Tacoma Ry. & Power Co. et al., 53 Atlantic Rep., 680.)

NEW JERSEY.—Street Railroads—Establishment—Municipal Consent—Consent of Abutting Owners—Execution—Seal—Acknowledgement — Statutes—Repeal—Construction—Extensions—Maps—Description—Variance—Judgments—Estoppel.

1. P. L. 1896, p. 329, provides that no street railroads shall be constructed except on consent of the governing body of the municipality on the written consent of one-half of the abutting owners filed with the clerk of such governing body. Held, that since the filing of the requisite consent by the property owners was a condition precedent to the passage of an ordinance granting authority to construct a railroad, it would be presumed, in the absence of a contrary showing, in a subsequent proceeding, that the township committee before authorizing such construction determined that the consent of such owners had been filed.

2. Under P. L. 1896, p. 329, declaring that no ordinance for the construction of a street railway shall be passed until consent in writing of abutting owners, executed and acknowledged as are deeds, entitled to be recorded, has been filed with the clerk of the governing body of the municipality, consents filed, but not sealed, were sufficient to confer jurisdiction on a township committee to authorize the construction of a road.

3. Where consents of abutting property owners to the construction of a street railway were sealed, an acknowledgment thereto that the grantors signed and delivered the same as their voluntary act and deed was not objectionable for failure to recite that the grantors sealed the same, the sealing being implied from the acknowledgment that the instrument was the signer's deed.

4. P. L. 1894, p. 374, providing that no street railway shall be constructed upon any street or highway in a municipality, except on consent of its governing body and on consent of a certain proportion of the owners of abutting property on streets to be used, was superseded by P. L. 1896, p. 329, covering the same subject.

5. P. L. 1896, p. 329, provides that no street railway shall be constructed in any city, town, township, village, or borough except on consent of the governing body of such municipality, etc., and that such consent shall not be granted except on filing with the clerk of such governing body of the consent of a certain proportion of abutting owners. Section 2 authorizes the change of motive power, and is followed by a proviso that if any board, body, or public authority other than the governing body of such municipality, etc., shall have control of the streets or highways over which the proposed road is to be constructed, the consent of such board or public authority shall also be required, which shall be granted only on notice. Held, that the consent of abutters was only required to be once given and filed before the municipal authorities mentioned in the first section grant permission, and the act did not require the filing of the same consents as a condition to the railroad's obtaining the additional consent of the board of chosen freeholders of the county under such proviso.

6. Under a statute providing that before the beginning or construction of any extension to a street railway the corporation shall file in the office of the Secretary of State a description of the route of such extension, showing the termini, with a map exhibiting the same, with the courses and distances thereof, the fact that the map of an extension marked a distance running 1462 ft., more or less, while the description filed omitted the words "more or less," was immaterial, since such words might be rejected as surplusage.

7. A decree in a proceeding by certiorari to determine the validity of an ordinance granting a street railway company the right to lay its road on the highway within a township, determining that such ordinance was valid, did not estop the contestant in a subsequent new proceeding to contest the validity of the ordinance for reasons not advanced or considered in the prior suits.—(Mercer County Traction Co. vs. United New Jersey Ry. & Canal Co., 54 Atlantic Rep., 819.)

NEW YORK.—Street Railways—Construction—Consent—Partial Compliance.

1. Where a railway company proceeded under the Railroad Law, sections 91, 92, to obtain the consent of the Commissioners of Highways of a town to construct its track over and along about 5 miles of a certain highway, and filed the written consent of the owners of more than two-thirds of the value of the property along the proposed route, the company could not abandon all but about 3100 feet of the route, and construct their track for only that distance on such highway, by virtue of the consents obtained.—(Collins et al. vs. Commissioners of Highways vs. Amsterdam St. R. Co. et al., 78 N. Y. Supp., 470.)

NEW YORK.—Deed—Highway as Boundary—Title to Fee of Road—Evidence—Railway in Highway—Rights of Abutter.

1. A deed of land described as on the easterly side of the highway, beginning at a locust stake driven in the ground, thence along said highway a certain distance, thence by courses and distances, and returning a specified number of feet to the highway aforesaid to the point of beginning, and likewise a deed of land described as on the north side of the highway, beginning at a locust stake, and running along the northerly side of the highway a certain distance, and thence by courses and distances, returning a certain number of feet to the place of beginning, excludes the highway from the land granted.

2. It is evidence that a deed of land bounded on a highway and described by courses and distances excludes the highway, that it contains the amount it purports to convey without including the highway.

3. An abutter on a highway, owning no part of the fee thereof, cannot complain of the construction of a railway therein under lawful authority.—(Kennedy vs. Mineola, H. & F. Traction Co., 78 N. Y. Supp., 937.)

NEW YORK.—Street Railways—Merger—Effect—Subsequent Liabilities—License Tax on Cars—Actions—Pleading—Joinder of Causes.

1. Where a street railway company was merged into another corporation, which assumed all the obligations of the corporation merged, such corporation, while existing as a corporation, so far as existing creditors at the time of the merger were affected, became extinct as to all future transactions, and could thereafter create no new obligations, or be liable for the acts of the corporation into which it was merged.

2. Prior to the incorporation of the Sixth Avenue Railroad Company, its incorporators contracted with the city of New York to pay an annual license fee to the city for each passenger car to be "used on its road." The corporation was afterwards organized under an act authorizing it to construct its line as designated in the respective grants, licenses, resolutions, or contracts with the city; and thereafter a city ordinance was passed declaring that each and every passenger railroad car running in the city below 125th Street should pay to the city the sum of $50 annually for a license. Thereafter the Sixth Avenue Railroad Company leased its lines to the Houston, West Street & Pavonia Ferry Company, which latter company was subsequently merged into the Metropolitan Street Railway Company, after which neither the Sixth Avenue nor the Houston Company operated any cars previously operated by the Sixth Avenue Company. Held, that since, under the contract of the Sixth Avenue Company with the city, it was liable to pay only for cars it "used on its road," which liability terminated, as to it, on its lease to the Houston Company, and as to the latter on its merger in the Metropolitan Company, a complaint against the three companies, alleging such facts, to recover license fees for cars run on the road, stated a cause of action against the Metropolitan Company only, and was therefore not demurrable for misjoinder of causes.—(City of New York vs. Sixth Ave. R. Co. et al., 79 N. Y. Supp., 319.)

NEW YORK.—Street Railways—License Fee—Lease of Road—Liability of Lessee.

1. Where the incorporators of a street railway company contracted with the city that the company would pay a certain license fee for each car operated, and subsequently the company leased its lines to another company, which took the property, etc., "subject to all debts and liabilities of the first company," the lessee was not liable for license fees accruing and payable by the lessor prior to the lease.—(City of New York vs. Third Ave. R. Co. et al., 79 N. Y. Supp., 431.)

NEW YORK.—Street Railroads—Rights in Streets—Rival Roads—Injunction—Discretion—Appeal—Defenses.

1. Plaintiff and defendant were rival street railroads, each having secured the necessary certificate to enable it to construct its road; plaintiff having perfected its proceedings prior to defendant. Both roads desired to construct their lines on a certain street of a village, which lay in proximity to a State canal, which street was insufficient to accommodate the lines of both companies. Plaintiff had not acquired the consent of the Superintendent of Public Works or of the board of trustees of the village to the location of its line on such street. Held, that an order vacating a temporary injunction restraining defendant from laying its road on such street during the pendency of an action to determine which company was entitled to the use of the street was not such an abuse of discretion as to require reversal on appeal.

2. Where a street railway company seeks to enjoin another company from using a certain street for its line, it cannot object to a defense that, because of its failure to procure the consent of the Superintendent of Public Works and of the village trustees, it is not entitled to use the street, on the ground that such defense can be urged only by the public officials.—(Rochester & E. R. Ry. Co. vs. Monroe County Electric Belt Line Co., 78 N. Y. Supp., 998.)

NEW YORK.—Street Railways—Municipal Regulation—License Fees—Ordinances—Validity.

1. A city ordinance providing that every passenger car running in the city of New York below 125th Street shall pay to the city the sum of $50 annually for a license, and prohibiting the running of cars without payment of the license fee, was not a police regulation, but was a mere imposition of a duty for the purpose of revenue, and was invalid in so far as it affected a street railway company, the franchise of which authorized the company to operate its cars without any other condition than payment of a certain percentage of its receipts.—(City of New York vs. Twenty-Third St. Ry. Co. et al., 79 N. Y. Supp., 323.)

NEW YORK.—Highways—Abutting Owner's Rights—Title to Center of Street—Railroads—Streets—Right of Way—Abutting Owner's Rights—Injunction.

1. The fact that the original patent to land bounded the premises on the west by a street did not preclude the patentee and his successors from claiming title to the center of such street, it being presumed that a grant by the State of land bordering on a highway conveys title to the center thereof.

2. An abutting owner, holding title to the center of a street, whose right has not been acquired by a railroad company, is entitled to enjoin such company from building or operating its railway line on such street.

3. An injunction will not be refused an abutting owner seeking to restrain a railroad from constructing its line in the street, where the company has not acquired such abutting owner's rights, on the ground that the company has proceeded to construct its line through the street, and has expended considerable money in such undertaking.—(Paige vs. Schenectady Ry. Co., 79 N. Y. Supp., 266.)

NEW YORK.—Railroads—Extension—Powers.

1. Laws 1890, chapter 565, provides that every railroad corporation, except elevated roads, may alter any part of its route, or locate it or any part thereof in a county adjoining any county named in its certificate of incorporation, if the directors believe that the line can be improved thereby, on making and filing a survey and map of such change. Held not to permit a railroad to select a new terminus in an adjoining county, 7 miles from its original terminus, and extend its line thereto, where such change is only made for the purpose of increasing the business of the road, and not for the purpose of benefiting the line originally located by the articles of association.—(Greenwich & J. Ry. Co. vs. Greenwich & S. Electric R. R. et al., 65 N. E. Rep., 278.)

NEW YORK.—Elevated Railroad—Construction—Persons Entitled to Damages—Lessees—Renewal Lease—Consent of Lessor—Effect—Reduction of Rent—Breach of Covenant of Lease—Recovery of Damages—Release.

1. A city leased property for twenty-one years, with covenant of renewal. On the expiration of the lease, which by several assignments had come to plaintiffs, a renewal was executed to her for another twenty-one years. Pending the original term, an elevated railroad had been constructed in front of the property. Held, that plaintiff could recover for the damage to her leasehold therefrom, her title under the renewal lease relating back to the original term, and therefore occurring before the construction of the road.

2. A city which had leased premises to a third party could not thereafter, by consenting to the construction of an elevated railroad in front of the property, deprive the lessee of the right to recover any damage to the leasehold.

3. Where property was leased for a specified term, with covenant of renewal on terms to be agreed on by the parties, and the lesee had erected a building on the premises, the fact that the rent for the renewal term was paid with reference to the presence of an elevated railroad in front of the premises, which had been erected during the original term, did not preclude the lessee from recovering for damages to the leasehold.

4. The fact that lessees assigned their lease in violation of a covenant against assignments did not preclude the assignee from recovering against third persons for erecting an elevated road in front of the premises, when notwithstanding the assignment the lessors continued to collect the rents, and afterwards executed a renewal to the assignee.

5. Where a lessee recovers damages due to the erection of an elevated railroad in front of his property the company is entitled to a release from him, and conveyance of the easement, not merely during the existing term, but during future renewals stipulated for in the lease.—(Storms et al. vs. Manhattan Ry. Co. et al., 79 N. Y. Supp., 60.)

PENNSYLVANIA.—Joint Tort Feasors—Action—Dismissal as to One.

1. Plaintiff sued two railway companies and a construction company to recover damages for the construction of a street railway on a highway on which his land abutted, without his consent, alleging injuries to his crops and fences, and injuries from the reckless manner of operating the cars. It appeared that one of the street railway companies had leased its franchises and property to the other, which was alone responsible for the negligent operation of the road; that the construction company alone was responsible for the destruction of the crops and fences, and that the construction company and the other street railway company were liable for the construction of the road without plaintiff's consent. Held, that a nonsuit could be entered as to the defendant not connected with the joint tort, or a verdict directed for him, and the case submitted to the jury, as to the other two.—(Minnich vs. Lancaster & L. Electric Ry. Co. et al., 53 Atlantic Rep., 501.)

PENNSLIVANIA.—Foreign Corporations—Failure to Register—Right of Action.

1. Act April 22, 1874 (P. L. 108), prohibiting foreign corporations from doing business in the State without complying with its provisions, was passed in order to bring such corporations within the reach of legal process; and, where such a corporation does not register as provided by such act before entering into a contract sought to be enforced in the courts, it has no right of action therefor.

2. Where a foreign corporation constructs an electric railway in the State for six months, employing nearly all of its capital therein, and files no statement with the Secretary of the Commonwealth as required by Act April 22, 1874 (P. L. 108), until two months after the completion of the work, it cannot sue to recover for labor and materials furnished by it during the progress of the work.—(Delaware River Quarry & Construction Co. vs. Bethlehem & N. Pass, Ry. Co. et al., 53 Atlantic Rep., 533.)

PENNSYLVANIA.—Appeal—Final Order—Street Railways—Appointment of Viewers—Constitutional Law—Public Use.

1. An appeal will lie from an order of court on a petition of a street railway company appointing viewers to assess damages, and approving bonds of the petitioner, seeking to complete its circuit by the use of tracks of another railway company, though no assessment of damages has been made.

2. Act May 14, 1889 (P. L. 216, section 14), as amended by Act May 21, 1895 (P. L. 93), giving a street railway a right to use 2500 feet of the tracks of another street railway company on payment of damages, is unconstitutional, as an exercise of the right of eminent domain; the object being not the benefit of the general public, but to aid a new corporation in taking possession of the franchise of the property of the old one for its own benefit.

3. A street railway company organized under the act of May 14, 1889 (P. L. 211), is not estopped to deny the constitutionality of section 14 of the act, as amended by the act of May 21, 1895 (P. L. 93), giving a street railway company the right to use the tracks of another, inasmuch as such section may be eliminated from the act, leaving all other provisions to stand in full force.—(Petition of Philadelphia M. & S. St. Ry. Co., 53 Atlantic Rep., 191.)

FINANCIAL INTELLIGENCE

WALL STREET, July 22, 1903.

The Money Market

There were no important developments in the money market this week. The demand for funds for all periods continued light, owing to the continued liquidation in the stock markets, and to the fact that many of the larger commission houses have already secured enough funds to carry them into the new year. Local institutions, however, were not disposed to offer with any degree of freedom. Despite the continued influx of currency from the interior, and the gain made in other quarters last week, the banks lost to the sub-treasury $3,703,000, but since last Friday they have gained nearly $1,500,000 as a result of pension payments and the receipts of new gold from the Klondike. Call money ruled comparatively easy, transactions being made at between 2 per cent and 3 per cent, but time loans ruled firm, at about last week's level of rates. Sixty and ninety-day funds were offered in moderate amounts at 4¾ per cent by foreign houses, but the amount of business reported was extremely small. For the longer periods, especially for six months' contracts, a fair demand existed throughout, but nothing was obtainable under 6 per cent, except where all dividend-paying railroad shares were offered in collateral. At the close indications are that the rate will continue to hold firm at near the present level. The time is approaching when the local institutions will be called upon to supply funds for moving the crops, and preparations are now making to meet these demands. On the other hand, money continues to come from the interior in fair amounts, and although rates of exchange on New York are somewhat lower than a week ago, sufficient premiums yet remain to insure a continuance of the movement in this direction, at least for the present. A favorable feature is the market weakness in sterling exchange rates, which eliminate all possibilities of gold exports to Europe. The weakness in this department is due principally to the offerings of bills against London's purchases of stocks and bonds in the local market. Loan bills are also offered in fair amounts. There were no material changes in the discount rates at any of the leading European centres. The open market rate at London remains unchanged at 2¼ for short bills. At Berlin the rate declined ⅛ to 3 per cent, while a similar decline was recorded at Paris, the rate there being 2⅝ per cent. Amsterdam was unchanged at 3 per cent.

The Stock Market

From the lowest level for the list, as a whole, reached upon Wednesday there was a fairly steady advance until just before the close Saturday. The situation did not clear, but the wild rumors of the early part of the week were not followed by specific news developments, and traders took the ground that if facts did not appear in the crisis of that day, the bear contingent must have been the sole originators of the more disquieting tales. Attention was paid to railway earnings, crop news and favorable news of the general business situation. Saturday's bank statement showed gratifying increases in cash and surplus reserve, but operators for the decline argued that a season when a big decrease in the loan item was reasonably due, but did not appear, there must be some large interests involved in the market which had to be carried over. Such suspected accounts were gunned for, and successfully. On Monday one loan of about $3,000,000, with Steel shares the largest part of the collateral, became due, and could not be renewed. The stocks were thrown over, with the result that new low records at 22 and 70 for the common and preferred were made. A weak account in Rock Island had been uncovered, said to be of 30,000 shares in St. Louis, but this was closed out when the stock reached 24. The resistance of the railway list on Monday to the influence of Steel was noted by the short interest, as well as some quiet buying throughout the list by several leading banking houses. The result was a decided rally on short covering, and some further good investment purchases on the following day. No sign of a weak spot appeared, as all the leading stocks advanced. In the afternoon the completion of buying orders and the $9,000,000 building firm failure in Boston gave the bear contingent another opportunity to strike at the market, and part of the advance was lost.

Local tractions were comparatively inactive, except for Brooklyn Rapid Transit. Metropolitan Street Railway fell as low as 115½, and Manhattan to 131⅜. No news developments affecting these properties appeared. Brooklyn Rapid Transit made a new low record at 45⅝, and became almost the market feature one day. No facts as to the company's condition and operations came out. A prominent politician, with some friends, was reported to have been unable to renew a pool loan, protected in large part by this stock, and was obliged to liquidate the pool holdings.

Philadelphia

A declining market was experienced throughout the week, largely under the leadership of the steam railroad and industrial shares, which are dealt in on both the New York and Philadelphia markets. The local securities withstood the pressure very much better, although there was considerable long stock liquidated, especially in United Gas, which closed on July 21 at 82. American Railways, in spite of its favorable earnings, which show an increase of $231,000 for the year, has fallen off ½ point during the week, while the Philadelphia group, that is, Rapid Transit, Philadelphia Traction and Union Traction, show a loss for the first two of 1 point each, and ¾ of a point for the latter. Philadelphia Company is also down about ½ point from last week to 40, in spite of the fact that its June statement showed a large increase in earnings. Other traction sales during the week include Consolidated Traction of New Jersey at 65, Railways Company General at 3½, New Jersey Traction 5s at 104½, Newark Passenger 5s at 113½, and Electric People's Traction 4s at 99¼ to 98½.

Chicago

The Chicago high-priced railway properties in common with the rest of the market, reflect the necessity of certain holders for ready cash, whereas the low-priced securities have held their own fairly well during the past week. City Railway scored a new low record in touching 180, which is 5 points below the price at which it was quoted on July 14. Union Traction, on the other hand, both common and preferred, are unchanged in price, at 4 and 30 respectively. South Side Elevated is down 2 points to 97, and Northwestern Elevated common ½ point to 20½. Lake Street Elevated reflects the general expectation that the proposed reorganization of the property will be successful, and is being quoted at 6¼, or ¾ of a point above the quotation of last week. Metropolitan West Side common is unchanged at 20, but the preferred is down 3 points to 63, on the rumor that the directors, who will meet the first week in August to consider the semi-annual dividend, will reduce it from 1½ to 1 per cent.

Other Traction Securities

The Boston securities, in common with the general market, are lower than last week, the Elevated being down to 138 from 140, while Massachusetts Electric Companies common at 24½, and preferred at 81¾, show decreases of 2½ and ¼ points, respectively. West End common and preferred remain practically stationary, with very few transactions recorded. The Baltimore market has been without much life. While there was a little liquidation there was also almost an equal absence of buying indicated, so that most of the securities remained about stationary. The transactions included the United Railways & Electric common at 11, the income bonds at 63 and 62¾, and the 4s at 93 to 92⅝. On the New York curb the tractions have been rather neglected, although Syracuse, on reports of increased earnings, has formed an exception to the general tendency of the market, and on July 22 was quoted as 29½ for the common and 75 for the preferred. New Orleans common is down ¾ of a point, to 11¼, and the preferred shows a loss of 1¾ points, at a quotation of 40¼. Interborough Rapid Transit closed at 100¼, and Twin City Rapid Transit at 95½. The Washington Railway & Electric preferred sold at 37⅝, which is a low record price. St. Louis Transit was 19¼ bid, while the preferred was offered at 71.

Practically every traction issue on the Cincinnati Exchange showed a decline last week. Detroit United sold to extent of about 600 shares, and made a low mark of 69½, declining from 72½ at the opening, and closing the week at 70. Several small lots of Toledo Railways & Light sold at 23½, and one lot went at 22⅞. Cincinnati, Dayton & Toledo sold at 30, and a few small lots of Cincinnati Street sold at 133½. On news of the receivership for the Miami & Erie Canal this issue dropped to 7½, and then tumbled to 5½ on a small sale; the issue has been selling around 20 recently. Cincinnati, Dayton & Toledo bonds were in

good demand at around 84. Columbus, Delaware & Marion bonds sold repeatedly at 101. At Cleveland there were few sales, but they were well scattered. Cleveland Electric advanced to 74 on one sale Lake Shore Electric preferred sold at 47½ and 48, new low marks. Western Ohio receipts dropped to the low mark of 17. Northern Ohio Traction & Light sold to the extent of 100 shares, and declined to 20, a drop of 1½ points from last sales.

Security Quotations

The following table shows the present bid quotations for the leading traction stocks, and the active bonds, as compared with last week:

	Closing Bid	
	July 14	July 21
American Railways	45	44½
Aurora, Elgin & Chicago	a17½	17½
Boston Elevated	140	138
Brooklyn Rapid Transit	52⅜	46½
Chicago City	185	180
Chicago Union Traction (common)	4	4
Chicago Union Traction (preferred)	30	30
Cleveland Electric	74	74
Columbus (common)	104	101
Columbus (preferred)	102	103
Consolidated Traction of New Jersey	66	65
Consolidated Traction of New Jersey 5s	105	104
Detroit United	65	69¾
Elgin, Aurora & Southern	a48	b52
Lake Shore Electric	a14	b10½
Lake Street Elevated	5½	6¼
Manhattan Railway	132	131½
Massachusetts Elec Cos. (common)	24½	22
Massachusetts Electric Cos. (preferred)	82	81¾
Metropolitan Elevated, Chicago (common)	20	20
Metropolitan Elevated, Chicago (preferred)	66	63
Metropolitan Street	118¾	116⅛
New Orleans (common)	12	11¼
New Orleans Railways (preferred)	42	39½
North American	85	82
Northern Ohio Traction & Light	21	18
Northwestern Elevated, Chicago (common)	21	20½
Philadelphia Rapid Transit	15	15
Philadelphia Traction	96	95
St. Louis Transit (common)	20½	19½
South Side Elevated (Chicago)	99	97
Syracuse Rapid Transit	25	b29½
Syracuse Rapid Transit (preferred)	73	b75
Third Avenue	112	111½
Toledo Railway & Light	20	20
Twin City, Minneapolis (common)	96⅜	95½
Union Traction (Philadelphia)	44¾	44
United Railways, St. Louis (preferred)	71	69½

a Asked. b Last sale. * Ex-dividend. † $10 paid.

Iron and Steel

The weak feeling about the iron market, to which reference was made last week, continues to be the prdominating factor. While there has been no great change in quotable prices, the purchases have been light and confined to immediate needs. The finished iron and steel market remains dull and easy. Quotations are as follows: Bessemer pig, $18.75 to $19; Bessemer steel, $27 to $27.50; steel rails, $28; girder rails, $33 to $33.50.

Metals

Quotations of the leading metals follow: Copper, 13½ to 13⅝ cents; tin, 27½ cents; lead, 4⅛ cents; spelter, 5¾ cents.

THE ELECTRIC RAILWAY ALONG CHAUTAUQUA LAKE, NEW YORK

The Chautauqua Traction Company, of Jamestown, N. Y., anticipating a favorable decision from the Railroad Commissioners on its application for permission to build its proposed line, some time ago purchased the entire equipment for the road, and the rails, ties, poles, etc., have been distributed along the proposed route in order that there shall be no delay in construction. Already a construction gang is at work on the proposed line from Jamestown to Lakewood, via Celoron, which will take the place of the present Lakewood line of the Jamestown Street Railway Company, which is closely identified with the new company, its principal executive officers being the same. Just how long it will take to complete the line it is impossible to say at this time, but the promoters expect to operate cars between Jamestown and the Chautauqua assembly grounds before the close of the present season. The power house in Jamestown is being erected with as much haste as is consistent with good work, and rolling stock and power equipment of the road have already been shipped by the manufacturers The road will follow the contour of Chautauqua Lake closely from Lakewood to Mayville, passing along what is known as "the Lake road." It will not enter the Chautauqua grounds, but will establish a station in accordance with the wish of the institution, probably opposite the Vincent Avenue gate. The road will offer a quicker and more convenient route to Chautauqua for tourists from both Mayville and Jamestown. It will mark an era in the development of that portion of the country which lies along and to the southward of Chautauqua Lake.

ELECTRIC RAILWAY PROGRESS IN COPENHAGEN

In the trade report of Denmark for 1902 there are some interesting particulars bearing on Copenhagen's tramway system, which is very complete and extensive. The power is delivered from the overhead trolley system, storage batteries have been entirely done away with, and horse traction is being gradually abolished. One can travel any distance from one to five or six miles for 1d. (2 cents), and transfer tickets enabling passengers to change cars are supplied free.

The working expenses are about 7¼d. (14.5 cents) per mile. The tramways belong to a company which has a forty years' lease from 1898 from the municipality, and the municipality has the right to buy the various lines in 1908. The company has a capital of 889,000*l.* ($4,225,000), and employs 793 conductors and drivers, with about 127 hands in the various sheds, track cleaners, &c., besides day laborers.

The motor cars number about 184, and there are besides seventy-five trailers, twenty-six horse cars, and seventeen omnibuses. The length of the tracks, double lines, is 33,500 km and 11,700-km single lines, and the total length of the various routes where cars run by electric power is 45,810 km. The length of routes where horse-power is used is 10,255 km. In a very short time horse-power will be done away with, and every car will be electric.

ELECTRIC RAILWAY FROM MONDARIZ TO VIGO VIA PORRINO, SPAIN

The concession for the first section of this important railway between Monderiz and Porrino is on the point of being granted by the Ministry of Public Works, and that for the second section between Porrino and the port of Vigo after crossing the latter town, is being applied for.

The line runs over the provincial road from Mondariz to Peunteareas, and over the excellent road from Villacastin to Vigo. The entire length of the line is 36 km (23 miles), whereof 20.5 km (12.5 miles) are of the second section.

Electric power is derived from two waterfalls, named Crusion and Tranguselo, on the River Tea, between Mondariz and Peunteareas, and from another named Barral on the River Mino, near Ribadavia, about 25 km (15.5 miles) from the center of the line, where the sub-station will be erected. The minimum power of the two falls on the Tea is 268 hp at the axis of the turbines, and that of the Mino 1375 hp; total, 1643 hp. As the traffic of the line will only require a force of 375 hp, the remainder will be transmitted to Vigo, where about 1000 hp, at least, will be employed in the industries of that town.

NEW PUBLICATIONS

Duncan's Manual of Tramways, Omnibuses and Electric Railways. Published by T. S. Whitney & Sons, Ltd., 7a South Place, E. C., London. Price, 5 shillings.

The 1903 edition of this well-known reference book has just been issued. It is a complete manual of the tramways, omnibuses and electric railways of the United Kingdom, and also of the foreign and colonial companies listed on the London Stock Exchange. The capitalization, earnings, dividends, names of officers, and numerous other details are given respecting the companies listed. A feature of this book is a directory of directors, officials, engineers, auditors, etc., connected with tramway companies.

Hamburg and Its Street Railway System, by Gustav Schimpff. 48 pages, with four large plates illustrated. Published by Julius Springer, Berlin.

This is a reprint of an article which appeared in Mitteilungen des Vereins Deutscher Strassenbahn-und Kleinbahn-Verwaltungen, a supplement to the Zeitschrift für Kleinbahnen, and is a very thorough discussion of the street railway traffic conditions in Hamburg and its suburbs. Tables are included showing the population and its distribution of traffic per car mile and mile of track, classification of fares, distribution of traffic in different hours of the day, earnings, expenses, etc. The plates include maps of different parts of the city, and also an ingenious diagrammatic map in which the traffic on all of the different lines is indicated on a scale of 1 mm. to 25,000 seats per day.

UNIQUE TESTIMONIAL

The Sanderson & Porter Company, of New York, recently received a very unique communication from the town of Killingly, Conn., advising it that the Board of Selectmen had adopted a formal vote "of its entire approval and warm commendation of the shape in which the Worcester & Connecticut Eastern Railway Company has left the highways through which its tracks run, from Railroad Square in the Borough of Danielson, and thence southerly, through the town of Killingly, and also from Elmville Junction, easterly, to the Jacques Station at East Killingly; for which excellent condition of said highways this Board feels that great credit is due, not only to the Worcester & Connecticut Eastern Railway Company as a corporation, but to the contractors, the Sanderson & Porter Company, and in particular to their chief engineer, C. H. Nichols." Needless to say, this testimonial is highly prized by the recipients.

ABUSE OF TRANSFERS IN CLEVELAND

Officials of the Cleveland Electric Railway Company are not satisfied with the results being obtained from the recent adoption of universal transfers, and particularly the concession by which transfers are given on transfers to and from the Wilson Avenue cross-town line. It has been the aim of the company to make it possible for a person to ride from a given point to any other given point in the city for one fare, and it was the idea to make it possible for a workingman to travel on any east and west line, transfer to the cross-town line and then continue on any other east and west line to his shop, direct, all for one fare. It seems, however, that instead of appreciating the advantages of universal transfers and six tickets for a quarter, many people are spending their time encircling the city and riding an unlimited time for a single fare. It is claimed that on a recent Sunday the travel on the system was the heaviest ever experienced, but that the receipts fell below those of last year. The reduction in fare to six tickets for a quarter came a long way from making up for the discrepancy, proving that many people were taking an unfair advantage of the universal transfer system. The company is planning to obviate the difficulty. One plan which is being considered is that of giving a passenger the privilege of taking two transfers. The first would be punched once, and the second would bear two punch marks. A passenger holding a transfer with the double punch mark would not be entitled to another transfer. It is also planned to change the routes of a number of lines so that more through city routes will be provided, which will greatly reduce the necessity for so much transferring. To provide for these new lines the company will lay a large amount of new special work and will provide complete curves wherever one line crosses another.

FRANCHISE LIMITATIONS IN NEW YORK

A new policy has been introduced by the present city administration of New York on the question of permitting corporations to transfer franchises. During the consideration by the Rapid Transit Commission of the proposed franchise to the Hudson & Manhattan Railroad Company for a tunnel under the North River, connecting Jersey City with Manhattan at Cortlandt Street, Mayor Low opposed permitting the sale of the property by the company, when the franchise is granted, except with the approval of the Board of Estimate and the Board of Alderman, as well as of the Rapid Transit Commissioners. An amendment to the franchise was decided upon, and several other suggestions were adopted.

Clauses of the contract were amended so that the trolley system in the tunnel cannot be extended without the consent of the Board of Aldermen, and so that the railroad shall be diligently and skillfully operated with due regard to the convenience of the traveling public. The Mayor also secured the insertion of a clause giving the Rapid Transit Commissioners the absolute right to order, from time to time, such an increase of service and such an improvement of accommodations as it, in its judgment, may deem proper.

Appeals from such decisions on the part of the board may be taken by the tunnel company to the Appellate Division of the Supreme Court in the First Department, the decision of this tribunal to be binding on both parties, but on any such appeal the burden of proof must rest with the tunnel company if the reasonableness of the demand of the board is brought into question.

It was determined to amend the proposed contract so as to include all these items, and then to bring the amended contract before the next meeting, so that it can be approved at that time.

BIDS FOR THREE-CENT LINES IN CLEVELAND

Bids have been opened by the City Council of Cleveland for the privileges of building 3-cent fare lines over routes recently established by the city. One proposal was submitted by attorneys for the promoters for the proposed interurban line from Cleveland to Akron. The route is known as the Seneca Street route, and is considered the most desirable of the routes established by the Council. The People's Railway Company, which is alleged to be headed by John B. Hoefgen, created a surprise by bidding for only one of the eleven routes laid out. Mayor Johnson claims that he is well satisfied with this arrangement, since there will undoubtedly be litigation before the matter is settled. If the 3-cent fare company finally wins out, it will only be necessary to grant extensions of the original grant. The Cleveland Electric Railway presented a formal protest against the granting of the Rhodes Avenue franchise to the People's Railway Company, claiming that the 3-cent fare clause with the demand for universal transfers made it impossible for the old company to bid for the right. At the same time the Cleveland Electric Railway Company has applied for an extension of its present franchise on Rhodes Avenue. The company has a short piece of single track on this street, and now applies for the right to double the track and extend the line. If the grant can be obtained, it will cover the ground for which the People's Railway Company has entered a proposal.

AMERICAN BLOWER COMPANY'S NEW OFFICE BUILDING

The American Blower Company has recently erected an office building adjacent to its factory in Detroit, sparing no expense to make it a model of convenience and taste. The first floor is occupied by the commercial departments, and the second floor by the engineering and drafting departments. The blue print and dark room is on the roof to secure the best light for sun printing. The basement is used for storing catalogues, letters, files, etc. The building is equipped with electric lights, annunciator bells, dumb waiter, an outside telephone system and an independent interior telephone system.

As the manufacture of heating and ventilating apparatus forms a large part of the American Blower Company's business, this part of the equipment naturally received considerable attention, and the system installed follows the latest and best practice. The apparatus is located at one side of the basement. Fresh air enters the building through one of the basement windows, and by a fan is drawn over a tempering coil which heats it to about 70 deg. The fresh air is then drawn into the fan and forced over the heater, where it is heated to about 140 deg. Beyond the heater is located a reservoir for the heated air, known as the "plenum chamber," from which the air is conveyed to the offices by galvanized iron ducts. A "by-pass" under the main heater permits part of the air to pass under it and into lower section of the plenum chamber, the hotter air from the main heater passing into the upper part of this chamber. Each pipe leading to the offices has a connection to each of these sections of the plenum chamber. In each main where the pipe divides into these two sections, there is located a set of mixing dampers, automatically controlled by diaphragm valves,—a part of the Johnson Service Company's system of heat regulation, which is employed throughout the building. By this system a constant flow of pure air at the proper temperature is automatically maintained at all times. The fan is operated by one of the American Blower Company's vertical engines. Direct coupled to this engine is an exhaust fan which draws the vitiated air out of the building.

The heating system is extremely economical in operation. The heating coils utilize the exhaust from the factory engine, and as the fan engine exhaust is also turned into the heater coil, the cost of operating the system is practically nothing.

Taken as a whole, this building with its equipment is by many said to be the most complete of its kind in this country.

CHICAGO FRANCHISE MATTERS

An ordinance providing for an extension of the franchises of the Chicago City Railway Company has been drawn up by a Council committee, and in the clause specifying the amount of compensation to be paid the city there is left a blank. This is the ordinance over which the attorneys for the city and the attorneys and officers of the Chicago City Railway Company have been working for a number of weeks, and action will not be taken by the Council until after the summer vacation of that body.

Judge Grosscup has appointed John S. Miller, a prominent Chicago attorney, as his representative to negotiate with the city for

a renewal of the Union Traction franchises. The selection is regarded as an excellent one. Mayor Harrison has written a letter to Judge Grosscup relative to the instructions of the judge to the receivers of the Chicago Union Traction Company, dated July 10. The Mayor says that the city desires "a just and prompt settlement of the street railway problem by means of unacrimonious negotiations," and he adds:

"It is assumed that a purpose of the receivership is to bring order out of chaos by such reorganization as will result in a responsible corporation controlling the entire situation in Union Traction territory, with which the city may safely deal. The city will make a grant, on just terms, which shall be in lieu of all existing franchise rights and claims of the companies.

"In view of the character of the so-called 'ninety-nine year act,' and particularly of the new contention that said act placed the city for a century at the mercy of the street railway companies and reduced it to a position of mere subserviency to them, it will neither now nor after litigation, whatever its result, make further grants to supplement that legislation. It has no policy of confiscation, but it insists that the companies must rely on their present rights or accept a new grant expressing all their rights. Their choice lies between stale claims and a modern grant. They may cling to an insufficient state, grant or accept an adequate municipal franchise."

The city sent notice July 17 to the Chicago Union Traction Company that no permits for any repair work in streets would be issued after July 30, and all previous permits withdrawn on that date. The city attorneys explained that this was a legal move considered necessary in view of the fact that the city maintains that the franchises on certain streets expire July 30, hence the city could not formally admit that the company had any right on the streets after that date. It was explained that a special order of the Council would probably be passed allowing the company to operate sixty days longer. No notification was sent to the Chicago City Railway Company because that company is already negotiating for franchise extensions.

Immediately following the notification sent by the city to the Chicago Union Traction Company Judge Grosscup was notified by the receivers that their rights were being interfered with, and the judge issued temporary injunctions, forbidding the city from interfering with or repealing any of the rights of the company for its existing street railways. The hearing is set for July 27.

A truce was called in the traction war at the City Council meeting Tuesday evening, when it was agreed to suspend hostilities until Nov. 30. It is said that the first step in the battle will be to contest the right of jurisdiction of Judge Grosscup and the Federal Courts to render permanent his recent injunction. In the case of the City Railway Company a temporary ordinance was issued by the city, the terms of which had been agreed upon and accepted by the company prior to its introduction at the Council meeting. A resolution was passed in the case of the Union Traction Company by which the hearing on the temporary injunction issued against the city by Judge Grosscup, which had been set for July 27, should by agreement be postponed to Nov. 30 next. At the same time, by implication, it was agreed that permits for repairing should be issued by the city after July 30 until Nov. 30.

PROPOSED PLAN OF REORGANIZATION OF CHICAGO UNION TRACTION COMPANY

Although no official announcement has been made, it is understood among those interested in the affairs of the Chicago street railways, particularly in financial circles, that the terms of the plan of reorganization have been decided upon, and that they have already received the approval of the protective committees of the North and West Side companies and the reorganization committee of the Chicago Union Traction Company. It will be necessary to execute new leases between the Union Traction Company and the North Chicago and West Chicago street railway companies, owing partly to the confusion existing at present over the ownership of the several franchises and leases belonging to the subsidiary companies of the Union Traction Company. It appears that the Union Traction Company holds the assignments of franchises under the ninety-nine-year act and many ordinances of the City Council, and the North and West Chicago companies have only a few of the more unimportant franchises left to them. It is understood that the ownership of all the franchises is being vested in the North and West Chicago companies under the new leases, and that, furthermore, the new franchises or agreements that may be granted by the city will be secured to the North and West Chicago stockholders.

The plan, as outlined and generally understood among those interested in the subject, provides for raising the money and improvements by a bond issue to be floated by the Union Traction Company, and it is agreed that the interest on these bonds will take precedence over the dividends on the stock of the North Chicago and West Chicago companies. It is understood that the guaranteed dividends on the North and West Chicago companies are to be changed to cumulative dividends, and no forfeiture attached to the failure of the Union Traction Company to pay them in full. However, all arrears of dividends will be accumulated and paid when the earnings of the company are sufficiently large to furnish the money. This plan eliminates the present ruinous penalties attaching to the failure of the Union Traction Company to pay the dividends on its underlying companies. All surplus earnings above the fixed charges and guaranteed dividends are to be applicable to the Union Traction Company's stock, provided all arrears of dividends on the North and West Side stocks have been made up. This establishes simply an equity for the Union Traction Company's stockholders, who must wait several years before getting returns on their investments.

ELECTRIC RAILWAY AT LINARES, SPAIN.

The contractor for the new electric railway at Linares, province of Jaen, is the "Industria Electrica" of Barcelona. This company will furnish all the material for the road with the exception of the rails, which come from Paris. The work on the road is progressing finely. The roadbed of the entire 14 km (5¼ miles) has all been laid, and the construction work is more than half completed. Although a Barcelona company is the contractor the entire line has been sub-contracted to Linares people. The engineer is Emilio Soriano, Linares.

STREET RAILWAY PATENTS

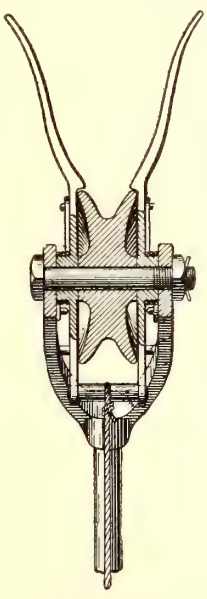
UNITED STATES PATENTS ISSUED JULY 14, 1903

[This department is conducted by W. A. Rosenbaum, patent attorney, Room No. 1203-7 Nassau-Beekman Building, New York.]

733,496. Trolley for Electric Lines; Kennedy Lyons, New Rumley, Ohio. App. filed March 5, 1903. Relates to spring guards for holding the trolley wheel in contact with the wire.

733,524. Trolley Pole Guide; Hazekiah O. Woodbury, Beverly, Mass. App. filed Oct. 13, 1902. A pair of flaring arms, mounted one on each side of the trolley wheel, are adapted to be thrown upward to act as a finder for the trolley.

733,619. Trolley Circuit Breaker; Charles P. Breese, Norfolk, Va. App. filed April 1, 1903. To maintain continuity in the supply of electric current to the trolley wheel during the change from one section to the adjacent section, the conductor of one section overlaps the conductor of the adjacent section, so that a wheel in passing will always be in contact with at least one of the conductors.



PATENT NO. 733,524

733,653. Nozzle Appliance for Cleaning Railways; Frederick A. Jones, Perth, Western Australia, Australia. App. filed July 17, 1902. Consists of a traveling tank and a nozzle leading therefrom, through which water, under pressure, is directed against the rails.

733,727. Trolley Head; Frederick V. Marsh, Haverhill, Mass. App. filed Aug. 22, 1902. The trolley wheel shaft is screwed into the end of the harp, the latter being in two pieces, so that by releasing one of said pieces from the trolley pole and swinging it around, it is unscrewed from the shaft and the wheel released.

733,866. Hand Strap; Joseph H. Myers, New York, N. Y. App. filed April 28, 1903. Comprises a main loop and two loops diverging therefrom and connecting with the first named loop by shank portions of such stiffness that the divergence of the loops is maintained without supplemental stays.

733,867. Hand Strap; Joseph H. Myers, New York, N. Y. App. filed April 28, 1903. Comprises a strap having its central portion rolled upon itself and folded to form a loop for the hand, the portions of the strap leading from the rolled portion being wider than the latter and diverging, their upper ends provided with loops adapted to receive the suspending rod, and a slidable loop embracing the rolled folded portion of the strap.

733,900. Electric Brake System; Frank E. Case, Schenectady, N. Y. App. filed Feb. 19, 1900. See following patent.

733,901. Method of Braking Moving Loads; Frank E. Case, Schenectady, N. Y. App. filed Feb. 19, 1900. The method of

braking a moving load which consists in so connecting the electrical circuits of a dynamo electric machine that it will operate to retard the movement of said load when connected thereto, and gradually clutching said dynamo electric machine to said load.

PERSONAL MENTION

MR. J. B. MARVIN, who has been general manager of the City Electric Railway & Electric Light Company, of Rome, Ga., for the past eight years, has resigned his position and will be succeeded by Mr. C. N. Fuller, of New York.

MR. E. O. REED, for some time secretary and auditor of the Toledo Railways & Light Company, of Toledo, Ohio, has resigned from that company to go into the manufacturing business. Mr. Reed was for many years assistant auditor of the Clover Leaf Railroad.

MR. H. H. VREELAND, president of the Interurban Street Railway Company, of New York, who is now in London, has been invited to be the guest of honor at a complimentary dinner to be extended to him by the Tramways & Light Railways Association of Great Britain.

MR. J. W. TOMPKINS has been appointed master mechanic and constructing engineer of the Indiana Union Traction Company's system at Ft. Wayne, Lafayette and Logansport. Mr. Tompkins has been superintendent of the Ft. Wayne Traction Company's line for a number of years.

MR. M. R. McADOO, of New York, has been appointed to the position of general manager of the Mexico Electric Tramways, Ltd., of Mexico. It is the intention of the company to equip the remaining horse car lines with electricity and to apply for concessions covering about 100 miles of additional streets.

MR. MICHAEL J. KEHOE has been appointed chief engineer and electrician of the Indiana Union Traction Company's lines at Ft. Wayne, Lafayette and Logansport, both the city and interurban lines coming under his jurisdiction. Mr. Kehoe has been chief electrical engineer of the Ft. Wayne Traction Company for four years.

MR. HENRY J. PIERCE, president of the Netherlands Tramway Corporation, has just returned to Buffalo from a visit in Holland. Mr. Pierce's company controls the lines in the city of Haarlem as well as some interurban roads extending from that city to Bloemendaal and Vondvoort. The company has also built a line from Haarlem to Amsterdam.

MR. E. S. DIMMOCK, general manager of the Bay Cities Consolidated Railway Company, of Bay City, Mich., will sever his connection with that company on August 1, and will enter the service of Stone & Webster, of Boston. The Bay Cities Consolidated Railway was placed in the hands of receivers on August 1, 1899, at which time Mr. Dimmock was appointed general manager for the receivers. During the four years which have elapsed, Mr. Dimmock has brought the system up to a high state of efficiency, the track has been reconstructed throughout, and a new power station and car house have been built. The company has also established a summer resort known as Wenona Beach, which is one of the finest summer resorts in Michigan.

MR. ELIPHALET W. BLISS, of Brooklyn, died at his summer home, Owl's Head, on Tuesday, July 21. He had been ill with acute indigestion for a week, but announced his intention of making a long-contemplated trip to Germany, and called his wife in consultation about the arrangements for their journey. While talking with her he was stricken, and before Mrs. Bliss could reach his side he was dead. Mr. Bliss was one of the best-known business men of Brooklyn. He was the head of the E. W. Bliss Company and the United States Projectile Company, and was an inventor and manufacturer of presses and dies and a manufacturer of special machinery for working sheet metals. He had done much toward developing the open hearth cast-steel machine, cut gears and pressed high carbon steel pinions, which brought him directly in touch with the electric railway field.

MR. WALTER L. ADAMS has resigned as superintendent and purchasing agent of the Montville Street Railway Company and the Norwich Street Railway Company of Norwich, Conn. Mr. Adams has been superintendent and purchasing agent of the Norwich company since 1896. He came from Newburyport, Mass., in 1892, where he was engaged in street railroading. He was employed by the road for four years and was promoted to the superintendency at the resignation of Mr. E. P. Shaw, Jr. At the organization of the Montville Street Railway Company in 1900, he was made superintended of the company and has held that position since. During Mr. Adams' term as manager many changes and improvements have been made in the road, both as regards operation and equipment. The line has been extended from Taftville to Baltic, two extensions have been made to the West Side line, and the extension of the Yantic road to Fitchville is ready to be put through.

MR. FRANK B. MUSSER, the newly elected president of the Central Pennsylvania Traction Company, of Harrisburg, Pa., which has taken over the Harrisburg Traction Company, was born in Columbia, Lancaster County, Pa., Feb. 19, 1864. Mr. Musser spent his youth in his native town, receiving his primary education in the public schools. He began his business life in the service of the Philadelphia & Reading Railroad Company as telegraph operator, and remained in the employ of the company in various capacities for nine years. After severing his connection with the Reading Railroad Company he entered the service of the Columbia Electric Light Company, serving as superintendent for three years. In March, 1889, he was appointed general superintendent of the East Harrisburg Passenger Railway Company. By fourteen years of successful management Mr. Musser has demonstrated his general business ability and fitness for his new position.

MR. G. W. CHANCE, general manager of the Trans-St. Mary's Traction Company, has just resigned from that company to open an office as consulting electrical engineer in the Drexel Building in Philadelphia. Mr. Chance has had a long experience in railway service since his graduation from the University of Pennsylvania, where he took a civil engineering course, and also a special course in electricity. His first railway work was with the Norfolk & Western Railway, but he soon left that company to accept the position of assistant chief engineer with the Lake Erie & Western Railway, and then that of assistant superintendent of William Wharton, Jr., & Company, of Philadelphia. He later returned to active railroad work as assistant engineer of the Chicago & Northwestern Railway, and afterwards was appointed general manager of the Tagona Water & Light Company. Several years ago Mr. Chance was offered and accepted the management of the International Transit Company and the Trans-St. Mary's Traction Company, the Terminal Railway Company and the Power & Light Company, four associated companies at Sault Ste. Marie, Mich. The street railway system at this point was fully described in the STREET RAILWAY JOURNAL for July 4, 1903, and was constructed under Mr. Chance's supervision, and has been operated by him up to the present time. His long experience in electric railway construction and operation, as well as in steam railway engineering, makes him particularly fitted for general consulting engineering practice.



G. W. CHANCE

MR. LUTHER STIERINGER, who had achieved prominence in many different parts of the field of incandescent electric lighting, died on Friday, July 17, at Pasadena, Cal., from consumption complicated with Bright's disease. Mr. Stieringer first showed signs of breakdown in the fall of 1900, and despite the fact that he soon sought seclusion and retirement in the far West, his health was bettered only temporarily. Mr. Stieringer's boyhood was passed in New Jersey, where he attended the public schools. After leaving school he served a short apprenticeship as a gasfitter in New York City. He had a keen, inquiring mind, and was always an omnivorous reader, so that he was soon a master of his profession. He joined Mr. Edison at a very early stage of the electrical art at Menlo Park. His first work there was the adaptation of incandescent lamps and their connections to existing gas fixtures, while his subsequent work lay largely in the exploitation of the incandescent lamp. He was a pioneer in the electric illuminating art, and successfully introduced many fundamental inventions of his own, of which three systems of interior wiring are now in universal use. The illumination for the Louisville Exposition of 1883 was planned and installed by him, this being the first exposition entirely lighted by incandescent light. The 1893 Chicago Columbian World's Fair illumination and electric fountains, as well as other prominent expositions since, including the Omaha Exposition of 1898, and the recent Pan-American, were designed and installed by him, he also holding the position of consulting electric engineer in most of them. Medals and diplomas were awarded to him for many of these illuminations. He first introduced the outlining and accentuation of the buildings on a large scale with incandescent lamps at the Chicago Fair of 1893. The further development reached its climax at the Omaha Grand Court and surrounding buildings, the lighting being effected by small incandescent lamps. Mr. Stieringer may justly claim to have, by persistent effort, introduced and demonstrated the value of a small unit of light as exemplified on a large scale at the recent Pan-American. Just before his death he was awarded the John Scott medal by the Franklin Institute for his work.

NEWS OF THE WEEK

CONSTRUCTION NOTES

BIRMINGHAM, ALA.—Work has begun on changing the Powderly-Bessemer line of the Birmingham Railway, Light & Power Company from steam to electricity. This line is 7 miles long, and one of the oldest in the county. It was formerly the old Birmingham, Powderly & Bessemer Railway, and hauled thousands of people before the Birmingham-Powderly end was made an electric line. This new work will require heavy rail and ballast, and will be the last of the change from steam to electricity. Every line in the county will be run by electricity when the conversion of this line is completed. The company is now laying the track south of the railroads with 70-lb. rails slag ballasted.

FLORENCE, ALA.—The contract for the grading of the electric railway to be constructed between Florence, Sheffield and Tuscumbia has been awarded to T. M. Crow, civil engineer and contractor, of Florence, and a large force has been put to work. According to the terms of the contract, the work must be completed by December.

MOBILE, ALA.—The Mobile Light & Railroad Company has moved into its new offices. The building that it now occupies is a reconstructed hotel property, and has been fitted up especially to meet the demands of the company. On the west side front of the first floor is to be the general office. The east side of the ground floor will be used as a general supply room for the trolley and lighting departments, with a special room for the display of electrical devices. There are larger storerooms at the rear. In the hall, under the stairway on the first floor, is a series of closets to be used by the employees for storing their clothes during the day and leaving their working garments at night. The second floor is devoted solely to offices, except in the annex, where will be storerooms and testing places for lighting and power devices, arc and incandescent lamps, etc. On the west side front is the office of the president. The superintendent of the lighting department has a room at the rear of the president's, and back of this are the chief inspector's apartments. On the east side front is the office of the general superintendent. Back of this office are a number of storerooms. The entire top floor is devoted to the benevolent association composed of employees of the company. The large room on the west side is the gymnasium, which will also be used as a meeting room. The east side front is a library and reading room, supplied with daily papers, magazines, and many of the best works of fiction, as well as standard books on educational subjects. The fittings here are first-class, with appointments that appeal to the men and will be inducive of their spending their spare time here. Back of the reading room is the lavatory, where there are also hot and cold baths, showers, etc., and every convenience. The entire building will be heated by steam and lighted with electricity.

LOS ANGELES, CAL.—On Aug. 1 the Los Angeles shops of the Huntington-Hellman syndicate will be running with 700 operatives, and it is expected that by Jan. 1 about 1000 men will be employed. Besides overhauling the regular rolling stock of the syndicate's properties, the plans are to rush the construction of new cars for city and for interurban service. At the first of the year the capacity of the plant is expected to be four city and two interurban cars a month.

POMONA, CAL.—The City Trustees have accepted the bid of the Pacific Electric Railway Company for a franchise for an electric railway system in Pomona.

SAN JOSE, CAL.—The San Jose & Interurban Railway Company, recently financed by the Germania Trust Company, of St. Louis, to the extent of $500,000, has ordered its equipment in St. Louis. The American Car Company has an order from the company for thirty cars, each of which will cost $3,000. They will be large cars, something after the pattern of the new cars of the St. Louis & Suburban Company, of St. Louis.

APALACHICOLA, FLA.—The City Council has granted a franchise to citizens of Apalachicola for a street railway.

JACKSONVILLE, FLA.—The Jacksonville Electric Company has been granted permission to build a 1-mile extension.

BELLEVILLE, ILL. Articles of incorporation have been filed at Belleville by the Southern Illinois Electric Railroad Company, capitalized at $50,000. The principal office of the company will be at Mount Vernon, Ill. The incorporators are: J. R. Pierce, G. F. M. Ward, Sam Casey, Louis G. Pavey, Samuel T. Maxey and A. N. Johnson. The company proposes to operate an electric railway from East St. Louis through the counties of St. Clair, Clinton, Washington, Marion, Jefferson, Hamilton and White, to a point on the Wabash River, near Maunie.

MONMOUTH, ILL.—The Western Illinois Traction Company has been granted a franchise by the City Council.

OTTAWA, ILL.—All the property of the Ottawa Railway, Light & Power Company has been sold to Rollins & Sons, the Boston bankers, who hold all the outstanding bonds of the company. The bid made was $160,000, and for that amount the road was sold. It is understood that the purchasers will at once proceed to make many improvements in the road.

ROCKFORD, ILL.—The Interstate Electric Railway Company, of Rockford, has been incorporated, with a capital of $50,000. The railway is to be constructed from Rockford northwesterly to a point on the Illinois State line northwest of Durand, Winnebago County, Illinois. The incorporators and first board of directors are: N. F. Thompson, M. A. Beal, E. H. Keeler, H. N. Starr, R. G. McEvoy, all of Rockford.

ARDMORE, I. T.—The Ardmore Coal & Power Company has applied to the City Council for a franchise to construct an electric railway here. The application has been referred to the ordinance committee.

ANDERSON, IND.—The Union Traction Company has begun work at Newcastle and Middletown on its line to be built between Anderson and Newcastle.

BLUFFTON, IND.—The Muncie, Hartford & Fort Wayne Interurban Railroad Company has bought ground to be used as a location for the power plant and car houses at Bluffton, which will be one of the division points.

CARLISLE, IND.—The Western Indiana Traction Company has been granted a fifty-year franchise for the use of certain streets through Carlisle. The granting of this franchise completes the route of the traction company all the way from Vincennes to Sullivan, franchises having already been secured in all of the other cities and towns through which the proposed road will pass. The company is now ready to begin the survey for the road. This work will be in charge of Civil Engineer R. L. Bailey, of Sullivan, who will commence the work at once.

COLUMBUS, IND.—Work on the extension of the Indianapolis, Columbus & Southern Traction Company's road is almost completed, and it is expected that the line will be opened by Aug. 15.

DANVILLE, IND.—The Town Council has granted the Plainfield Electric Railway Company a franchise right to enter this city as far as the public square, on Wayne and Marion Streets. Work of grading the extension has begun, and when completed this city will have trolley connection with Indianapolis by way of Plainfield. Albert Lieber is president.

JEFFERSONVILLE, IND.—The Commissioners of Clark County have granted to the Ohio Valley Electric Company a franchise to construct an electric railway through the county from Jeffersonville to Marysville. The promoters say the line will be built at once.

INDIANAPOLIS, IND.—The Indianapolis & Northwestern Traction Company has connected its interurban track with the street railway tracks at Thirty-Fourth Street. The line connects with Lebanon, Frankfort, Lafayette and Crawfordsville. The track is now practically complete as far as Lebanon and 16 miles of track have been laid between Lebanon and Frankfort. The machinery is now being placed in the power house at Lebanon, and it is expected that cars will be running between Indianapolis and Lebanon by Oct. 1.

INDIANAPOLIS, IND.—It is reported that the Southern Indiana Traction Company, recently incorporated, with $3,000,000 capital stock, to build 200 miles of electric railway in Southern Indiana, has been financed by New York and Chicago firms, and that the stock will soon be put on the market.

INDIANAPOLIS, IND.—The grading on the Indianapolis & Cincinnati Traction line between Indianapolis and Rushville is going on rapidly. As soon as the road is completed to Rushville cars will be run between that city and Indianapolis. The contracts for the building of the power house at Rushville are now being let.

INDIANAPOLIS, IND.—A portion of the contracts to erect the new nine-story traction company station in this city have been let, the contract for the structural iron work going to the Noelke-Richards Iron Works, of this city. The firm has already gone to work on the new steel for the building. The work of razing the old building from the site has commenced.

INDIANAPOLIS, IND.—The Clark County Commissioners have granted to former Senator Joseph H. Shea a franchise for an electric railway from Jeffersonville to Columbus. He is said to be representing the Union Traction Company.

INDIANAPOLIS, IND.—The Indianapolis & Southwestern Electric Railway, the new Martinsville line by the way of Waverly, is to be constructed by the Interurban Railway Construction Company, of Indianapolis, which has been incorporated, with $10,000 capital stock. F. E. Bakeman, W. S. Taylor, Mrs. Jean Brudi, W. G. Wagenhals and O. M. Murphy are the directors.

INDIANAPOLIS, IND.—Work on the Indianapolis, Danville & Rockville Traction Company's line, which will reach the Parke County coal fields, will begin this month, according to the announcement of President Fauvre, of the Indianapolis & Eastern, of which the new road will be an extension. The Danville Construction Company, which is to build the road, has been incorporated with $100,000 capital. F. M. Fauvre, John W. Chipman, Medford B. Wilson, Ansel Fatout and C. E. Morgan are directors. The distance between Indianapolis and Danville is 20 miles. The line will follow the Rockville Road, which is due west of the city.

MICHIGAN CITY, IND.—The Chicago & Indiana Air Line Railway Company, which proposes to build an interurban line from South Bend to Michigan City and from Michigan City to Chicago, has formally accepted the franchise granted it by the South Bend Common Council by filing a $10,000 bond indemnifying the city against any loss by reason of negligence during the construction of its line, and also depositing the $1,000 forfeit provided in the measure if the system is not ready for operation in two years. The company is now working on the Chicago end of its line. Most of the grading in St. Joseph County is completed, while in Michigan City nothing has been done other than to lay out the route. The company intends to operate a rapid transit line from South Bend to Chicago via Michigan City. It expects later to connect with Toledo and other Eastern points. Judge Carlos M. Stone, of Cleveland, Ohio, one of the backers of the company, says the company will have several miles of track laid within the city limits of Chicago inside of one hundred days, and that work on the western terminus of the line will be pushed as rapidly as possible.

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EDITORIAL NOTICE

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The Electrification of British Railways

Most American street railway managers and engineers have been so occupied with the problems connected with the electrical equipment of the city and interurban railways of this country that they have not watched particularly closely the progress being made in Great Britain toward the electrification of certain of the trunk line systems. As shown by an article by a British engineer in our issue of July 4, however, the competition of the electric tramways with the steam railways around Manchester and Liverpool, Birmingham and other dense centers of population is very keen, and the electric lines have so spread out from the various towns and cities that it will soon be possible to go straight from Liverpool to Leeds by the trolley car. The railways in these districts are feeling the competition very sharply, and, it is needless to say, are also sustaining heavy losses as a result.

Thoroughly to understand why the steam railway companies have been endeavoring to defer installing electrical equipment until absolutely forced to do so, a few words of comment are necessary.

England is an old country, and the safety and general welfare of the traveling public have always been safeguarded by very stringent regulations, which in some cases have tended towards mere grandmotherly legislation. As a consequence of this the railway lines built in the first half of the last century were constructed so solidly that the capital expense involved was enormous; furthermore, speculators rushed wildly into railway enterprise, and the cost of obtaining statutory powers and purchasing land was excessive.

In time certain amalgamations were brought about by the large companies absorbing the smaller ones, which greatly reduced the number of competing lines. The amounts paid to bring about these changes were, in many cases, very large, with the result that the majority of the lines are overcapitalized, and to make matters worse, the great mistake has been made in bygone years of writing off far too little each year of the value of rolling stock and machinery for depreciation. This position greatly handicaps railway company directors, since the introduction of electric traction would necessitate not only a considerable increase of capital (already too large), but also a decrease in the assets, owing to the high value at which machinery and rolling stock, which would have to be scrapped, stand in their books at the present day.

The railways, consequently, adopted a "dog-in-the-manger" policy. They had no wish to introduce electric traction themselves, but still less did they desire anybody else to do it, and they did everything in their power to impede the progress of electric tramways and interurban railways. But though in the early stages of the campaign their efforts to quash the tramways were successful, the need for the latter was so urgent that the railways soon found that they had "bitten off more than they could chew," and they are now rapidly realizing that their stop-progress attitude cannot be kept up much longer.

Under the stimulus of the keen competition of the electric tramways the steam lines are beginning to bestir themselves. Some of the more progressive spirits amongst them have gone so far as to introduce electric traction experimentally on some of their branch lines, as in the case of the North-Eastern Railway around Newcastle-on-Tyne, and the Lancashire & Yorkshire Railway with its Liverpool & Southport line. Other companies, likewise realizing the necessity for action, but not being quite so venturesome (or probably not feeling the pinch of competition quite so sharply), have called in the services of electrical traction experts to advise them; in other cases the permanent officials of the company have carefully investigated the whole problem, and have studied the course of progress in America and on the Continent of Europe. Mr. Jacomb-Hood, the chief engineer of the London & South-Western Railway Company, appears to be a firm believer in the future electrification of steam railways, certainly in respect to hauling local and suburban trains, and has expressed his views on this subject in a paper which he read at the Engineering Conference which was recently held in London. He also draws attention to the serious financial difficulties which have to be met owing to the over-capitalized condition of the railways.

While some of the companies are thus honestly trying their best to solve the problem before them, there are, unfortunately, other cases where the permanent officials are trying to delay the introduction of electric traction as long as possible, because they know that should such a step be taken the changed condition of affairs would result in more work for them to accom-

plish and new methods to which they would have to adapt themselves. This they are unwilling to do, and so are attempting to preserve the old regime until their terms of office shall have expired.

The problem is further complicated by the large number of side issues which have been raised, such as the contention that in many cases the congestion of tracks in freight yards and terminal stations would so complicate the installation of the electric conductors as to render their installation practically impossible.

At the present moment the rapid transit problem in London is receiving very careful consideration, and a great and useful work is being carried out by the London County Council, and also by Charles T. Yerkes and his associates. The various other proposals made by numerous private interests are being carefully weighed and discussed by the Royal Commission which has been appointed for the purpose. This body will not only recommend the adoption of a better and simpler form of legislation in respect to the granting of franchises, but will thoroughly sift the whole matter to the bottom. To a certain extent this commission is on much the same lines as the Rapid Transit Commission of New York, and we look for important and far-reaching recommendations to result from its work.

The whole situation in Great Britain may be briefly summarized as follows: The steam railways are over-capitalized, and apparently the fact that plant depreciates has been ignored.

The directors in a very large number of cases have no practical experience in railway work, and their only thought is to be able to declare a dividend, lest they lose their position.

Many of the permanent officials fight shy of electric traction, because it is to them a new thing, concerning which their knowledge is negligible, and also because its introduction would mean a considerable amount of personal hard work. They are not blind to the fact that electrification is bound to come, but if they can help it they do not mean it to come in their time.

The probabilities are that in the near future, notwithstanding the very low average speeds which are legalized in the streets, the ever-growing competition of the electric tramways and the clamoring of a public educated thereby to a much higher standard of comfort than is given by the railways, will force the hands of the latter and compel them to supply a better and cheaper service of trains. Parliament has hitherto always safeguarded the interests of railways as long as they serve the public properly, but if the railway companies do not bestir themselves it will, very properly, grant franchises to other companies to do the necessary work, and there would be no difficulty in raising the requisite capital for such purposes.

That railways are not in a worse position than they are at the present day is largely due to the rules and regulations which so carefully safeguard the life and limbs of the British subject in his own country. Were this not the case it would be quite feasible for the tramway companies to have high-speed interurban lines built on their own right of way in the open country between towns, and to run the cars over the existing tracks belonging to the town tramways on coming within the boundaries of the latter. Although this is not possible at present, owing to the regulations as regards the narrow grooved type of rails imposed by the Board of Trade, there is no doubt that the necessary capital will be found to build either underground tubes or elevated lines within the boundaries of large towns, by means of which high-speed railroads could reach the crowded centers.

The amount of capital required is, however, considerable, and this has somewhat delayed progress and prevented the competition of the electric roads from becoming as dangerous to the steam roads as would otherwise have been the case. But this situation will not last much longer, and the electrification of suburban lines in the big English towns will undoubtedly take place within the next few years.

Standard System of Accounting in Great Britain

The owners and operators of the municipal and other tramways of Great Britain will, at no great distant day, congratulate themselves that the subject of a standard system of accounting has reached the point of serious consideration with them. Ever since the adoption of the American standard by the Street Railway Accountants' Association of America the subject has been a topic of more or less debate among tramway managers in Great Britain, as evidenced by the submission of a proposed standard system to the Board of Trade by the secretary of the Tramways & Light Railways Association, the presentation of a paper on this subject, by James Dalrymple, C. A., at the meeting last month of the Municipal Tramways Association, and a similar paper read last July at the London meeting of the International Tramway Association, which embraces the principal tramway companies on the Continent. Mr. Dalrymple's paper and proposed standard are published in full in this issue.

Of the three standard systems of accounting which have been brought forward for European use Mr. Dalrymple's seems to us the most desirable. Yet it is with great regret that we notice that the proposed form differs radically, and it seems to us needlessly, from its predecessor, adopted by the Street Railway Accountants' Association of America, to which the writer refers in his report. This feeling of regret is caused, of course, not entirely because the American standardization happened to be the first adopted, although that of itself would constitute one great reason in favor of its adoption in principle, but also because it seems to be the simpler and therefore the more effective. Owing to the close relation now existing in the mechanical conditions of the two countries, a like similarity in the classing accounts, especially of operating accounts, is much to be desired.

We, of course, recognize that an absolutely verbatim copy of the American system could hardly be used in Great Britain, at least until at such a future date when operating conditions are more similar. But now that the British Association has arrived at the time when standardization of accounts is recognized as desirable, it might as well, while causing the confusion out of which is to come uniformity, go a step farther and arrive as closely as possible to an international uniformity, at least with America.

The proposed standard classification of the International Tramway Association, as given in the report printed in this journal of the London meeting last summer of that association, is so completely at variance with the adopted American or the proposed British municipal standard classification that it can hardly be considered. At any rate, it does not destroy any argument for a standard classification that may be useful and operative in countries that have so much in common as America and England. This is all the more forcefully brought out when it is remembered that investors of either country are large holders of the securities of the other. The support given to the American standard classification by the financial interests of the country has been so cordial and uniform that should the

Municipal Tramways Association adopt one along the same plan it would be considered a fortunate and wise action.

The complete report, as published elsewhere in this issue, deserves the careful and thoughtful consideration of everyone. It will be noticed that the usual British custom of providing for depreciation is included, the figures which Mr. Dalrymple uses being a little more than 18 per cent of the total working (operating) expenses.

Accounts, No. 20, Local Taxes; No. 21, Properties and Income Tax; No. 38, Permanent Way Renewal Fund, and Nos. 39 to 46, Depreciation, will give a very great difference in "per cent of operating expenses to gross earnings" when used as a comparison with American reports.

The general plan of the report closely follows the published annual reports of the Glasgow Corporation Tramways, of which Mr. Dalrymple is chief accountant, but, as Mr. Dalrymple says in his letter of submission, he has consulted the American report, for the definitions of the accounts are frequently identical. Having gone thus far, it would be easy to take the whole plan of the American association, which is quite flexible enough to allow such changes that are necessary and still follow the arrangement of maintenance, transportation and general divisions of operating accounts.

From an American point of view, the American income account, which is the gist of the year's figures, is more logically arranged and is expressed compactly, while in the report under discussion it is not gathered into any one tableau of figures, but is spread through revenue, net revenue and appropriation accounts. It would also seem that capital expenditure and capital accounts, which are shown on two debit and two credit pages, are more clearly shown in their relation to each other, without repetition, in the American schedule "D."

The report is of undoubted ability, and while it is probably intended solely for use by British municipal corporations it cannot be considered a British standard until unified with the "Model Form of Returns," referred to above, as having been drawn up by the Tramways & Light Railways Association, and which is open to certain serious criticisms. Space will not permit a detailed consideration of this report here; it may, however, be explained as being prepared from an engineering rather than from an operating standpoint. These two forms are so dissimilar that it would seem they could never be combined without destroying wholly what similarity there is between the Municipal Tramways proposed report and the American standard, and in view of the great desirability of an international standard, it is to be hoped these two British associations will see the advantages of adopting the American standard, not because it is American, but because it has been in use long enough to have been thoroughly tested and found worthy of the name "standard." In addition to this, while the effort to make uniformity will create its confusion and somewhat dissipate comparisons for at least a year, the adoption of the American standard will cause no more confusion to adopt and will result in intelligent understanding of the report or returns of the companies of either country by the investors and operators of the other. It is to be hoped, therefore, while giving Mr. Dalrymple full appreciation for his excellent work, that the question may be squarely faced whether it would not be better after all to adopt the American standard, not in any sense as "American" but as international, for the reasons given above and which will be recounted: (1) The American system is much simpler and is hence more effective; (2) from the standpoints of both the operating manager and investor like systems of classifying accounts, especially operating accounts, is most desirable; (3) the American system has already been adopted by a large number of companies, and so could not be easily changed to the English standard, whereas the latter, being as yet only proposed, could easily be modified to similarity with the American standard; (4) the American standard has proved satisfactory after an experience of five or six years by railway companies varying in size from those operating small systems to the very largest, whereas the English standard is still largely theoretical; (5) the changes required for practical uniformity are not radical, and could easily be made without any sacrifice of principle.

Sleeping Cars on Interurban Lines

While there may have been a disposition in some quarters to think lightly of the proposition to establish sleeping car service on electric interurban lines, there is no doubt in the minds of those familiar with the conditions of interurban service in Indiana, Ohio and Michigan that there will soon be a great demand for this service over certain routes. Those who think slightingly of the proposition are those who are least familiar with the present status of interurban railroading and the practical requirements of the traveling man, who is the best patron of the sleeping car service on the steam railroads. At the present time there are a number of cities which are not a sufficient distance apart to make a night's journey on a steam road, but which are, nevertheless, far enough apart so that an annoying amount of time is consumed in traveling the distance between them. Take, for instance, two cities in the Central States from 100 miles to 150 miles apart. The chances are ten to one that a traveling man, to whom every minute of the business hours is valuable, and yet who can little afford to break into a regular night's rest, is obliged either to consume part of the business day making a journey between those two towns, or if he does not do this he is obliged to lose a part of his night's rest. Electric sleeping cars, making the trip in a night between towns situated as outlined, are sure to have patronage. A little investigation of this matter by those not familiar with the steam road schedules between large towns 100 miles to 150 miles apart would prove a revelation. Trains are run to suit the convenience of passengers traveling between the largest terminal cities. Those boarding or leaving the train at smaller intermediate points must simply make the best of an inconvenient schedule.

There is also another opportunity for the interurban sleeper which is, perhaps, more limited than the business just outlined.

Where two large cities are too near together to make a full night's ride on an ordinary steam road schedule, say, 150 miles to 225 miles, it is customary for the steam roads to provide sleeping cars which can be occupied all night without regard to the time of arrival and departure of the train; but this is true only between the larger cities, and further than this one who has had experience with this class of service knows that a sleeping car standing still on a hot night is not the most desirable place to rest. The average traveler would much prefer to be moving even though at a slow rate of speed.

As said before, it is only between the larger places that all-night sleeping cars are provided in present steam road service, and there are dozens of routes between smaller towns which offer opportunity for profitable interurban sleeping car service for distances of 150 miles to 250 miles. In case of direct competition between steam and electric sleeping cars the cleanliness of the electric service ought to be sufficient to take many away from the somewhat faster service on the steam roads.

ELECTRIC INTERURBAN BETWEEN COLUMBUS AND ZANESVILLE

In the articles describing the Appleyard system of roads in Ohio, published in the Street Railway Journal of May 16 and May 23, reference was made to the connecting lines controlled by Tucker, Anthony & Company, of Boston, the plans being worked out by the two interests for operating through trains between Cincinnati, Cleveland, Pittsburg and Toledo were explained, and a map was presented showing the proposed system. As was intimated at the time the chief efforts of Tucker, Anthony & Company are being directed toward the completion of a through line between Columbus and Cleveland. At present the most important property in this group is the Columbus, Buckeye Lake & Newark Traction Company, which, by reason of an extension to Zanesville, is soon to be known as the Columbus, Newark & Zanesville Traction Company. The line has been in operation between Columbus and Newark for about fifteen months, and it undoubtedly places in the hands of its owners the key to the most desirable route east from Columbus, as it forms the logical entrance to Columbus for lines building to the northeast. The Ohio River & Western Railway, an Appleyard property extending from Zanesville to Wheeling, will secure connection with the capital city over this line.



REVERSE CURVE ON C., B. L. & N. RAILWAY, WHERE IT PASSES CANAL ON ONE SIDE AND THE STEAM LINE AND HIGHWAY ON THE OTHER

THE ROUTE

Between Columbus and Hebron, 29 miles, the line follows the old National Pike, a military road built by the national government before this section of the country was settled, and over which the company has twenty-five-year franchises from the counties traversed. This highway is also followed by the Columbus, London & Springfield Railway between Columbus and Springfield. The trolley is built at the side of the highway, but because of this it should not be considered in the same class as ordinary pike roads, since the highway is nearly 100 ft. wide and the railway is separated from the wagon road by a ditch. It is, moreover, practically fenced in on one side by the company's pole line, the other side having already been occupied by the long-distance lines of a telephone company. This portion of the line is almost a perfect tangent, and the few grades met are long and hardly noticeable, as the country is very flat. Between Hebron and Newark, a distance of 9 miles, the line traverses the berme bank of the Ohio & Erie Canal, under a lease from the State. There are, of course, no grades on this section of the road, but the meanderings of the canal introduce nineteen curves in the 9 miles. Only a few of these are severe enough to necessitate the use of guard rails, and in every case they can be taken at a good rate of speed. This portion of the route provides rather unique scenery, and at one point, side by side, are exemplified four ages or methods of transportation, namely, the National Pike, the old and abandoned canal, the steam railway and the up-to-date electric railway. A view of this interesting feature is presented herewith.

The road under construction from Newark to Zanesville is on private right of way, ranging from 50 ft. to 75 ft. in width, the greater portion being cross-country route. The line parallels the Licking River, and at one point there is a tunnel nearly 400 ft. long, which was built to avoid several bad curves. In Newark the syndicate operates 8 miles of city lines with a suburban line to the neighboring town of Granville, 7 miles. These constitute the Newark & Granville Railway, which was purchased by the syndicate several months ago, and is operated by the interurban management. From Hebron to Buckeye Lake, 2½ miles away, there is a cross-country spur line, while between Etna and Pataskala, 2¼ miles, a private right of way has been secured and a spur line will be built at once. When completed, as outlined, the system will include 64 miles of main line, 12 miles of spur lines and 8 miles of city lines, a total of 84 miles, not including sidings.

The company built its own entrance into Columbus by way of Mound Street as far as the interurban loop, and all cars operate to the Union Passenger Station on Gay Street. The city portion of the line is leased to the Central Market Street Railway, which furnishes city service. All of these features, as well as the type of construction used on the city line, were described in the article on the Appleyard system in the May 16 issue of this paper.

The Newark & Granville Railway has recently been rebuilt with 9-in. 90-lb. girder for the city lines, and 70-lb. T-rails for the suburban, and new overhead construction throughout. The interurban system is designed for high speed, with 70-lb. rails in 30-ft. lengths, laid on 6-in. x 8-in. x 8-ft. oak ties. American Steel & Wire protected bonds are used on a portion of the system and General Electric flexible bonds on the balance. They are used in connection with standard six-bolt, 30-in. fish-plates. Sidings are 400 ft. long, and are 5 miles apart. They have spring switches, low-stand targets and frogs of steam railway pattern. On the present line there are six steel bridges, from 20 ft. to 156 ft. in length, seventy tile and iron culverts, varying from 6 ins. to 3 ft. in diameter, and three concrete arch culverts of 6-ft. span, as well as drainage tile under all highway and driveway crossings. There are several large pile trestles, and at Alum Creek, near the Columbus city limits, there is one 800-ft. trestle and steel bridge, forming an overhead crossing over two steam roads as well as crossing the

stream. Six inches of gravel is placed under the ties and filled up even with the tops on the interurban line, while the paving used in cities is vitrified brick in thick concrete base and grouted with cement.

OVERHEAD WORK

Poles are 35 ft. tall, and spaced 100 ft. apart; a portion of them are red cedar and the balance chestnut. There are two cross-arms, the upper for the high-tension wires and the lower for the direct-current feeders. There are also two sets of small side brackets for the telephone system and block signal system. Brackets 9 ft. long, of 1½-in. pipe, and provided with guy wires, are employed, and a single trolley wire of the 0000 grooved pattern is used. Between Hebron and Columbus there are two 0000 copper feeders, and between Hebron and Newark two 0000 copper and two 330,000 circ. mil aluminum feeders, the latter supplying the Newark & Granville system. At the Newark city limits the feeders divide; the city system is supplied by one 0 and one 0000 copper feeders, while the Granville suburban line is supplied by three feeders arranged as follows: One 330,000 circ. mil aluminum, 4 miles; one 0000 copper, 6 miles, and one 0 copper, 7 miles. The high-tension wires are of No. 4 B. & S. gage. Two of these are attached to the ends of the upper cross-arm, while the third is mounted on a saddle-pin at the top of the pole. This pin is of iron, with a wooden tip, and it is attached to the pole by three lag screws on each side. No. 2 triple petticoat Provo-type insulators are used for securing the high-tension wires.



BIG WALNUT BRIDGE ON C., B. L. & N.

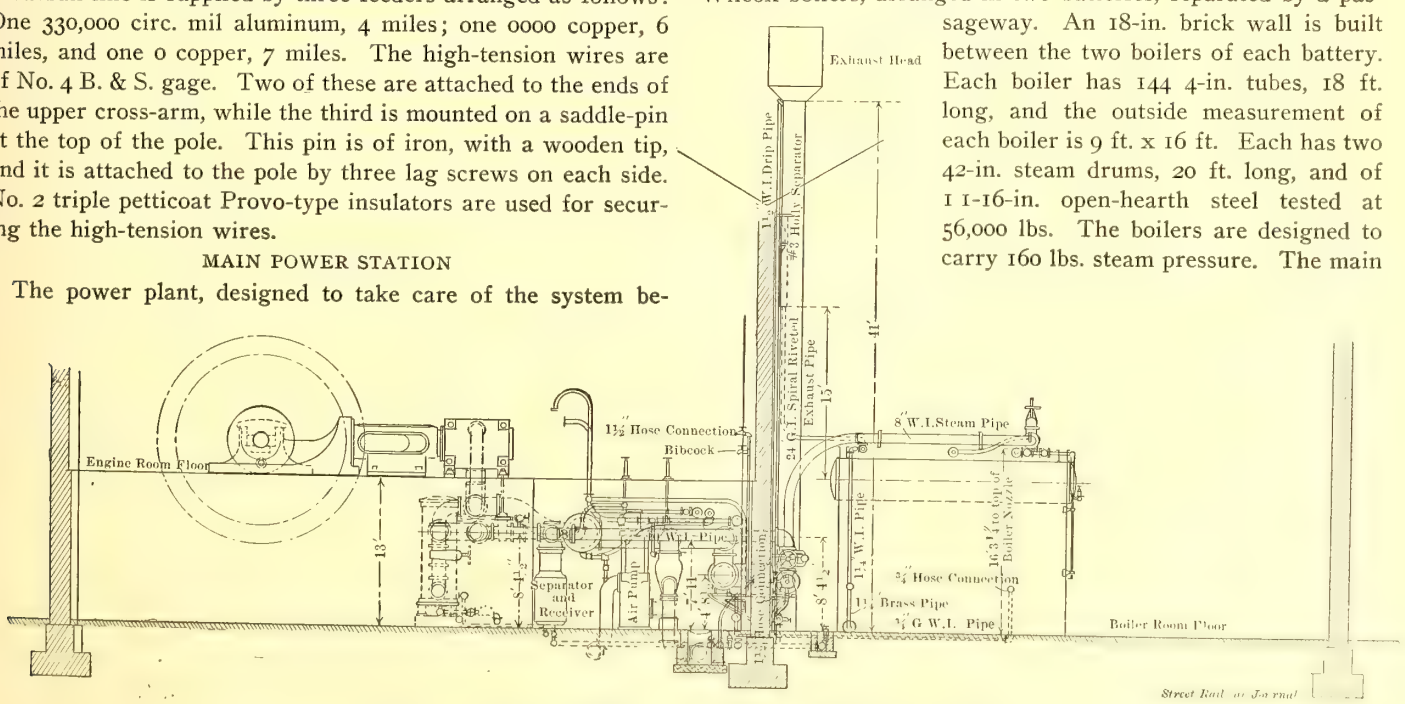


HEBRON POWER HOUSE, C., B. L. & N.

MAIN POWER STATION

The power plant, designed to take care of the system between Columbus and Zanesville, is located at the village of Hebron, within a short distance of the bank of the canal from which water is obtained. A constant supply of good water is always assured, since the location is only about 2 miles from Licking reservoir, better known as Buckeye Lake, which feeds a greater portion of the canal system. This location was selected also because of its proximity to the pipe lines from neighboring natural gas fields, from which the plant derives its chief fuel supply.

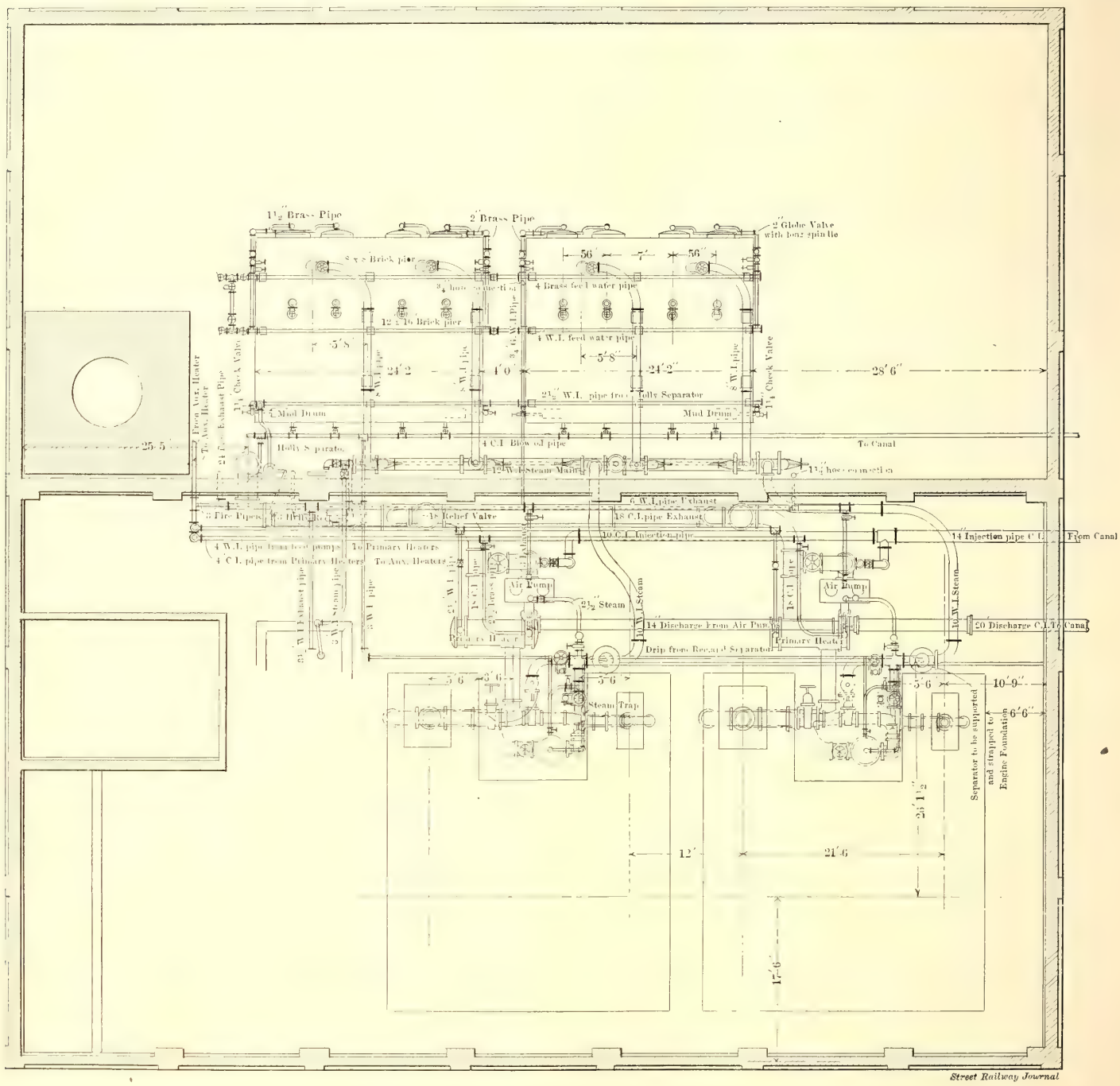
The building is a large brick structure of unusually attractive design. It is divided into two wings, the engine room, 61 ft. x 112 ft., and the boiler room, 50 ft. x 112 ft. At the side of the boiler room there are coal bunkers, 22 ft. x 112 ft., having a capacity of 1000 tons. There is a steel I-beam trestle for dump-bottom coal cars. The roofs are iron truss with slate, and there is a stack 150 ft. 6 ins. tall, with 7-ft. flue. It is constructed of radial brick and rests on a square base within the boiler room. The boiler equipment consists of four 300-hp Babcock & Wilcox boilers, arranged in two batteries, separated by a passageway. An 18-in. brick wall is built between the two boilers of each battery. Each boiler has 144 4-in. tubes, 18 ft. long, and the outside measurement of each boiler is 9 ft. x 16 ft. Each has two 42-in. steam drums, 20 ft. long, and of 1 1-16-in. open-hearth steel tested at 56,000 lbs. The boilers are designed to carry 160 lbs. steam pressure. The main



CROSS SECTION, SHOWING PIPING IN HEBRON POWER PLANT

steam header is 12 ins. in diameter, and the connections have 2-in. flanges. A Walworth valve, having an 18-in. gate, separates the two sets of boilers, and each boiler is also fitted with a separate valve, so that any of the four may be cut out. There are also separate valves on the tops of the boilers.

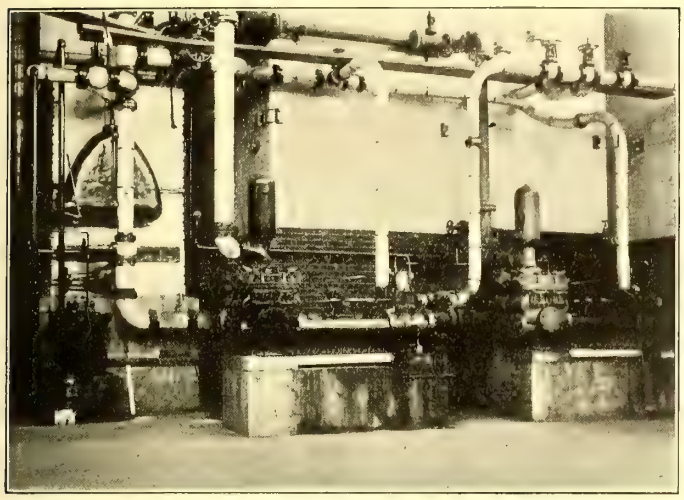
As already intimated, natural gas is used for fuel supply. This is received through a 4-in. pipe, tapped from an 8-in. main, supplying the city of Newark, and passing a short distance from the power station. The pressure in the main line varies from 80 lbs. to 140 lbs., necessitating equalizing and reduction. A regulator house has been erected a short distance from the plant, containing two sets of reducing regulators, the first of which cuts the pressure down as low as 20 lbs., while the second, or low-pressure regulator, reduces the pressure to the desired number of ounces. In the boiler room is located a steam gas regulator, which governs the flow into the burners. There is a lever provided with weights similar to the balance on a scale, and this is set according to the steam pressure desired in the boilers. Connected with the steam regulator outfit are two meters, each carrying half the load. Readings are taken every morning by the gas company. The gas burners are a modification of the Klein type, furnished by Tate, Jones & Company, of Pittsburg. There are three sets of burners for each boiler, two at the sides and one above. The center burner is 14 ins. above the grate inside the center door, and throws its flames through the center towards the rear of the boiler. The side burners are set at the same height at each side, so that the flames incline towards the center of the flues. Only three of the four boilers are equipped for gas, the other being held in reserve for the speedy use of coal. It is claimed that it is not necessary to remove the burners if it is necessary to burn coal, but they can be taken out in two hours if it is desirable to do so.



PIPING PLANT OF HEBRON POWER STATION

The plant is supplied with recording watt-meters, and a careful record is being kept of cost of generating current, but by reason of recently discovered discrepancies in the instruments the management deemed it inadvisable at this time to go into a detailed statement relative to the efficiency and the economy derived through the use of gas. It is known, however, that there is a saving of from one-fourth to one-third, compared with Sunday Creek run of mine coal, at $2.20 per ton.

which has been used on certain occasions. The engineer of the plant stated that during several days' continuous tests an average of 35 ft. of gas was consumed per electrical horse-power. J. R. Harrigan, general manager of the company, states that the present cost of power is estimated at 0.5 cents per kilowatt-hour. From an informant, other than the company itself, it is understood that gas is purchased at the low rate of 8 cents per 1000 ft.



FEED-WATER PUMPS AND COCHRANE HEATER AND PURIFIER IN BOILER ROOM

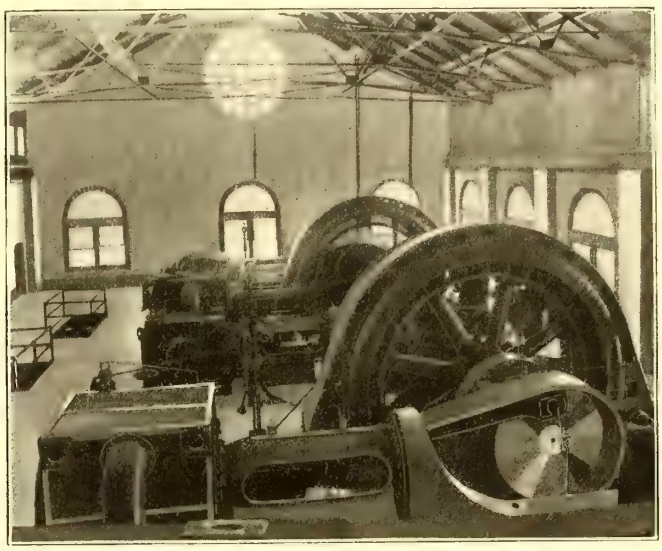
In the boiler room there is a Cochrane open heater and purifier, also two Blake double-feed water pumps. The engine room floor is 10 ft. above that of the boiler room, and in the auxiliary room below and extending up through the floor are two Blake vertical twin condenser pumps. These are designed to run at 27-in. vacuum. There is a primary heater in the exhaust line and the feed water passes through this first and then through the Cochrane heater, enabling the water to be put into the boilers at 206 degs. The exhaust line is 18 ins. in diameter, and in the line is an atmospheric valve.

THE ENGINE ROOM

There are two engines of the Hamilton-Corliss cross-compound type; the high-pressure cylinders being 26 ins. in diameter, and the low pressure 50 ins., with a stroke of 48 ins. There is a reducing valve in the main steam line connected with the low-pressure cylinder, so that in case it is desired to run the low-pressure side of an engine independent of the high-pressure side the latter may be cut off from the main steam line. A fire system has been provided throughout the plant in which the feed-water pumps may turn their full pressure into fighting fire.

Directly connected to the engine shafts are 800-kw General Electric generators. They are of the three-phase, revolving field type, operating at 94 r. p. m., and wound for 13,200 volts, the pressure selected for the transmission lines. This system makes it unnecessary to step-up the current in the station. Attached to the fields are the engine fly-wheels, which are 18 ft. in diameter, and have a web 18 ins. deep and 20 ins. wide; the total weight being 100,000 lbs. Current for excitation of generator fields is supplied by two 35-kw, 125-volt exciter sets; one of them driven by a small General Electric marine engine, and the other by an induction motor. The engine-driven set is used in starting, and is shut down when the generators are up to voltage and the motor-driven exciter is started.

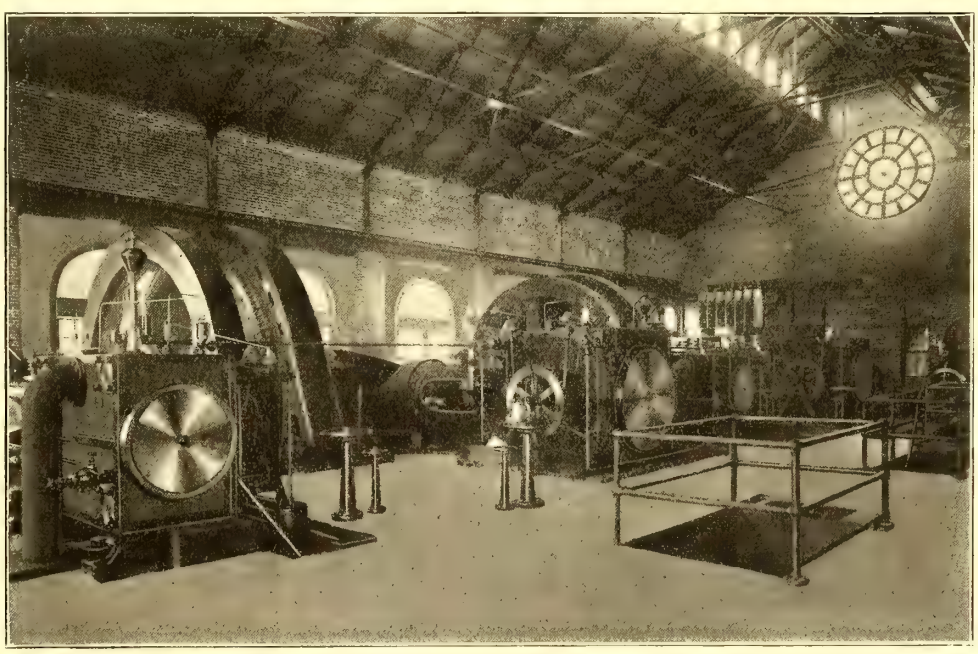
There is a sub-station outfit in the main station. Two 300-kw



GENERATING SETS IN MAIN POWER HOUSE AT HEBRON

rotary converters adjoin the exciter sets at one end of the building and the floor below these is open, affording good ventilation. To the rear of the converters is the station switchboard, and back of these are the oil switches, transformers and lightning arrester gallery.

There are two rows of oil switches of the General Electric hand-operated, single-pole, form K-type, the three single-pole switches for one circuit being controlled by one handle. These

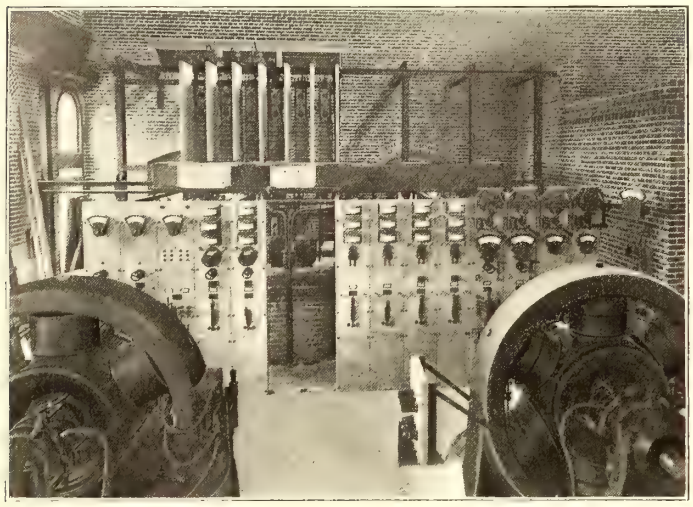


GENERAL VIEW OF ENGINE ROOM IN HEBRON POWER HOUSE

are in brick concrete and soapstone cells. Current from the generators is carried to the generator switches by triple-conductor, paper-insulated lead-covered cables. The three phases are separated in terminal heads and current passes through the generator oil switches, and from there to the station bus-bar, located above and between the two rows of oil switches.

High-tension oil switches of the same type are also used between the bus-bars and the transformer banks for the rotaries in the station. There are three 120-kw transformers

for each rotary. Current is reduced in the transformers to 370 volts for the rotaries. There is a reactive coil in front of each bank of transformers, which adds to the compounding and assists in hand regulation of voltage. The transformers are cooled by fans driven by 1-hp 350-volt induction motors. In line with modern practice the whole basement under transformers, blowers, reactive coils, etc., has been walled off for an air-blast chamber, thus giving a convenient place to work on wiring, etc., that enters the bases of transformers.



ROTARIES AND SWITCHBOARDS IN HEBRON POWER HOUSE

The lightning arresters for the outgoing lines are suspended on an iron frame and isolated by means of barriers.

SWITCHBOARD

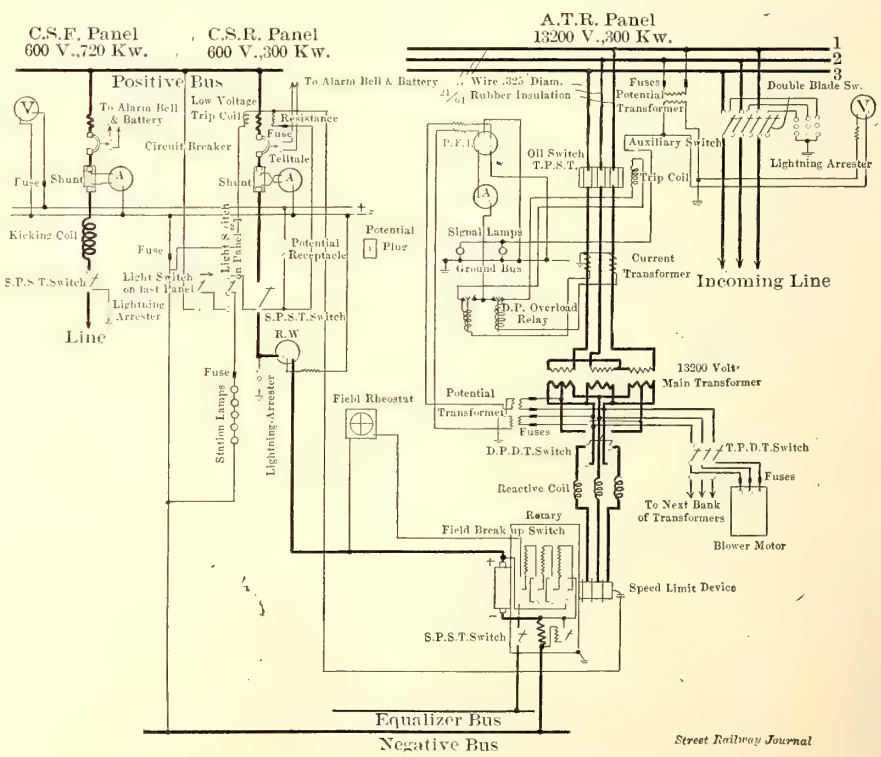
The station switchboard is of blue Vermont marble, and has fifteen panels, arranged as follows from left to right: Two exciter panels, one exciter feeder or field panel, two generator panels, two spaces for future panels, two outgoing transmission line panels, two 13,200-volt alternating-current panels, two direct-current converter panels and two for direct-current feeders. On each generator panel there is a power factor indicator, an ammeter, a voltmeter and a recording wattmeter. The two outgoing line panels have three ammeters each. The direct-current converter panels have automatic circuit breakers and ammeters, also recording wattmeters. Current transformers for ammeters on the board and potential transformers for the volt meters are located above the oil switches; the former are connected in series with the line and the line and the latter are connected across the line.

There has recently been installed in the station a gravity system of oil-feed which is saving the work of one man. Another valuable device is a Christensen air compressor outfit, which is used in blowing out the bearings of all machinery. One corner of the room is partitioned off for an office for the engineer. It is neatly furnished and provided with connection from the line telephone system. A person visiting the station cannot fail to be impressed with the extreme cleanliness pervading the entire place, made possible by the use of gas as fuel. The walls of both engine room and boiler room are painted white. When the station is in operation lighting current is taken from the railway circuit, and when it is closed down current is taken from the 125-volt steam exciter. A 58-ft. crane has been installed. It spans the entire engine room, and comprises a 15-ton hand-power crane and a 3-ton auxiliary hoist. The outfit weighs 36,000 lbs., and was furnished by the Whiting Foundry & Engine Company, of Chicago. The power station was designed by Sheaf & Jastaad, of Boston.

THE SUB-STATIONS

At the present time but one sub-station is in operation. This is located at Hibernia, half-way between Hebron and Columbus. The equipment of this station consists of two 300-kw rotaries, six 120-kw air-cooled transformers, arranged in two banks, together with the necessary oil switches, circuit breakers and switchboard. The sub-station feeds directly to the center of Columbus on one side and half-way to Hebron in the other direction. While the Hibernia station is theoretically a terminal station for this system, it is equipped with outgoing high-tension lines which connect with the Columbus sub-station of the Columbus, London & Springfield Railway. As outlined in the description of the power equipment of the system published in the May 23 issue of the Street Railway Journal, the power houses of the two systems may be operated in parallel through the compensating transformer equipment in the Columbus sub-station.

At present the rotary equipment in the main station supplies between Hebron and Newark, the Newark city system and the Newark & Granville line. To provide for the extension now under construction to Zanesville, there will be two additional sub-stations. One of these is under construction in connection with the car houses at Newark, plans for which are presented on another page, while the locations of the other two have not been fully decided upon. The equipment of these will be similar to that of the Hibernia sub-station, except that they will have two three-phase air-cooled transformers instead of six single-phase. Additional current for the extension will be provided by a new unit, consisting of a 1500-kw General Electric generator, directly connected to a 2500-hp Hamilton-Corliss engine. This will necessitate the extension of the building southward, but there is space at present for the additional oil switches, switchboard, lightning arresters and other auxiliary equipment that will be required. All machines will be run in parallel.



SWITCHBOARD WIRING FOR SUB-STATION

CAR HOUSE AND REPAIR SHOPS

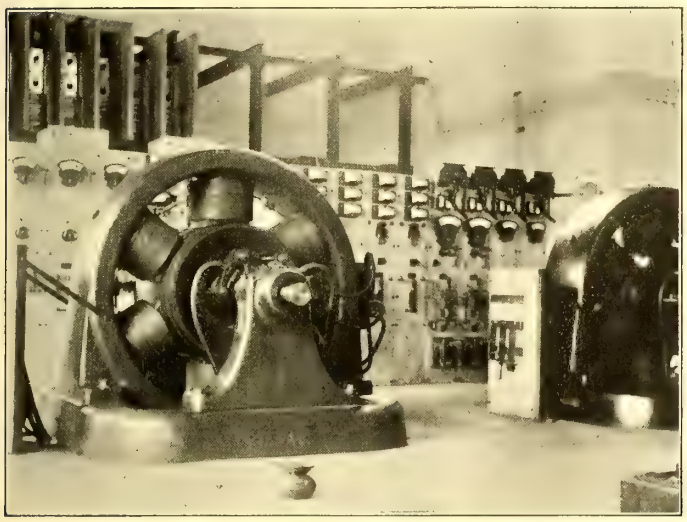
At Newark are being erected the car house, shops and rotary station mentioned. The structure is of brick with sandstone trimmings. It is divided into two parts by a brick fire-wall.

Each half is 60 ft. from wall to wall, and contains working pits, wash room, repair shops, etc. There are ten tracks, with capacity more than sufficient to hold all the cars on the system. The roof consists of steel trusses covered with corrugated iron on purlines. An annex, as shown, contains the offices, men's lounging room, boiler room and sub-station.

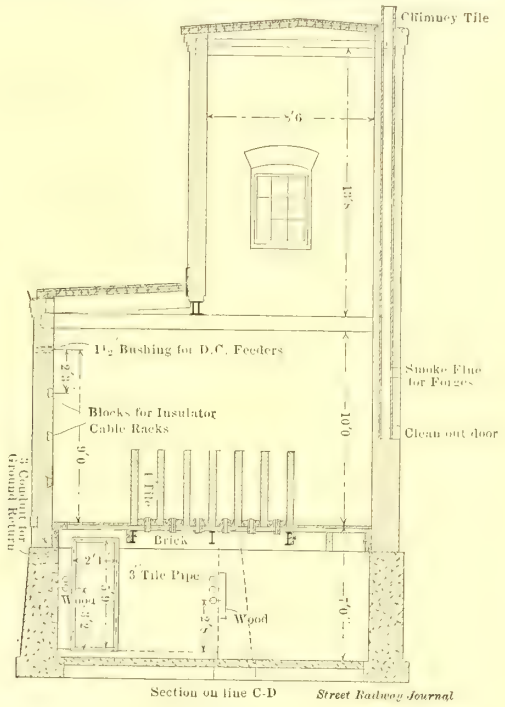
Plans for this structure were prepared by E. H. Kitfield, of Boston, from whom the accompanying diagrams were procured.

CAR EQUIPMENT

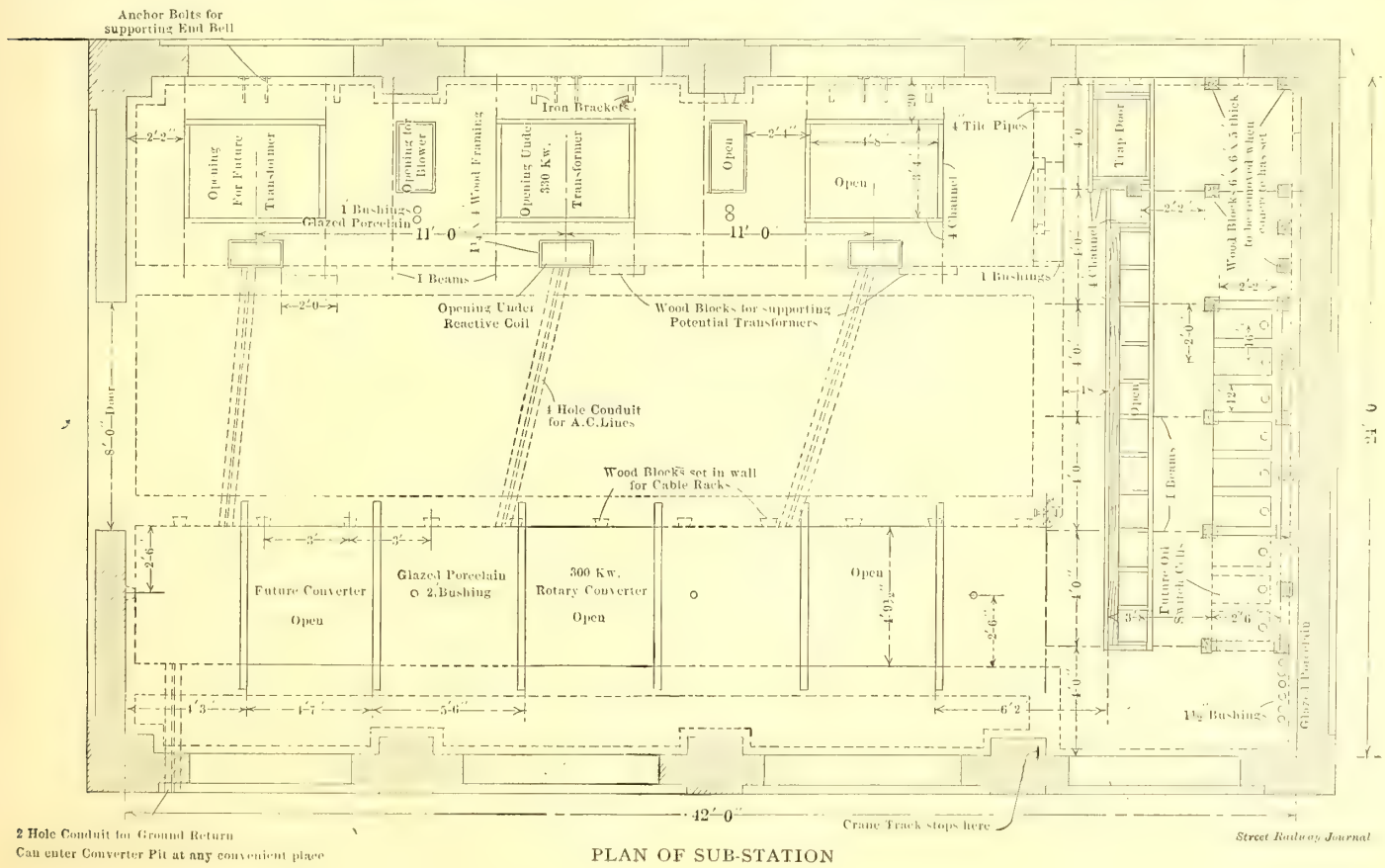
The rolling stock for the present Columbus-Newark line consists of four 62-ft. and four 50-ft. Barney & Smith cars. The former seat sixty-two people, and have baggage compartments in addition to smokers, while the latter seat fifty people. They are finished in dark mahogany, and each has a water-cooler and closet. They are equipped with four General Electric No. 73 motors, mounted on Barney & Smith type-J trucks, center nose suspension. M. C. B. journals and 33-in. wheels with Chrome steel tires are employed. The longer cars weigh about 75,000 lbs. Four of these cars are used on hourly headway, and they make the 37 miles in 1 hour and 50 minutes. The company will shortly institute limited service between these points, and for this purpose has a 62-ft. Barney & Smith parlor car with chair seats, which will make the run in 1 hour and 20 minutes. For express service there are two 60-ft. Barney & Smith express cars equipped with four General Electric No. 57 motors. The summer traffic on this line is very heavy, and for this service there are five 62-ft. semi-convertible cars, built by the Jewett Car Company. They have center aisles and slat seats, and are equipped with Peckham M. C. B. No. 32 trucks and two General Electric No. 73 motors. The Newark & Granville line has a 50-ft. combination passenger and baggage car, built by the



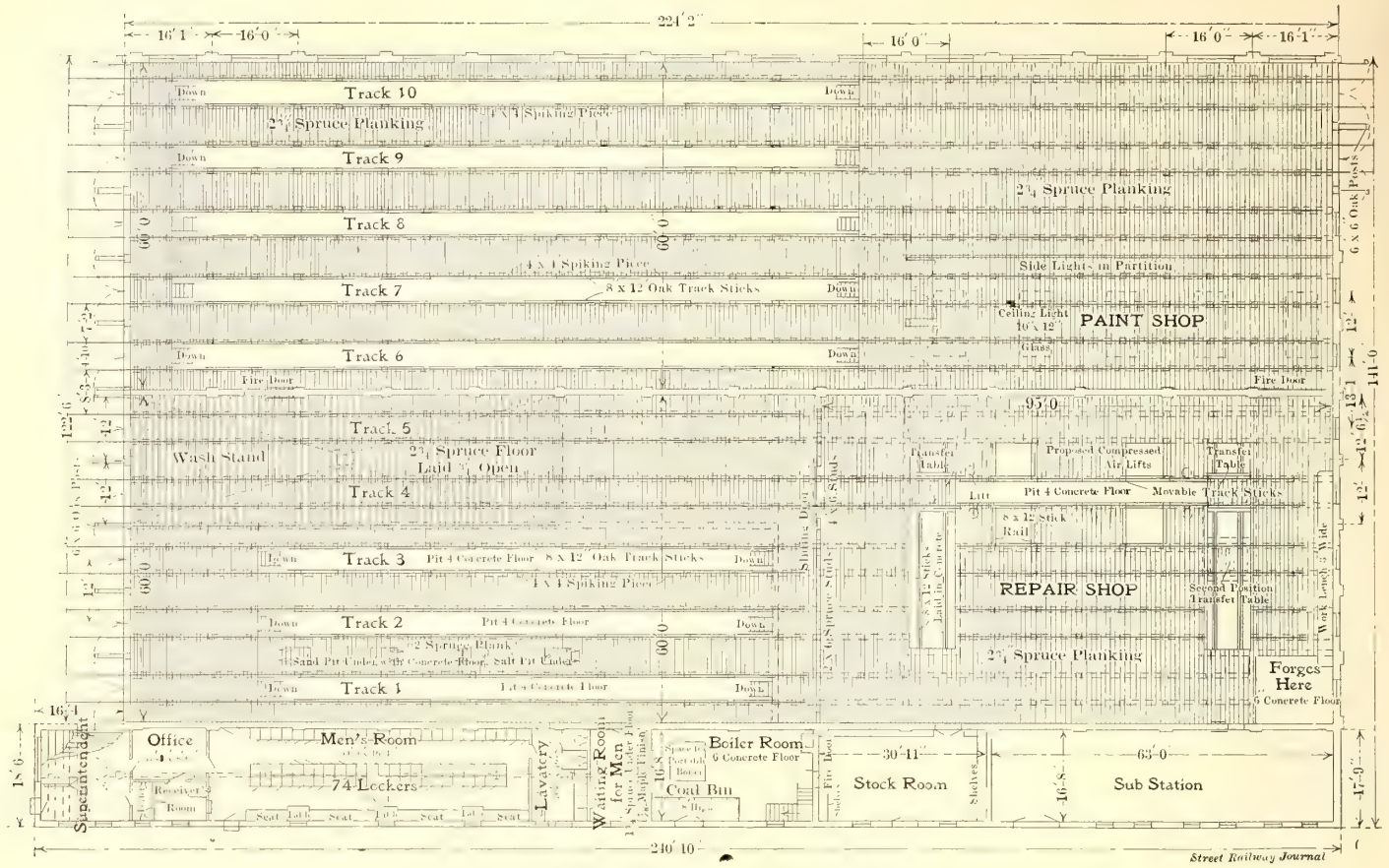
ROTARY CONVERTERS, SWITCHBOARD AND HIGH-TENSION SWITCHES



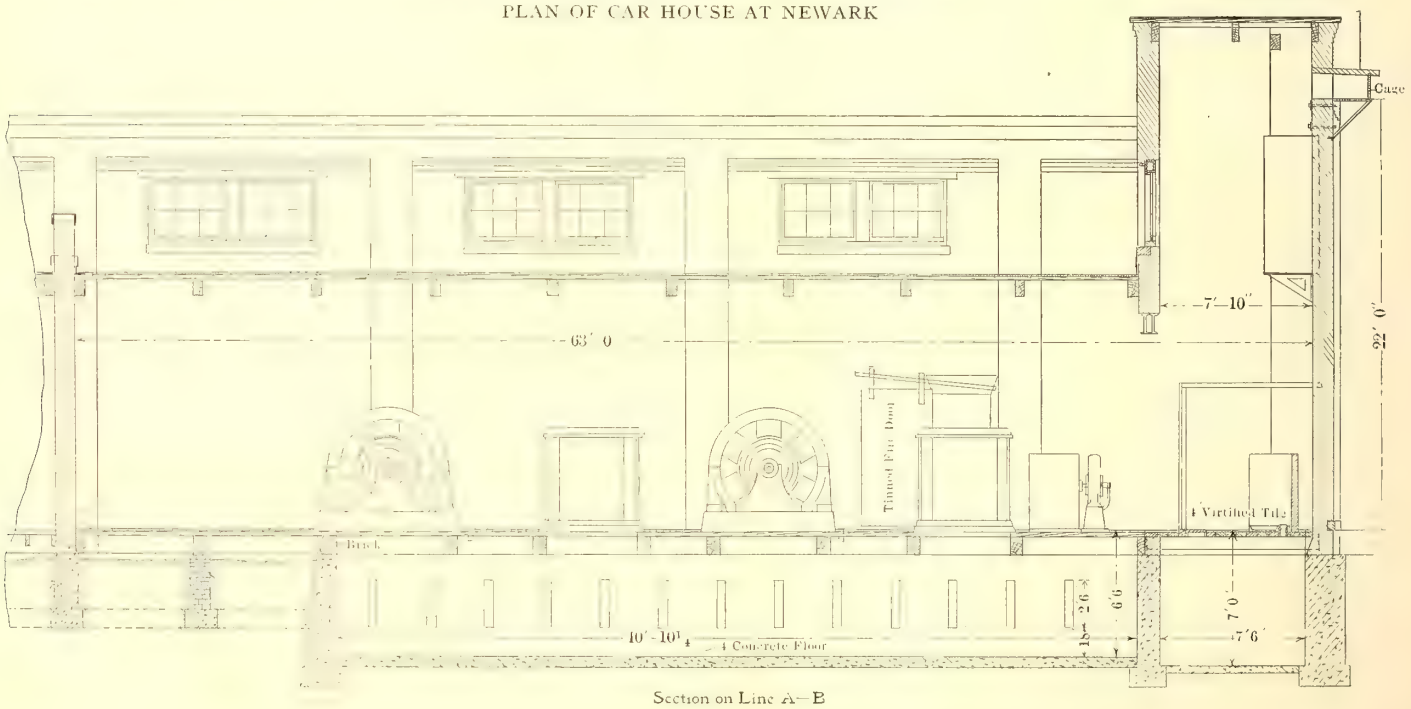
SECTION OF SUB-STATION IN CAR HOUSE



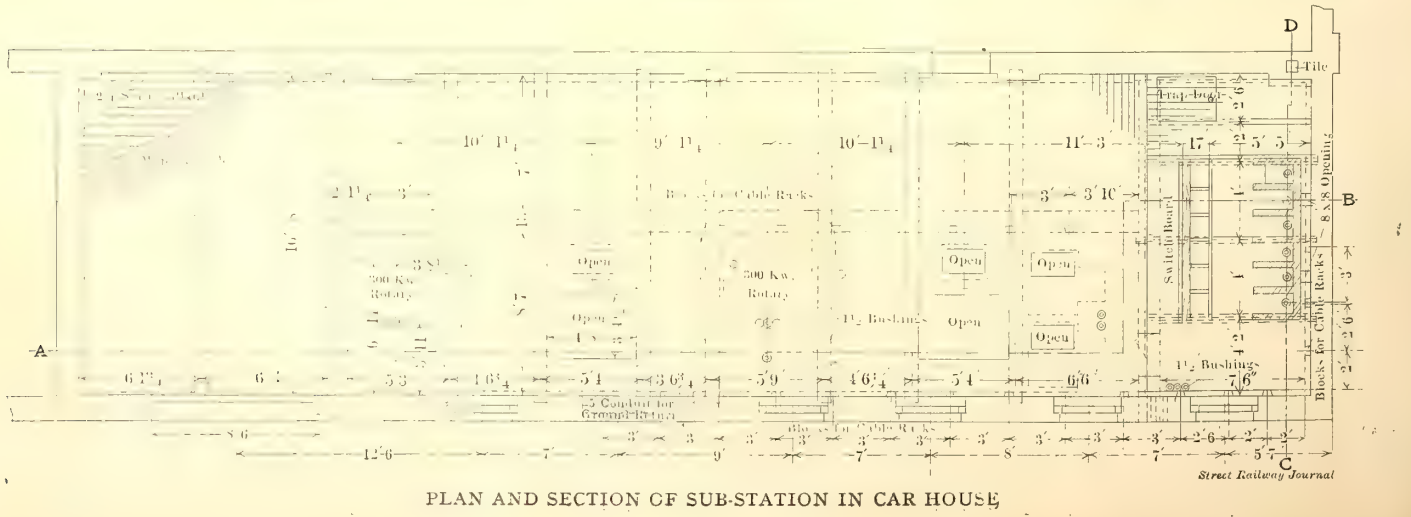
PLAN OF SUB-STATION



PLAN OF CAR HOUSE AT NEWARK

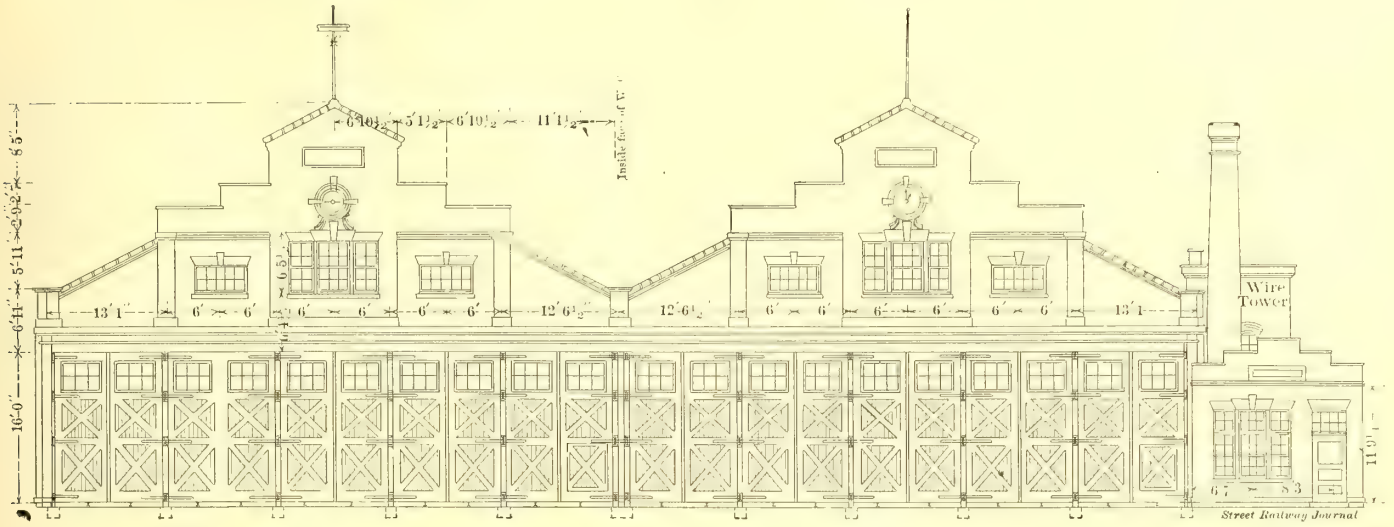


Section on Line A—B



PLAN AND SECTION OF SUB-STATION IN CAR HOUSE

Jewett Car Company. It has Peckham trucks and four General Electric No. 57 motors. For the Newark city service there are six very handsome 34-ft. double-truck cars, built by the Jewett Car Company. They are finished in oak and are equipped with



FRONT ELEVATION OF C., N. & Z. CAR HOUSE

Peckham trucks and two General Electric No. 67 motors. There are also ten single-truck open cars and two fifteen-bench open excursion cars. To provide for possible third-rail operation when the through systems are connected up, all trucks on interurban cars are provided with lugs for third-rail shoes.

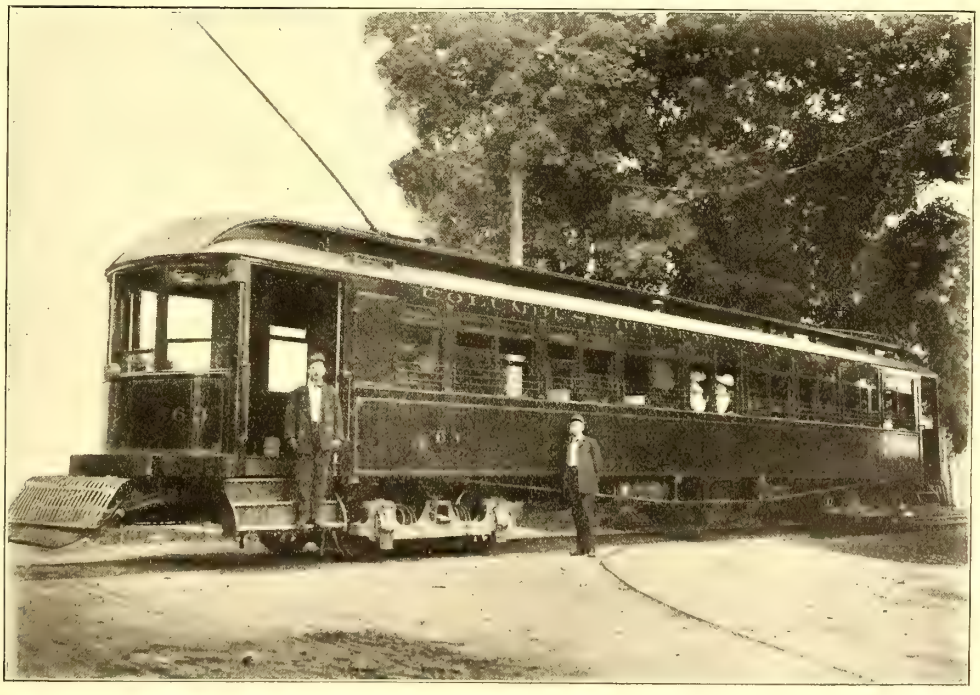


SEMI-CONVERTIBLE CAR

The interurban cars all have Christensen air brakes, Nichols-Lintern air sanders, Knutson trolley retrievers, Wagenhals arc headlights and are operated by the General Electric multiple-control system. The management of the road is thoroughly convinced as to the advantages of the "dead man's" handle, and has stringent rules against "plugging" the device. This is the result of a recent incident in which a car was making a high rate of speed along the canal bank, when some one threw a stone which struck the motorman in the head, knocking him insensible. A few seconds later the car came to a stop at a curve, which could not have been taken at high speed.

DESPATCHING SYSTEM

The system is covered by the United States Signal Company's block system of red and white lights, but train despatching is done by telephone from the despatcher's office at Hebron, where a ten-drop switchboard is installed. Each division has a separate circuit, and telephones have been placed in all the offices and sub-stations along the line. The booths are provided with switches so that the telephone is cut out when the door is shut. The despatcher does not employ the usual train sheet, but has a board with pegs, showing the movements of cars. When orders are given from the despatcher's station they are written in triplicate or quintuplicate (on heavy days cars are run double headers), and copies are given to conductors and motormen. An order taken on the line is received by the conductor, who writes it in duplicate on a pad in the booth, the despatcher at the same time making a copy in his station. The conductor then repeats the order back to the despatcher, who, if order is correct, will say "complete," adding the time of the order. The conductor notes the time and hands one copy to the



62-FT. PASSENGER CAR

motorman. The fact that the time is indicated on the order is the motorman's assurance that it has been repeated and is complete. This system was devised by C. W. Hoisington, trainmaster, formerly despatcher for the Rock Island Railway at Chicago. While the method takes a trifle more time than some other systems it has been found to be very safe and satisfactory, as demonstrated by the fact that the road has never had an accident caused by misunderstanding of orders. In addition to



BUCKEYE LAKE, SHOWING BOAT LANDING

the use of standard steam colored signals for day and colored lamps for night, all cars are provided with "fugees" for use during foggy weather or on dark nights. These are manufactured by the Consolidated Fireworks Company, of Chicago, and they burn for 15 minutes after being dropped from the car. A red light is a signal to stop, and a green light a warning that the car is not making standard time.

THE TERRITORY

The present road draws from a population of about 250,000, including Columbus, and the extension to Zanesville will bring about 50,000 more into the company's territory. Newark, the operating headquarters of the road, is the seat of Licking County, one of the banner agricultural counties of Ohio. The city has a population of about 22,000, and within the last few years has made remarkable strides as a manufacturing city as well as a distributing center. It has five prosperous banks, a stove works that employes 500 men, glass plants giving work to



PICNIC GROUND AT BUCKEYE LAKE PARK

several hundred more, and is the home of the Jewett Car Company. Although the Pennsylvania and the Baltimore & Ohio operate between Columbus and Newark, the frequent service, high speed, comfortable cars and low rates of the electric line have taken from the steam road the majority of the business, including the better class of traveling men, who, in other localities, seldom take an electric car when they can catch a train. Zanesville has 35,000 inhabitants, and is a prosperous manufacturing city. The electric road will undoubtedly capture the great majority of the passenger business between Zanesville, Newark and Columbus, since only a branch steam line, with infrequent service, connects them. Granville is a college town of 1500. There is no direct steam route between Granville and Columbus, and the electric road furnishes the most desirable service. The farming country along the national pike in this district is noted as being among the best in the State. It was settled very early, and the people are prosperous as a rule. The towns along this route are:

Reynoldsburg, 400.
Wagram, 150.
Etna, 350.
Kirkersville, 300.
Hebron, 650.

The steam lines to Columbus do not come within 3 miles to 5 miles of these towns, and the electric road carries practically all the business, both passenger and freight. The rates of fare on the present line are shown in the accompanying table:

Stations	A. M.		Fare	Round Trip	Miles from Columbus
Lv. Columbus	6.00	Thereafter	---	---	---
Capital University	6.25	every hour	5c	10c	4.2
Doneys	6.30	until 10 p.m.	10c	20c	6.9
					11.1
Reynoldsburg	6.40	Running	15c	25c	
Wagram	6.50	time between	20c	35c	14.9
Etna	7.00	Columbus	25c	45c	17.3
Kirkersville	7.15	and	35c	60c	21.9
*Hebron	7.30	Newark	45c	75c	27.6
Ar. Newark	7.50	1.50	60c	$1.00	36.9

In Newark the company gives fifteen-minute service over 8 miles of road, connecting all parts of the city. The local cars,



HOTEL AT BUCKEYE LAKE

together with the Newark & Granville car, connect with the interurbans in front of the company's waiting room facing the public square. City tickets are sold at the rate of six for 25 cents. These are also good on the Granville line, the fare being 15 cents one way or 25 cents round-trip. In the city of Columbus the company handles the local traffic, as it is obliged to do so, and sells seven tickets for 25 cents, but the Central Market Street Railway, which operates over the same tracks, takes up the greater portion of this business, since it sells eight tickets for 25 cents; of course, the tickets are not interchangeable. The company sells round-trip tickets only at ticket offices, which are maintained in all towns. The interurban cars have no fare registers, and duplex cash fare tickets are used. In connection with all the Columbus interurbans the company sells mileage books, which are transferable and afford a rate of 1¼ cents per mile.

PLEASURE RESORTS

As a route for pleasure and summer traffic few roads enjoy the advantages of the Columbus, Buckeye Lake & Newark. Picturesque scenery and quaint villages mark the line, and there are a large number of pleasure resorts worthy of more than passing mention.

The road affords the only direct route between Columbus

and Buckeye Lake and the shortest route between Newark, Zanesville and this resort, which has long been one of the most popular pleasure points in Ohio. The lake is owned by the State, and it is set aside as a public park. It is a beautiful artificial body of water, 7 miles long, with an average width of 2 miles. It is stocked with fish of many kinds, and in the fall it is famous as a duck hunting ground, and a number of sporting clubs have houses on its shores. There are camp grounds and cottages thickly distributed around the entire lake and on the numerous islands. The company has taken advantage of these opportunities and has spent thousands of dollars in improving the resort. It has purchased 95 acres of land adjoining its terminal, and has erected a summer hotel, a large dancing pavilion, dining hall, bath house, boat house, laughing gallery, figure-eight roller coaster and merry-go-round. Two 40-ft. naptha launches make regular trips around the lake, and rowboats, bathing suits and fishing tackle are supplied. No admission is charged to the grounds. The resort is operated on a percentage basis by W. C. Wells. No liquors are sold or allowed on the ground, and every effort is made to exclude undesirable people.



GOV. NASH AND STAFF AT STATE ENCAMPMENT ON NEWARK & GRANVILLE LINE

The company is further planning to establish summer towns along the lake. Three miles of lake front has been leased, and it is the intention to lay out streets and give ten-year leases to parties who will erect cottages. It is the plan to divide the tract into communities for Columbus, Newark and Zanesville people; no lease to be made without the consent of the cottagers in the respective communities. In this way each city will be represented by a summer town of its own.

Idlewilde Park, located at the junction of the main line and the Newark & Granville line, 3 miles from Newark, has recently been acquired under a five-year lease. This is second only to Buckeye Lake as a pleasure resort for this district. Formerly the Licking County Fair Grounds, it has been greatly improved during the last few months. There is an artificial lake of 50 acres, and overlooking this a large casino and summer theater has been erected. This is provided with 1500 opera chairs, a stage, 56 ft. x 56 ft., and is decorated after the Japanese fashion. The manager is a member of the Association of Vaudeville Managers, and is in the Burke circuit of attractions, which includes parks at Boston, Cincinnati, Philadelphia, Erie, Toledo and other places. High-class vaudeville will be given for forty weeks each year. One of the chief attractions of the park is a huge artificial mound, three-quarters of a mile in circumferance, erected by the mound builders. Inside the mound a half-mile trotting track and a baseball diamond have been constructed, together with a large grandstand. The park supports a baseball team, and three professional games a week are scheduled. A summer trotting meet is also held. A hotel, bowl-alley, shooting gallery, boating and numerous other features are among the attractions. This is also a temperance resort.



BRIGADE REVIEW ON THE PARADE GROUND



GENERAL VIEW OF STATE ENCAMPMENT

Still another source of great revenue for this road is the Ohio State Encampment Grounds, constituting one of the most famous prehistoric works to be found in America. It consists of a circular fort, containing 20 acres, connected with another mound, octagonal in form, having eight openings with a protecting wall in front and containing 80 acres. The tract of 150 acres is owned by the State, and the entire State militia, comprising infantry, artillery and cavalry, make their annual encampment here from May until October. The presence of hundreds of troops with drills, parades, martial music



HOLIDAY SCENE DURING STATE ENCAMPMENT ON NEWARK & GRANVILLE LINE

and receptions attract thousands of visitors. Several views of the State Encampment Grounds, the brigade review and Governor Nash's headquarters are presented, together with a view



PREHISTORIC MOUNDS



SCENE IN IDLEWILD PARK

showing the dense throngs that are attracted by this display. The encampment is reached by the Newark city cars and the Newark & Granville line, which run within a short distance of Idlewilde Park. Typical views of Buckeye Lake, showing some of the characteristics of this beautiful resort, are also presented. This park is particularly adapted for picnics and family gatherings, and its location is exceptionally favorable for attracting this class of visitors. During the season the lines leading to the parks are very well patronized.

EXPRESS

The package express business is now being developed by this company, and the cars for this service make two round-trips each day. Goods are delivered from the interurban union station in Columbus and from the company's freight station at Newark. The standard steam classification is used, and the table in use is shown herewith. The rates average about 15 per cent less than express charges:

RATE-BASING SHEET

To Be Used In Connection With Classification.

Stations To	From Columbus	Capital University	Crumms	Reynoldsburg	Wagram	Etna	Parkinsons	Kirkersville	Luray	Hebron	Buckeye Lake	Tailor's Bridge	Armstrongs	Newark
Columbus	0	1	1	1	1	1	1	2	2	2	2	2	2	2
*Capital University	1	0	1	1	1	1	1	2	2	2	2	2	2	2
*Crumms	1	1	0	1	1	1	1	2	2	2	2	2	2	2
*Reynoldsburg	1	1	1	0	1	1	1	1	2	2	2	2	2	2
*Wagram	1	1	1	1	0	1	1	1	1	2	2	2	2	2
*Etna	1	1	1	1	1	0	1	1	1	1	2	2	2	2
*Parkinsons	1	1	1	1	1	1	0	1	1	1	1	2	2	2
*Kirkersville	2	2	2	2	2	2	1	0	1	1	1	1	1	1
*Luray	2	2	2	2	2	2	1	1	0	1	1	1	1	1
Hebron	2	2	2	2	2	2	1	1	1	0	1	1	1	1
*Buckeye Lake	2	2	2	2	2	2	1	1	1	1	0	1	1	1
*Taylor's Bridge	2	2	2	2	2	2	1	1	1	1	1	0	1	1
*Armstrongs	2	2	2	2	2	2	1	1	1	1	1	1	0	1
Newark	2	2	2	2	2	2	1	1	1	1	1	1	1	0

*Prepaid

Rate Basis	Classes—Rates in Cents Per 100 Lbs.					
	1st	2d	3d	4th	5th	6th
1	10	9½	9	8½	8	7
2	12½	12	11½	11	10½	10

ORGANIZATION

The Columbus, Buckeye Lake & Newark Traction Company has an authorized capital stock of $1,500,000, with $1,000,000 issued. The funded debt is $1,500,000, of which $1,125,000 was issued to build the original 40 miles of road. The balance sheet, dated Dec. 31, 1902, indicated that the investment was $2,634,927. No financial statement has yet been issued, for the reason that the road was opened for business last spring, but under conditions which gave no criterion of the earning value of the property. The road was operated for several months with direct current at a three-hour headway, which was afterward shortened to a two-hour headway, but the system practically did not get into full operation until late last fall. Another feature which has militated against a good showing from an operating standpoint is the fact that a great deal of little work had to be done to get the road into first-class condition; all of which tended to increase the operating cost.

The officers are: S. Reed Anthony, president; Arthur E. Appleyard, vice-president; Frank W. Merrick, secretary; Chauncy Eldridge, treasurer; J. R. Harrigan, general manager, and A. M. Frazee, superintendent of motive power. The entire work of construction was in charge of the Great Northern Construction Company, of Boston, of which A. E. Appleyard is president, and C. A. Alderman, chief engineer.

CAR ATTENDANCE IN THE SOUTH

The discussion of the "Jim Crow" laws in Southern States as applied to street railway companies has brought out some interesting information about operating practice in that section which illustrates the difficulties under which some of the companies labor. In one city where the negro population comprises about one-half the total population, the street railway company estimates that only 25 per cent of the patronage comes from the blacks, and most of this traffic is confined to an hour in the morning and an hour in the evening when they are going to work and returning to their homes. At these hours the whites do not ride at all if they can help it, so that the entire service is at the disposal of the colored element. This is the result of a tacit agreement, and its recognition by both whites and blacks has prevented any violent conflict. The company has done much toward removing any cause for complaint by taking extra precautions to have its cars in first-class condition at all times. At the end of every trip the cars are run into the car house and cleansed thoroughly. They are washed down, inside and outside, and compressed air is used for clearing all crevices and corners where dust and dirt might accumulate. After the runs devoted to negro traffic disinfectants are used and special precautions are taken. The cars are painted frequently, so that they present a very attractive appearance at all times.

These precautions make it necessary for the company to spend considerable money in the course of a year, and keep more cars on hand than might be necessary otherwise, but it has prevented any serious trouble over the race question, and the entire community is satisfied. The wisdom of this policy is therefore shown in the results attained.

THE MISSOURI RIVER POWER STATION OF THE METROPOLITAN STREET RAILWAY COMPANY, OF KANSAS CITY, MO.

One of the largest electric railway power stations at present under construction in the United States, and probably the largest outside of New York city, is that being built by the Metropolitan Street Railway Company at Kansas City, Mo., under the supervision of Ford, Bacon & Davis. This station is known as the Missouri River power house of that company. On account of its size and also because of the proposed use of steam turbines, its design presents many features which make it of interest. As far as the mere matter of size goes, several of the mammoth stations in New York city equal or exceed this, but the introduction of steam turbines involves new problems in design, which have only recently been grappled with. Next after the Fisk Street station of the Commonwealth Electric Company, of Chicago, which was the first station to be designed for the use of 5000-kw steam turbine units, this Kansas City power house is the farthest along in design and construction of any of the large new generating stations in the country in which the use of Curtis steam turbines is contemplated.



FIG. 1.—VIEW OF POWER STATION SITE BEFORE WORK WAS BEGUN

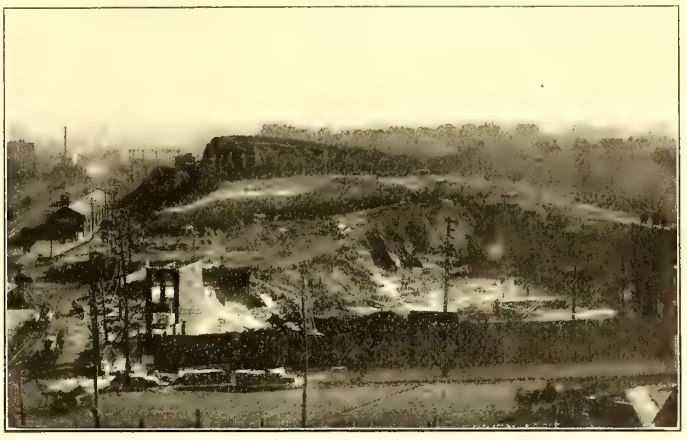


FIG. 2.—POWER-HOUSE SITE ON OCT. 11, 1902

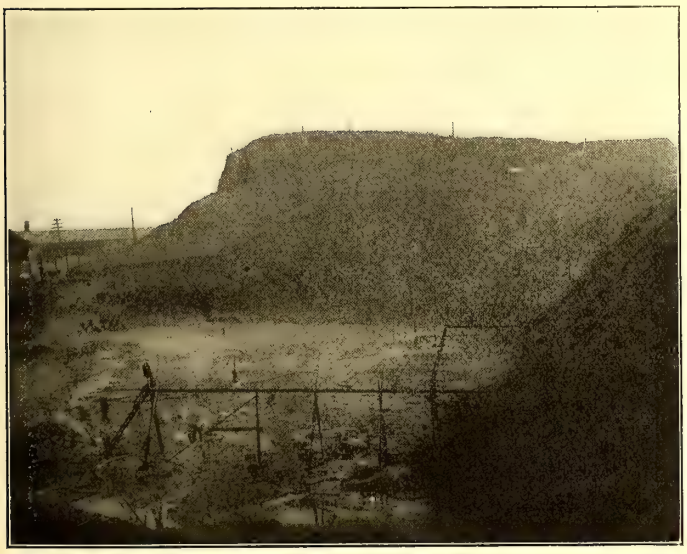


FIG. 3.—POWER-HOUSE SITE ON NOV. 15, 1902

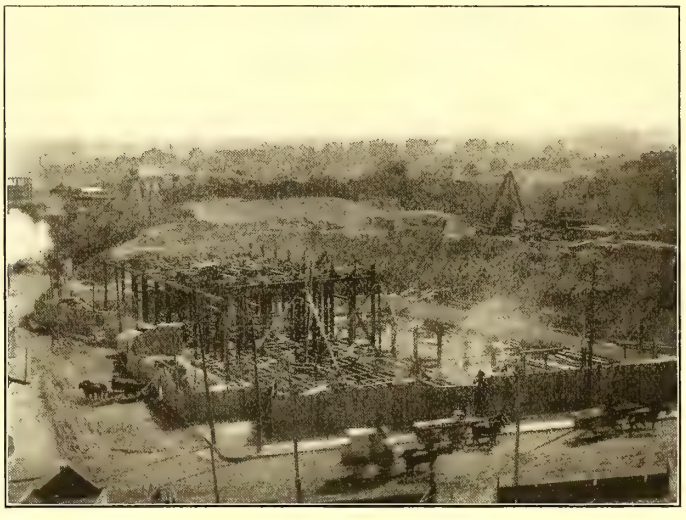


FIG. 4.—POWER-HOUSE STRUCTURE ON MARCH 25, 1903

The station is laid out for an ultimate nominal capacity of 40,500 kw. Owing to the fact that three reciprocating-engine units were already ordered at the time the design of this station was begun, and because of the necessity of obtaining power from this station before the steam turbine makers could insure delivery, about 10,000-kw capacity of this station will be in the form of engine-driven units. The balance of the capacity, it is expected, will be in the shape of 5000-kw turbines. It might be noted incidentally that the engine room space required by the three 3500-kw engine units to be first installed is practically the same as the space that will be required by the six 5000-kw turbine units.

The power station has been laid out on broad gage lines, and will provide for the needs of the company both for railway and electric lighting service for many years to come, unless the street railway and electric light development in Kansas City is out of proportion to any street railway growth which has been recorded. There has been no temporizing in the design of this plant. It is laid out to give the company all the advantages to be derived from electric railway power generation on the largest scale and with the most economical apparatus known to modern engineers.

The few facts just stated by way of introduction will serve to give a general idea of the magnitude and importance of the work now under way at Kansas City, and the several features of this undertaking will now be taken up one by one.

THE POWER STATION IN KANSAS CITY

Before taking up the actual features in the construction of the Missouri River power house it is in order to look briefly at the situation as regards the Metropolitan Street Railway Company's power. On account of the great number of heavy grades cable lines have been retained in Kansas City much longer than would have been otherwise the case. At the time Ford, Bacon & Davis were called as consulting engineers for this property the Metropolitan Street Railway Company was operating about 33 miles of cable road and about 149 miles of electric. The cable lines, of course, cover many of the routes of heaviest

traffic. Comprehensive plans were made by which most of these cable lines can be abandoned and electric traction substituted for them by slight changes in routes, so that grades in excess of 8 per cent will be avoided. All the details have not been worked out for the abandonment of some of the cable lines, but it has been decided to operate practically the entire system by electricity. This, in itself, will call for a considerable increase in the amount of power. Besides this the growth

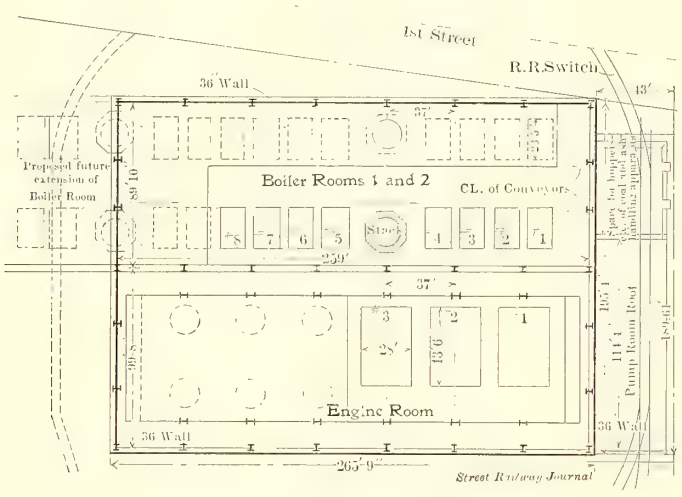


FIG. 5.—PLAN OF PROPERTY AND POWER STATION

of business has necessitated immediate action to relieve the present power house of an overload. About 245 cable and electric cars are now operated on regular schedule plus 153 trippers at rush hours. It will be remembered, from previous articles in the Street Railway Journal, that the Metropolitan Street Railway Company has a large direct-current power station situated on Central Avenue, just west of the Kaw River, in Kansas City, Kan. This station is about 2 miles west of the center of load, and is a station which has had a national reputation for economical power production. It is, however, fully loaded, and various temporary expedients have been resorted to to aid in carrying the load, including purchase of power from the Kansas City Electric Light Company, an allied corporation.

The new Missouri River power house is to be an alternating-current station of sufficient capacity for operating the entire system, and further for supplying power to the Kansas City Electric Light Company.

A number of the cable power houses will be turned into sub-stations, though at the present writing the location of all the sub-stations has not been determined. The Missouri River power house is a short distance north of the business part of the city, is about 800 ft. from the harbor line of the Missouri River, and situated so as to be served by several lines of railroad and obtain condensing water from the river. Being able to obtain coal supply from several roads and of having good terminal and storage facilities is of first importance in connection with power plants of such large capacities, where the ultimate coal consumption will reach into thousands of tons. Although Kansas City has a great amount of water front, as it is situated at the intersection of the Missouri River and Kaw River, it was not entirely an easy matter to secure a location for a large power plant, which would have a sufficient number of railroad approaches to permit of the delivery of enough coal each day to supply the needs of the station, and also allow the station to be run with condensing water from the river, as there is great variation in the height of the latter at different seasons.

When the Missouri River power house is completed it will be of sufficient capacity to allow all the small, wasteful, temporary electric railway and light stations to be shut down and the Central Avenue direct-current station can be used simply to supply the western portion of the territory, the part of the territory it is geographically best located to supply.

PREPARATION OF THE SITE

The land selected adjoined and formed part of a bluff about 100 ft. high. A view, Fig. 1, taken before work had begun is here shown, but it does not give as good an idea of the amount of excavation required as some of the subsequent views, Figs. 2, 3 and 4, taken from the same position. The method of excavating, as seen in these views, was practically that used in placer mining—streams of water, under high pressure, being thrown against the side of the bluff until it was gradually eaten away and the mud flushed into a sewer which passes directly under the property. In this way much of the excavation of the bluff was done by washing it into the sewer, and so ultimately into the Missouri River, which is about 800 ft. distant. A temporary pumping plant was also used at

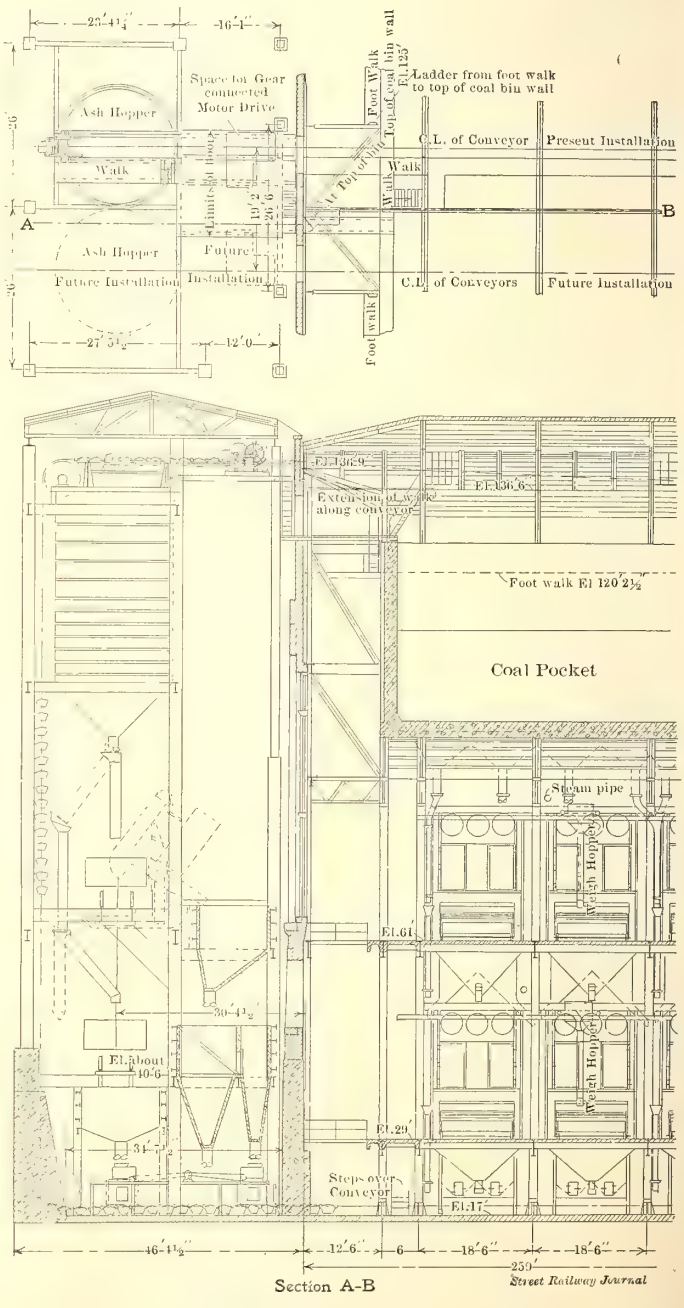


FIG. 6.—SECTION AND PLAN OF END OF BOILER-ROOM, SHOWING CONVEYOR SYSTEM

the site, discharging into a pipe line running to the river, and part of the excavation was done by teams. Comparing the view taken of the power house site during the latter part of the work with the one taken before construction began, it is seen there was an immense amount of excavation, amounting in all

to about 175,000 cu. yds. In the view taken April 25, 1903, Fig. 8, the tracks of the Chicago & Alton and other roads are seen at the left, while at the right at the southern edge of the property are the tracks of several other steam roads. As seen by the accompanying plan of the power house and property,

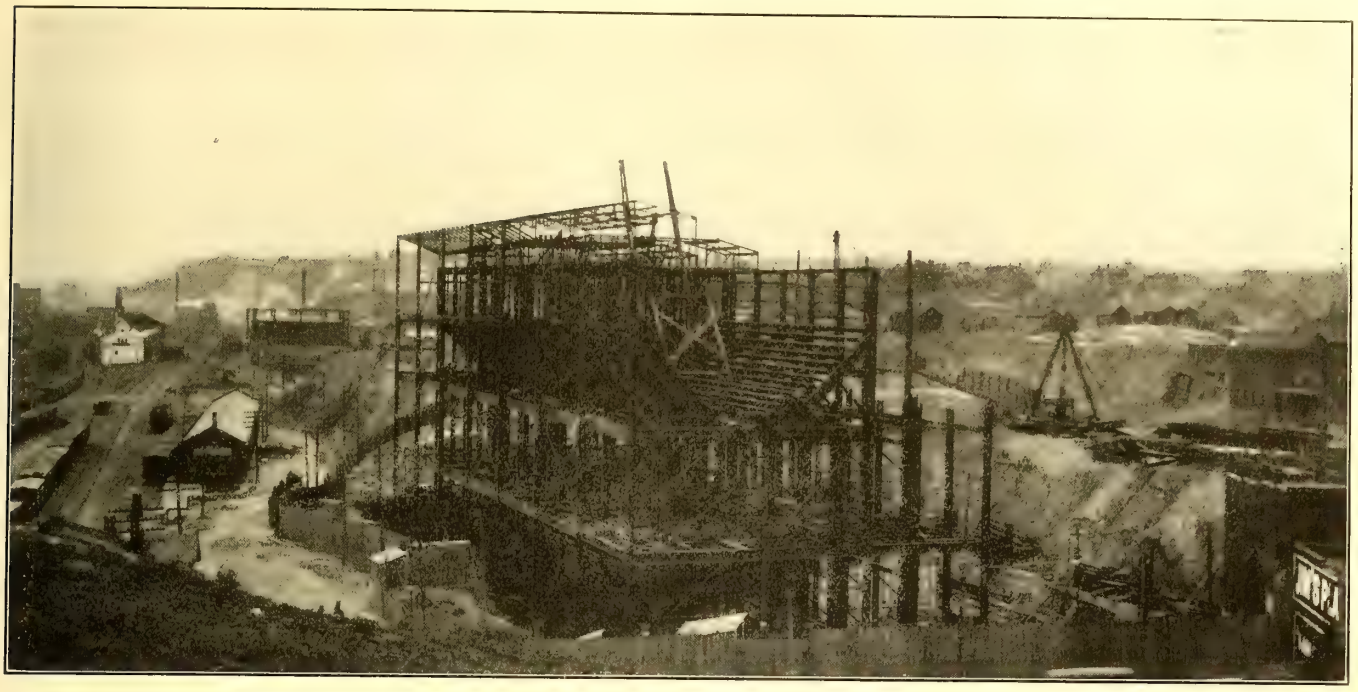


FIG. 8.—THE STEEL STRUCTURE ON APRIL 25, 1903

Fig. 5, the company has over two city blocks. The frontage on First Street is 374 ft. The property widens to 544 ft. on Second Street. The company owns the entire plat of land except one lot located in the southwest corner.

POWER-HOUSE ARRANGEMENT

Referring again to the plan, Fig. 5, which gives a general idea of the lay of the property and the ground plan of the power house, it is seen that the present building occupies a space 266 ft. x 195 ft. The boiler room is in the north part of the power house, and the engine room in the south part. The engine room, or turbine room, as it might more properly be called, is 99 ft. 8 ins., and the boiler room is 89 ft. 10 ins., inside measurement. The boiler room is to have two boiler floors, above which is the coal storage. At present the engine units numbered 1, 2 and 3 will be put in, and the boilers numbered 1 to 8 inclusive on one floor of the boiler room, and on the second floor eight more boilers occupying the same relative position, so that there will be sixteen boilers in all. Provision is made for two stacks in this part of the power house, although one only will be erected at present. From the dotted lines it can be seen that the idea is ultimately to extend the boiler house through to the Grand Avenue boundary, thus giving boiler capacity that may be needed with large turbine units. Provision for the future does not end there, however, because a good-sized boiler house can be and is planned to be erected, when required, south of the engine room, between the present house and Second Street.

In designing this steam turbine power house the engineers have had to meet the perplexing problem, which has only recently come up, of designing a steam turbine power house which shall be symmetrical, so as to permit of extensions according to a predetermined plan, and at the same time secure enough boiler capacity for each turbine unit without wasting station space and without undue length of piping or other objectionable arrangements of boilers. A symmetrical power house can obviously only be obtained when boilers to supply a given unit occupy the same length in any section of the power house as the steam consuming unit. As the steam consuming units are gradually increased in size and their outputs per square foot of floor space is increased, engineers have been compelled to resort to various expedients to get enough boiler capacity for these large units within a reasonable piping distance and into a reasonable cubic space. Now the steam turbine has further enormously increased the difference in the relative space occupied by the boilers and generating units. A 5000-kw steam turbine takes a formidable array of boilers to supply it. In the first large station designed for the use of 5000-kw steam turbines, namely, that of the Commonwealth Electric Company in Chicago, land was plenty and the boilers were placed all upon one floor and in rows at right angles to the direction of growth of the power house. In this case each turbine unit has what might be considered its own special battery of boilers. In the Kansas City plant under discussion sufficient boiler capacity has been obtained by placing the boilers in two tiers, one above the other, and placing two rows on each floor. The Chicago arrangement has the advantage of requiring only one boiler room floor, while the Kansas City arrangement saves ground space and makes it possible to serve the entire row of boilers on one floor with the same

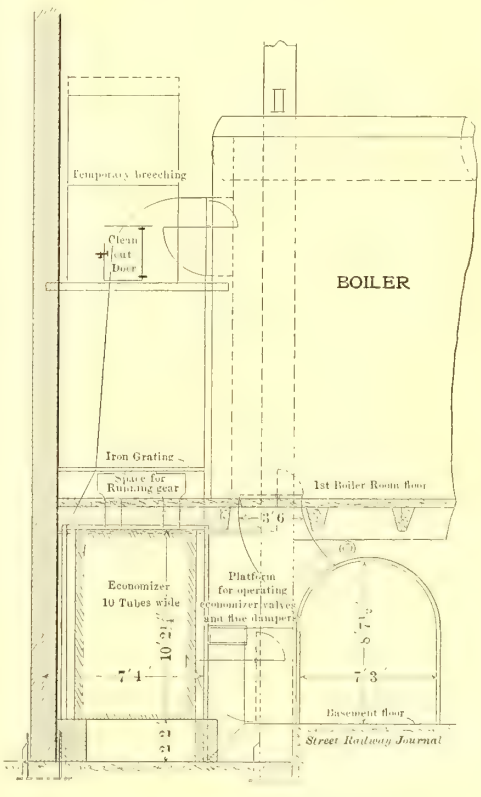


FIG. 7.—PROPOSED ARRANGEMENT OF ECONOMIZERS

coal conveyors, and somewhat simplifies the coal handling.

The present stack is not being located exactly in the middle of the building, the reason for which will be obvious when it is seen that when the boiler room is extended another pair of stacks will be placed in what is now the west wall of the power station.

There are to be sixteen Babcock & Wilcox water-tube boilers of a rated capacity of 578 hp each. The general plan, Fig. 5, showing the boiler equipment which will be first installed, is published herewith, from which all dimensions can be obtained. Provisions have been made for economizers for each boiler, although these economizers will not be put in for the present. The space in the middle between the two sets of boilers and near the stack will be used for pumps, heaters and all main boiler feed connections. A freight elevator for coal, ashes and machinery will be located in the middle of the east end of the building, and nearby will be a passenger elevator and

well as the foundations for all the auxiliary machinery, are solid concrete mixed in the proportions of one part Portland cement, three parts sand and six parts broken stone. Practically all of the rock for the concrete was taken from and crushed on the site.

Both enclosing and division walls of the building are brick, laid in cement mortar. These walls are approximately 100 ft. high. The window sashes and door frames are of iron. The window frames are made up from T, L and Z-bars, which support the galvanized iron casings. The windows being of such great height and width require unusual methods of construction. These windows will have the horticultural type of sash openers. All the floors will be of the concrete slab construction, laid between I-beams with expanded metal in the concrete. The stairs will be of iron.

The high-tension oil switches and bus-bars will be located in compartments on the mezzanine and engine room floors next

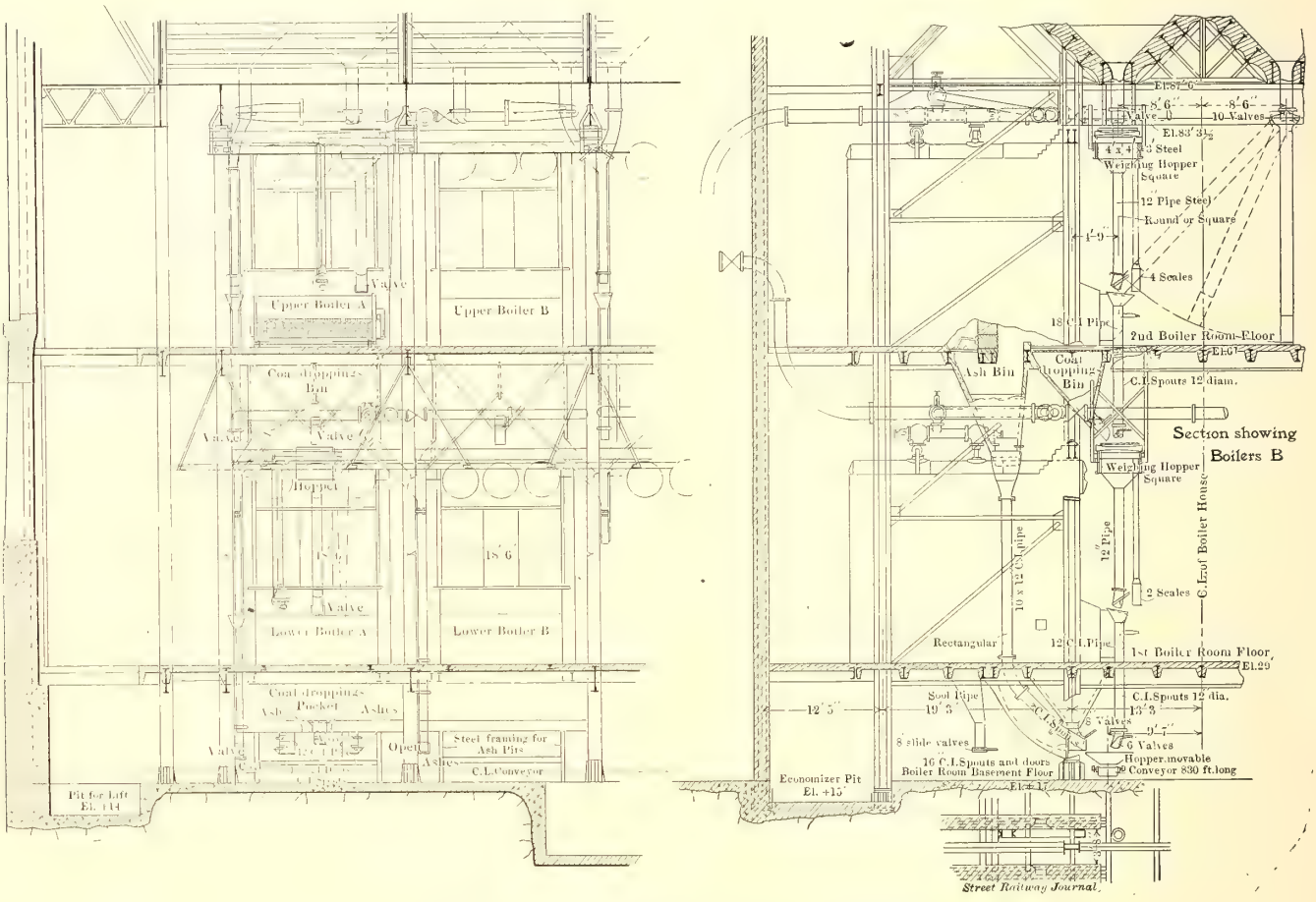


FIG. 9.—COAL AND ASH HOPPERS ON BOILERS

stairs the full height of the building, for access to conveying machinery, coal bunkers and the various floors. The engineers' rooms are also in the east end of the engine room, as the east end is the permanent end, the west end being arranged to permit of extension of the station in that direction. On the first floor of the boiler room will be the firemen's lavatory.

The location of the feed pumps is to be in the basement between the stacks. The ash conveyors run through the basement, taking the discharge of the ash hoppers as indicated. When fuel economizers are installed they will be placed for the boilers on the first floor in the basement, and for the boilers on the second floor under the coal pockets. The accompanying diagram, Fig. 7, which gives a longitudinal section through the proposed economizers and flue, shows the arrangement for the boilers on the first floor. The building has, as will be seen, a massive steel frame resting on concrete foundations, which were carried to solid rock, about 25 ft. below the engine room floor. The engine and generator foundations, as

to the division wall, and above on a gallery, which also supports the steam headers, will be located the controlling and operating boards. Of course, full precautions will be taken to keep any water drip away from these switch compartments.

The boiler house has three floors with the basement, with a mezzanine floor between the first and second floors. The main entrance to the building for the operating forces is from Locust Street to this mezzanine floor, while the public entrance will be on the engine room floor level on Grand Avenue.

BOILER HOUSE

As said before, the present equipment is to be sixteen Babcock & Wilcox boilers of 578 rated horse-power each. They will be equipped with the Green traveling link grates. The present boiler house will hold twenty such boilers on each floor, or forty boilers altogether. The proposed extension of the boiler house will accommodate sixteen more boilers of the same size. The superheating coils which will be used in these boilers are to be installed for only the amount of superheating

considered permissible with the reciprocating engines which are to be installed at the start, or, in other words, for about 100 degs. F. to 125 degs. F. of superheating. As more superheating than this will be permissible with steam turbines, because there are no pistons or valves to lubricate, the superheating coils are so designed that they can be enlarged when the steam turbines are installed. Two open feed-heaters of the Warren Webster type, located at the base of the stack on the first boiler room floor, take the exhaust from the auxiliary engines, including feed pumps and condenser air pumps. The feed pumps will be Blake, two in number, compound duplex with outside-packed plungers and pot valves. Each of these pumps will be good for feeding 10,000-hp of boilers. All the other pumps, including the sump tank and oil pumps, are of Blake manufacture also. The hot-well and sump pit are in the basement, together with a blow-off tank and all the drainage features of the station. The coal pockets are in two divisions, one on each side of the stack. The ventilation of the boiler house is also provided for between and on the sides of the coal pockets. The stacks, one of which will be built at present, are to be 265 ft. high by 14 ft. inside diameter. For a height of 90 ft., or about the height of the power house building, they will be of hard-burned brick lined with firebrick. Above that there will be hollow, radially moulded brick of the Custodis make. The stacks are designed to stand 50 lbs. per square foot of wind pressure.

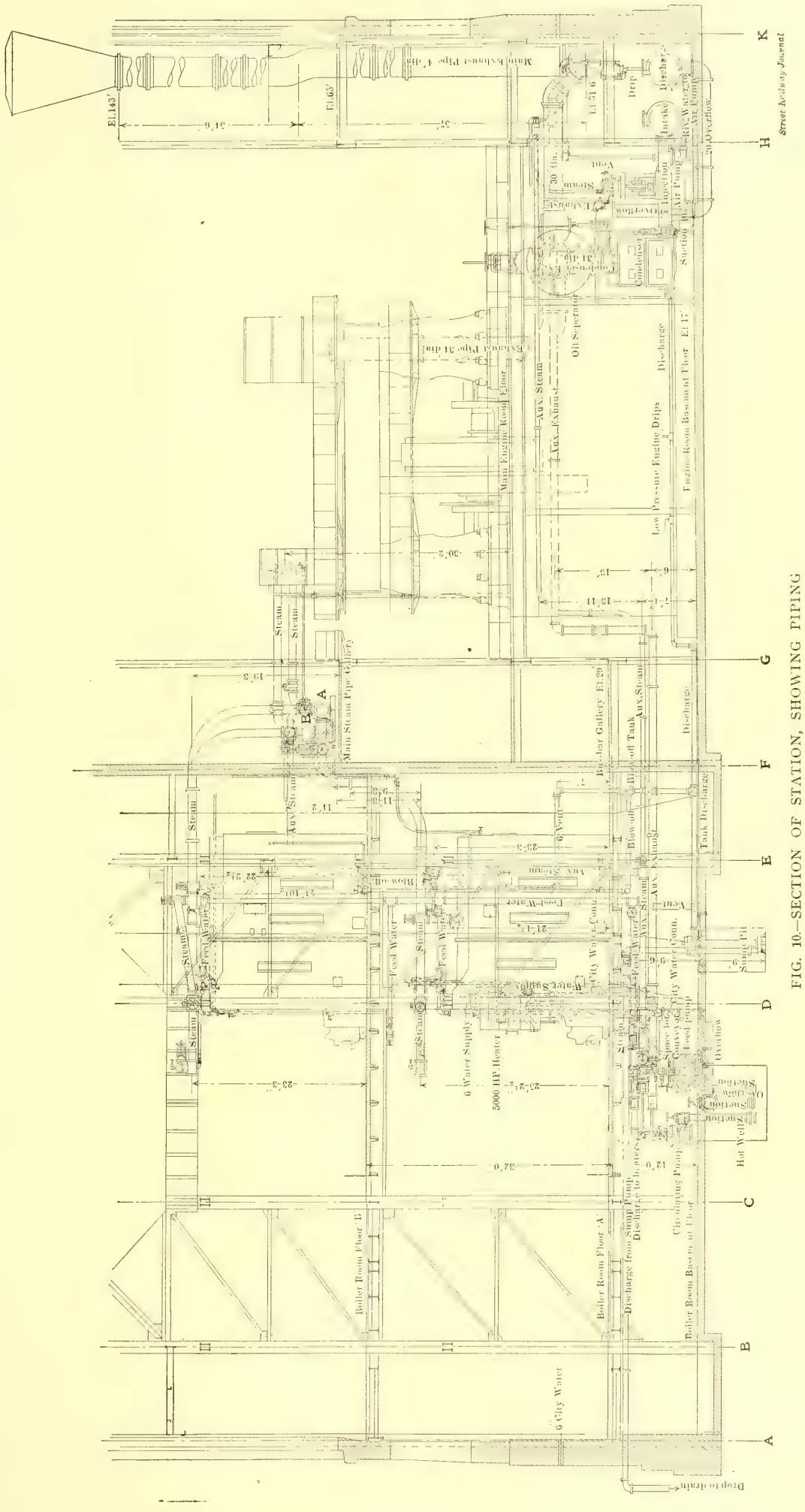


FIG. 10.—SECTION OF STATION, SHOWING PIPING

COAL AND ASHES

Storage is provided in two coal pockets above the boilers for about 10,000 tons of coal. The entire boiler house is served at present by one endless Mead conveyor, which deposits coal in the pockets above the boilers and takes the ashes from the basement. The coal cars from the steam railroads enter the east end of the building, as seen in the

plans, Fig. 6. There are two of these coal tracks, one directly above the other.

Provision is made for the use of bottom-dump cars, but in case these are not available a car dumper or unloading machine can be installed. This is indicated by the dotted lines on the plan Fig. 6, which show the position when dumping the coal. Coal when dumped falls into hoppers which feed the coal crushers, that in turn discharge into the coal conveyor, which takes it to the pockets above the boilers. These same cars, or cars on the same track, can be loaded with ashes from the large ash pocket directly over the switch tracks, and the pipes or chutes from the boiler room coal is delivered into spouts, which can be swung either to feed the upper tier of boilers or to discharge into a pipe which will take the coal through the lower weighing hopper to another tier of boilers. One feature in this plant which has not heretofore been common is the hopper for taking the fine coal droppings from the traveling link grates, which droppings are usually shoveled up by hand. A hopper for these coal droppings is placed under the front end of the link grates, and this hopper can be made to discharge into the coal conveyor in the case of the lower tier of boilers, or in the case of the upper tier of boilers the hopper can be discharged

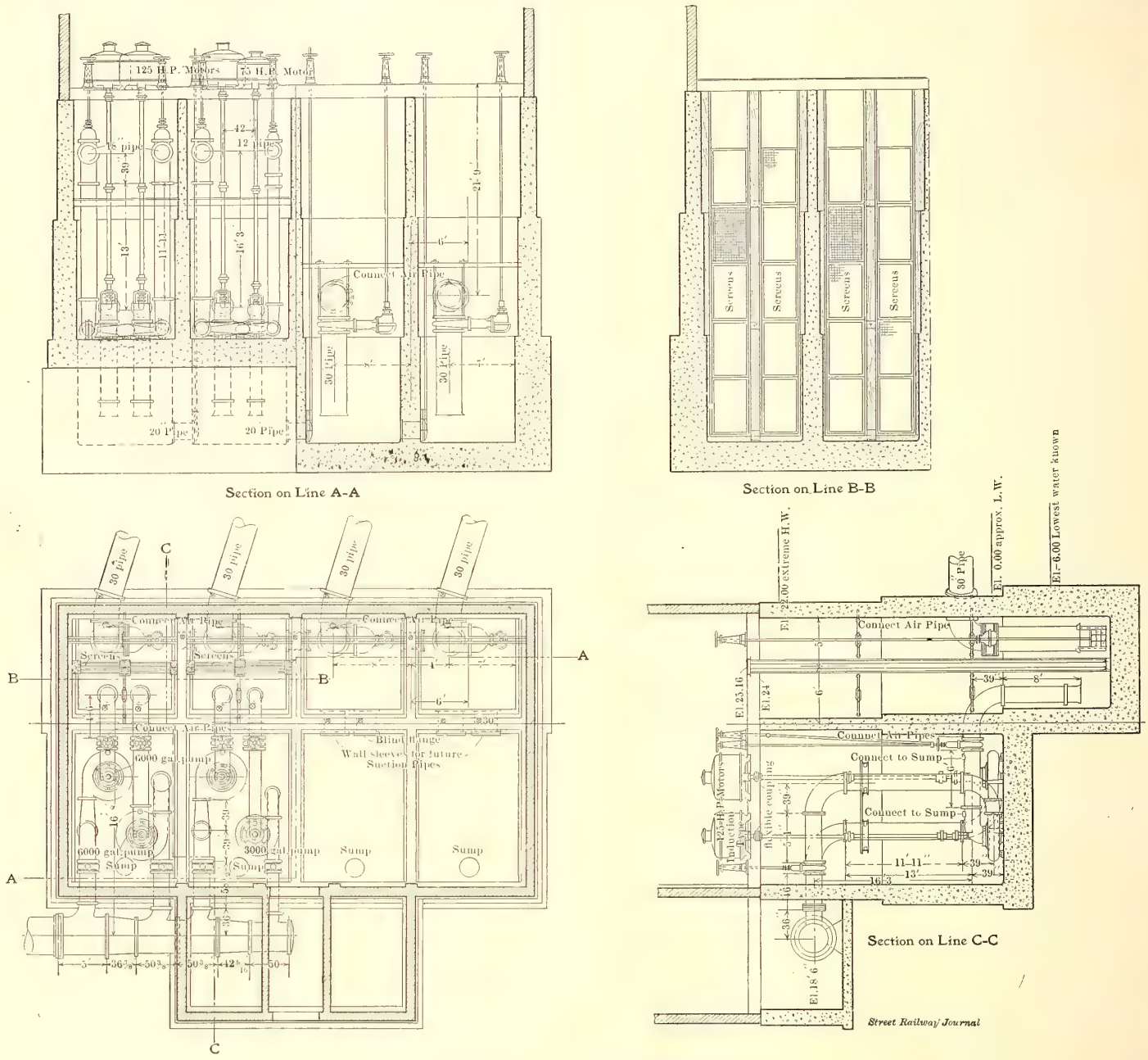


FIG. 11.—GENERAL PLAN OF POWER STATION

ash pocket are so arranged that the cars on either the upper or lower decks can be made to receive the ashes. When conveying ashes the conveyor dumps automatically above the ash pocket. The relative size and position of the coal pockets is best shown by a photograph of the steel structure, Fig. 8, taken April 25, 1903. The automatic movable weighing hoppers and pipes for discharging coal from the coal pockets to the hoppers of the automatic stokers are well shown in the accompanying detailed drawing, Fig. 9. The coal when descending from the coal pockets to the boilers first passes directly to weighing hoppers for the upper boilers and through long spouts to the lower weighing hoppers, which in turn can be used to return coal to the conveyor in case of fire in bunkers. On the opposite side of either into the lower tier or into the conveyor. The ash bins under each boiler discharge into the coal conveyor at such times as it is desired to use it as an ash conveyor. The coal conveyor is to be driven by a variable speed direct-current motor. An independent direct-current motor will drive the coal crushers. A take-up device to prevent slack in the conveyor is located in the west end of the boiler house in the basement. The coal crushers are located under the hoppers into which the coal cars discharge when the coal first enters the building.

ENGINE AND TURBINE ROOM

The engine and turbine room is designed to take six 5000-kw steam turbine units and three 3500-kw engine-driven units. The three engines will be of the vertical Reynolds-Corliss type,

made by the Allis-Chalmers Company. They will be compound condensing, 46-in. and 94-in. x 60-in. stroke, running 75 r. p. m., and rated at 4600 hp. They will have Corliss valves, and operate under 100 degs. superheat to 125 degs. superheat. The flywheels are 28 ft. diameter, and weigh 320,000 lbs. Each engine will have on its shaft a revolving field, 25-cycle, 3500-kw, three-phase General Electric generator, and each engine will have a Wheeler surface condenser. The exciter plant will consist of two 150-kw motor-driven generators, together with a storage battery consisting of 78 cells, having a capacity of 60 kw, based upon the hour discharge rate. The piping, as can be seen from the accompanying plans, Fig. 10, will be practically in duplicate, consisting of duplicate headers and separate pipes to each header from all boilers and engines.

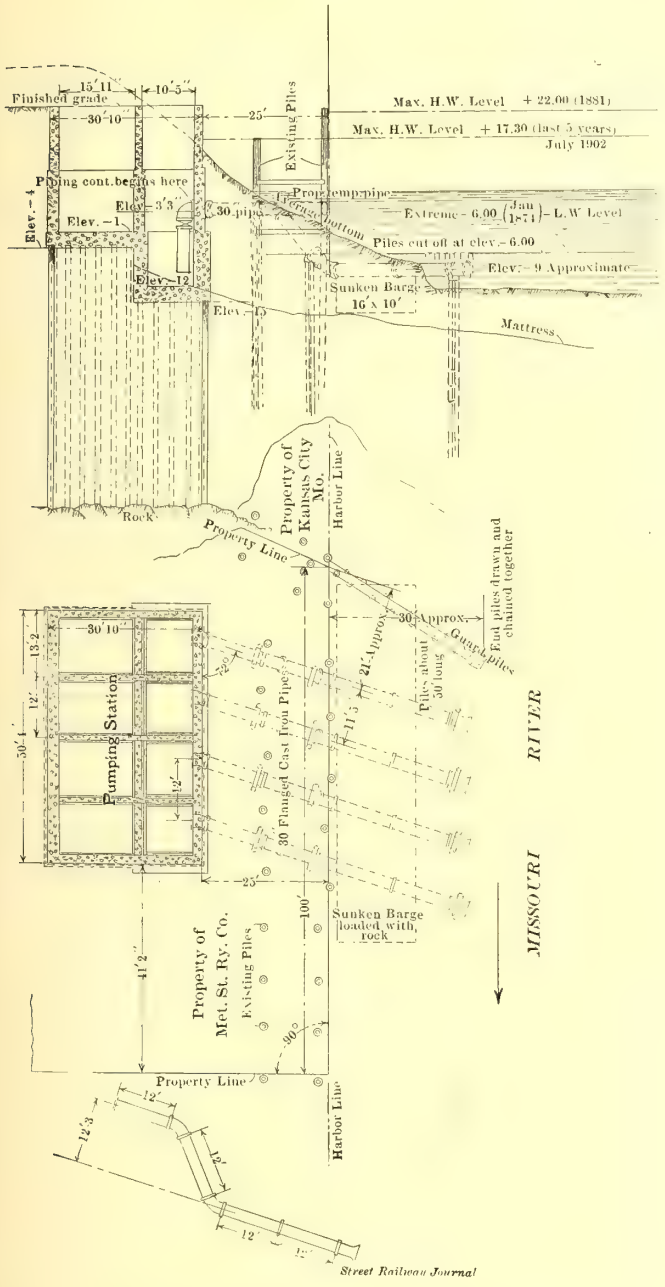


FIG. 12.—CIRCULATING WATER PLANT, SHOWING LOCATION

CONDENSING PLANT

Each of the Wheeler surface condensers has 10,000 sq. ft. of cooling surface, and will be capable of condensing the steam from a 5000-hp engine when operating at 50 per cent overload. These surface condensers have copper tubes of 1½-in. diameter. Blake twin vertical air pumps, 14 ins. and 38 ins. x 21 ins., have been ordered. In each engine exhaust next to the condenser in the basement is to be a Cochrane 48-in. oil separator. A Blake 30-in. automatic relief valve, with hydraulic control, will be placed in each engine exhaust, to allow the engine exhaust to the atmosphere in case the condenser fails to operate. All engines will exhaust into one common main. This exhaust main will be of riveted steel.

The condensing water will discharge through a 48-in. cast-iron main into the large city sewer which passes under the company's property, this sewer saving the company the expense of a separate discharge pipe to the river. This discharge from the condenser to the sewer is sealed, to give the advantage of the negative head afforded by the fall to the sewer. The main in-take and discharge pipes connect to each condenser, and the amount of water to each condenser can be regulated by means of valves in these pipes. The air pump suctions can be all connected together, so that any pump can work on any condenser. The air pumps discharge into the hot-well in the boiler room basement.

The plant for furnishing the circulating water to the condensers, shown in Fig. 12, is an important feature in itself. The pump house shown in the accompanying plans is located at the harbor line of the Missouri River. Centrifugal pumps, driven by induction motors, force the water through a 48-in. cast-iron water main about 1000 ft. long from the pump house to the condensers. The variation in the height of the river, as shown by the plans, is 28 ft., and the concrete foundation walls of the pump house are built so as to leave a clearance of about 2 ft. above the highest water ever recorded. The suction pipes from the pump house point slightly down stream to avoid the danger of catching mud and drift-wood. They are located 3 ft. below extreme low-water level, and are supported on piles. These in-take pipes are 30 ins. in diameter. The lift to the power house with extreme low water is 27 ft., and therefore with extreme high water there will be practically no lift. The drawings make plain the arrangement of the pump house, centrifugal pumps and piping. In order to place the centrifugal pumps near the water level the vertical shaft type of pump and induction motor was decided upon. This type of pump, which is used extensively in California irrigation work, having proved to be the most efficient because of the possibility of placing the pumps practically at or below water level. The induction motors are of General Electric make, 440-volt three-phase. The centrifugal pumps will be furnished by the Morris Machine Works. Thrust bearings on both motors and pumps will be provided, and there will be a flexible coupling between the motor and the pump. Three of the pumps will be of a capacity of 6000 gals. per minute, driven by 125-hp motors. One pump will be of 3000 gals. capacity, driven by a 75-hp motor.

For the design and construction of this power house and the other important engineering work which Ford, Bacon & Davis have undertaken for the Metropolitan Street Railway, a large branch office of that firm has been established at Kansas City, with C. N. Black as engineer in charge. H. P. Quick, as steam engineer and chief draughtsman, has had the mechanical features of the design of this power house as his special work.

FREIGHT BUSINESS ON OHIO INTERURBANS

The Toledo, Bowling Green & Southern Traction Company is making preparations to enter the freight business on an extensive scale, following the example of the Toledo & Western Railway. Standard box freight cars will be purchased, and they will be hauled by electric locomotives. In Toledo the cars will be operated to the center of the city over the Toledo Belt & Terminal Railway by means of steam locomotives. The line is to be straightened and a large consolidated lighting and railway power house will be erected. To carry out these improvements the company will pass its dividends for the year. At present the company has a surplus of $150,000, which will also be used for improvements.

DENVER & NORTHWESTERN INTERURBAN ROAD FOR HAULING COAL

There are not many, in fact there are very few, street railway companies that can have their coal brought direct from the mine to the power house by cars operated over their own tracks and supplied from their power station. This unique and economical method is being carried out in Denver, Col., and it possesses several interesting features. Although a number of different corporations enter into the mining, transportation and use of the coal, they are all owned by the same financial interests, and may be considered as allied companies. The Leyden Coal Company owns the coal lands and mines and sells the coal, the Denver & Northwestern Railway Company owns the electric railway over which the coal is hauled, and the Denver Tramway Power Company owns and operates the power station where the coal is being used as fuel. This last-named corporation is very closely allied with the Denver City Tramway Company, the street railway operating company of Denver, to which it supplies all its power. As stated above, these companies are closely associated, but they are kept distinct as far as their functions and operating departments are concerned, for business reasons.

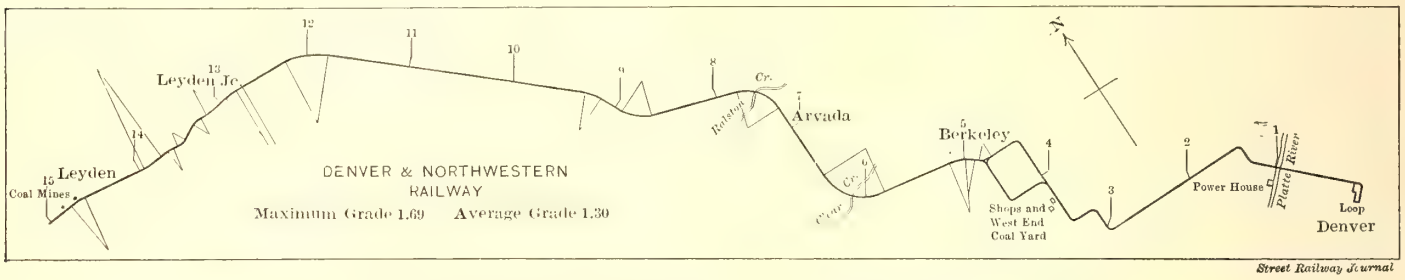


FIG. 1.—MAP OF SYSTEM OF DENVER & NORTHWESTERN RAILWAY

COAL MINES AND PLANT

The Leyden Coal Company owns about 1000 acres of coal land at, and in the vicinity of, what is now called the town of Leyden, located 15 miles northwest of Denver (see map. Fig. 1). The vein of coal is about 7 ft. to 14 ft. thick, and lies from 600 ft. to 1000 ft. below the surface. The coal is a high-grade bituminuous lignite, and is the best coal for steaming purposes in the Northern Colorado coal fields. It can be mined with comparative ease, and can be transported easily, as the country in that vicinity and en route to Denver is rolling and the grades are low. The Rocky Mountains are just beyond to the west.

At present the company is mining coal from a 6-ft. 9-in. x 8-ft. shaft that is 705 ft. deep. An Ingersoll-Sergeant air compressor is used to operate the pneumatic coal cutters used. This shaft first began to produce coal on Jan. 20, 1903, and is now turning out from 30 tons to 50 tons a day. The capacity of the plant is 400 tons per day, but before it is brought up to this production the company will have in operation its main shaft, which is now being sunk a few hundred feet from the first one. The new shaft will be 8 ft. x 17 ft. in size, and will have a daily capacity, when developed, of 1500 tons to 2000 tons of coal. Plans are now being drawn for the power plant equipment. The boiler equipment will comprise six 66-in. x 18-ft. horizontal tubular boilers, and there will be installed two 20-in. x 42-in. direct-acting hoisting engines, feed-water heaters, shaking screens, etc. It is possible also that electric power from the city power house will be used eventually for operating chain cutters and punchers.

Fig. 2 shows the present temporary shaft house and the method of discharging coal from the hoist into two hopper cars at the same time. In Fig. 3 is illustrated a coal train, consisting of one motor car and four trail cars, all being of the hopper-dump type. Back of the train may be seen the operations that have been begun on the new main shaft. In the distance are indicated, in dim outlines, the foothills of the Rocky Mountains.

At present the Leyden Coal Company is hauling coal to a distributing yard a little over 3 miles from the heart of the city, at what is known as the West End car house, as shown in Fig. 1. There the dump cars are run onto the elevated track illustrated in Fig. 4, from which they are automatically dumped into receiving bins. The wagons used in the local distribution of coal are loaded from these bins. It is the company's plan to locate five of these distributing yards at convenient points about the city, so that any prospective customer may be quickly reached. The dump cars will be hauled to these yards at night over the tracks of the Denver City Tramway Company. The facilities at the West End yards are such that thirty carloads, or 450 tons of coal, can be hauled there in a day. The coal company pays the Denver & Northwestern a stipend per ton for all coal hauled over its line from the mine to the city. This charge is so reasonable and the other items of expense so low that the company is already able to retail coal in competition with the other local dealers at $3.50 a ton, which is 75 cents a ton cheaper than the prevailing rates for the same

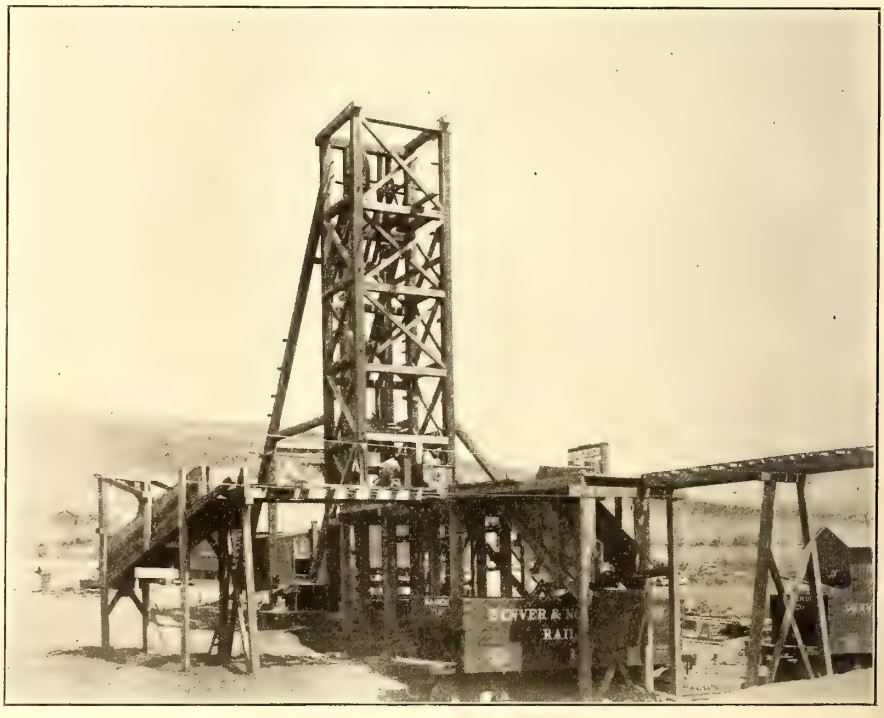


FIG. 2.—TEMPORARY COAL SHAFT AT LEYDEN

grade of coal. For receiving coal at the Tramway Company's new power house on the Platte River, in Denver, special provisions are being made. A track will be run into an annex of the boiler room, where the coal will be dumped into a large receiving bin. This bin will discharge into a cross conveyor that will carry the coal to the main conveyor, which will discharge into the hopper bins above the boilers. By this arrangement the coal will not be handled manually after it is mined. As the coal receiving apparatus will not be ready for several weeks, coal is now being temporarily dumped directly through windows onto the boiler room floor. Only a little coal is being received in this way, however. The power station uses about 120 tons of lignite slack a day, and gets it at prices varying all the way from a little over $1.00 to $2.16 per ton. It is not known exactly at which price the coal can be delivered under the new arrangement, but it is evident that the officials figure on a cost of less than $1.00 a ton.

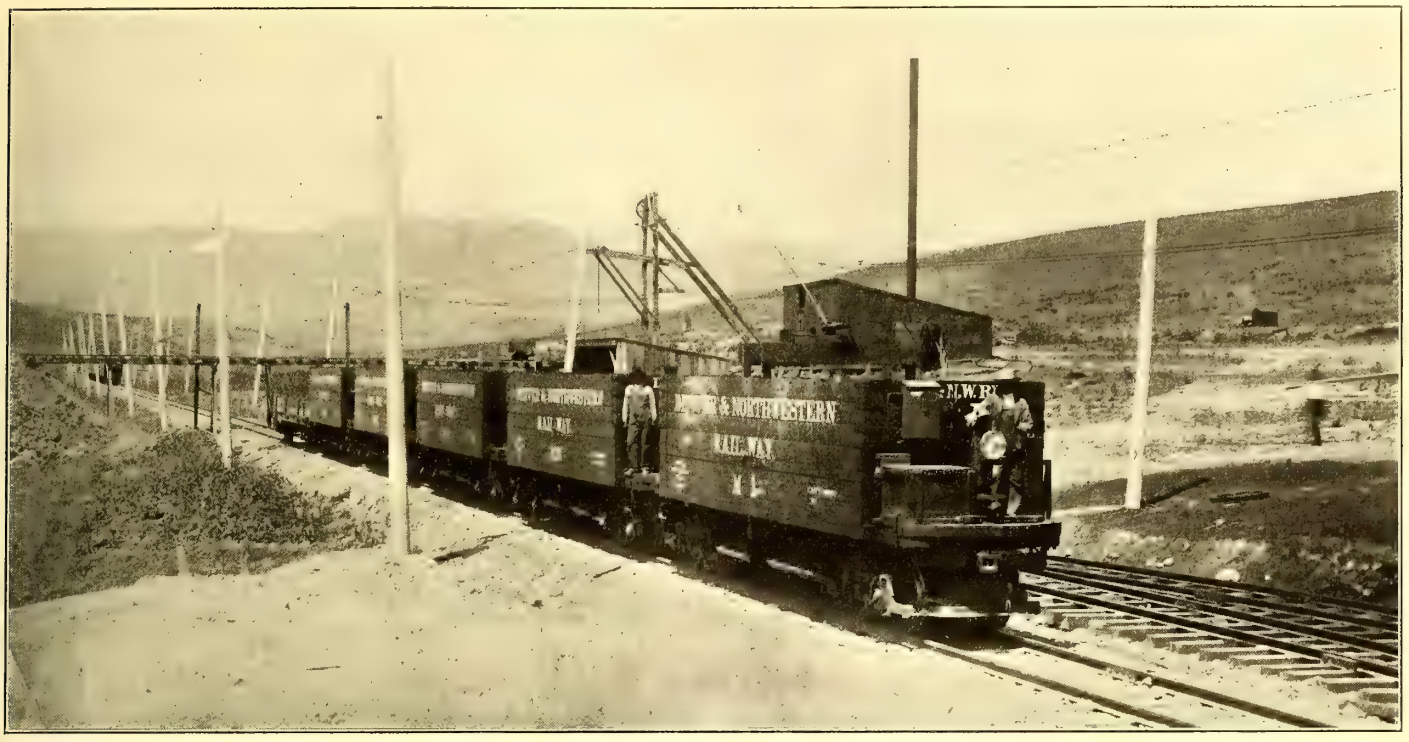


FIG. 3.—TRAIN OF COAL DUMP CARS AND WORKINGS FOR NEW SHAFT

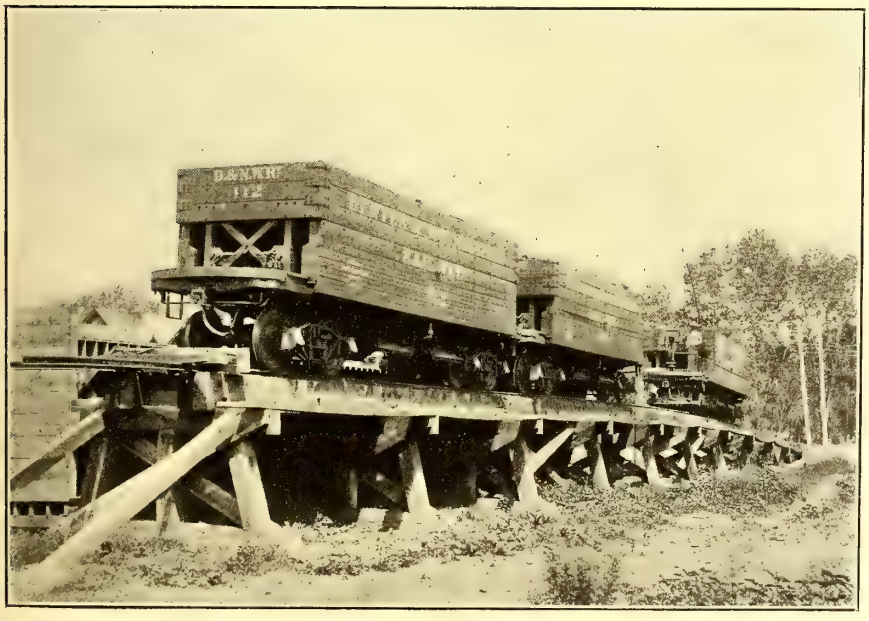


FIG. 4.—UNLOADING TRACK AND BINS AT WEST END YARD

The track of the Denver & Northwestern, as well as that of the Denver local system, is all laid on a 3-ft. 6-in. gage, so that standard coal cars used on steam roads cannot at present be handled. The road is laid, however, with ties long enough for an extra rail, and it is the company's intention to lay this rail soon, so that it can compete for the steam road trade. The electric motor cars will be able to haul these standard-gage coal cars as well as the narrow-gage dump cars. The details of the management of the Leyden Coal Company are under the supervision of S. M. Perry, general manager, and J. G. Perry, superintendent.

TRACK CONSTRUCTION

The track construction of the Denver & Northwestern is built for carrying 100-ton standard gage locomotives, although at present only the narrow-gage track is laid. It seems unfortunate that an interurban road of this nature, where heavy freight will be regularly handled, had to be built on a 3-ft. 6-in. gage, but that is the gage that is used throughout Denver by the Denver City Tramway Company, and as it was quite necessary that the city system be used in the distribution of the coal there was no other alternative than to build the track and rolling stock to conform with the city practice. As stated above, the roadbed is built for standard steam road operation, and it is the company's plan to lay a third rail, so as to accommodate standard freight cars. This will be done at least from the coal mines to Leyden Junction, where connections may be made with the new Denver, Northwestern & Pacific Railway, popularly known as the Moffat Short Line, which is now being built from Denver to Salt Lake City. This latter railway is to be a standard-gage steam railroad, and when originally proposed it was planned to run over the track of the electric road from Denver to Leyden Junction, or beyond. This plan has since been deemed impracticable, however, and it has been decided to use a slice of the private right of way of the electric road from a point just outside of Denver to Leyden Junction, and build a separate roadbed and track for

the steam line. In Fig. 5, which is a view of straight track on the electric line, the graded roadbed for the steam road may be seen at the right. The tents belong to one of the construc-

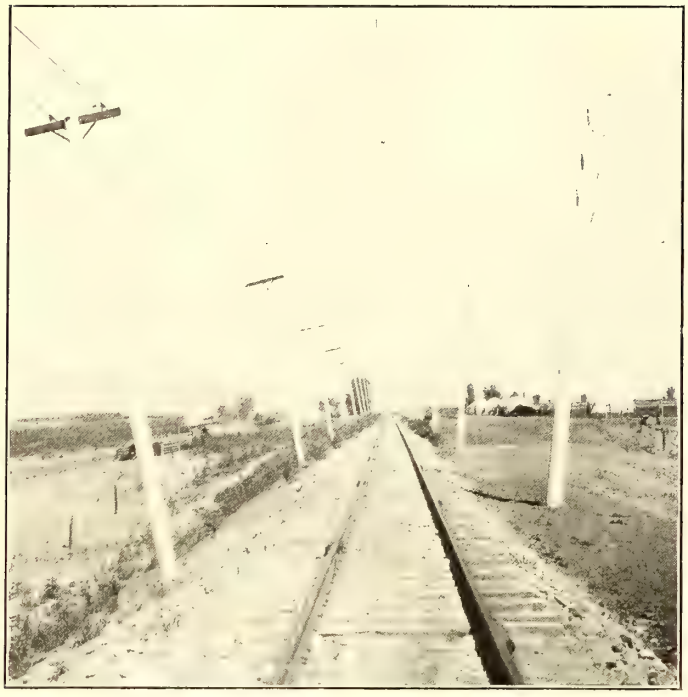


FIG. 5.—VIEW SHOWING TRACK AND OVERHEAD CONSTRUCTION

tion camps that are now scattered along the route of the new Moffat Short Line every few miles.

The Denver & Northwestern track is laid with 80-lb. T-rail, A. S. C. E. section, in 33-ft. lengths with angle-bar and Weber railway joints. Spring frogs are used at turn-outs. All the special work was constructed at the shops of the Denver City Tramway Company, and conforms to that company's excellent standard. The track and overhead work were constructed by the tramway company. The ties are made of Ozark Mountain white oak and Texas long-leaf pine, and are 6 ins. x 8 ins. x 8 ft., long enough for standard gage rails, as shown in Fig. 5. The ties are laid a little less than 20 ins., center to center, or 3220 to



FIG. 7.— CUT UNDER STEAM AND WAGON ROADS AT ARVADA

the mile, with 14 ins. rock and gravel ballast, including the bed. The gravel is obtained from the company's own pit in a cut on the line. For track bonding there are used Ohio brass crown bonds, 10 ins. between centers, American Steel & Wire 316.000-circ. mil bonds and Brown solid copper bonds.

The map, Fig. 1, shows the general alignment and direction of the road from where it leaves the Denver City Tramway Company's loop at Fifteenth Street and Arapahoe Street to the end of the line at Leyden. From the loop to Berkeley, a distance of 4.78 miles, the track is part of the local city system and is operated and maintained by the tramway company. Beyond that point the Northwestern Company owns its own private right of way. The total length of track, including the city end, is 15.02 miles. There are five sidings en route and about 3000 ft. of sidings at the coal mines. At Arvada, where are located the superintendent's and despatcher's office and pole and storeyard of the company (Fig. 6), there is a Y and about 1100 ft. of sidings. Another Y is located at Leyden, half a mile from the end of the line.

The maximum grade on the line is 1.69, while the average grade is 1.30. Just beyond Arvada, as shown in Fig. 7, is the deepest cut on the road. It is 26 ft. deep and about 1200 ft. long. The road at this point passes under the track of the Colorado & Southern Railroad and two wagon roads. The curvatures of the track reach as high as 12 degs.. The greatest fill is about 2800 ft. long and 25 ft. high. A heavy fill is also shown in Fig. 8, where the track crosses Clear Creek on a



FIG. 6.—STORAGE YARD, FREIGHT HOUSE AND DESPATCHER'S OFFICE AT ARVADA

400-ft. wooden bridge, supported on piling. As this stream is apt to run high in the spring, wing dams have been thrown up and down stream, each about 500 ft. long. Fig. 12 shows the typical bridge construction adopted by the Denver & Northwestern, and illustrates the method of supporting the trolley poles.

OVERHEAD CONSTRUCTION

For the overhead work 35-ft. and 40-ft. Idaho cedar poles are used, set 100 ft. apart. They have 9-in. tops, are set 6 ft. in the ground on level roadbed, and are painted with P. & B. paint. The side pole and span wire construction is used throughout, the bracket construction not being in favor among the Denver traction men. At all curves the poles are guyed by means of 6-in. Stombaugh guy anchors. From Berkeley to Arvada No. 0 trolley wire is used and from there on the trolley is No. 0000 American Steel & Wire grooved wire, supported by Detroit clamps and cap and cone insulators from 5-16-in. span wire. Pole ratchets are used on one end of the spans and 5/8-in. eye bolts on the other end. Brooklyn strain insulators are employed for dead-ending the trolley wire at Y's and side tracks. The plan adopted at sidings is to run a full span of

trolley wire beyond the switch points, with no overhead switches, so as to allow the main line cars to take the siding points at high speed.

From the power house of the tramway company in Denver to Arvada there are run one No. 0000 and three 500,000-circ. mil copper stranded feeder cables. From Arvada to Leyden Junction two of the heavy cables are carried, and one is run on to a point near the end of the line. By the aid of a booster at the power house a very good working potential is maintained all along the road. A No. 0 feed tap is used between feeder and trolley every 500 ft. The feeder wire outside of the city limits is bare, and is supported on Knowles No. 2 cable glass insulators with grooved tops. General Electric, style MD, magnetic blow-out lightning arresters are used, there being twenty-five of them in 11 miles of track.

The cross-arms are of Oregon fir, 4 ins. x 6 ins. x 6 ft., and are secured to the poles by means of ¾-in. bolts with sheet washers, one washer being straight and the other curved to conform to the pole. The washers are made of ⅜-in. iron. The cross-arm braces are made of ¼-in. iron, 26 ins. x 1½ ins.,



FIG. 8.—400-FT. BRIDGE ACROSS CLEAR CREEK

put on with ⅝-in. lag screws, 3 ins. long on the arms and 4 ins. on the poles. Figs. 5 and 8 illustrate the different features of the overhead construction spoken of above.

At the Berkeley Junction, or Y, a special construction was used to make a turn in the feeder lines, as no pole could be erected at that point. A set of No. 101 Peru porcelain knob insulators were supported by means of steam insulators from an adjoining pole, as illustrated in Fig. 13. The car shown in this picture is one of the new forty-one combination cars used on the Denver city lines. Fig. 13 also illustrates a telephone station for the despatching system. These telephones are of the Bell type, and are placed at each siding and at the terminals. They are mounted on separate stub poles. All cars, freight, passenger and work cars are operated strictly on a despatching system, the despatcher at present being located at the despatching office of the tramway company in Denver. Eventually the despatcher's office for the Denver & Northwestern line will be located at Arvada.

There is now being installed in the power house a 1600-kw, 2300-volt, 25-cycle alternator, and it is the intention in the very near future to run a transmission line to Arvada, a distance of nearly 7 miles, and install there a rotary convertor sub-station to feed the railway in both directions. The transmission will probably be made at 26,000 volts, three-phase.

ROLLING STOCK

The rolling stock of the Denver & Northwestern Railway

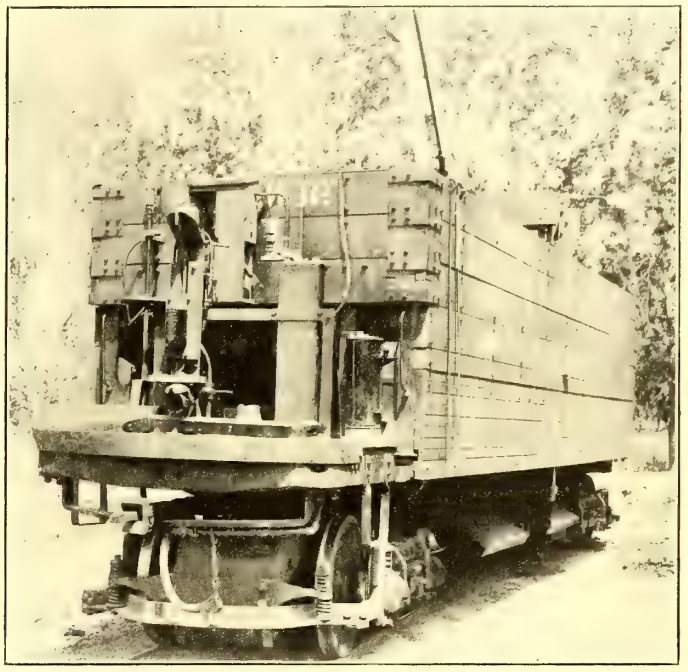


FIG. 9.—MOTOR DUMP CAR

consists at present of five motor and thirty trail dump cars, built expressly for hauling coal, and twelve flat cars and two steam motors used in construction work. The dump cars were built by the American Car & Foundry Company, of St. Louis, under specifications drawn up by L. L. Summers, consulting engineer for the Denver City Tramway, and are the first of their type to be placed in operation in the country. Each car is designed to carry 15 tons of coal, and the hoppers were made especially for use in handling the slack coal used in the power house. Figs. 9 and 10 illustrate the ends of one of the motor

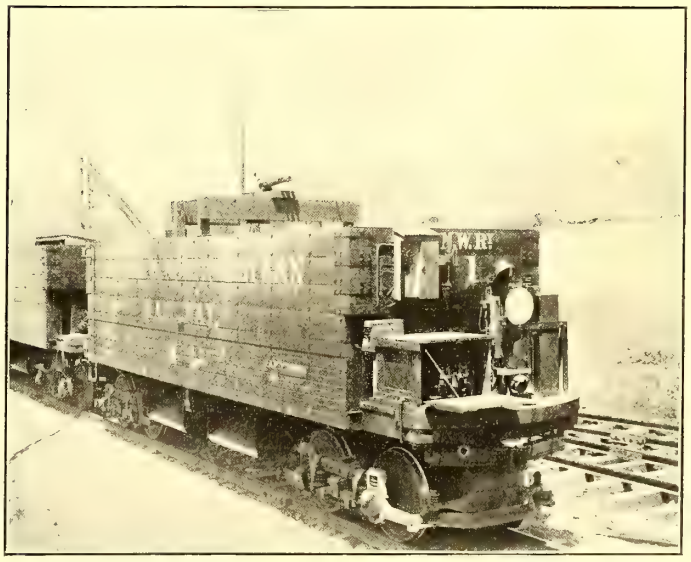


FIG. 10.—MOTOR DUMP CAR, SHOWING COMPRESSOR MOTOR

dump cars. The type of trail cars is illustrated in several of the accompanying pictures.

Outside of the addition of the electrical and air-brake equipment the motor cars do not differ from the dump cars used as trail cars. The cars are equipped with four hoppers, arranged to dump all the load on either side, and the cars are entirely self cleaning. The hoppers are placed well back under the running gear so that it will not foul. The door opening of



FIG. 11. STANDARD PASSENGER CAR

each hopper is 3 ft. 10½ ins. long and 16 ins. wide. The doors are slung underneath on long rods operated by levers at the ends of the car. A 12-in. I-beam runs the length of the car and forms the support for the hoppers. The inside length of the car is 24 ft., and the overall height to the top of the car from the track rail is 9 ft. 6 ins. The top of the platform is 4 ft. 4 ins. above the track. The stakes that hold the planks of the car sides are 4½ ins. x 4 ins., and are placed inside the car so as to make a smooth outside surface that will not catch on obstructions. The inside width of the car is 7 ft. 2 ins., and 2¾-in. planking is used for the sides and ends. The sills are rounded so that the cars may take sharp curves with facility. The bumpers are provided with coiled springs.

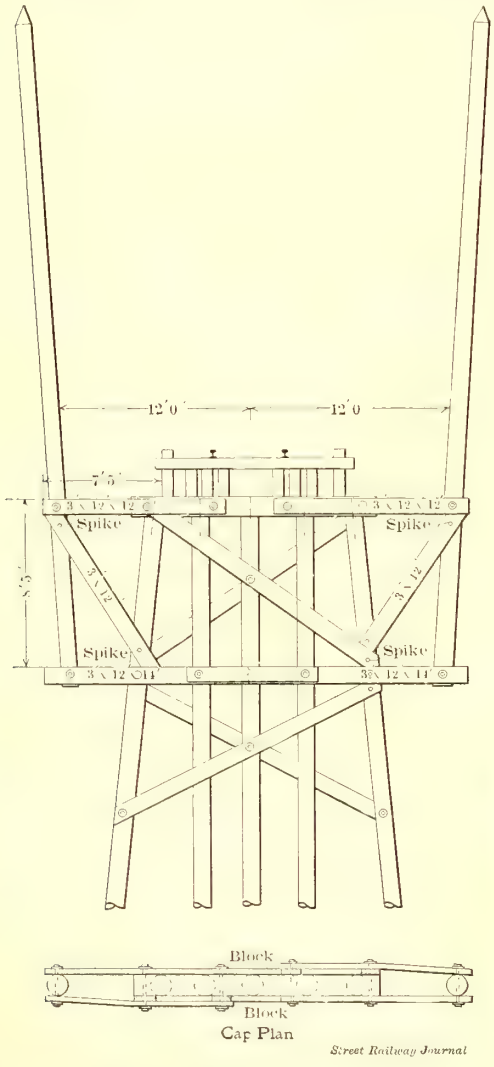


FIG. 12.—TYPICAL BRIDGE CONSTRUCTION

The motor cars are mounted on double Brill trucks of special G-27 type. Each truck is equipped with two General Electric 53 railway motors. These motors are rated at 42-hp, but are capable of developing 50 or more horse-power each. The cars are equipped with the General Electric multiple train-control system, and each motor car is capable of hauling a train of five or six loaded trail cars to Denver from any point on the road. The cars are geared for 12 miles an hour, but can be arranged to make 25 miles an hour. All cars are equipped with the Christensen automatic air-brake system, 90 lbs. pressure being carried in the main reservoir. The motor-driven air compressor is mounted on one end of the motor car, as shown at the left of the front platform in Fig. 10.

The dump cars were received from the car works without any electrical equipment, that being subsequently installed in Denver under the supervision of A. M. Ballou, chief electrician for the Denver City Tramway Company. All connections are run in covered cable, and the switches, connectors, fuses, etc., are installed in boxes lined with ¼-in. sheet asbestos. Each car is equipped for Eureka arc headlights, but at present Syracuse incandescent headlights are used, as shown in Fig. 12. The weight of each motor car empty is 41,600 lbs., while the trail cars empty weigh 24,000 lbs. each.

The company expects in the near future, as its mining operations are developed, to add to its rolling stock several more dump cars and also flat and box cars. No tests have as yet been made of the operation and performance of these hopper cars, but it is expected that they will be made soon, and some interesting and valuable data are looked for. As stated above, each motor car is capable of hauling a train of five or six loaded trail cars and, by equipping the trail cars with electrical connections, trains of twenty-five cars or thirty cars can be handled with the five motor cars distributed throughout the train. A train of one motor and four trail cars is shown in Fig. 3.



FIG. 13.—BERKELEY Y, SHOWING SPECIAL FEEDER SUPPORT

PASSENGER OPERATION

The passenger traffic on the new road is handled entirely by the operating department of the Denver City Tramway Company, and the cars used are owned by that company. These cars are of the 41-ft. combination type, which were built by the Woeber Carriage Company, of Denver, and only recently delivered. One of the cars is illustrated in Fig. 11. They are equipped with double 27-G Brill trucks, each truck having two General Electric 58 motors. The equipment also comprises K-6 controllers and Christensen air brakes. The general features of this car were described in the STREET RAILWAY JOURNAL of Feb. 7, 1903.

On week days an hourly service is run and on holidays and Sundays a 30-minute service is put on. This road can hardly be called an interurban line, as there are scarcely 1000 people living along the route, Arvada having only about 700 people and Leyden not more than 100. Yet the passenger traffic has been very satisfactory, and on Sundays and holidays the half-hour service has been taxed to the utmost. There are several reasons that can be given to explain this large traffic. One is, that Denver has no other really interurban electric railway, that is to say, none extending beyond the suburbs, and as Denver has many pleasure-seeking people who patronize the street railways, and is always filled with tourists and transients, the new road attracts a great many passengers, especially as the ride is made directly toward the mountains, affording a good view of them the entire distance. Another factor that has helped materially to increase the passenger receipts is that many of the workmen and officials employed on the new Moffat Short Line ride back and forth between Denver and the working camps on the electric cars. Those who are working beyond the electric line ride to Leyden Junction, where they are met with wagons and carried farther on. One weekday morning when the writer rode over a portion of the line, there were 105 passengers carried, many of them, however, being members of a new gang of workmen who were going to one of the steam road camps.

Arvada and Leyden are rapidly growing towns, and there is no doubt but that this electric road will repeat the history of other interurban lines in the East, and create considerable new traffic to exceed the present demand. Branches of the road are talked of to Golden, 15 miles west of Denver, and Boulder, 29 miles northwest.

CONCLUSION

The Denver & Northwestern is also doing considerable business in hauling package freight and supplies for the contractors of the steam road. This freight is received in Denver or at Arvoda from the Colorado & Southern Railway, and hauled to different points along the line. Some local freight business is also being done for farmers and truck raisers living in the districts tributary to the road.

The company will have its shops at the West End barns in Denver, while a blacksmith shop for small repairs is located at Arvada. The pole yard and storage for supplies and material, as illustrated in Fig. 6, is also maintained at Arvada.

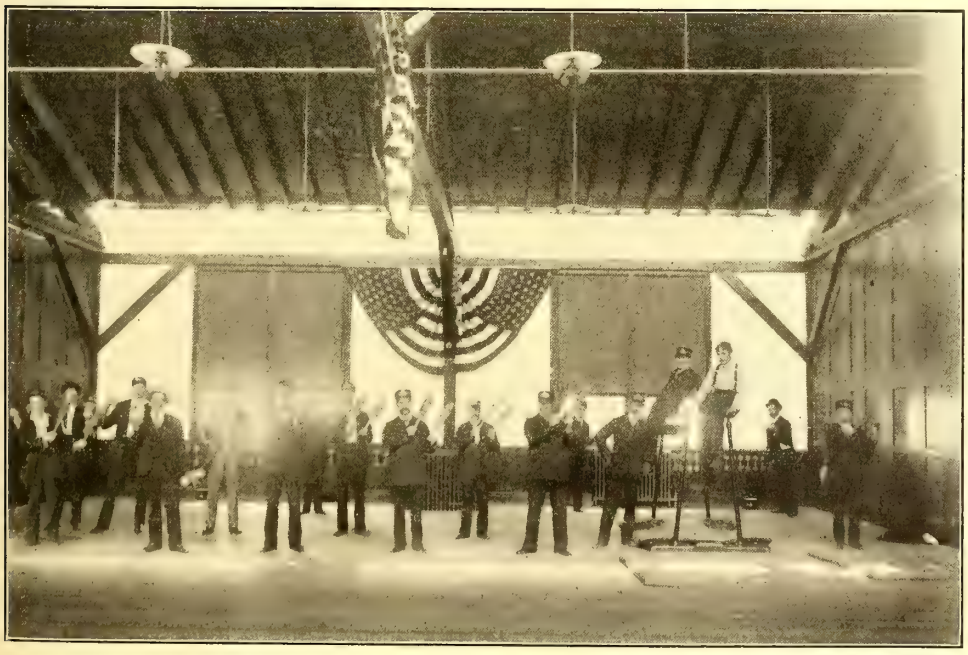
The following-named gentlemen are officers of the Denver & Northwestern Railway Company: President and manager, S. M. Perry; vice-president and general superintendent, W. G. Smith; secretary, Fred. G. Moffatt; treasurer, Thomas Keely; purchasing agent, F. A. Perry; engineer, W. A. Burbower; chief electrician, John A. Beeler.

Y. M. C. A. STREET RAILWAY WORK IN BROOKLYN

The movement which culminated in the opening on July 7 of a magnificent building for the use of employees of the Brooklyn Rapid Transit Company was inaugurated five years ago by Clinton L. Rossiter, then president of the company.



VIEW OF BUILDING, LOOKING FROM JAMAICA AVENUE



SWINGING INDIAN CLUBS AND DUMBBELLS IN THE BROOKLYN Y. M. C. A. GYMNASIUM

Mr. Rossiter believed that the Young Men's Christian Association work which has met such unqualified success on steam railroads was equally adaptable to street railway men. J. L. Greatsinger, Mr. Rossiter's successor, endorsed his plans and enlarged them. President E. W. Winters, now in office, and General Manager J. F. Calderwood have greatly broadened the original plans and have surprised all concerned by carrying to completion the splendid club house now at the disposal of the company's employees.

The structure as now equipped has cost the company about $40,000. The designing and furnishing of the building was in the hands of D. R. Collin, the architect, who is entitled to much credit for the results which he has achieved for the amount of money expended. Of the five illustrations given here one shows the club house on its opening day, the others being views of different parts of the interior.

A detailed description of this building was presented in the STREET RAILWAY JOURNAL for Dec. 13, 1902, but it may be well

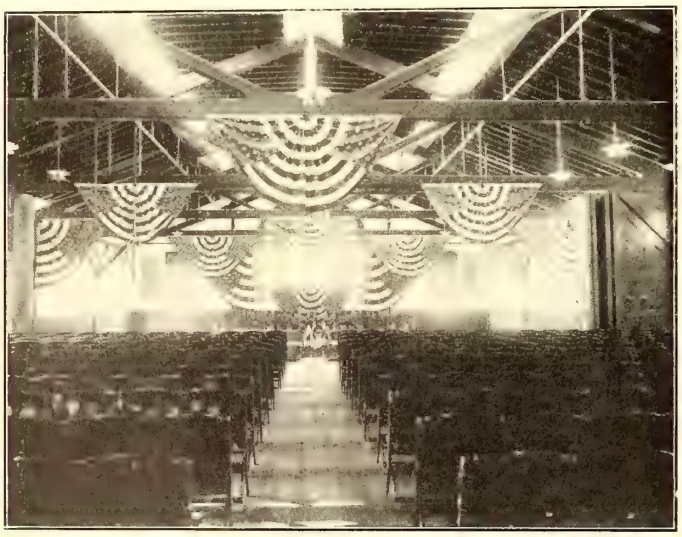
to restate its principal features. The structure has three stories in front and two in the rear, and is 60 ft. wide by 170 ft. long. The first floor contains bowling alleys, tub and shower baths, lockers and lavatories. The second floor contains the auditorium, gymnasium, car instruction room, billiard room, reading room and the secretary's office. This floor has been so planned that by removing the sliding doors the capacity of the auditorium can be increased from 400 to 1000. The third floor contains three class rooms.



LIBRARY AND READING ROOM

Among the principal social features will be entertainments, which are to be given in the auditorium by home talent or professional actors. The company has also arranged to give excursions twice a week during August, for the benefit of the men and their families, to Rockaway Beach, a fine seaside resort near Brooklyn. The cost of these excursions, including meals and fare, will be 60 cents each for adults and 30 cents each for children. These outings were instituted last year and have become very popular.

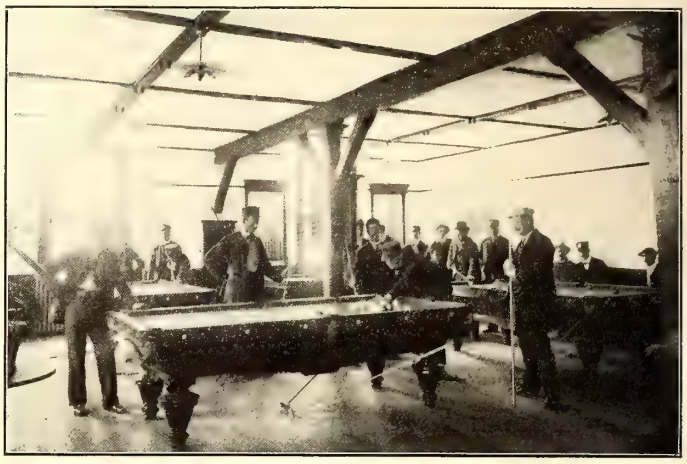
The benefits of the finely equipped gymnasium will be greatly enhanced by the presence of a competent physical culture director, who will instruct the men in the intelligent use of the gymnasium facilities. Bowling and billiard tournaments will also be a prominent feature.



THE AUDITORIUM ON THE OPENING NIGHT

The educational department will include an instruction room on the second floor, where the company intends to place a skeleton car, to be used for teaching the men the principles of car operation. The class rooms on the third floor will be used for teaching English, penmanship, arithmetic, electricity, mechanical drawing and music. Classes in each study will be held about two nights a week.

The club house is furnished with an excellent reading room, and an arrangement has been made with the Brooklyn Public Library whereby the latter will establish a branch in the building, placing over 1000 volumes at the disposal of the employees. In addition to this about fifteen portable libraries of fifty to 100 volumes each will be circulated between the power houses, shops and depots of the street railway system. Plans are also being prepared for a technical library.



POOL ROOM

The building is managed by a committee consisting of the following employees of the company: John Keating (chairman), conductor on the elevated division; F. A. Overfield, shop foreman; T. J. Clisset, timekeeper; D. S. King, motorman. The greater part of the club house is free to all employees, regardless of membership in the Brooklyn Rapid Transit Employees' Sick and Death Benefit Association or the Young Men's Christian Association. The very small fee of $2.00 a year is charged for use of the educational classes, gymnasium, baths and lockers.

The general supervision of the work is in the hands of J. M. Dudley, who has devoted many years to similar labor in the steam railroad branches of the Young Men's Christian Association. Mr. Dudley has spent over a year and a half in Brooklyn to study the situation, and he believes that the Young Men's Christian Association, because of its non-sectarian character and tolerance toward all creeds, and its practical efforts to raise the physical, intellectual and moral standard of its members, must prove as successful in the street railway as in other fields.

SOME DUTIES OF THE GENERAL MANAGER

BY LINCOLN NISSLEY

If there is any line of business in the world that requires thorough organization it is electric railroading. There is no line of business in which such a large proportion of the gross earnings go back to supervision and labor as in electric railroads. There is no line of business that requires better or quicker action. There are more emergencies occurring in the electric railway service than in any other line of business, and owing to its great ramification the business must of necessity be handled by the various heads of departments, who must be capable of acting wisely and quickly without being able to advise and consult at all times with the general manager. This makes it especially important that in electric railroading there be first-class organization.

To maintain such an organization, not for one year but indefinitely, to have for the heads of departments men of character and ability to operate progressively and economically, to properly manage men and to have loyal and efficient

co-workers, are some of the more important duties of the general manager.

We are confronted to-day with a set of conditions entirely different in many respects from those existing some years ago. The number of employees coming under one organization is growing larger and larger; there is a growing tendency to centralize authority; the organization of labor into unions, once local, is now national, and there is a strong influence in some cases towards separation of interest between executive heads and other employees, and these are the conditions we have to meet to-day. It is not the intention of the writer to discuss here the merits or demerits of all of these conditions, as they are too large and somewhat beyond our control.

Among organizations as large as are often found in electric railways it would seem that enthusiastic and loyal effort must be a most important factor to the railway. To establish the condition of active thought is one of the highest duties of the general manager. It means leadership and breadth as against mere supervision and keeping everything to oneself.

When minds are at work on problems they are sure to produce results, and when they are not they produce nothing. But the moving spirit in bringing about such a condition, like water, cannot be expected to run from a lower level to a higher one, it must start from the higher level. No theorist alone can meet the call. He is required to furnish superior copy and forever divorce himself from the pernicious theory of a certain aristocracy of the service based on official position and prerogative. This relic of Babylonian age, yet extensively adhered to by a large per cent of the official strata, has robbed the stockholders of vast sums by its implied imputation of personal inferiority of the operative whose nature is quick to resent. The result is that many of his possibilities, which will always lie outside the limit of the mechanical rule, are allowed to lie dormant, and he remains indifferent to the threat of injury to the interests involved. On the other hand, the successful manager fashions these possibilities into a magnet to save from waste the thousand atoms from the much-stirred mass, which, under the regime of the theoretical manager, will continue to find their way to the commercial scrap heap.

The writer is equally convinced that the average American operative leans strongly to the side of loyalty and superior effort, but he looks for an affinity in his immediate and managing official, and yields in a degree according as that affinity is recognized. He is quick to take his cue from such discovery. It is to be deplored that so many officials seem to dread a certain lowering of the dignity from any kind of familiar contact with the operative. The real dignity of ability can never be lowered, but it can attract and elevate and form an example. It is a sacred duty of the general manager to the stockholder that he recognize this truth and act on it.

On the other hand, it is not uncommon to see leaders of labor with radical and sometimes violent views and feelings; men half-learned and teaching half-truths to the large body of those with whom they have associated. Such teachers and bad literature are the sources from which they derive their view of things at times, and this goes on in many cases uninterruptedly and without any counteracting influence from executive heads. This is not a proper condition of affairs.

Why is it that one man is selected from among a number to direct or command? For one reason, and only one, viz., because he has greater intelligence, because he knows more and is a greater force. It is a mistake to elect or select on any other grounds. This is the fundamental law of all organizations and government.

The moral responsibility of every one is as great and as constant whether one is here or there, or doing one thing or another, and this responsibility is in exact proportion to the intelligence of the individual. Therefore, if one occupies a position as a result of superior intelligence it is hardly sufficient that it should carry with it greater skill or mere supervision of work alone. The greater intelligence must carry with it in a higher degree all the attributes that go to make a better manhood, including better judgment and greater justice.

The selection of a suitable man for a position is a matter that is constantly arising, and often the right man does not appear to be at hand. Whenever this is the case it is evidence that an important duty has been neglected. It is a clear indication that sufficient time and interest has not been devoted to the most important requirement. Managers too often think only of power stations, cars and shops and neglect men and organization.

How are we to operate progressively and economically? All that may be supplied in the way of facilities and equipments will avail but little without men to properly direct their use. A cheap head of department is neither progressive nor economical. Having found the right man for a position he should be given every opportunity to progress; every reasonable inducement should be held out to him to "think" and to make his thoughts known. He should be given an opportunity to demonstrate, to some extent, some of the creations of his mind, for this is the food on which a thinking man lives. It is far better to grant such opportunities, and thus stimulate thought and action, rather than to suppress it. Among hundreds or thousands of employees there are more men having capacity than we think, but this capacity must be sought and invited to activity. There are plenty of men there. The fact of the matter is, if the influence, the proper influence, is exerted they will come out; but it is terribly neglected. The writer has personally known a great many young men, who, as a result of having an opportunity and good influence, developed into excellent men, but they required both the opportunity and the influence.

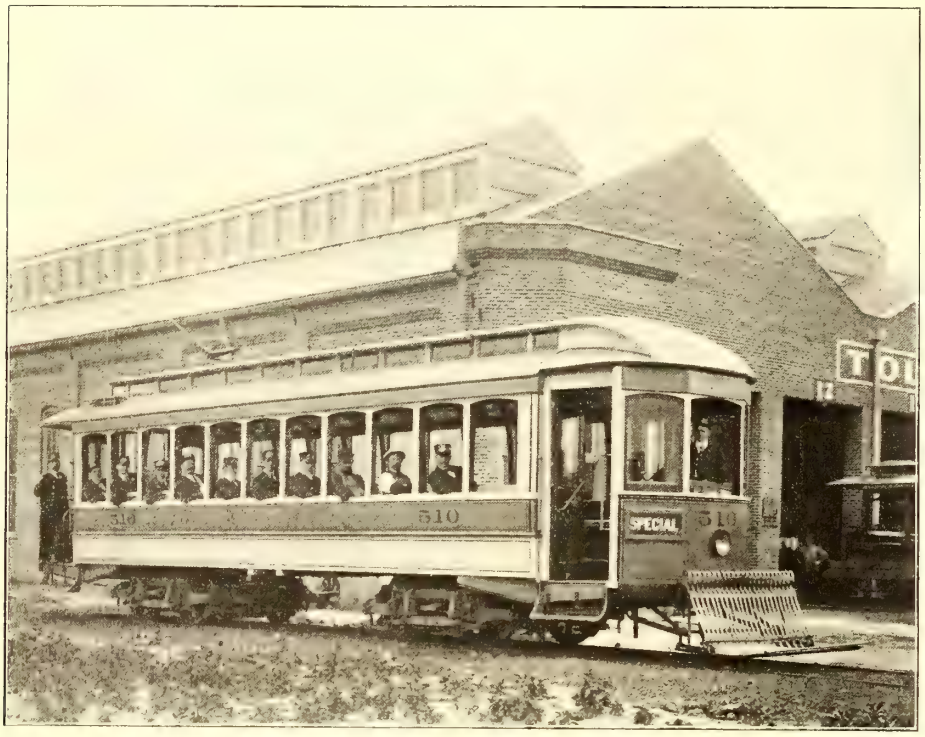
It should be understood, of course, when such opportunity and authority are given, an exact accounting should be required. The principle of having authority and discretion go with responsibility is the one above all others that is most important in obtaining the best results. There are conditions sometimes existing in electric railway organizations where the responsibility is imposed and the authority restricted, or where both responsibility and authority are restricted to an unreasonable extent, but such a plan is not likely to effect the best results. The first condition implies "heads of departments" fit in every way to carry the responsibility. It requires that men "shall be responsible" and maintains action. It makes men of sterling qualities and establishes confidence, making the organization self-sustaining and equal to the constantly growing demands. The other conditions will not accomplish this, they breed irritation, distrust, discontent, and kill that "loyal and voluntary" effort that counts far more than anything else in a large organization.

The general manager should know how to maintain an organization. He should know how to select, he should know how to develop and make responsible, and he should know how to discipline, and those who grow up under him will know how to do these things also. On the other hand, one who blindly drives, accepting no suggestions, will raise antagonisms that will alienate the support that is indispensable. No man can stand by himself alone. The writer would like to have anyone point out whether anything of lasting value was ever accomplished except by intelligence and better impulses. He contends that it is a most important duty of executives to consider that their responsibility does not end with the production of power houses, car equipments, etc., but in the management of men by their own action and their greater intelligence to exert an influence that will tend to better understanding, confidence and harmonious work, to the end that the organization may be maintained.

AUTOMATIC CAR FENDER

The Toledo Railways & Light Company has recently placed on trial an automatic car fender, invented by W. T. Watson, of Newark, N. J. The accompanying cut shows one of these fenders attached to a Toledo car.

This fender has the advantage of being furnished with two automatic releasing devices in addition to the ordinary foot-



AUTOMATIC FENDER ON TOLEDO CAR

drop in common use. One of the automatic devices consists of a front trip-bar, which is forced back on coming in contact with obstructions. The transmission, through levers and cranks, of the motion caused by the impact operates the foot-pawl of fender. Where snow obstructs the track this trip-bar might, however, prove inconvenient. It may, therefore, be turned against the fender and the other automatic device used instead. This latter is operated by the weight of the body struck falling on the fender cradle, which causes the fender to drop to the roadbed. The dropping of the fender pulls forward rocker-arms connected to levers, which operate the foot-pawl just as if the motorman's foot were used.

The complete fender may be quickly attached to the car by two bolts connected to the outside sills of the car platform. It folds compactly, is interchangeable to any style of car, and does not interfere with car coupling or car headlights.

THE IMPERIAL RAIL-JOINT

By introducing the Imperial rail-joint to British tramway engineers, Estler Brothers, of London, believe that a considerable advance has been made toward the attainment of a perfect rail-joint. This rail-joint has already met with great success on the European Continent and other parts of the world through the efforts of the patentees, Scheinig & Hoffman, of Linz, Austria, and has been in use on a number of electric railways long enough to demonstrate its merits. Among the electric tramways using this rail-joint may be mentioned those in Aussig and Peplitz, Bohemia; Rouen, France; Barcelona, Spain; Elberfeld, Germany, and the railway between Linz and Urfahr, in Austria.

The construction of the rail-joint is clearly shown in Fig. 1. The joint consists of three parts, namely, a heavy cast-steel shoe, "A," with recess to fit flange of rail, a cast-steel block, "B," provided with machined recess to fit the opposite side of flange, and a wedge-shaped piece, "C." Besides these three parts a thin zinc sheet, about .2 mm thick, is placed over the face at "D," and gripped by the recesses in the shoe and block. This is required for making a good electrical joint.

The joint is fitted in the following manner: The shoe "A" is heated in a portable forge until bright red, and meanwhile the block "B," which is not heated, is driven firmly over the rail flange so that the joint in rail is midway between the ends of the block—the rail flange having been thoroughly cleaned previously with a wire brush and file, and the sheet zinc mentioned above placed in position. The red-hot shoe can now be driven in position, care being taken that block "B" is not loosened. Finally the wedge, "C," can be driven home, care being taken that it is driven quite straight. The wedge "C" must be quite parallel longitudinally. If the wedge fits too easily a thin liner must be added. On the cooling of the above a thoroughly solid and firm joint is obtained, which is also very good electrically, owing to the large contact surface of zinc. This latter quality is evident from the following data:

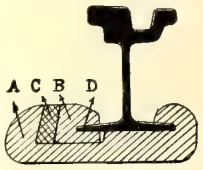


FIG. 1.—CROSS SECTION OF IMPERIAL RAIL JOINT

Some resistance tests were made of rail-joints under different conditions with rails weighing about 90 lbs. per yard. The resistance of an old joint with angular fish-plate, about 20 ins. long, and copper bond, 39 ins. long by .18-sq. in. cross-section, was .0000930 ohms, and that of 1 m of rail only .0000343 ohms; of a joint with patent shoe (no zinc in joint) and the same bond as before, .0000233 ohms, and that of 1 m of rail .0000337 ohms; of a joint with patent shoe, but fitted with sheet zinc, as described, and without copper bond, .0000085 ohms, and that of 1 m of rail .0000367 ohms.



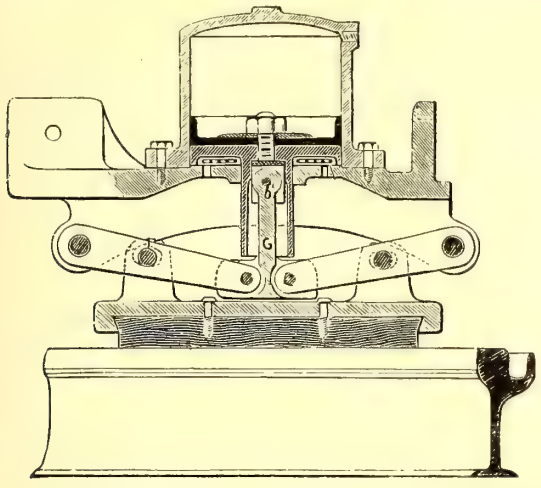
FIG. 2.—RAIL-JOINT ATTACHED TO RAIL

Fig. 2 shows a complete joint in actual piece of rail by means of the Imperial rail-joint. About four men are necessary to make the joints, and the entire operation takes only from 5 minutes to 10 minutes. Very little difficulty is experienced in fitting this joint, as hardly any excavation is necessary and traffic need not be stopped.

The Union Traction Company of Indiana has placed orders for three buffet cars for use on its lines. The cars will be the same size as the ones now in use; but the interior and exterior finish will be more elaborate. It is stated that the service will include everything usually offered in railway diners. Another innovation planned by the company is the operation of sleeping cars. These cars will be placed in service as soon as the company completes its line to Chicago.

PNEUMATIC SLIPPER BRAKE

The following is a description of an emergency brake which has met with considerable success in England. After being in practical use for over two years it is now in service upon 150



CROSS SECTION OF PNEUMATIC SLIPPER BRAKE

cars, yet not a single accident is said to have occurred to a car equipped with Hewitt & Rhodes pneumatic slipper brakes.

This brake is in use on the electric tramways at Oldham, Stockport, Dundee, Rochdale and the Potteries Electric Traction Company at Stoke-on-Trent. It is adaptable to all types of cars and can be used in connection with any style of air compressor.

The section view of the brake shown in the cut clearly indicates the construction. An air cylinder is carried on a bracket attached to the truck. The piston of the cylinder is connected by a swinging rod to two levers which have their fulcrums on another bracket. The levers carry a slipper shoe, on which is fixed a brake block of oak, beech or other hard-wood. The brake blocks can be used efficiently until they are worn down to within a quarter of an inch of the steel shoe, and can be renewed in a few minutes. There is nothing in the slipper brake which is likely to get out of order, but it is necessary to examine the flexible connections daily to insure their being in perfect condition.

Exhaustive tests have been carried out with this brake, and the makers believe that it is the most powerful emergency brake on the market, while on the other hand it can be so easily controlled that it can be used with considerable advantage as an ordinary service brake. It has been found that a considerable saving is effected in the cost of maintenance of car wheels and tracks where this slipper brake is in use.

GARBAGE CARS ON SAVANNAH ELECTRIC RAILWAY

The Savannah Electric Company will shortly place in service on its lines six dump cars, each of 30,000 lbs. capacity, which will be used for hauling garbage under a contract with the city of Savannah.

These cars are of the side-dump pattern, with a raised letter "A" floor and a water-tight false bottom. The cars are to be set under a loading platform on which the city wagons will be driven and the garbage dumped directly into the cars through hatches on their roofs.

This loading work will be carried on during the day, and drains in the bottom of the cars will, in the meantime, be left open to allow the liquid material to drain into the sewers. At night, after the traffic ceases, the cars will be hauled to the county farm, which is about 3 miles from the city. An elevated track has been built on this farm. The cars will be run on this trestle and their contents dumped. The material will then be picked over by the county convicts. All matter suitable for fertilizing will be used on the county farm, and salable pickings will be sacked up and sold by the county.

SPIRAL JOURNAL BEARINGS

A journal bearing which has become well known among steam railroads and is now beginning to find more extensive use among electric railroads because of the increasing weight and speed of cars which are being employed, is the spiral journal bearing made by the St. Louis Car Company. This bearing is now usually put on the journal boxes of the heavier trucks manufactured by that company. The greater part of its business in spiral journal bearings in years past has been with steam railroads, which are quick to appreciate anything that will relieve the tendency to hot-boxes, which are likely to be so troublesome with heavy cars and high speeds. The construction of this journal bearing is illustrated by the four figures herewith. Fig. 3 is a malleable iron back. Fastened to this back is a skeleton bronze lining, Fig. 1, from which the spiral journal bearing gets its name. Around and over this skeleton bronze lining is poured babbitt metal, so that the journal, when

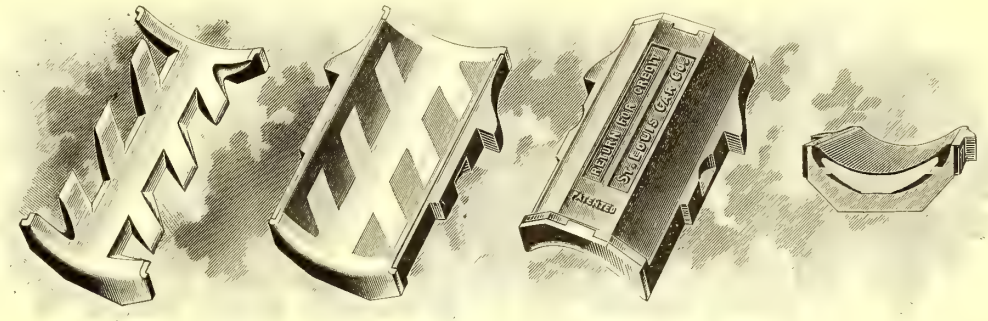


FIG. 1.—SKELETON BRONZE LINING

FIG. 2.—BEARING SURFACE AFTER LEAD LINING IS WORN THROUGH

FIG. 3.—BACK VIEW

FIG. 4.—SECTIONAL VIEW

finished, is in section like Fig. 4. After the babbitt is worn out of the bearing it presents the appearance shown in Fig. 2. That is, part of the bearing is on the skeleton bronze lining. The bearing is not renewed as soon as the babbitt is worn through, as is likely to be the case with the common journal bearing. The malleable iron backs and bronze linings, of course, last indefinitely. The babbitt is the only part that it is necessary to renew.

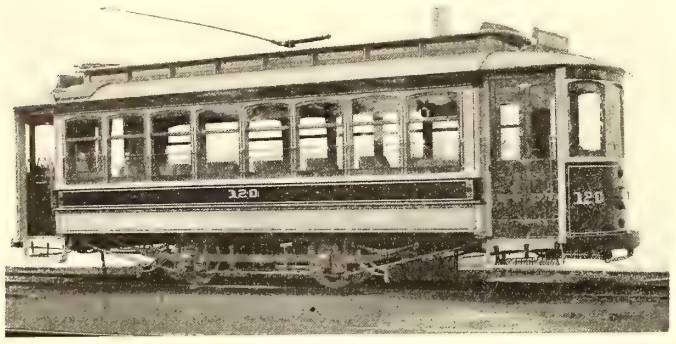
CLOSER INSPECTION REQUIRED

Only a few days ago the air brakes on a car equipped with 200 hp in motors failed to work near a cross-over in a prominent Eastern town, and a collision occurred, which, fortunately, caused no loss of life. In a section of an adjoining city an electric light pole crashed into the street, barely missing a death-dealing blow to a crowd of passers-by. When the pole was examined it was found to be so rotten that an ordinary pencil could be pushed far into it.

Such incidents ought not to pass unheeded by the operating companies' management, and illustrate the never-failing truth that upon eternal vigilance depends the safe and successful operation of great and small industrial enterprises. There are some accidents which human skill seems powerless to forestall, but the two quoted above are not of that order.

SEMI-CONVERTIBLE CARS FOR NASHVILLE

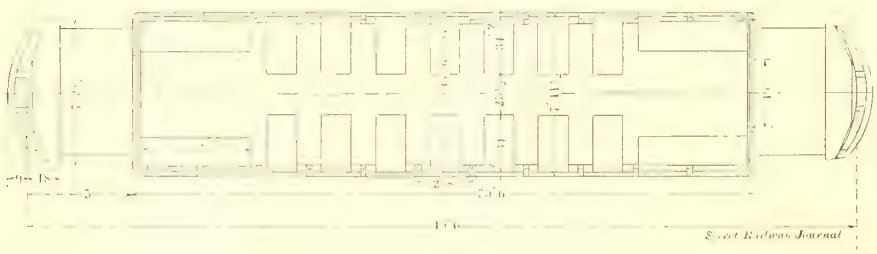
The J. G. Brill Company recently shipped twenty-five semi-convertible cars of its patented type to the Nashville (Tenn.) Railway, fifteen of which have 30-ft. 6-in. bodies, and ten



SINGLE-TRUCK SEMI-CONVERTIBLE, FOR THE SOUTH

measure 22 ft. 7 ins. These cars are shown in the accompanying illustrations. The cars are intended for city and suburban service, and therefore the step heights were arranged to be as easy as possible to facilitate ingress and egress, and the longitudinal seats at the doors of the longer cars doubled in length to prevent crowding at these points. Wherever a transverse seating arrangement is desirable the builders claim that the features of this type make it especially suitable. The absence of wall window pockets, by reason of the roof pocket storage of windows, has enabled in this case the use of an unusually low window sill. From top of floor to top of window sill is but 25 ins., giving a large window opening and adding much to the comfort of the cars in warm weather. The window sill is too low to be reached by the elbow of a seated adult passenger, and, therefore, an arm-rest is bracketed to the side lining just below the sill, and of a length not to interfere with the window lifts. Simple as it is this arm-rest is an important item, and was specially devised recently by the builders, and a patent applied for. A removable net window guard is an excellent feature in connection with the low window sill.

The interiors are richly finished in cherry with bird's-eye maple ceilings undecorated. The vestibules are also finished in cherry. The doors are double and have openings 40 ins. wide. The lower window sash is 25½ ins. x 29⅝ ins., and the



SEATING PLAN FOR LARGE SEMI-CONVERTIBLE CAR

upper, 17¼ ins. x 29⅝ ins. Spring-cane walk-over seats are 34 ins. long, and 65-in. longitudinal seats are placed at the corners of the long cars. The seats are brought against the side linings between the posts, leaving the aisle 23½ ins. wide. The windows in the ends are arranged to drop into pockets, as are also the vestibule windows. The platform knees are reinforced with angle-iron and protected and strengthened at the ends with angle-iron bumpers of the builder's patented type. The four steel rafters at the center of the cars, under the trolley base, are extra heavy, to enable the roof to support 500 lbs. extra which may be placed upon it in the future.

The dimensions of the larger cars are as follows: Length over corner posts, 30 ft. 6 ins.; length over vestibule dashers, 40 ft. 6 ins.; length over bumpers, 42 ft.; width over sills, 7 ft. 8 ins.; width over water table (*widest* part of car), 8 ft. 1½ ins.; height from under side of sill over trolley board, 8 ft. 8⅝ ins. Length of platforms, 5 ft.; length of steps, 3 ft. 6 ins. From center to center of posts, 2 ft. 8 ins.; thickness of side posts, 3¼ ins.; corner posts, 4½ ins. x 5½ ins. Distance between bolster centers is 18 ft. 8 ins.; under truss rods, 1⅛-in. diameter, are secured at bolsters. Side sills of long-leaf yellow pine are 4¾ ins. x 7¾ ins., plated on the inside with ⅜-in. x 12-in. steel, turned on end sills 6 ins. White oak end sills are 5¼ ins. x 6⅞ ins. Four cross sills are 3⅜ ins. x 4¼ ins., and two needle beams, 4½ ins. x 5½ ins. A large water-proof tool box is secured under the center of these cars. The trucks are Brill 27-G, with 4-ft. wheel base, 33-in. wheels. Each truck is equipped with two 38-hp motors. Weight of a truck is, without motors, 5725 lbs., with motors, 10,665 lbs. Total weight of car, trucks and motors, 40,700 lbs. The seating arrangement is shown in the accompanying plan.

The dimensions of the shorter cars are as follows: Length over corner posts, 22 ft. 7 ins.; length over vestibule dashers, 32 ft. 7 ins.; length over bumpers, 34 ft. 1 in. Length of platforms is 4 ft. 6 ins.; length of steps, 3 ft. Width and height are the same as longer cars. Side sills are 4½ ins. x 6 ins.; wheel pieces, 4¼ ins. x 4 ins., plated with angle-iron, ⅜ ins. x 3½ ins. x 6 ins.; end sills, 3½ ins. x 6⅝ ins.; cross sills, 3½ ins. x 5½ ins., plated with ½-in. x 2½-in. steel. These cars are mounted on Brill 21-E trucks, with 7-ft. 6-in. wheel base and 33-in. wheels. The trucks are equipped with two 38-hp motors. Weight of truck without motors is 5165 lbs.; with motors, 10,000 lbs. Total weight of car, truck and motors is 23,100 lbs. All the cars are furnished with radial draw-bars, "Dumpit" sand-boxes, "Dedenda" gongs and other patented specialties of the builders' make.



LARGE SEMI-CONVERTIBLE CAR FOR NASHVILLE

The summer season is in full blast at East Lake, the summer resort maintained by the Birmingham Railway, Light & Power Company, of Birmingham, Ala. To meet the traffic demands Manager J. B. McClary, of the railway department, has put on a fast night schedule. East Lake is 7 miles from Birmingham, and the old running time of 40 minutes has been reduced to 15. A few days ago, on a regular trip timed for speed, the car that left the city at 8:20 pulled into the station at East Lake at 8:35. This trip, too, was made with a dozen stops for railroad crossings. The track is 90-lb. steel on 14 ins. of slag ballast.

ANNUAL CONVENTION OF THE MUNICIPAL TRAMWAYS ASSOCIATION OF GREAT BRITAIN

The first annual conference of the Municipal Tramways Association of Great Britain was held on July 8 and 9 in the Council chamber of the magnificent Municipal Chambers of the City of Glasgow, which had most kindly been put at the disposal of the association by Lord Provost Sir John Primrose and the members of the Glasgow Corporation. The association was formed about a year ago, but outside of committee meetings to arrange the objects of the association, and decide upon those members of corporations and local authorities eligible for membership no actual conference had previously been held. This first meeting, under the presidency of Mr. John Young, of Glasgow, is consequently the first actual meeting of the kind in Great Britain, and marks a new era in municipal ownership of tramways, and the diffusion of that general information so necessary for their successful operation. The executive committee for the past year, 1902-3, consisted of the president, John Young, Glasgow; the vice-president, C. R. Bellamy, Liverpool; the secretary and treasurer, J. M. McElroy, Manchester, and J. Aldworth, Nottingham; A. Baker, London; A. L. C. Fell, Sheffield; J. B. Hamilton, Leeds; E. Hatton, Salford, and F. Spencer, Halifax, members of committee. A full report of the papers read at the meeting is given below, and it is only necessary to state here that a very full attendance was manifest when Mr. Young called the conference to order on Wednesday morning, punctually at 11 o'clock. It was interesting to learn that nearly all the corporations operating tramways had joined, the membership now being ninety-three.

The first paper presented was in the shape of a report by J. Dalrymple, the able accountant of the Glasgow Corporation Tramways, on the Standardization of Tramways Accounts, accompanied by the presentation of a suggested form of accounts, so that each corporation could readily compare the expenses of the various departments with those of other corporations. This form had been drawn up after communicating with all the members of the association, and with the treasurers of other associations, in other countries. It had been confidently expected that Mr. Duffy, of the Street Railway Accountants' Association of America, would be present to give valuable information on this point, but unfortunately at the last moment he found it impossible to get away. The vexed question of depreciation was specially recommended to be left out of the discussion, and though there were a few minor differences of opinion, it appeared to the members discussing the report that the suggested form was a very good one, and a sub-joint committee was formed to act with the Burgh Treasurers' Association to fully consider and recommend a standard system of tramway accounts.

An able report by Mr. Baker, of London, was then read on the Hours of Labor, etc., of Tramway Employees, and largely discussed by the members present. Fifty-four hours a week was generally conceded to be about right for motormen and conductors, though there was a wide difference of opinion as to whether a motorman ought to have more wages than a conductor.

After luncheon, served in the City Chambers, a report on Permanent Way Construction and Maintenance, prepared by Mr. King, of Glasgow, was submitted by the chairman, and widely discussed, especially with regard to the question of rail-joints. Some members were of opinion that sooner or later some method of bolting the rails down to the concrete bed would be adopted.

In the evening a dinner was tendered to the members in the magnificent banquet hall of the City Chambers, at the invitation of the tramways committee of the Glasgow Corporation, Lord Provost Sir John Primrose presiding. The dinner proved to be a most enjoyable function, the Lord Provost especially making a most eloquent speech in favor of municipal tramways, reminding all the members present of the responsibilities which attached to their labors, and the great work of the amelioration of the masses and the improvements in the cities in which they were working, by the tramway systems in which they were individually engaged. Sir John succeeded in placing the tramway enterprise on a high plane of civil life, and stirred the best sentiments in those present to redoubled effort. John Young came in for many thanks in the course of the evening for the uniform courtesy which he has extended to visiting delegates, and also for the able management which he has shown in the conduct of the Glasgow tramways.

Previous to the conference being resumed the business meeting was held. The vice-president, C. R. Bellamy, general manager of the Liverpool Corporation Tramways, was elected president in succession to Mr. Young, and Alfred Baker, chief officer of the London County Council Tramways, was appointed vice-president in room of Mr. Bellamy. Six new members were elected to the executive committee—namely, Councillor Walter Paton, Glasgow; Councillor Boyle, Manchester; and Councillor Smithson, Leeds, as representing Corporations; and Mr. C. J. Spencer, Bradford; H. England, Sunderland; and P. Fisher, Dundee, as representing tramway managers. The conference of 1904 was fixed to be held at Liverpool.

On Thursday C. J. Spencer, of Bradford, read a most interesting paper, which he had very hurriedly prepared on Tramway Conditions in America and Great Britain, which opened almost too wide a subject of discussion, every point in tramway management, from the universal fare of America, as compared with the fares by stages in Great Britain, and the use of half-penny fares, to the smallest detail in overhead or track construction, being eagerly discussed.

A paper on Selection and Training of Motormen and Conductors was then presented by L. MacKinnon, traffic superintendent, Glasgow Tramways, was then taken as read, the time being short.

After luncheon, again served in the City Chambers, special cars took the members to the Pinkston power station, and by a circuitous route through the west end of Glasgow to the Corporation Car Works, on the south side. In the evening an informal dinner of the association was held in the banqueting hall, Mr. Young presiding, Sir John Primrose and Lady Primrose being present as guests. Many other ladies were present, and it is safe to say that never was a more enjoyable evening spent, as the press not being present (at least as members of the press) most informal speeches and songs followed, and a thoroughly happy evening was spent. The succeeding day was devoted to pleasure, an excursion to Inverary on the turbine steamer "King Edward" being arranged for and taken advantage of by almost all the delegates and their ladies who could possibly stay. Though not particularly favored by the weather, except on the homeward way, when coming through the beautiful "Kyles," yet all appeared to enjoy themselves thoroughly, in spite of the Scotch mist, doubtless assisted by other Scotch productions of strongly antidotic tendencies.

It is, perhaps, not out of place here to say that undoubtedly the association has now taken strong root, that it is founded on the proper lines, and will in time work an immense amount of good, especially in the way of that standardization in all departments so much needed, and evidently the lack of which is not yet sufficiently comprehended by the various corporations or their consulting engineers, and which prevents that unity of enterprise, that interchange of traffic and that economy of operation which must follow its more general adoption. Finally, we have to thank Mr. Young and the members of the association for a most enjoyable time in their midst, and for the many acts of courtesy extended to us.

THE SELECTION AND TRAINING OF MOTORMEN AND CONDUCTORS ON THE GLASGOW CORPORATION TRAMWAYS

BY L. M KINNON, TRAFFIC SUPERINTENDENT, GLASGOW

In Glasgow the selection of these men is attended to personally by the traffic superintendent. This necessarily entails a considerable amount of work, and takes up a good deal of time, but the advantages of this method more than compensate for the extra labor. The superintendent thus knows his own men thoroughly from the very start, and by choosing the best class of men for the service his work is afterwards very much lightened. Roughly speaking, three applicants are found to be unsuitable for every one whose application is worth considering, and out of those whose applications are considered only about 40 per cent. are finally accepted, and enter the service of the department.

No man is engaged as a motorman or conductor who is under twenty-one years of age, and it is the endeavor of the department to obtain the services of young men.

When the traffic superintendent considers that an applicant, from his general appearance and from his replies to a few preliminary questions, will make a good servant, he hands him two schedules to be filled up in the applicant's own handwriting. The first schedule, or application form, requires the applicant to give particulars of his employment for previous five years. The second or supplementary schedule requires the applicant to answer the following questions:

1. Are you at present in good health?
2. From what ailments have you suffered? (Mention only those which lasted more than one week.)
3. Have you ever had:
   Rheumatism?
   Spitting of blood?
   Fits of any kind?

4. Have you ever met with a serious accident?

5. Have any of your parents, brothers, or sisters died of consumption?

6. Have any of your parents, brothers, or sisters suffered from insanity?

7. If you are married, please say if your wife is in good health, or what ailments she has suffered, or is suffering, from.

When these schedules are received back at the head office, former employers are communicated with, and in the event of the replies received being satisfactory, applicant is called to head office on a Friday morning at 9 o'clock. During the forenoon he is tested by one of the officers of the traffic department for eyesight, color sense, hearing, and general intelligence.

For eyesight, "Snellans'" test card is used. The applicant is placed at a distance of 12 ft. from the card and asked to read the bottom line on same, the type being 3-16-in. long. If he is able to do this promptly he is marked "V. G." Those who are able to read the bottom line on card at a greater distance than 12 ft. are marked "Ex." The second line on card is ¼ in., and applicants who are only able to read this line are passed and marked "G." All men unable to read this line are rejected. Each eye is tested separately, and the usual test is also applied for astigmatism.

For color sense variegated wools were used for a long time, but lately "Rumbles'" test for color blindness has been adopted. This is a large card with two small circles near the top. At the back of the card two discs are attached with a series of colors in celluloid. When the card is held before a window or artificial light and the disc turned, the various colors are shown through the circular holes, and the applicant is required to name them, and also to match the colors shown on one circle with the colors shown on the other. In examining men, especially from the country, cases of color ignorance are often found, which should not be confounded with color blindness.

Hearing is tested with a small ratchet operated by the examiner while the applicant stands at a distance of 10 ft. from him, and each ear is tested separately. Location of sounds is also tested by buzzers operated by the examiner.

When the applicant has passed satisfactorily through the preceding tests, he is afterwards asked to write a report on a subject set by the examiner. If this is also satisfactory, he is instructed to return in the afternoon to be examined by the medical officer.

The instructions to the medical officer are as follows:

The medical officer will reject applicants for any of the following: Tubercular disease; constitutional syphilis; bronchitis; heart disease; generally impaired constitution; loss of teeth, if numerous; deformity of chest, or joints, including flat foot; abnormal curvature of spine; hernia; hæmorrhoids; varicose veins or varicocele beyond a limited extent; obstinate skin disease; chronic ulcers; fistula; or any defect or disease unfitting applicant for employment either as conductor or motorman.

Should the applicant get through all these tests, he is put under training as a conductor for eight days, during which period he is paid full wages. The best qualified conductors at each depot take charge of the learner and train him carefully in his duties. During his period of training he is expected to have a turn on all the routes operated from the depot at which he is trained, and he is frequently visited by an inspector, who observes his progress. At the end of his period of training, if satisfactory, the probationer's practice note is signed by the men who have been teaching him, and he undergoes an examination by a ticket inspector, who also signs the practice note, if satisfied. On presentation of this note at the head office, the applicant is engaged. All the men are finally seen by the general manager.

After a period of satisfactory service as conductor—generally about six months—each man is withdrawn from the cars and put under training as a motorman.

In Glasgow a fully equipped school for training motormen has been fitted up at the Coplawhill Car Works, where the men are trained by an experienced engineer.

The period of training extends over twelve days, during which full wages are paid to the men. A single truck car of the standard type is erected over an inspection pit and supported on blocks so that the motors and gearing may be seen in operation. The car body is simply a skeleton which is mounted on a truck. All motor cables and lighting wires are painted in distinctive colors. This enables learners more readily to understand the general scheme of connections and location of various switches, fuses, etc. The braking gear and sand apparatus can easily be inspected. The car has a movable floor, so that the motors may be laid open for examination. On the platform a series parallel controller is erected with the usual operating gear, and glow lamps are connected across the motor terminals so that the action of the controller may be more easily understood. The trolley is connected to a "live" wire supplying the necessary current for motors and lights. The school is also equipped with samples of each trolley pole and standard used on the cars.

On a long platform at the side of the school, opposite the car, ten controllers and brake handles are erected in the same position as they are fitted on the cars, and samples of all types of controllers in use on the system are fitted up for examination and inspection. The brake spindles on the platform are each connected to a strong spring, so that their action is practically the same as the actual car brake.

Large diagrams showing controller connections are used to explain the action and proper working of the controllers and electric brakes, and men are also instructed in the use of a telephone similar to those erected at various points on the system.

The class in the school generally consists of twelve or fifteen men. From 25 per cent to 30 per cent fail to pass the necessary examination. Each man is supplied with instruction book, and during his first three days' tuition he attends the school. On the first day the instructor carefully explains the use and action of the various appliances fitted on the car, and shows how the mechanism should be operated. Learners are also drilled by means of the fixed controllers and brake already referred to, and the correct manipulation of the handles is explained, particular attention being paid to correct methods of acceleration and braking of cars for service and emergency stops.

On the second day the men are taught how to detect common faults in the car equipment, and also what to do in the event of any breakdown in the electrical apparatus or overhead gear. On the afternoon of the second day all the points taken up are again gone over and a preliminary examination made to see how each man is progressing.

On the third day the class is taken out to Coplaw Street, where a depot connection with a considerable grade has been laid. Here the men are tested on a special school car fitted with magnetic and rheostatic brakes. Each man is carefully coached in running the car both backwards and forwards, and every possible care is taken to instruct the men in all points relating to practical operating of the cars. Men are also taught to handle live wires and how to make them "dead" when necessary.

For the next four days—that is, on the fourth, fifth, sixth and seventh days—the learner is out on the road under the care of an experienced motorman, who has, after examination, been authorized to instruct learners. He here learns to handle the car through traffic. The learners are frequently visited on the road by the motor inspectors, who make notes of the progress shown, and report to the chief instructor.

On the afternoon of the seventh day the learner goes back to school for a preliminary examination in his knowledge of car details and platform duties, unsuitable men being rejected and returned to conducting. The next three and a half days are again spent on the road, under an experienced motorman, and special attention is given to those men who have shown signs of nervousness or carelessness. The afternoon of the twelfth day is taken up with an examination conducted by the chief instructor at the school, when suitable men are passed, and their lines forwarded to head office. As the tramway system has been steadily extending, there have been for some time past about forty men under instruction each month.

A system has been instituted in Glasgow of examining each motorman or motorman-conductor once every three or four months, and men who fail to answer questions satisfactorily at this examination are withdrawn from the list of motormen. These periodical examinations are absolutely necessary on a large system, as it is impossible for the superintendent otherwise to get at the undesirable. Some men who qualify will forget all they have learned within a very short time. A periodical examination every three or four months has also been instituted for conductors. This examination embraces all the rules laid down as to the duties of conductor.

It will be admitted that every possible precaution is taken to secure the very best possible material for motormen, and there is no doubt that the stringency of the examination before admitting men to the service has tended towards getting a better class of men into the department, and it has also had the effect of making those who secure situations value them more highly.

The Public Service Corporation of New Jersey has adopted as standard for its cars a yellow upper-body with an orange underbody and slate-colored trucks. The combination is extremely pleasing and harmonious, and does not show the dust and wear so readily as does the color scheme in use at present. As a matter of fact the new color scheme is similar to that in use in New York, St. Louis and Detroit. On each car will be painted in dark letters, edged with gilt, the name, "Public Service Corporation."

HOURS OF LABOR AND RATES OF PAY OBTAINING

BY ALFRED BAKER, CHIEF OFFICER, LONDON COUNTY COUNCIL TRAMWAYS

In this paper Mr. Baker confined himself to the pay of conductors and motormen and gave the statistics printed below. He states that, with only one or two exceptions, every town has adopted a graduated scale of pay for drivers and conductors, new men starting at the lowest rate and rising to the maximum by length of service varying from six months to three years. Taking the maximum rate of pay in all cases for motormen and conductors, the average over the whole country is as follows: Motormen, 6¼d. per hour; conductors, 5¼d. per hour. This works out, taking 60 hours a week as the standard, at 31s. 3d. for motormen and 26s. 3d. for conductors.

Out of the 33 towns observed only two, viz., London and Glasgow, pay motormen and conductors equal wages. In the remaining 31 towns motormen are paid at higher rates than conductors. For this he does not see any legitimate reason.

Placing the towns in order according to the wages paid, the list comes out as follows:

Towns	Motormen per hour	Conductors per hour
London County Council	7½d.	7½d.
Brighton	7d.	5½d.
Manchester	7d.	6¾d.
Halifax	7d.	5¾d.
Glasgow	6¾d.	6¾d.
Huddersfield	6¾d.	5½d.
Rotherham	6¾d.	5¼d.
Birkenhead	6½d.	5½d.
Burnley	6½d.	5½d.
Cardiff	6½d.	5¾d.
Bradford	6½d.	5½d.
Nottingham	6½d.	5¾d.
Sunderland	6½d.	5d.
Leeds	6¼d.	5d.
Rochdale	6¼d.	5¾d.
Wallasey	6¼d.	5½d.
Blackpool	6d.	5½d.
Bolton	6d.	5½d.
Darwen	6d.	5d.
Dundee	6d.	5d.
Oldham	6d.	5d.
Portsmouth	6d.	5d.
Southport	6d.	5d.
Stockport	6d.	5d.
Warrington	6d.	5d.

Other towns slightly less.

With regard to hours of labor the position is different. Glasgow, Doncaster, Cardiff, Plymouth, Halifax and Manchester have adopted a nine-hour day, 54 per week. Warrington and Darwen follow with 56 and 57 hours per week, respectively, while all the remainder, with the exception of three, have set up the 60 hours' standard. With regard to these three, it is only fair to say that considerable reductions in the hours of labor have been made as compared with the companies who worked the undertakings previous to the corporations obtaining possession. In one case the men worked under the company as much as 91 hours a week; this has been reduced to 65. In another 95 hours a week were worked; this is reduced to 63. In the third case 81 hours has been reduced to 64¼. I am quite sure that in some towns the men would rebel at anything less than 60 hours a week; that is, if the reduction involved a diminished earning capacity. I believe that having had their hours reduced to reasonable limits the tendency of the men will be rather toward increased rates of pay.

In the course of his inquiries Mr. Baker found only one town where preferential treatment seems to have been meted out to tramway men, even as against employees of the same corporation. Here the men work 54 hours a week, but are paid time and a half for Sundays, double time for bank and national holidays, and an attempt is being made to classify Good Fridays and Christmas Days as national holidays. Besides paying the men who work on bank holidays double pay, the men who do not work are paid a day's wages. He believes that every town must pay its men according to local conditions, and if it is the practice in the neighborhood to deal with the workmen in this magnanimous way there is nothing further to be said. If this policy is improperly forced on the corporation he considers that municipal tramway enterprise in this country is seriously prejudiced, besides which a grave injustice is being done to the ratepayers.

TRAMWAY CONDITIONS IN AMERICA AND GREAT BRITAIN COMPARED

BY CHRIS. J. SPENCER, GENERAL MANAGER OF THE BRADFORD CORPORATION SYSTEM

I was in the United States and Canada in the latter part of April and the early part of May, 1902, and while there visited the cities of New York, Pittsburg, Cleveland, Buffalo, Boston, Philadelphia, Toronto and Montreal, so that the impressions gathered of American and Canadian practice were from the above mentioned places. My British comparison was the state of affairs in Bradford, a city in the West Riding of Yorkshire with a municipal tramway system of about 230 cars serving a population of 281,000 (each of whom has a different opinion on tramway administration) scattered over an area of 22,800 acres of very hilly ground, so that the lines in Bradford present, in addition to traffic problems, engineering difficulties.

FARES

I found that in the majority of cities the fare problem, as we know it in England, did not exist. We all no doubt have met the man who requires a stage 100 yards or so further along the route, nearer a point where he happens to live. Not, of course, because it would in any way benefit himself, but for the welfare of the city. On the other side of the Atlantic the universal 5-cent fare does away with the stage system. I believe that to this universal fare system, the Americans owe a great measure of their success. We all know that tramways are achieving a great social reform in this country—that the health and happiness of the community is being directly benefited by the removal of the crowded population from the restricted area of the center to the broad acres of the suburb. To achieve this, cheap long-distance fares have to exist.

Unfortunately in England the 1d. seems to be the only universal fare that can be considered, and as most systems depend upon the receipts from the short distance passenger, it is often found that traffic returns will not allow more than about 2 miles for this fare. The possibilities of the nimble 1d. are certainly wonderful but they are limited. Compare this with the American (2½d.) fare. We must remember that the receipts from the short distance passengers are 150 per cent. higher than we obtain in England.

Not many tramway committees would, I venture to suggest, consider very long what to do did they know tnat their passengers would be willing to pay 2½d. where they now pay 1d. for short distances, on consideration that all stages be abolished. True, wages and perhaps some other expenses are higher in the States than here, but not by any means are they pro rata with the fares. Apart altogether from the outcry of the public, an increase in the minimum fare on British tramways would not pay. Englishmen will walk short distances rather than pay even 1d. Scotchmen, I am informed, are much worse; not so the American; he realizes that time is money, and that the expenditure of a 5-cent fare is small compared with the saving of time. I have heard it suggested that the street railway companies always manage to have the streets in a state that makes walking nearly a craze for the bold and brave. I have, however, no evidence to offer on that point, and do not desire to commit myself. We are, it is said, being Americanized, and perhaps even the American universal fare will yet come as a boon and blessing, and a balm for all our sorrows in respect to fares.

FARE COLLECTING

Everything in America appears to be standardized, and the system of fare-collecting is no exception to the general rule. No conceivable system could be simpler. The conductor receives his 5 cents and registers the fact on a clock face indicator, by pulling the indicator cord running the full length of the car. The check. I was informed, is the fear of the unknown passenger, who can easily see if any roguery is taking place. Should a man be reported by a "spotter" for sharp practice, his chances for further employment as a car conductor for the company by which he was employed, or any other, are remote. His photograph is sent round to each line along with the cause of his dismissal. On the face of it this system seems good and should be very effective, though one is inclined to think that the amount of power in the hands of the spotter is a trifle excessive. Yet I regret to state I saw three or four distinct cases of fraud on street cars. In two cases my own fare was taken by the conductor, who failed to register it.

I had the pleasure of discussing the matter with a street railway manager, who admitted freely the weaknesses of the system. I naturally asked if the bell-punch and tickets had been tried, and he replied, "Yes, but I guess it takes too much gilt off the nickel." I also asked if they had tried a locked fare box, similar to what we use in Bradford, and those I had seen in Montreal and Toronto. His reply was "Yes, and that would have been all right, but our

passengers thought the conductor was carrying a spittoon, and used it for that purpose." Fare-collecting systems are determined by the conditions that determine fares, so that a simple system similar to the American is only possible where fares are simple also.

TRAFFIC CATERING

So far as the frequency of service, etc., is concerned, I saw nothing different to the usual practice in this country; the service run on any particular section is determined by the earnings per car mile. Americans are, perhaps, as may almost be expected, just a little more enterprising in this direction than the average tramway manager here. For example, in one city visited I noticed on a traffic return sheet that a certain section was earning not more than 6 or 7 cents (3d. or 3½d.) per car mile, and that a fairly good service was being run. Upon inquiry I found that this particular section had been laid for the purpose of developing an estate, which I presumed was owned by the street railway company.

PLEASURE TRAFFIC AND ADVERTISING

Our traction friends of the States quite appreciate the effect of good pleasure attraction at the outside terminus of a line. In many places I found street railway companies owning and running pleasure parks, etc., and advertising with due modesty the wonderful beauty and suitability for pleasure purposes. In these matters we certainly have something to learn. I believe that many lines which are at present non-paying could be improved by a little judicious expenditure in the direction just mentioned.

SPEEDS

To mention speeds to a British tramwayman is almost like waving a red rag to a bull. It is unnecessary to state that speed limits in America are very different from what obtains at this side of the "pond." Though they are fixed by the various cities in which the street railway companies operate their lines, yet it seems to be recognized that the speed per hour allowed is the average schedule speed, and not the maximum attained between any two given points.

On the other hand, cars do not travel in the busy streets of the cities much quicker than they do here. I heard it stated, for example, that the average speed, including stops, was 10 miles per hour on Broadway, New York. I tested this one morning when I was in a hurry, but if the average speed exceeded 3 miles per hour on that occasion I am very much surprised; so I found that the American tramway manager can no more perform miracles than his English brother.

Much, however, is made of quick acceleration, and a good average speed is obtained more by this means than by running at the high maximum rate. The controlling pointer is shifted from the zero position to full speed in an incredibly short space of time, and it is as well that American passengers have become accustomed to it. I am afraid that did we in Bradford commence to accelerate our cars at such a rate as, say in New York, the number of nervous ladies clinging to stout old gentlemen, who in turn would be compelled to sit down hurriedly on the laps of other ladies, would, I am afraid, be appalling, and cause quite a public uproar. We have, however, something to learn with regard to acceleration, and I do not think its benefits have yet been fairly recognized in England. In Bradford I have for twelve months been gradually increasing the acceleration with a result that my average speed has increased from about 5½ to 6¾ miles per hour on all sections, and current consumption falling from 1.6 to 1.4 units per car mile. The passengers can be educated to the quick start, and its benefits are far reaching. True, the wear and tear on the equipment is increased, but to use a trite Americanism, "it pays."

We have been successful in Bradford in getting increased speed, and our maximum, previously 8, is now 12 miles per hour. We have had this granted, so say the Board of Trade, due to our good conduct, and it is held out that some time in the dim future, if our conduct is still good, that on certain quiet country roads we may be allowed to run as high as 16 miles per hour. I am afraid that by the time our conduct has attained such perfection nature will have provided for us wings, and new legislation for aerial navigation will be required.

OUTWARD APPEARANCES

In outward appearance the average American system does not strike an Englishman favorably. The overhead equipment is generally put up roughly, cheap and nasty. The cars are far from clean and the track in many instances bad. Neither can the average conductor be complimented on his civility. I must say that my remarks do not apply to all the systems I saw. Several are the very opposite, and rank, I should say, among the smartest and best tramway organizations of the world. After dealing with merely outside appearances, one must acknowledge that the facilities which the tramways give the public in the way of rapid transit from one point to another with frequent quick services, are excellent. In one case only did I see a slower service than a five minutes, and in the busy parts of the cities there was a continuous stream of cars going in both directions. In fact, every one seemed to be riding and no one walking. I am told that the American cannot afford to walk—he has not time. Trams are, therefore, to him not a luxury, but a necessity.

OVERHEAD EQUIPMENT AND PERMANENT WAY

I saw nothing in the overhead department very different from our standard practice here. I was very much interested in the different systems of permanent way construction—the electric welded joints in Buffalo, and cast welded joints in other cities visited, provided interesting matter for British consideration. As this subject, however, is being dealt with in another paper before the conference, it is unnecessary for me to go into further detail.

ROLLING STOCK

On the question of design, up-keep and care of cars, I found that matter stood pretty much the same as they are here. Engineers have different ideas, and work differently. In some cities I found the engineer advocated a regular overhaul of the equipment. At others it was considered good policy to allow the motors, etc., to run until they showed distinct signs that unless an immediate overhaul was made, a breakdown would occur. At Cleveland, Ohio, I found a system of inspection of equipments that I considered very good, and have since adopted the principle at Bradford, with excellent results.

Motors, controllers, etc., are examined daily while the cars are in service at some convenient terminus. It thus becomes unnecessary to employ a large staff of nightmen for inspection on small work repairs. The motor inspector notes any defect which is developing, and orders the car to remain at the repairing depot—he is better able to find and hear of the little faults in the daytime and during service hours. This, to my mind, seems better than either of the extremes, viz., waiting for breakdowns to know that something is wrong; or incurring heavy expenses by a regular and periodic overhaul.

I also found many useful practical hints, especially in the workshop and car-repairing department. As the majority of the workshops that I visited were originally built for other purposes, I did not find that the buildings themselves were very well adapted for the work for which they were employed. I found, however, all sorts of little plans of overcoming what might be termed natural difficulties, and a great number of labor-saving devices in the way of machinery employed to bring down the cost of running.

In all the workshops I came across a compressed air plant was in operation, which was used for various purposes; cars were swept out, motors cleaned, and building surfaces cleaned by air jets. Pneumatic tools—drills, chisels, hammers, lifts, etc., in successful operation, connected to the compressed air main laid in the shop. We have since my visit adopted a compressed air plant in our own repairing shops with corresponding benefits.

GENERAL

I fail to see that we are behind America in this country with regard to tramway matters, and while we may learn much from our friends across the Atlantic, yet in some things I feel that the Americans would equally benefit by a visit to this small island.

I desire to place on record my grateful thanks to those officials in the States who kindly placed so much information in my hands, and helped me in my inquiries. The uniform courtesy and friendliness that I received was very welcome to a stranger, and I hope that I may some time have the opportunity of reciprocating the kindness.

STANDARDIZATION OF TRAMWAY ACCOUNTS

BY JAMES DALRYMPLE, C. A., OF THE GLASGOW CORPORATION TRAMWAYS

As requested by the executive committee of the Association, I have the pleasure to submit herewith a report on Standardization of Tramway Accounts. From the report you will see I have considered it advisable to confine myself to a form of the annual financial statement, including revenue and expenditure account, capital account and balance sheet, with an appendix giving a complete classification of construction and equipment accounts and operating expense accounts. The purchasing, receiving and despatching of stores, and the recording of time and material might form the subject of another report.

I have been in communication with all the members of the Association, and with several financial officers of the corporations concerned, and have endeavored to draw out a form which

could be adopted by all municipal tramway managers and borough accountants in stating their annual tramway accounts. In so doing I have endeavored to adhere as closely as possible to the standard form which has been adopted by the street railways and steam railroads of America. The report on the uniform classification of working expenses presented at the meeting of the International Tramways Union in London in July, 1902, was also consulted in this connection.

I trust that at the meeting of the Association to be held in Glasgow the report will be fully discussed, and that it will be possible to adopt a standard form of tramway accounts, which can be brought into use during the coming year.

SUGGESTED STANDARD FORM OF ACCOUNTS

REVENUE ACCOUNT FOR YEAR FROM JAN. 1 TO DEC. 31, 1902

Kw-Hours, 1,920,000. Car Mileage, 2,181,819.

EXPENDITURE

DR.	Average per Kw-Hour d.	Average per Car-Mile d.	£ s. d.	£ s. d.
Power Expenses—				
1. Salaries and wages	.16	.15	1,363 12 9	
2. Fuel	.14	.13	1,181 16 4	
3. Water	.013	.012	109 1 10	
4. Oil and waste	.03	.027	245 9 1	
5. Miscellaneous supplies	.003	.003	27 5 5	
	.35	.322		2,927 5 5
Traffic Expenses—				
6. Superintendence	.07		636 7 3	
7. Wages of motormen and conductors.	2.27		20,584 8 3	
8. Wages of other traffic employees	.18		1,688 5 5	
9. Cleaning and oiling cars	.26		2,363 12 9	
10. Lighting cars	.017		154 10 11	
11. Cleaning, salting and sanding track	.05		454 10 11	
12. Fuel, power, light and water for depots	.03		272 14 6	
13. Ticket check	.13		1,181 16 4	
14. Uniforms	.08		727 5 5	
15. Miscellaneous	.039		354 10 11	
	3.126			28,418 2 8
General Expenses—				
16. Salaries of general officers and staff.	.14		1,272 14 7	
17. Auditors' fee	.004		35 0 0	
18. Store expenses	.02		181 16 4	
19. Rents of offices, etc	.03		272 14 6	
20. Local taxes	.31		2,818 3 8	
21. Property and income tax	.075		681 16 4	
22. Printing and stationery	.024		218 3 8	
23. Fuel, light, and water for offices	.006		54 10 11	
24. Legal expenses	.002		18 3 7	
25. Accident insurance (third party)	.12		1,090 18 2	
26. Employers' liability insurance	.012		109 1 10	
27. Fire and boiler insurance	.03		272 14 6	
28. Miscellaneous	.04		363 12 9	
	.813			7,389 10 10
Repairs—				
29. Track and roadway	.20		1,818 3 8	
30. Electrical equipment of line	.10		909 1 10	
31. Buildings and fixtures	.06		545 9 1	
32. Steam plant	.01		90 0 0	
33. Electrical plant	.01		91 16 4	
34. Workshop tools and sundry plant	.015		136 7 3	
35. Cars	.11		1,000 0 0	
36. Electrical equipment of cars	.22		2,000 0 0	
37. Miscellaneous equipment	.15		1,363 12 9	
	.875			7,954 10 11
Permanent Way Renewal—				
38. Permanent way renewal fund at £450 per mile of single track per annum.	.87			7,909 1 11
Depreciation—				
39. Electrical equipment of line	.30		2,727 5 5	
40. Buildings and fixtures	.17		1,545 9 1	
41. Power plant and sub-station plant	.35		3,181 16 5	
42. Workshop tools and sundry plant	.035		318 3 8	
43. Cars	.23		2,181 16 5	
44. Electrical equipment of cars	.23		2,000 0 0	
45. Miscellaneous equipment	.02		181 16 4	
46. Furniture	.008		72 14 7	
	1.343			12,209 1 11
Total amount of working expenses	7.349			66,807 13 3
Balance, carried to net revenue account, folio 5	2.71			24,601 8 10
	10.06			91,409 2 6

REVENUE

CR.	Average per Car-Mile d.	£ s. d.
Traffic Revenue	10.00	90,909 2 6
Sundry Revenue—		
Advertising	.06	500 0 0
	10.06	91,409 2 6

NET REVENUE ACCOUNT

DR.	Average per Car-Mile d.	£ s. d.
I. To Interest on Capital @ 3 per cent	1.03	9,390 0 0
II. To Sinking Fund—		
Sinking fund on £320,921 12 4 @ 2 per cent. £6,418 8 7		
Interest on £6,285 14 9 @ 3 per cent. 188 11 5	.73	6,607 0 0
	1.76	15,997 0 0
To balance, being net surplus carried to appropriation account	.94	8,604 8 10
	2.70	24,601 8 10
CR.		
By revenue account, folio 4	2.70	24,601 8 10
	2.70	24,601 8 10

APPROPRIATION ACCOUNT

DR.	£ s. d.
To amount carried to general reserve fund	12,000 5 6
To balance carried to balance sheet, folio 8	8,604 8 10
	20,604 14 4
CR.	£ s. d.
By net surplus for year to Dec. 31, 1901	12,000 5 6
By net surplus for year to Dec. 31, 1902	8,604 8 10
	20,604 14 4

CAPITAL EXPENDITURE ACCOUNT

Amount Expended on Capital Account for Year to Dec. 31, 1902

DR.	£ s. d.	£ s. d.
To Permanent Way (Track and Roadway)—		
Paid to account of various extensions during year		5,000 0 0
To Electrical Equipment of Line—		
Bonding	100 0 0	
Duct and manholes	1,000 0 0	
Feeder cables	1,500 0 0	
Poles and Rosettes	300 0 0	
Overhead wires	400 0 0	
		3,300 0 0
To Buildings and Fixtures—		
Brown Street Depot—paid to account	1,500 0 0	
Car works extension—paid to account	500 0 0	
		2,000 0 0
To Power Plant—		
Engines—paid to account	1,500 0 0	
Boilers—paid to account	1,000 0 0	
Switchboards—paid to account	500 0 0	
		3,000 0 0
To Cars—		
Fourteen cars, at £500 each		7,000 0 0
		20,300 0 0
CR.	£ s. d.	£ s. d.
By amount debited to capital account, folio 7		20,300 0 0

CAPITAL ACCOUNT

DR.	£ s. d.	£ s. d.
To Permanent Way (Track and Roadway)—		
Cost of construction as at Dec. 31, 1902		110,000 0 0
To Electrical Equipment of Line—		
Bonding	5,000 0 0	
Ducts and manholes	25,000 0 0	
Feeder cables	25,000 0 0	
Poles and rosettes	8,000 0 0	
Overhead wires	5,000 0 0	
Section boxes	1,000 0 0	
Telephones	200 0 0	
Miscellaneous	300 0 0	
	69,500 0 0	
Deduct—Depreciation as at last balance £2,500 0 0		
Deduct—Depreciation for year to Dec. 31, 1902 2,727 5 5		
	5,227 5 5	
		64,272 14 7
To Ground		15,000 0 0
To Buildings and Fixtures	50,000 0 0	
Deduct—Depreciation as at last balance £1,400 0 0		
Deduct—Depreciation for year to Dec. 31, 1902 1,545 9 1		
	2,945 9 1	
		47,054 10 11
To Power Station and Sub-Station Plant	50,000 0 0	
Deduct—Depreciation as at last balance £3,000 0 0		
Deduct—Depreciation for year to Dec. 31, 1902 3,181 16 5		
	6,181 16 5	
		43,818 3 7
To Workshop Tools and Sundry Plant	15,000 0 0	
Deduct—Depreciation as at last balance £318 3 8		
Deduct—Depreciation for year to Dec. 31, 1902 318 3 8		
	636 7 4	
		14,363 12 8
To Cars	25,000 0 0	
Deduct—Depreciation as at last balance £1,900 0 0		
Deduct—Depreciation for year to Dec. 31, 1902 2,181 16 5		
	4,081 16 5	
		20,918 3 7
To Electrical Equipment of Cars	25,000 0 0	
Deduct—Depreciation as at last balance £1,900 0 0		
Deduct—Depreciation for year to Dec. 31, 1902 2,000 0 0		
	3,900 0 0	
		21,100 0 0
To Miscellaneous Equipment—		
Sundry vehicles	700 0 0	
Horses	500 0 0	
Harness	70 0 0	
Uniforms	1,000 0 0	
Miscellaneous	1,000 0 0	
	3,270 0 0	

Deduct—Depreciation as at last balance	£181 16 4		
Deduct—Depreciation for year to Dec. 31, 1902	181 16 4		
		363 12 8	2,906 7 4
To Office Furniture		500 0 0	
Deduct—Depreciation as at last balance	£72 14 7		
Deduct—Depreciation for year to Dec. 31, 1902	72 14 7		
		145 9 2	
			354 10 10
To Parliamentary Expenses			10,000 0 0
To Preliminary Expenses			1,000 0 0
			350,788 3 6

CR.

	£ s. d.
By amount of capital account carried to balance sheet, folio 8..	350,788 3 6
	350,788 3 6

BALANCE SHEET

As at Dec. 31, 1902

DR.	£ s. d.	£ s. d.
To Capital Account—		
Amount of capital account as on folio 7		350,788 3 6
To Stores—		
General stores	5,000 0 0	
Depot stores	1,000 0 0	
Stores in power station	2,000 0 0	
Stores in car works	2,000 0 0	
Permanent way material	5,000 0 0	
Salt and sand	50 0 0	
Fuel	300 0 0	
Tickets	100 0 0	
Miscellaneous	100 0 0	
		15,550 0 0
To Sundry Debtors		1,000 0 0
To Unexpired Licenses		50 0 0
To Cash in Bank		100 0 0
To Cash on Hand		599 7 10
		368,087 11 4

CR.	£ s. d.	£ s. d.
By Amount Borrowed as at Last Balance	320,921 12 4	
Deduct—Amount of sinking fund applied in reduction of debt	12,891 14 9	
	308,029 17 7	
Add—Amount borrowed during year to Dec. 31, 1902	10,000 0 0	
		318,029 17 7
By Sinking Fund—		
Amount for year to Dec. 31, 1901	6,285 14 9	
Amount for year to Dec. 31, 1902	6,606 0 0	
		12,891 14 9
By Permanent Way Renewal Fund—		
Amount as at last balance	7,500 10 6	
Add—Amount debited to revenue for year to Dec. 31, 1902	7,909 1 11	
	15,409 12 5	
Deduct—Amount expended during year on renewal of permanent way	2,500 10 11	
		12,909 1 6
By General Reserve Fund—		
Amount transferred from appropriation account		12,000 5 6
By Sundry Creditors		3,431 16 9
By Prepaid Tickets—		
Value of tickets sold and in hands of public		220 6 6
By Appropriation Account—		
Net surplus for year to Dec. 31, 1902		8,604 8 10
		368,087 11 4

SUNDRY INFORMATION

Total borrowing powers	£
Borrowing powers exercised	£
Unexhausted borrowing powers	£
Gross capital expenditure	£
Capital expenditure, as reduced by depreciation	£

Mileage of Track—

	SINGLE			DOUBLE			TOTAL		
	Miles	Fur	Yards	Miles	Fur	Yards	Miles	Fur	Yards
Owned									
Leased									
Totals									

Population served by tramways	
Traffic revenue	£
Total revenue	£
Working expenses (excluding depreciation)	£
Working expenses (including depreciation)	£
Interest on capital	£
Sinking fund	£
Net balance	£
Disposal of net balance	£
Car miles	
Passengers carried	
Average number of cars in use for hour day	
Percentage of working expenses (excluding depreciation) to receipts	
Percentage of working expenses (including depreciation) to receipts	
Average traffic revenue per car-mile	
Average traffic revenue per mile of single track	
Average total revenue per car-mile	
Average car-miles per day per car	
Average speed per hour	
Average car-hours per day	
Average working expenses per car-mile (excluding depreciation)	
Average working expenses per car-mile (including depreciation)	

Scale of Fares—

	½d.	1d.	1½d.	2d.	2½d.	3d.	3½d.	Average Fare charged per mile
Aver. distance (miles),								

Average fare paid per passenger	
Average number of passengers per car-mile	
Average journeys per head of population per annum	
Numbers of cars in stock	
Total amount of sinking fund	£
Amount of sinking fund applied in reduction of debt	£
Amount of renewal fund	£
Amount of reserve fund	£

CLASSIFICATION OF CAPITAL ACCOUNTS FOR ELECTRIC TRAMWAYS

A.—Permanent Way (Track and Roadway).
B.—Electrical Equipment of Line.
C.—Ground.
D.—Buildings and Fixtures.
E.—Power Station and Sub-Station Plant.
F.—Workshop Tools and Sundry Plant.
G.—Cars.
H.—Electrical Equipment of Cars.
I.—Miscellaneous Equipment.
J.—Office Furniture.
K.—Parliamentary Expenses.
L.—Preliminary Expenses.

Account A.—Permanent Way (Track and Roadway)

Charge to this account all expenditure for track and roadway construction, including labor, materials, tools, freight, cartage, cost of grading, excavating, track laying, ties, yokes, slot rails, sewer manhole frames and covers, rails, rail fastenings, welded joints, special work (including crossings, crossovers, curves, frogs, guard rails, switches), concrete, paving, oils, pitch, gravel, chips, asphalt, bitumen, drain boxes, sewer boxes, F. C. traps, gratings, C. I. pipes, F. C. pipes, iron paving blocks, bricks, bolts and nuts, coal, cement, dog spikes, road metal, sand, spelter, F. C. syphons, lifting wood, fences, bridges, culverts, trestles, subways, tunnels, etc., engineering and superintendence, wages of clerks, timekeepers, watchmen, light and water, street improvements, and other expenses not detailed above.

The cost of tracks in car depots and other buildings should be charged to this account.

The cost of preparing rails for bonding should be charged to Account B.

Account B.—Electrical Equipment of Line

Charge to this account all expenditure for electrical equipment of line, including labor, materials, tools, freight, cartage, cost of preparing rails for bonding, rail bonds, ducts, manholes, poles, rosettes, cables, guard wire, span wire, strain wire, supplementary wire, trolley wire, ground feeders, underground feeders, pole fixtures, overhead appliances, conduit appliances, surface contact appliances, engineering and superintendence, wages of clerks and timekeepers, and other expenses not detailed above.

Account C.—Ground

Charge to this account cost of ground purchased for power station, substations, workshops, car sheds, offices, and other buildings used in operation of line.

Ground purchased to form tramway track should be charged to Account A.

Account D.—Buildings and Fixtures

Charge to this account all expenditure for buildings and fixtures, including labor, materials, tools, freight, cartage, and all other expenses incidental to the work.

Buildings and fixtures include power houses, sub-stations, car sheds, workshops, stores, stables, offices, waiting rooms, etc.

Account E.—Power Station and Sub-Station Plant

Charge to this account all expenditure for steam and electrical equipment of power station and sub-stations, including foundations for equipment.

The cost of buildings used for power station and sub-stations should be charged to Account D.

Account F.—Workshop Tools and Sundry Plant

Charge to this account all expenditure for shop tools and workshop machinery, car-shed tools, granary machinery, permanent-way plant, sand-drying plant, and other appliances, including foundations for same.

Account G.—Cars

Charge to this account all expenditure in the construction of cars from the operation of which revenue is derived.

The term "car" includes the car-body and truck and all fixtures or appliances inside of or attached to the car-body or truck.

The electrical equipment should be charged to Account H.

Account H.—Electrical Equipment of Cars

Charge to this account all expenditure for electrical equipment and wiring of all cars.

Account I.—Miscellaneous Equipment

Charge to this account cost of sundry vehicles, including water cars or carts, sand and salt cars or carts, store cars, snow plows, sweepers, lorries, vans, broughams, horses, harness, uniforms, cash boxes, ticket boxes, bell punches, etc.

Account J.—Office Furniture

Charge to this account cost of furniture for head office, sub-offices, etc.

Account K.—Parliamentary Expenses

Charge to this account costs of acts of Parliament promoted by the Corporation for tramway purposes.

Account L.—Preliminary Expenses

Charge to this account all preliminary organizing expenses not chargeable under any of the foregoing accounts.

CLASSIFICATION OF WORKING EXPENSE ACCOUNTS

POWER EXPENSES

Account No. 1.—Salaries and Wages

Charge to this account proportion of chief engineer's salary and all wages in the power station and sub-stations, except wages of men engaged in repairing plant. This account should include wages to the following employees: Superintendent of station, engineers, greasers, feed-pump attendants, stokers, coal and ash attendants, electrical engineers, switchboard attendants, motor attendants, basement attendants, cranemen, cleaners, boiler fitters, clerks and storemen, watchmen, sub-station attendants, sub-station improvers, sub-station cleaners.

ACCOUNT No. 2.—Fuel

Charge to this account all expenditure for coal or other fuel used at the power station, including freight, cartage, and removal of ashes.

ACCOUNT No. 3.—Water

Charge to this account cost of water for boilers and condensers.

ACCOUNT No. 4.—Oil and Waste

Charge to this account all expenditure for lubrication of power plant and sub-station plant, including oil, grease, waste, rags, etc.

ACCOUNT No. 5.—Miscellaneous Supplies

Charge to this account all sundry expenditure in the operation of the power station and sub-stations not detailed under the foregoing accounts. Material used in repairs should not be charged to this account.

The following is a list of some of the items chargeable to this account: Globe metal polish, emery and glass paper, brushes and mops, oil cans and spouts, soaps and sodas, tallow, turpentine, graphite, stenoline grease, pumice stone, ground black lead, bath bricks, chalk, squeegees, toilet rolls, twines.

TRAFFIC EXPENSES.

ACCOUNT No. 6.—Superintendence

Charge to this account salary of traffic superintendent and assistants.

ACCOUNT No. 7.—Wages of Motormen and Conductors

Charge to this account wages of motormen and conductors engaged in operation of cars.

ACCOUNT No. 8—Wages of Other Traffic Employees

Charge to this account wages of depot clerks, traffic regulators, trolley turners, points boys, etc.

ACCOUNT No. 9.—Cleaning and Oiling Cars

Charge to this account wages paid to car cleaners and oilers and costs of all cleaning material, brooms, brushes, buckets, chamois skins, dusters, mops, polish, soap, sponges, waste, disinfectants, oil, grease, etc.

ACCOUNT No. 10.—Lighting Cars

Charge to this account cost of power for light and incandescent lamps.

ACCOUNT No. 11.—Cleaning, Salting, and Sanding Track

Charge to this account wages of men employed in cleaning, salting and sanding track, cost of tools for cleaning track, salt and sand.

ACCOUNT No. 12.—Fuel, Power, Light, and Water for Depots

Charge to this account cost of fuel for depot offices, power for shifting cars, cost of lighting depots and water other than water for cleaning cars.

ACCOUNT No. 13.—Ticket Check.

Charge to this account cost of tickets, conductors' punches, wages of ticket inspectors, clerks in punch and ticket office.

ACCOUNT No. 14.—Uniforms

Charge to this account cost of uniforms supplied to traffic staff.

ACCOUNT No. 15.—Miscellaneous

Charge to this account cost of trolley rope, bell cord, commutator brushes for cars, tools for motormen, employees' badges and inland revenue and police licenses for cars.

GENERAL EXPENSES.

ACCOUNT No. 16.—Salaries of General Officers and Staff

Charge to this account salaries of general manager, accountant, and all officers and clerks not engaged exclusively in any one department.

ACCOUNT No. 17.—Auditors' Fee

Charge to this account fee paid to auditors for audit of books and accounts.

ACCOUNT No. 18.—Store Expenses

Charge to this account all salaries and expenses in connection with storeroom, including wages of vanmen conveying supplies from general store to depots and collecting scrap.

ACCOUNT No. 19

Charge to this account rental of head offices, sub-offices and wayleaves.

ACCOUNT No. 20.—Local Taxes

Charge to this account all local rates and taxes, including municipal rates, police rates, poor and school rates, etc., on the annual value of the tramways undertaking.

ACCOUNT No. 21.—Property and Income Tax

Charge to this account annual charge by the inland revenue authorities for income tax on profits and property tax.

ACCOUNT No. 22.—Printing and Stationery

Charge to this account all expenditure for printing and stationery supplies. The cost of tickets should be charged to Account No. 13.

ACCOUNT No. 23.—Fuel, Light and Water, for Offices

Charge to this account cost of coal and other fuel for head office and sub-offices, also cost of electric light, gas, and water for same.

ACCOUNT No. 24.—Legal Expenses

Charge to this account all legal expenses except those incurred in connection with damage claims.

ACCOUNT No. 25.—Accident Insurance (Third Party)

Charge to this account the annual premium on third-party policy or if claims are settled by the department the amount of claims paid and the legal expenses connected therewith.

ACCOUNT No. 26.—Employers' Liability Insurance

Charge to this account the annual premium on employers' liability policy, or if claims are settled by the department, the amount of claims paid and the legal expenses connected therewith.

ACCOUNT No. 27.—Fire and Boiler Insurance

Charge to this account the annual fire insurance premium and boiler insurance premium.

ACCOUNT No. 28.—Miscellaneous

Charge to this account any other sundry expenses not included in any of the foregoing accounts, including repairs to office furniture.

REPAIRS.

ACCOUNT No. 29.—Track and Roadway

Charge to this account all expenditure for repairs of track and roadway, of culverts and subways, of tracks in yards, depots, and other buildings, including wages, material, tools, fuel, light, water, freight, cartage, and other expenses in connection with this work.

The cost of taking up track, whether or not a new track is laid in its place, should be charged to this account.

The cost of preparing rails for repair of bonding, and of removing and relaying paving, etc., for repair of electrical equipment of line, should be charged to Account No. 30.

The cost of repairing harness and carts used in connection with this work should be charged to Account No. 37.

The proportion of feed and keep of horses used in connection with this work should be charged to this account.

The expenses of the permanent way yard, including wages of yardmen, would be distributed over the accounts benefited.

ACCOUNT No. 30.—Electrical Equipment of Line

Charge to this account all expenditure for repairs of overhead, conduit, or surface-contact electric line, including wages, material and tools employed or used in taking up, resetting, and repainting poles, taking down trolley, feed, guard and supplementary wires and substituting new, repairing conduits for wires, repairing rail bonding, removing and relaying paving for repairs of the electric line, repairs to ducts and cables, section boxes, etc.

The cost of repairs of electric line in yards, depots and other buildings should be charged to this account.

The proportion of feed and keep of horses in connection with this work should be charged to this account.

The cost of repairs of harness and carts and tower wagons used in connection with this work should be charged to Account No. 37.

ACCOUNT No. 31.—Buildings and Fixtures

Charge to this account all expenditure for repairs of buildings and fixtures used in connection with the operation of the tramways, including wages, material, tools, freight, cartage of materials, and all other expenses connected with this work.

The term "Buildings and Fixtures" includes power station and sub-stations, workshops, office buildings, waiting rooms, car sheds, stables, stores, etc., and all fixtures, including gas pipes, water pipes, drains, heating apparatus, lighting fittings.

The cost of repair of tracks in yards, car sheds and other buildings, should be charged to Account No. 29.

The cost of repairs of electric lines in yards, car sheds, and other buildings should be charged to Account No. 30.

ACCOUNT No. 32.—Steam Plant

Charge to this account all expenditure for wages, material, tools, freight, cartage of material, and all other expenses in connection with repair of steam plant, including engines and engine parts, appliances and fixtures, belts, belt tighteners and fixtures, receivers, lubricators and oiling devices, boilers, furnaces, economizers, pumps, feed-water heaters, tanks, condensers, coal and ash conveyors, mechanical stokers and, other boiler-room appliances, piping and steam fitting, including valves, separators, water connections and water meters.

ACCOUNT No. 33.—Electrical Plant.

Charge to this account all expenditure for wages, material, tools, freight, cartage of material, and other expenses in connection with repair of electrical plant, including generators, switchboards, cable and feeder terminals, storage batteries, transformers, rotaries, boosters, rheostats, circuit breakers, ammeters, and other electrical equipment.

Commutator brushes for generators should be charged to Account No. 5.

ACCOUNT No. 34.—Workshop Tools and Sundry Plant

Charge to this account all expenditure for repair of workshop tools, machinery, and appliances, such as engines, boilers, shafting, motors, etc.; also permanent way plant, including temporary crossovers, street lamps, and timber for barricading.

Hand tools of tradesmen or laborers should be charged to the account benefited by their use.

ACCOUNT No. 35.—Cars

Charge to this account all expenditure for repairs of cars, including wages, material, tools, freight, cartage of material, and all other expenses connected with this work.

The term "Cars" includes car-bodies and trucks and all fixtures or appliances inside of or attached to the car-body or truck, except the electrical equipment of the car.

Bell cord, trolley rope, commutator brushes and other supplies should be charged to Account No. 15.

The cost of incandescent lamps should be charged to Account No. 10.

ACCOUNT No. 36.—Electrical Equipment of Cars

Charge to this account all expenditure for repairs of the electrical equipment and wiring of cars, whether revenue cars or other cars, including wages, material, tools, freight, cartage of material and other expenses connected with this work.

The cost of commutator brushes and other supplies for the electrical equipment of the cars should be charged to Account No. 15.

The cost of incandescent lamps should be charged to Account No. 10.

ACCOUNT No. 37.—Miscellaneous Equipment

Charge to this account all expenditure for repairs of water cars or carts, sprinkling cars, sand and salt cars, supply cars, snow plows, sweepers, lorries, wagons and other sundry vehicles, including wages, material, tools, freight, cartage of material, and other expenses connected with this work.

Replacing horses and repair of harness should be charged to this account.

Repairs of electrical equipment of all sundry vehicles should be charged to account No. 36.

PERMANENT WAY RENEWAL.

ACCOUNT No. 38.—Permanent Way Renewal Fund

Charge to this account the estimated annual amount necessary for the renewal of the track. This sum should be carried to a permanent way renewal fund, and all expenditure for renewals should be taken from this fund.

DEPRECIATION.

ACCOUNT Nos. 39 TO 46

Charge to these accounts the estimated annual amount which is necessary to keep the plant, buildings and equipment up to their original perfect condition. In other words, the amounts here charged annually are the estimated amounts necessary to meet the depreciation which has taken place during the year, in addition to the sums which have been expended and charged under accounts Nos. 30 to 37.

PERMANENT WAY CONSTRUCTION AND MAINTENANCE

BY CHARLES A. KING, B. SC., C. E., OF GLASGOW

This article is based upon a long list of replies to some seventy questions on track construction, which were sent to different roads by the managers of the Glasgow tramways, and which replies were tabulated. Replies were received mainly from British roads, but eight American and Canadian roads, viz., those in Boston, New York, Baltimore, Pittsburg, Philadelphia, Washington, Montreal and Toronto also supplied information. Six continental replies were also received, viz., from roads in Dresden, Munich, Zurich, Milan, Budapest, Berlin. The paper summarizes these replies as follows:

In Great Britain and Ireland the girder rail is the only rail in use on public streets. For straight track rails the minimum weight recorded is 65 lbs. per yard, and the maximum 105 lbs., but by far the greater number of systems adopt a rail weighing

between 90 lbs. and 100 lbs. A large number of towns use a heavier rail on curves, in one instance the weight being 117 lbs. per yard. Almost 50 per cent of the systems have a rail 7 ins. deep, a considerable number having 6½ ins. and 6 ins. Except in America, where deeper rails are used, these limits are very rarely exceeded. It is of interest to find that out of every three tramway systems, two use rails with a flat head, and one has the head coned.

The width of the groove on straight track rails varies on different British systems from 1 in. to 1¼ ins., but only on seven systems is the groove wider than 1⅛ ins., this width and 1 in. being by far the most common. In America 1⅜ ins. is in use on straight track. A large number of systems widen the groove on curves by about ⅛ in. Norwich is unique in widening from 1 in. on straight track to 1⅜ on curves, and, what is worthy of note, the managers state that they consider this too wide, and would prefer 1¼ ins. on curves. About 35 per cent of the tramways reporting use a specially high guard lip on the curve, of which the maximum height in this country seems to be ¾ in. above the tread. Several systems use check rails on the sharper curves.

There has been some controversy as to the best length of rail to use. The returns show that at the present time 40 per cent of the systems use 45 ft. rails, the 60-ft. rail coming a close second with 33 per cent in its favor, the remaining 27 per cent of the systems using shorter lengths than 45 ft. Each length has its keen supporters, and the chief arguments in favor on each side are as follows:

Those who support 45 ft. lengths say: Most convenient to handle and turn; most easily curved; less movement than longer rails; also that the longer rail causes more trouble with paving; more undulatory movement and hogbacking and acquires a permanent set by sagging with its own weight. Those who favor the 60-ft. rail put forward as their main argument: Fewer joints, and, therefore, less maintenance and less electrical resistance, and maintain that the extra difficulty in handling is very slight, and that this long rail sits quite as securely on its bed as its shorter rivals.

There is considerable variation in the gages adopted. The most common is 4 ft. 8½ ins., but several systems have a 4-ft. gage and about twenty use 3-ft. 6-in. gage. One or two systems have gages peculiar to themselves. That this is an inconvenience is apparent to everyone, and in the future as lines extend and in many cases join this will be more acutely felt.

The tests which engineers require the rails to satisfy vary considerably in severity, but the nature of the tests is very similar. A given weight falling from a fixed height on a given length of rail resting on rigid supports placed at a specified distance apart must not produce more than a given maximum of distortion or permanent bending. This is known as the drop test, and is almost universal. In many cases this is the only mechanical test applied; but it is often accompanied by the ordinary tensile test, with a specified elongation and contraction. A few specifications require, in addition to the drop test, the bending of a small bar cold, without fracture, or the bending of the rail to a small radius without showing any signs of cracking or rupture.

The chemical composition specified by the different systems shows that a considerable difference of opinion exists among tramway engineers as to what is required. With regard to the carbon, which is the main constituent, one specification is as low as from .28 per cent to .40 per cent, while another is as high as from .55 per cent to .66 per cent. The average carbon aimed at in the majority of cases seems to be about .53 per cent. Regarding the rail in its capacity as an electrical conductor, the percentage of manganese is of importance. One specification asks for an average of 1.10 per cent, and another specifies no more than .1 per cent, showing a very wide divergence of opinion. The average quantity of manganese wished for in most cases appears to be about .90 per cent, which certainly does not err on the low side. In several cases a high silicon is specified with a very high carbon, which, if obtained, would necessitate a careful handling of the rails. It would be interesting to have some records of the analysis of the actual rail as compared with the composition specified. Generally, the tendency is to specify a higher carbon rail than was formerly used.

After the rail itself there is no more important problem which presents itself to the engineer than the method to be adopted in joining these into a continuous smooth running road.

Having only comparatively recently adopted electric traction on a large scale, we in this country are realizing to the full the very exacting demands it makes on the permanent way as compared with horse traction. Nowhere is this more in evidence than at the joints. The number and diversity of the devices used, as shown in the replies, is evidence of this. There are at least a dozen separate methods, and many combinations of two or more of these.

Of the replies received 30 per cent rely on fish-plates unaided, 23 per cent combine these with anchor-plates, and 21 per cent use sole-plates in addition to fish-plates. Of the remaining methods of jointing the most interesting is, perhaps, the cast weld joint, largely adopted on four systems, two of those in America. That few of the above have proved entirely satisfactory is shown by the large number of systems on which trials are being made of other forms of joint than at present in use on these systems.

In this connection, mention must be made of the chemical welding material, "Thermit," lately put on the market. At least eight towns are at present experimenting with this device. At Dresden, on the Continent, and Leeds, in this country, the trials have been extensive, and both towns have reported very favorably. In Glasgow we purpose making a trial of several hundred joints this summer. The returns for cast weld joints are curiously at variance. Of nine towns reporting as having tried this method, in America two were favorable and two unfavorable. On the Continent one was favorable and one unfavorable; in this country, one favorable and one unfavorable; one made no comment. Only one city reported having used electric welded joints—Boston, United States. The result is stated not to have been a success. It must, however, be noted that these welds were made in 1893, at which time, it is now admitted, even by the contractors, that the methods were defective. The Lorain Steel Company, which owns the welding plant, claim that the present method is a great advance on the practice of 1893, and this form of jointing is making considerable progress in America. It has been arranged to make a number of these joints also in Glasgow in the autumn.

Before passing from the consideration of welded joints, it may be noted that the present practice regarding the bonding of these is to put no bonds with chemical and electrical welds. With cast welds about 50 per cent seem to bond in addition.

Apart from the question of joints, but to a certain extent connected with it, is the fixing down of the rails to the bed, not only at the end, but at intervals in the length. The tendency seems to adopt this much more largely in the future. Taking into consideration the increasing length and height of the rails, and the close butting of the ends, this is undoubtedly a step in the right direction. The rails are close-butted at the ends on over 75 per cent of the tramway systems under consideration.

A question of considerable interest and importance, affecting not only the permanent way, but also the rolling stock and the overhead trolley wires, is the placing of the rail joints. Of the total systems reporting, two out of every three have the joints placed opposite each other. Taking especially into consideration the rolling stock and overhead work, the writer believes this to be the best practice. At the same time the longer experience of some of the earlier systems has led them to adopt staggered joints. On most systems square joints are not insisted on at curves, but where the fish-plate adopted is long, the writer is strongly of opinion that on sharp curves the joints should be squared or far enough apart to get at least one tie-bar between them, otherwise a knee at the joint will result.

The most important feature in special work is, without doubt, the points, and more especially the tongues or switches. A defective tongue in a facing point may easily lead to serious accident. The returns show a variation in the lengths of tongue between 3 ft. 6 ins. and 9 ft. 6 ins. The tendency is clearly to go in for longer points and tongues than in the past. There can be no question that it is advisable to have the tongues at least six inches longer than the length of the single-truck car wheel-base to avoid the leading wheel throwing the tongue over before the rear wheel has entered. Other obvious benefits are derived from a long tongue, especially if curved on the branch-off side.

There is considerable diversity of opinion as to whether tongues should be placed on the inside or outside of curves; and as to the advantage of having two movable tongues instead of one tongue and a mate or dumb point. Also on some systems no tongue is used on trailing points.

The replies to the question regarding the "kicking" or rising vertically of the tongues of trailing points are of great interest to Glasgow, as this trouble has been considerable on this system. The great majority have had no such experience. Twelve towns—three in America—had the same trouble to a more or less extent. Without wishing in any way to disturb the peace of mind of those who have recently adopted electric traction, the writer notes that in all places where this action has developed, electric traction has been in use for a considerable time, and a large proportion of those towns reporting no trouble with trailing points have had only a short experience of the wear and tear of heavy electric cars. The writer has been giving attention to this matter for some time and is satisfied that the wearing of the floor of the casting is the cause of the springing upward of the

tongue, and that the depression on the top of the tongue is caused by the consequent heavy blow which it receives on rising to meet the advancing wheel. A pin in the nose of the point tongue lessens this evil to only a limited extent.

The replies regarding the use of hardened steel renewable center pieces are remarkably unanimous. About thirty towns, including four in America, have these in use; twenty are pronouncedly in favor; two—Montreal and New York—consider them unsatisfactory, the others have not had sufficient experience to express an opinion.

The essential feature of hardened steel renewable centers is that these can be renewed. It is certainly strange to find such perfect belief in this work as the replies disclosed, when practically the whole of the believers have had no experience of how this essential feature will work in actual practice. Carried out as directed by all the makers of this work, the results are anything but satisfactory. Great difficulty is experienced in cutting out the spelter and getting at the keys, and even when this is accomplished the center piece itself is difficult to lift out of its bed. In some cases the whole casting has to be lifted and taken to the yard, and the renewable piece removed there.

As will be seen from the report, the replies give very little help in this matter, with the exception of the three from America. Two indicate the method of replacing, but only one, that from New York, gives the whole operation. It is as follows: "Melt zinc with blow lamp or torch, wedge center in place, and pour in melted zinc, caulking well around the edges."

This is not quite such a simple matter as it seems, especially with large castings and long renewable pieces. After about a year's intermittent experiments, the writer has devised a means of melting out and renewing which will enable the work to be done in about one-fifth of the time formerly required, and effect a considerable saving in cost. About twenty-one towns have in use, to a greater or less extent, special work of wholly manganese steel. In most cases the work seems to have been lately laid down, and no opinion is expressed as to its merits, but five towns approve of this material.

In the list of questions sent out, one question was to the effect of special work constructed wholly of manganese steel throughout (as distinguished from manganese steel renewable pieces) in wearing down or cutting away the flanges of steel tired or other wheels. One of two replies to this question have been received from towns, which state that they have no special work wholly of manganese steel. Deducting all doubtful replies, the experience of four towns has been that there is considerable wear and chipping with this class of work. As a very considerable number of towns have put down this type of special work recently, this seems a point which it would be of considerable value to the Association to have a report further on.

In laying new track where a new concrete bed is required the replies show that engineers are divided almost exactly equally between two methods. The one section lay the concrete bed first. The rails are then laid down, lined and packed with fine concrete. The other section lay the rails first, setting them up to line and level on blocks. The concrete bed is then put in below the rails and leveled up tightly under the flange. In several cases the adherents of each system state that they purpose to adopt the other system in future. The balance of converts is slightly in favor of the method of laying the rails first and leveling the concrete bed up to them.

Wooden ties are used only to a limited extent in this country, but largely in America and on the Continent. The claims put forward on behalf of this construction are: Easier traction, more elasticity, easier riding of cars, acts as an anchor for rail, keeps track to gage, and lessens the noise. Toronto has used them under the old work and is of the opinion that cross ties are of no advantage.

The dimensions of the tie vary on different systems, but the general practice seems to be about 7 ft. x 8 ins. x 6 ins. Naturally, the timber used differs in different countries and localities. In this country Baltic redwood is the most usual, and this is creosoted in every case. Two replies from the Continent state that oak is used untreated. Oak, chestnut, long-leaf yellow pine and cedar are used in America, and in the majority of cases are not treated. The general practice is to place the ties between 2 ft. to 3 ft. apart. In Leeds, however, eight ties are put in under each 60 ft. length, the ones at the joints being 1 ft. 8 ins apart, and the others about 9 ft. 8 ins. apart. The rails are usually fixed down to the ties by spikes, but in Leeds three-quarter in. bolts, with fang washers and clips, are used.

The majority of the systems reporting pave the tracks with granite blocks, wood being the next in favor, and then basaltic blocks. It is unfortunate that only in very few cases is the class of wood used specified. The general experience with wood paving seems favorable with light traffic, but of doubtful efficiency in city streets, especially alongside the rails. From a limited experience of wood paving in Glasgow the writer is of opinion that the nature of the grouting of the joints has a considerable influence on the success or failure of wood paving, provided, of course, that the wood itself is satisfactory. The experience of those with large areas of wood paving would be of value to the Association, especially in view of the present crusade against "noisy streets."

In about a dozen towns widening of the gages has resulted from the expansion of the wood paving. The testimony against the use of asphalt between and alongside the rails is very strong. In most cases a toothing of stone or wood is laid alongside the rails, but even with this protection the asphalt has in most cases proved unsatisfactory, except under very light traffic.

Many towns experience trouble from the paving setts or blocks rising alongside the rails. This has been assigned to several causes, as, water getting down under the blocks and rails, the bitumen grouting in hot weather forcing the blocks up, the blocks resting on the rail flange; action of heavy traffic, etc. Probably each of these has at different times been a factor in raising the paving. The writer considers it certain that in almost every case where this evil of rising paving has been met with, it will be found that the rail is not lying soundly on its bed and is springing with the traffic. A small movement in the rail will raise the blocks butting against it very considerably. Each time the rail rises it takes up the paving blocks, and when it goes down again it leaves the block up, allowing sand and dirt to drop in beneath, and this taking place time after time, packs the block up. In wet weather this takes place much more quickly, owing to the water below the rails and paving.

The following are some of the remedies suggested in the replies: Anchor joints, holding-down bolts, use mastic packing to prevent the rail springing, use well tarred chippings laid on bottom flange to keep out water.

"Rutting" of the paving by heavy traffic seeking the rails is a source of expense in towns. About a dozen systems use cast-iron blocks chilled on the surface and laid alongside the rails to mitigate this wear. In Glasgow we have found them of very considerable value where the weight of individual vehicles is not excessive.

By far the greater number of towns use bitumen and oil for grouting the paving joints, some using this for part of the joint and cement and sand for the remainder.

The construction of the duct or cable track is a matter of great importance and interest, and more information on this subject would have been of value. Earthenware ducts or pipes are used on 65 per cent of the systems reported on. Almost all these lay the ducts solid in concrete. Thirteen per cent of the replies state that the cables are laid in earthenware or wooden troughs, and run solid with bitumen, while the cement lined iron duct laid in groups in concrete claims 9 per cent in its favor. The remainder are in pipes presumably of cast-iron. Note may be taken of the method in Zurich, where the earthenware ducts are laid in sand, and Zurich, where the lead cables, armored with iron strips, lie in the earth without any special duct. It is a matter of regret that the position in the roadway of the duct track was not stated, also the cost per yard and the depth at which the ducts are laid.

The spacing of manholes varies remarkably on different systems. The shortest distance apart recorded is 30 lineal yards, and the maximum 300 lineal yards. The average distance is about 100 yards. Only three systems go beyond 150 lineal yards. All these distances are, of course, on the straight; on corners the distance apart must vary with the radius of the curve.

The replies show that in no case has any chemical action on the cables from the material of the duct track been found. In view of sinister rumors, which probably most of you have heard, this is a reassuring return. The replies giving the methods of bonding were, unfortunately, not detailed enough to be of much value. The general result shows that by far the greater number of lines are bonded with solid or flexible Chicago or Neptune bonds. Plastic bonds claim one-sixth of the whole returns.

Cross bonding of the track is almost universal. The usual distance apart of the bonds is 40 lineal yards, but seven systems place these as far apart as 80 yards, which is the maximum distance recorded. In only four cases has any trouble been experienced from bonds working loose. The method of bonding up the special work is on almost all tramways the same as that adopted on straight track, with the addition of long bonds round the castings. Dublin varies its practice by bonding ordinary work into the web, and special work into the flange. Toronto, Canada, bridges the whole special work with cables. In Glasgow we are now adopting this system, and about a month ago applied it to a large and intricate three-story junction with a very considerable saving in time and cost.

We in Glasgow have had a considerable number of the horse shoe bonds in the flange of the rail but by the working of the paving stones under heavy traffic. Practically all the replies stated that this had not been experienced. Five towns—two in Britain and three in America—had found the same trouble. The very exceptionally heavy vehicular traffic in Glasgow is the chief cause of the evil.

The returns of the cost per mile of single track are interesting, but not of much practical value without full particulars in each case. The cost is greatly affected by so many different conditions as, the nature of the paving, the road-bed, whether in the central districts of a town or suburban, the facilities allowed for opening up the roads, and many other contingencies.

The average cost of 4 ft. 8½ ins. track per mile of single line seems to be between £5,500 and £6,000. Regarding the actual construction of the lines, one-half of the systems reporting do the work themselves, and the other half by contract; a few adopt both methods.

On very few systems does it seem possible to estimate the wear due to electric traction. In almost every town with tramways in the streets the vehicular traffic takes advantage of the easier traction on the rails to as large an extent as possible. This is bound to cause considerable wear, the extent of which it is difficult to arrive at. Figures for the wear due to both electric traction and vehicular traffic are of value only at the place where they are taken, unless particulars of the class, speed and frequency of the vehicles are given in addition to the car service. One reply states that a rail, after having been in position for five and a quarter years, and having carried 185,800 cars, showed 1-16 in. of wear. But we do not know the quantity or class of vehicular traffic over this rail. The general opinion appears to be that the wear from vehicular traffic is small compared with that from electric cars.

The writer, taking the replies of the number of men in the various permanent way squads, endeavored to arrive at an estimate of the average number of men per mile of track maintained, but found it was impossible to get this satisfactorily adjusted. The systems which have been longest in operation naturally have a larger proportion of men than those whose lines are recently put down. Towns with large engineering works, causing heavy vehicular traffic, have much more repair of paving than those where such works are few. Each town and system must be considered by itself, in conjunction with the special conditions obtaining there.

It is also useless to attempt any summary of the annual cost per mile of track for maintenance, the replies showing in some cases a few pounds, and in others many hundreds.

The general indication is that the greater part of the cost of maintenance in most towns is expended on the paving. It would be interesting to know the general practice of allocation of the cost of restoring paving which has become disturbed (as distinguished from rutted or worn) alongside the rail. This is not really a paving cost. The writer suggests that a good criterion of the actual wear on the paving would be the ratio of new stones used on repairs to the whole area of paving. In Glasgow "new setts" or paving blocks are a very large item of maintenance. Great numbers of setts, even of the hardest Scotch granite, are shattered and split the whole depth (6 ins.) of the sett, and are, of course, useless for redressing.

The limitations imposed on lines laid down in streets is well brought out by the return showing twenty-one systems on which it has been necessary to use curves of a radius of 35 ft. and under. The nicety of adjustment of both wheels and track to avoid severe grinding on such a curve must be patent to every one. In aggravation of this, one often finds that, owing to the hang of the street surface, the super-elevation must be put on the wrong rail.

In considering the question of curves it is interesting to note that there is very little variation in the lengths of the single-truck car wheel bases. Very few of the returns show a wheel base outside the limits of 5 ft. 6 ins. and 6 ft.

The grades in streets where it is imperative to have a tramway are frequently very severe. One system has a grade of 1 in 8.4, while there are seven records of grades less than 1 in 10.

The returns show that 65 per cent of the tramways sand both rails on gradients, while the remainder sand one rail only. A mechanical track cleaner is used on several systems, but its success seems doubtful. Information as to its ability to remove iron punchings, etc., jammed in the rail would be valuable, as these are very frequent in large towns.

The need of an emery rail grinder seems to be felt only on very few tramways. This is probably accounted for by the fact that the majority of the replies come from recently laid or relaid systems.

Seventeen tramways report the use of portable temporary cross-overs or shunts with electric cars without experiencing much trouble. It would be of value to know in how many of these cases bogie or double-truck cars were used.

Eight towns make provision for obviating a stoppage of the car traffic when the hose of the fire brigade is laid across the car lines. Six towns use a fire bridge which carries the cars over the hose. In three towns—Dublin, New York and Glasgow—the bridge accompanies the emergency wagon. In Newcastle and Munich the bridge is brought by the fire brigade. In Montreal the hose is carried by slings from the span wire. Ayr gets rid of any chance of stoppage from hose across the track by duplicating the fire hydrants.

LONDON LETTER

(From Our Regular Correspondent.)

The question of extending the system of half-penny stages on the Leeds tramways has, for some time past, occupied the attention of a special sub-committee and the general manager, Mr. J. B. Hamilton. There are now eleven stages in the city, chiefly arising from extensions to existing lines, but it is now recommended to the general committee that there shall be considerable additions by way of experiment. The special committee fixes a distance of about half a mile for each cheap stage, but in no single case will its recommendations affect the penny or through fares, if passengers ask the conductor for such tickets.

An agreement has been arrived at regarding the scheme for connecting Dundee and Broughty Ferry by tramway, and the question of running powers in Broughty Ferry is also being arranged. Steps are now being taken to arrive at an understanding with the Dundee authorities to permit the cars to run into the center of the city via the Ferry Road and Seagate route. Correspondence has been opened with Dundee with this end, and the promoters hope that a satisfactory understanding may be arrived at.

A decision recently given by the House of Lords will have an important bearing upon tramway development in England. The British Electric Traction Company, having obtained the co-operation of seven local authorities, adjacent to Birmingham, sought running powers over the lines belonging to, or to be acquired by the Birmingham Corporation. After a few days' hearing, the House of Lords refused to hand over the control of the streets of Birmingham to a private company. The decision is a check to the enterprise of one of the greatest of the tramway combines, and a great victory for those who believe in the municipalization of tramways. The result is that Birmingham will now take in hand the provision of electric tramways, not only for the city, but for the adjoining townships, either directly or by a system of through cars with a change of conductors at the boundary, and the division of profits on the railway clearing-house system.

Experiments of the Thermit system of welding rail joints are being carried out at Sunderland on the local tramways, the Tramways Committee having for some time past had this method under consideration. By the employment of the Thermit system of welding, fish plates and copper wire are dispensed with, and a continuous rail secured. The Thermit process of welding metals comes from Germany, its inventor being Dr. Goldschmidt.

The bill promoted by the South Lancashire Tramways Company has passed the House of Lords, the only opponents being the corporation of St. Helens. An arrangement was arrived at in the House of Commons by which the company is to have such running powers over the lines of the corporation (now leased to a company) as are necessary to conduct a through communication of passengers' luggage, and small parcels, and the company is not to enter into agreements with the company working the St. Helens lines except so far as is necessary to give effect to the running powers. Any dispute on the matter is to be referred to the Board of Trade.

Sir William Tomlinson, J. Briggs and other members of Parliament have made representations to the Board of Trade in favor of the principal provisions of the Railways (Electrical Power) Bill being extended to canals. The measure proposes to enable railway companies to issue new capital and acquire land with a view to the use of electric traction, and it is understood that this would apply also to canals owned by railway companies. The members who desire to extend similar powers to independent companies point out in the statement of their case that "more than one-third of the canal mileage of the country is already in the hands of railway companies, and to handicap the independent waterways by withholding the required powers would be to crush out such competition between railways and canals as still subsists, and would greatly impair the utility of the Canal Bill proposed by the Association of Chambers of Commerce, and approved by the Board of Trade." It is added that the Association of Independent Inland Waterways, which includes the Aire and Calder Navigation and other import-

ant canals, desires that the provisions in question should be extended to canals. It is understood that this object is beyond the scope of the present bill, the title and primary purpose of which cannot at this stage be modified, but it has been suggested to the Government that another short bill of one or two clauses extending its application might meet the case.

Another section of the electrified portion of the London County Council's South London tramway system has now been opened, this being the line running from Camberwell Green to Kennington, and thence over the already opened routes to Westminster, Waterloo, and Blackfriars Bridges. Previous to this only one series of electric cars ran from the bridges—that to Tooting, by way of Clapham—but now that the Camberwell route has been completed the advantage of the barriers which have been erected at Blackfriars Bridge, to obviate the rushes which took place every evening, is seen, and long lines of home-going workers wait patiently for the arrival of the cars.

As a direct result of the competition of the electric tramways the number of licensed cabs in Glasgow has decreased in the last twelve months by 150. A. C. S.

PARIS LETTER

(From Our Regular Correspondent.)

One of the main points of interest in traction matters in Paris has been the case brought in the courts by the Compagnie Generale des Omnibus against the city authorities. The hearing of the case has taken a long time and a deal of interest has been aroused. The results have been somewhat disappointing to the Cie Generale des Omnibus, but yet afford some hope of success in regard to new arrangements with the city, and the consequent extension of the company's monopoly. The following is a resume of the case. By concession which the city granted to the company in 1860 the latter secured the monopoly of street traction in Paris, the terms of the franchise being such that the company has deemed itself injured by every subsequent franchise given by the city to later concerns, such, for instance, as the Metropolitan Railway and the Tramways de Penetration. The Omnibus Company has always maintained the right to claim damages from the city for all such franchises, and, therefore, started an action to rescind its contract and to obtain damages.

The courts have interpreted as follows the exclusive right granted to the company in 1860. It has been held that the exclusive right of stationing vehicles was in no way prejudiced by the concession granted to the Metropolitan, which was in no way similar to that owned by the Omnibus Company. It was furthermore held that the Metropolitan Railway, the concession for which, by the way, was granted by the State as well as by the city authorities, is a railway of local interest, and does not in any way make use of the street surface and public roads. It was held also that the concessions granted to the Tramways de Penetration did not infringe the rights granted to the Compagnie Generale by the city, as they hold a State concession, and the only concessions given by the city interfering with the surface traffic over the public streets is the Funiculaire de Belleville, which is a rather small enterprise. Finally the court considered that the Cie Generale was not entitled to a recision of its contract, and concludes that the same must be maintained, but allows the company damages, the amount of which is to be fixed by experts from the city.

The general opinion seems to be that the Cie Generale did not get as much as might have been expected, but the net result appears to be that the city will be disposed to examine the projects of improvements offered by the Cie Generale, with a view to certain concessions and arrangements. It can be stated briefly that the proposed improvements amount to a quicker service, with cheaper fares, an authorization to use the trolley system being anticipated from the city, making thereby a practical guarantee of regular service and speed.

The public is very indifferent to the matter, and has not yet realized the fact that the trolley system is the only practical solution of the present difficulties.

The trolley system seems also to have found advocates among the inspectors and engineers of the "Service de Controle," who thus far have been opposed to the system, and it is this body who lead the public opinion and evolve most of the regulations governing Paris traffic.

The plans proposed by the Cie Generale appear to be fairly well worked out, and have in view a complete modification of its system. Some of the existing lines which are now carried on at a loss, will, it is hoped, become profitable, and quarters of the city which have hitherto been poorly supplied with means of public conveyance will be furnished with the same. The main modifications proposed comprise: (1) Reduction of running or operating expenses by the adoption of the trolley system; (2) sectioning of lines and the use of corresponding fares. The fares would be 3 cents, first class, and 2 cents, second class; each payment carrying the right to extend the journey on payment of an additional fare for the distance covered. The proposed system of the Cie Generale aggregates some 200 km of track.

As in the preceding plans of the Cie Generale no mention is made of any proposed change in the type of cars, it might be inferred that the present cars give complete satisfaction. This is, however, not the case, and many examples could be cited in support of this opinion. The Paris street cars have not yet arrived at their final shape and arrangement. The Cie Generale Parisienne de Tramways has lately put in service a central entrance type of car of a rather eccentric construction. No satisfactory results have thus far been obtained from this type of cars, and accidents to passengers owing to the use of an unaccustomed car are rather frequent. The type of car which appears to be most in favor is the single-truck car, with long rear platform. The Brill 21-E type of truck is generally used under these cars. On the other hand the "Cie de l'Est Parisien" has now definitely given up the central platform car, and adopted a long double-ended car, with which they have been experimenting. Fifty of the new type of cars have been ordered.

Returning to the Metropolitan lines in Paris the northern lines of the No. 2 project have been practically completed, and are in full working order. The southern part of the No. 2 line, which it will be remembered forms a belt around the city, will be completed before the bridges are prepared for their services. The bridges will take another two years for study and construction. The two bridges contemplated are those of Passy and Austerlitz. The Passy bridge has just been commenced, and will be constructed to allow of foot and vehicular traffic, as well as the Metropolitan line.

The most important work is just at present the great block of masonry being constructed beneath the Place de l'Opera. There is a small rectangular space or spaces railed in on the Place, and this is all that cen be seen of the great work proceeding beneath. It will be remembered that there are three lines of the Metropolitan converging at this point, and for certain reasons they must be placed one above the other. This necessitates a very solid construction. The sub-soil at this point is of light sandstone, with plenty of water, and the construction work has, therefore, to be advanced by means of caissons. The lowest of the three lines is 21 m beneath the surface. The whole work is being carried out without the least hindrance to the traffic at this important point. The soil removed is carried underground to the neighborhood of the Gare St. Lazare, and there raised by cranes. Several months have yet to elapse ere the excavation will be ready for the concrete construction.

The important station at La Nation has proved a great boon to the congestion hitherto obtaining in the line No. 2, but not a radical remedy to traffic congestion, which is being greatly felt at certain hours of the day. Besides, this station has a vast siding of 1200 m in length, and is thus capable of giving standing room to several trains, which can be moved out at very short notice. The Metropolitan trains are limited as to length by reason of the shortness of the platforms, which cannot be increased, and the headway of the trains cannot be decreased from the present limit of safety. However, it has proved very useful to have the reserve of trains offered by La Nation Station, and the place had much added to the already great success of the No. 2 line.

The last few weeks have been devoted to annual general meetings of the most influential tramway and traction companies.

In the last Paris letter reference was made to the report of the Cie Generale des Omnibus, and announced the Metropolitan railway report. The latter operates at 58 per cent to 60 per cent, and its total receipts in 1902 were £2,946,340, against £1,894,056 in 1901.

The report of the Compagnie Francaise Thomson-Houston is very interesting, as this company operates several systems in France, including one in Paris. The total amount of orders received from Jan. 1, 1903, to May 20 was £11,500,000, compared with from £10,000,000 to £11,500,000 during all of 1902. The £11,500,000 for new orders is made up of 34 per cent from allied companies, and 66 per cent from other customers. The total amount is divided as follows:

	Per cent
Tramway supplies and contracts	27
Railway and other power stations	31
Power transmission	11
Motors and sundries, including mines and metallurgy, telegraph and telephone, etc.	31
Total	100

To show the present state of tramway and light railway affairs

in the French capital a few extracts of annual general meetings of several other companies are given.

Among the more interesting is the Compagnie de Tramways Ouest Parisien. This company operates in the western part of Paris and suburbs and was originally equipped with the surface contact system and partly by trolley. The surface contact system never operated satisfactorily, and the whole aim of the company is now to obtain an authorization for the trolley system over all its lines. Meanwhile its business is in a very bad way. Without taking account of fixed charges, its operating expenses alone exceed the receipts by 40,000 to 50,000 francs per month. As has already been stated, the company has been authorized to raise the fares to the standard adopted by the Council of the Department of the Seine. The report of the company states that the new operation with increased fares has given poorer results than had been hoped for, and instead of supplementing the receipts by about 40,000 francs per month, the improvement amounted to only a small sum. The operating expenses in 1902 amounted to 1,394,910 francs. The total receipts for 1902 was 975,045 francs, making the deficit for the year 419,864 francs, exclusive of fixed charges.

The Compagnie des Tramways de l'Est Parisien has now 138 km. of track, with gross receipts during 1902 of 4,400,000 francs. This company also cannot earn its operating expenses, which, in 1902, amounted to 4,673,488 francs.

The total annual deficit is about 1,000,000 francs. It will be seen that the future of the company is very problematical in regard to dividends. This is especially true when it is noted that one of the best paying lines of the company, the line from the Opera Les Lilas, running right through the center of Paris, is threatened with dangers which are more than visionary. There is first a threatened application to replace the present trolley line, which was provisionally granted because of the Metropolitan tunnels disturbing the surface contact system, and, second, another danger consists in the competition of the new Metropolitan line running parallel to this line.

The company is not slow in realizing its dangerous condition and is doing its best to obtain from the authorities authorization of higher fares and more extended use of the trolley system.

The company known as Tramways Mecaniques des Environs de Paris operates 56 km. of track in the northwestern part of the city and suburbs. The financial situation of the company would not seem encouraging were it not that the receipts of the lines for the first five months of 1903 have increased very rapidly compared with the same period of 1902. The consumption of current on this line per car-kilometer is very high at present, owing to the partial use of storage batteries. The latter will be entirely abandoned by the company, which has now obtained leave to install the trolley, which will enable the company to meet the increasing demand for transportation of a district which is the busiest and richest of its system. The cars at present in use are rather heavy and unsuited to the needs of the light traffic on some of the smaller lines, being provided with double-decks, a double compartment body, two platforms at the ends and a center platform. The receipts for the first five months of 1902 amounted to about 703,000 francs, and for the same period of 1903, about 800,000 francs. The expenses during the first five months of 1902 were 877,000 francs, and during the same period in 1903, 794,000 francs. It will be seen from this that the line shows a small profit for the first five months of 1903, and the company's policy is that of increasing this profit by a careful improvement in operating conditions and reduction in cost of power.

Fortunately, the situation is not so bad, although not by any means good, for a number of other companies, among which can be mentioned La Compagnie des Tramways de Paris et du Department de la Seine, which operates some 125 kms. of track in the north of the city. There are a number of lines which penetrate the city and terminate at the Madeleine and the Etoile, called Tramways de Penetration, and these lines are allowed the use of the trolley outside the city limits. The greater number of the lines inside the city limits are operated with the use of storage batteries, and the results of the year's operation with this expensive system would show large losses had it not been for the higher fares than on the average of the other lines. The operating expenses in 1902 amounted to fr. 5,096,000 out of the total receipts of fr. 6,435,000. The 1902 receipts amount to some 200,000 francs over those of 1901. Some details can be given regarding the traction systems operated by the company. The steam locomotives are of the Lamm Francq system, and in 1901 ran some 648,457 kms., at a cost of 468,638 francs, and in 1902, 602,951 kms., at a cost of 354,868 francs, making for 1902 a cost per car-kilometer 0.588 francs, against 0.723 francs in 1901. Electric traction figures give for 1901 4,618,789 kms., at a cost of 2,043,519 francs, and for 1902, 5,057,327 kms. at a cost of 2,239,907 francs. These figures give for 1901 a cost per car-kilometer of 0.442 franc, and for 1902, 0.44 franc for electric traction.

The Tramways du Nord Parisien is but a small company operating some 17 kms. of track inside and outside of Paris, the whole operated by the trolley and the surface contact system, the latter, as usual, being inside the city limits. The company shows a profit for 1902 of some 150,000 francs. The surface contact system is on the Claret Vuilleumier system, and special switch boxes are placed outside the tracks in the street at intervals, each box controlling a number of contacts in the street. The system appears to be one of the least objectionable of the surface contact systems actually working in Paris, although it is sometimes out of order. The length of track operated is not great and the traffic is not heavy, as only 24 motor-cars are in service, with a few trailers. The car-kilometers run are less than 1,500,000 per year.

General remarks concerning the situation may not be out of place. The situation could be most favorable to the companies using the trolley, and where this has not been authorized, the underground conduit system appears to be the next best, notwithstanding the high cost of construction. Several companies have some few lines operating in various parts of the capital of this system.

The Compagnie Generale Parisienne de Tramways, or Tramways Sud, is undertaking some important changes, and rumors are afloat regarding a new generating station in Paris, destined for this company. The news may be rather premature, but of one point we are absolutely certain, the transformation of three lines (1) The Malakoff-Les Halles line, about 7 kms. This was first run by trolley and storage batteries, the former for one-fifth and the latter for four-fifths of the distance covered. Subsequently two-fifths of the part then run by storage battery was converted into conduit system. The tendency is now to abandon the storage batteries completely. (2) The line St. Phillip de Roule, which is a short line of 7 kms., which was first operated one-quarter by trolley and three-quarters storage battery. The properties are now reversed, two-fifths being operated by battery only, and three-fifths by trolley. The line is not very important. (3) The Clamart-St.Germain de Pres line, which is 9 kms long and was formerly run half trolley and half battery. Later the trolley absorbed two-thirds of the line and storage battery one-third, and now the trolley part amounts to three-fourths of the length. The remaining one-fourth storage battery will probably soon give way to the underground conduit system.

A number of the principal cities of France are appreciating the advantage of electric traction and endeavoring to change their system. Paris is slow to adopt the trolley for æsthetic reasons. The fight is not so keen, however, against the adoption of trolley in the country towns. For instance, Lille, a town of about 130,000 inhabitants, in the north of France, is a fair example of a good traction system and installation. In operation for a few months only, the lines are now approaching completion by a line from Lille to Roubaix. The service on this line is now by steam cars, but the electric service will soon be inaugurated.

Projects of trolley installations are made at Nantes, an industrial town on the seaboard and near the estuary of the Loire. The fares will be 2 cents, which bids fair to be popular in that industrial city. Low fares would also be a success in Paris were it possible to use the trolley system. There is little chance of satisfying the public wants in this respect as long as the authorization for a larger use of the trolley is refused.

We referred above to the fact that the Cie Generale des Omnibus was endeavoring to obtain a concession, or, rather, a renewal of the old concessions. The company submitted plans for a complete installation of the trolley system, with the use of the conduit system in the heart of the city. Some influential papers and the public itself, disregarding the obvious advantages of the trolley system, represented the company as threatening to invade the whole of the city with the odious trolley line and spoil the appearance of all the principal thoroughfares, have voted against the project and there is a rather hot fight about to occur on the very point. It is to be hoped that sound common sense will prevail and that practical considerations will outweigh sentimental and æsthetic reasons in providing a good tramway system for Paris, with a service at least comparable to any other modern cities of Europe.

In spite of the various difficulties which beset its path in more than one country of Europe, electrical traction is undoubtedly making progress, not only in tramway, but also in light railways and in the main lines of the country.

The Fayet-Chamonix line extension to Switzerland will soon be opened to public service and over the border. In Switzerland itself there is a great progress all along the line. Experiments and discussion is also taking place on a large scale in Germany,

where the Union Elektricitats-Gesellschaft has been authorized by the State to make experiments on the Johan line in the suburbs of Berlin. The U. E. G. is actually transforming two three-axle coaches of the railway company into motor-cars and three passenger cars are used as trailers. It is understood that the power will be derived from the Oberspree electrical station, single-phase alternating current being supplied at 6000 volts. It should be stated that the daily traffic on the line includes twenty-three trains in each direction, and the experiments are to be carried out without interference to the daily service. It is very desirable that such experiments be encouraged by all the various governments and central bodies in whose territory electrical traction appears to have a future. In Germany the fact is well recognized that electricity has come to stay, and railway companies vie with the government in giving all facilities to the promoters of the new schemes, who are, of course, on common ground with the constructors of electrical material. Switzerland is also to the fore in these matters. It should be noted that expenses are divided between interested parties, while the State gives its aid in a very practical way by means of grants.

In Italy electric traction is proving a very great success, and there is no reason why its application should not be greatly extended. The Milan Gallarate and Gallarate Varese lines are in full operation, and a duplication of its tracks is just receiving consideration of the public authorities. There is also a scheme for electric traction between Milan and Bergamo, the distance approaching 43 kms., with a difference of level of 119 m. It is expected that a maximum grade as high as 7 per cent will be encountered, the average grade being 3 per cent.

A company has also been formed, with a capital of 2,000,000 lire, for completing and operating the line near Naples and connecting Castellemare and Sorrento.

NEW YORK ELEVATED TIED-UP IN RUSH HOURS

Traffic was entirely suspended for about three-quarters of an hour during the busiest of the rush hours Thursday, July 23, on all lines of the Manhattan Elevated Railway, of New York, as a result of an explosion in a manhole in front of the company's power house at Seventy-Fourth Street and the East River. The feed wires were disarranged, and until repairs were made no trains could be moved. It was about 5.45 when all trains on the Sixth, Ninth, Third and Second Avenue lines came to a sudden stop wherever they happend to be. In nearly every case they were packed with persons returning home from offices and shops, and in many instances hundreds of men and women alighted from the trains and walked to the nearest stations, and there took surface cars. At the City Hall station, on the Third Avenue line, an enormous crowd jammed the platform and stairways at the bridge. Orders were rushed to the various ticket sellers, and they discontinued the sale of tickets until the trains began to move, shortly after 6.30 p. m.

NEW POLYPHASE TRAMWAY STATION AT BRUSSELS

The new power station, which has just been erected by the Brussels Tramways Company for operating the street railway system in that city, and the preliminary drawings for which were published in this paper for September, 1902, was officially opened last month. The Brussels company was one of the first to install the overhead system on a considerable scale in Europe, and its previous power station, equipped with direct-current apparatus and built in 1894, was considered at that time a model power station. The extension of the conduit system throughout the city, however, has compelled the introduction of more power and has resulted in the completion of one of the most modern and complete power stations on the Continent.

The new station contains seven units of 1500-kw each. The engines are cross-compound and were built by the Vandekerchove Machine Works, of Ghent. The alternators are of the General Electric type and were supplied by the Union Elektricitats Gesellschaft, of Berlin. They operate at 250 r. p. m. and generate three-phase current at 6600 volts and 25 cycles per second. The boilers were supplied by the Babcock & Wilcox Company and superheaters are used for raising the temperature of the steam to 330 degrees C. Green economizers are employed, and the tramway company has a guarantee of an indicated horsepower on 4.75 kg (10.45 lbs.) of steam. The switchboard was built at Schenectady by the General Electric Company.

The King of Belgium was present at the opening of the station, at which there were also a number of prominent electrical engineers and tramway managers from other countries. The King was received by Mr. Fayens, president of the Brussels Tramways Company, and Mr. Leon Janssen, general manager of the company, and made a personal inspection of all of the electrical apparatus, in which he expressed a great interest. Others present from the Brussels Tramways Company included Messrs. A. Janssen, D'Hoop, Pedriali, Lechat and Dugniolle. The following were also present: Messrs. Lavalard, manager of the General Omnibus Company of Paris; Pons, manager of the Toulouse Tramways Company; Hanspolen, general manager of the Union Elektricitats Gesellschaft; Perouse, member of the State Council of France; Loewe, president of the Union Electricitats Gesellschaft, and C. De Burlet, general manager of the Chemins de Fer Vicinaux, of Brussels.

LARGE TRIPLE EXPANSION ENGINES FOR MANCHESTER, ENGLAND

In the STREET RAILWAY JOURNAL for Sept. 6, 1902, a description was given of the new Stuart Street power station of the Manchester Corporation. The two 6500-hp engines for this station have just been completed by the Wallsend Slipway & Engineering Company, Ltd., Wallsend-on-Tyne. They are of the triple expansion, vertical type, having four cylinders, diameters, 37 ins., 59 ins., 72 ins. and 72 ins., respectively, with 60-in. stroke, capable of working either condensing or non-condensing without valve alteration. The boiler pressure will be 200 lbs. per square inch, and at the engine stop valve 190 lbs. per square inch, the steam being superheated to 500 deg. F. Special attention has been given to crank balancing, and all working parts on both engines will be interchangeable. Each engine will indicate 6500 hp when running at 75 r. p. m., making 13,000 ihp for the two engines. The crank shafts are 21 ins. diameter and the generator shafts 24 ins. diameter, increased to 30 ins. diameter in way of the fly-wheel, on each side of which are two large generator bearings 5 ft. 4 ins. long. All the crank shaft bearings are the same diameter. The bed-plates are provided with large wells, all suitably piped to the outlets for catching the waste oil. The cylinders are all made of special cast iron, and have separated liners fitted. Steam jackets are fitted to both the cylinder barrels and the covers. The piston rods are fitted throughout with United States metallic packing. The columns are of the partly enclosed type. The main bearings are of the half-round type fitted with water jackets, and arranged so as to be easily removable by simply easing up the crank shaft. The valve gear is of the Corliss type and so designed that it can be readily adjusted by hand if necessary.

Each engine is provided with two governors. One governor is designed to automatically control the speed so that it does not vary beyond certain fixed limits between no load and full load, whether working non-condensing or condensing. The second governor acts as an emergency governor, and cuts off all steam automatically if the speed of the engines increases more than 6 per cent. The emergency valve can also be worked by hand from starting position. The cylinders, main bearings, cross-heads, guides, crankpins, etc., are all lubricated by means of forced lubrication. Receivers of cylindrical type are fitted between the high and intermediate pressure cylinders and also between the intermediate and low pressure cylinders, the latter being arranged for reheating the steam as it passes to the low-pressure cylinders with steam direct from the boilers. The reheater is provided with by-pass fittings.

Each engine can be manipulated from one position on the floor, all the necessary apparatus being brought together for this purpose. Each engine is fitted with two air and two circulating pumps working by levers off the high and intermediate pressure engines.

It is recognized that the most extensive experience of multiple crank engines has been obtained by marine engine makers, and the successful work in large engines of this class by Andrew Laing, the managing director of the company's works, has been fully utilized in the design and construction of these engines.

FROM INDIANAPOLIS TO DAYTON

The connection between the Dayton & Western Traction Company and the Richmond Street & Interurban Railway Company has been made, thereby completing one of the longest traction lines in the world, reaching from Indianapolis, Ind., to Dayton, Ohio, a distance of 150 miles. In a short time the service will be extended to Columbus, Ohio. A through service from Indianapolis and Dayton will be established as soon as possible. As the line parallels the Pennsylvania Railroad all the way it is expected that company will be given stiff competition.

A NEW LINE IN THE OHIO VALLEY

It has developed that the proposed system of electric railways to be built between Avalon and Freedom, in the Ohio Valley, which Pennsylvania Railroad officials were quoted as favoring, is a project fathered by Murray A. Verner and his associates in Pittsburg and Youngstown. The plan is to build twenty-one miles of line to connect Pittsburg with the system of the Mahoning Valley Railway. Entrance to Pittsburg will be made on an elevated line on Liberty Avenue, and it is said that an elevated structure will also be built in Allegheny. In order to carry out the scheme six companies have been incorporated, viz: West Side & Mahoningtown Street Railway Company, Mahoningtown & Moravia Street Railway Company, Moravia & Wampum Street Railway Company, Wampum Street Railway Company, Wampum & Hoytdale Street Railway Company, Hoytdale & Beaver Falls Street Railway Company. The officers and directors of the various corporations have not yet been made public.

The new line will form a continuous system from Warren, O., through Youngstown, New Castle, Beaver Falls, Coraopolis and McKees Rocks, or through Allegheny to Pittsburg.

From Warren, O., to New Castle, passing through the towns of Niles, Lowellville, Edenburg, Hillsville and a number of other smaller villages, the Mahoning Valley Electric Railway system, also controlling the local trolley lines in New Castle, Youngstown, Niles and Warren, is without competition in the trolley passenger business. It is now intended to extend the lines from New Castle to Beaver Falls, at the latter place linking up with the Beaver Valley Electric Railway system and over the latter's tracks cars can be run as far as Freedom, to which point the Beaver Valley lines now extend. Commencing at Coraopolis, the continuous line to Pittsburg will likely be utilized in the project. To accomplish this object, bridging of the Beaver near Freedom would be necessary and an extension of the Beaver Valley lines from that point to Coraopolis.

Surveys for the entire route between Beaver Falls and New Castle have already been made. For the most part the new line will follow the west bank of the Beaver and will pass through Moravia, Hoytdale and Wampum.

CHICAGO TRACTION REORGANIZATION

The outline of the plans proposed for the reorganization of the Chicago Union Traction Company was presented in these columns last week, and since then an official statement has been issued confirming the announcement. As a result of these preliminaries, a new set of leases between the Union Traction and the North and West Chicago Street Railway companies was drawn up and adopted, subject to approval by the stockholders, by the members of the protective committees representing the three roads. The members of the protective committees of the two underlying roads were made members of the two boards of directors prior to the modification and adoption of the leases.

A formal statement setting forth what has been done by the three protective committees was issued after the conference as follows:

"Important developments heretofore foreshadowed took place, when a modification of the leases between the Chicago Union Traction Company and the North and West Chicago Street Railroad Companies was voted for, subject only to the approval of the stockholders at a meeting to be called later, and subject, further, to the opproval of the Circuit Court of the United States.

"This action, in the opinion of the North and West committees, will prevent a disintegration of the property and dispose of the embarrassment growing out of the ambiguity in the previous leases. It is provided that the lease agreements made in 1899 between the three corporations, under which it was claimed that the leases of the underlying North and West Side Companies were absolute transfers of those leases are made a subletting only, and the provision whereby the guaranty fund, in case of termination of the lease, becomes the property of the Chicago Union Traction Company is so changed that the fund shall be forfeited for failure to keep the covenants of the lease as to payment of rental or otherwise.

"For a period of five years from date the rentals reserved in the lease are to be a preferential charge up to 12 per cent and 6 per cent, but to the extent of 8 per cent upon the stock of the North Chicago, and 4 per cent upon the stock of the West Chicago companies, it shall be a preferential cumulative charge, and shall be payable before any dividends are paid upon the stock of the Chicago Union Traction Company, or its successors.

"After five years, as theretofore, the rentals shall continue to be paid up to 12 per cent and 6 per cent of the net earnings of the lessee company, but instead of being a cumulative preferential charge of 8 and 4 per cent it shall be a fixed charge, and failure to pay this fixed charge of 8 and 4 per cent after five years shall operate as a default under the lease, and a forfeiture of the guaranty fund to the North and West companies.

"The Chicago Union Traction Company is required to make any and all changes and improvements in and about the rehabilitation of the property, and bear all cost of maintenance of the property during the continuance of the leases, which is for the remainder of the unexpired period of 999 years.

"It is believed this is a most important step in the rehabilitation of the railways of the North and West street railroad systems. It puts all the properties in a position where there is internal harmony, and where any ambiguity in the construction of the leases is disposed of, and where important progress has been taken toward the solution of the transportation problem of the city.

"The modifications were brought about by the efforts of the two protective committees, who were unanimously in favor of them, the North protective committee being composed of Henry A. Blair, Charles L. Raymond, Azariah T. Galt, Charles R. Corwith and Fred H. Rawson, and the West committee of Benjamin B. Lamb, Wallace Heckman, James Bolton, Charles R. Corwith, Edward L. Brewster, William H. Gray and Fred H. Rawson, who became directors of the two boards before the modifications were voted for.

"The changes were also approved unanimously by the general protective committee, whose members are Walter G. Oakman, John J. Mitchell, Marshall Field, H. N. Higginbotham, John H. Wrenn, R. R. Govin, George E. Adams, H. B. Hollins, Norman B. Ream, Charles Steele, P. A. Widener and Oakleigh Thorne.

"Besides the formal communication which is to be made for the call of the meeting of stockholders, the two committees, now the members of the two boards of the North and West Side companies, will fully communicate to the stockholders their views as to the desirability of the changes made in the contractual relations of these companies."

It is generally believed that this action on the part of the committee will receive the sanction of the stockholders and the Court, although opposition is threatened by minority stockholders represented by Levy Mayer. Action will be taken on the leases Aug. 18.

PERSONAL MENTION

MR. MATTHEW NEILSON, manager of the St. John Street Railway Company, has been appointed manager of the Mexico Heat, Light & Power Company, of which Senator Cox, Sir William Van Horne and other Canadian capitalists are the promoters.

MR. E. W. CHANDLER, for some time purchasing agent for the Columbus, Delaware & Marion Railway, has been made superintendent of construction of the Joliet, Plainfield & Aurora Railway, which is being built by the Fisher Construction Company, of Columbus, Ohio, and Joliet, Ill.

MR. GEORGE A. COOKE, formerly of the Westinghouse Electric & Manufacturing Company died July 11 in Chicago. Mr. Cooke was the son of Mr. William J. Cooke, of the McGuire Manufacturing Company, and although a young man had established a high reputation in electrical work. After a course in electrical and mechanical engineering in Purdue University, which he finished about eight or nine years ago, he entered the service of the Westinghouse Electric & Manufacturing Company in its construction department, and visited a number of cities for it in the installation of railway and lighting plants, and also mining apparatus. He also spent a considerable time in Toledo installing underground conduits for the Toledo Traction Company. His health becoming impaired, he spent a winter in Florida, another in Arizona, and then went to Honolulu.

MR. J. S. BADGER, general manager of the Brisbane Tramways Company, Brisbane, Australia, and formerly of New York, is making a visit in this country. Mr. Badger was one of the pioneers in the electric railway business in this country, and supervised the installation of a number of the early roads for the Sprague Electric Railway & Motor Company, and its successor, the Edison General Electric Company. He was called to Brisbane from Schenectady, N. Y., about seven years ago to install an electric tramway system in that city, and upon its completion was appointed general manager of the company, a position he has since held. Mr. Badger left Brisbane on his visit to this country on May 18. He is a delegate to the Fifth Annual Convention of the Chambers of Commerce of the British Empire, as a representative of the Brisbane Chamber, and expects to attend the Convention to be held in Montreal September 17-20. He also expects to attend the convention of the American Street Railway Association in Saratoga. After the close of the Saratoga and Montreal conventions he is planning to visit London, where are located the headquarters of the Brisbane Tramways Company. He will then return to Brisbane via New York, and expects to reach home about the end of the year.

TABLE OF OPERATING STATISTICS

Notice.—These statistics will be carefully revised from month to month, upon information received from the companies direct, or from official sources. The table should be used in connection with our Financial Supplement "American Street Railway Investments," which contains the annual operating reports to the ends of the various financial years. Similar statistics in regard to roads not reporting are solicited by the editors. * Including taxes. † Deficit. *a* Including taxes, damages, tolls and rents.

Company	Period	Total Gross Earnings	Operating Expenses	Net Earnings	Deductions From Income	Net Income, Amount Available for Dividends
AKRON, O.						
Northern Ohio Tr. & Light Co	1 m., June '03	77,971	43,736	34,234	23,259	10,975
	1 " " '02	67,631	36,589	31,042	18 187	12,854
	6 " " '03	388,981	221,793	167,189	132,024	35,164
	6 " " '02	318,937	185,362	133,575	98,390	35,185
ALBANY, N. Y.						
United Traction Co.	3 m., June '03	429,949	316,080	113,869	------	------
	3 " " '02	379,379	255 075	124,304	------	------
	6 " " '03	1,590,357	1,083,171	507,186	------	------
	6 " " '02	1,471,516	1.011,263	460,253	------	------
ANDERSON. IND						
Union Traction Co. of Indiana	1 m., June '03	97,302	------	------	------	------
	1 " " '02	81,424	------	------	------	------
	6 " " '03	502,076	------	------	-----	------
	6 " " '02	339,067	------	------	------	------
BINGHAMTON, N. Y.						
Binghamton St. Ry. Co.	1 m., June '03	22,774	11,022	11,753	------	------
	1 " " '02	20,243	10,645	9,598	------	------
	3 " " '03	61,321	31,267	30,054	------	------
	3 " " '02	52,280	29,105	22,675	------	------
	12 " " '03	226,702	126,600	100,102	68,100	32,002
	12 " " '02	207,900	114,631	93,270	65,319	27,951
BUFFALO, N. Y.						
International Tr. Co.	1 m., May '03	327,126	174,458	152.669	131,698	20,971
	1 " " '02	264,185	146,787	117,398	125,476	† 8,078
	5 " " '03	1,481,935	837,035	644,896	637,169	7,727
	5 " " '02	1,263,104	727,766	535,338	622 529	† 87,191
CHICAGO, ILL.						
Chicago & Milwaukee Elec. Ry. Co.	1 m., June '03	22,483	7,743	14,740	------	------
	1 " " '02	17,750	7,065	10,685	------	------
	6 " " '03	93,721	39,847	53,874	------	------
	6 " " '02	78,940	38,052	40,888	------	------
Metropolisan West Side Elevated Ry.	1 m., June '03	167,420	------	------	------	..
	1 " " '02	152,614	------	----	-----	.. ..
	6 " " '03	1,031,51[illegible]	------	------	---	------
	6 " " '02	936,613	------	------	------	------
South Side Elevatad Ry	1 m., June '03	127,893	....	....	------	------
	1 " " '02	114,674	.....	------	------	------
	6 " " '03	782,283	------	------	------	------
	6 " " '02	712,368	------	-----	------	------
CLEVELAND, O.						
Cleveland Electric Co.	1 m., June '03	238,863	....	.. ..	------	------
	1 " " '02	214,985	------	------	------	------
	6 " " '03	1,318,356	------	------	------	------
	6 " " '02	1,170,544	------	------	------	------
Cleveland, Painesville & Eastern	1 m., June '03	19,765	11,487	8,278	------	------
	1 " " '02	18,716	10,488	8,228	------	------
	6 " " '03	91,404	55,910	35,494	------	------
	6 " " '02	84,145	49.287	34,857	------	------
DETROIT, MICH.						
Detroit United Ry	1 m., June '03	384,936	*222,797	162,139	82,823	79,316
	1 " " '02	336,744	*183,171	153,573	78,594	74,979
	6 " " '03	2,031,189	*1217487	816,700	490,765	325,935
	6 " " '02	1,821,266	*1038997	782,269	462,572	319,697
ELGIN, ILL.						
Elgin, Aurora & Southern Tr	1 m., June '03	42,575	22,818	19,758	8,333	11,424
	1 " " '02	33,874	19,433	14,441	8,333	6,108
	6 " " '03	211,120	124,996	86,124	50,060	36,124
	6 " " '02	186,457	111,600	74,857	50,000	24,857
HAMILTON, O.						
The Cincinnati, Dayton & Toledo Trac. Co.	1 m., June '03	46,496	23,767	22,729	16,070	6,659
	1 " " '02	40,586	20,576	20,009	16,330	3,679
	12 " May '03	489,493	271,812	217,681	193,673	24,008
HARRISBURG, PA.						
Harrisburg Traction Co.	1 m., June '03	481,423	263,141	218,280	60,650	157,630
	1 " " '02	466,530	198,673	267,857	168,857	100,000
LONDON, ONT.						
London St. Ry Co	1 m., June '03	16,224	10,484	5,740	2,154	3,586
	1 " " '02	13,643	8,558	5,084	2,287	2,797
	5 " " '03	75,569	51.226	24,334	12.888	11,446
	5 " " '02	65,064	43,167	21,897	13,593	8,304
MILWAUKEE, WIS.						
Milwaukee El. Ry. & Lt. Co.	1 m., June '03	249,684	121,334	128,350	72,134	56,217
	1 " " '02	222,450	107 193	115,257	66 015	49,242
	6 " " '03	1,430,676	734,114	702,562	424,447	278,115
	6 " " '02	1,294,629	612,304	662,325	389,554	272,771
MINNEAPOLIS, MINN.						
Twin City R. T. Co	1 m., June '03	347,745	168,745	178,999	60,890	118,109
	1 " " '02	309,884	131,367	178,516	58,733	119,783
	6 " " '03	1,918,653	922,372	996,281	365,318	630,963
	6 " " '02	1,666,439	780,370	886,069	351,533	534,536
MONTREAL, CAN.						
Montreal St. Ry. Co.	1 m., June '03	209,377	121,580	87,797	24,198	63,599
	1 " " '02	187,662	80,655	107,007	19,392	87,615
	9 " " '03	1,571,941	993,652	578,289	134,667	413,622
	9 " " '02	1,445,180	846,893	598,287	144,299	452,988
OAKLAND, CAL.						
Oakland Transit Consolidated Co.	1 m., June '03	95,312	47,843	47,469	------	------
	1 " " '02	82,920	45,139	37,151	------	------
	6 " " '03	542,588	280,328	262,260	------	------
	6 " " '02	449,486	278,133	171,353	------	------
PHILADELPHIA, PA.						
American Railways	1 m., June '03	114,742	------	------	------	------
	1 " " '02	101,154	------	------	------	------
	12 " " '03	1,240,807	------	------	------	------
	12 " " '02	1,009,504	------	------	------	------
ROCHESTER, N. Y.						
Rochester Ry	1 m., June '03	105,802	51,338	54,464	25,647	28 817
	1 " " '02	90,044	47,618	42,426	24,754	17,672
ST. LOUIS, MO.						
St. Louis Transit Co.	1 m., June '03	645,590	------	------	------	------
	1 " " '02	557,114	------	------	------	------
	6 " " '03	3,467,464	------	------	-----	------
	6 " " '02	3,014,587	------	------	------	------
SAN FRANCISCO, CAL.						
United Railroads of San Francisco	1 m., June '03	488,113	------	------	------	------
	1 " " '02	454,219	------	------	------	------
	6 " " '03	2,966,671	------	------	------	------
	6 " " '02	2,537,151	------	------	------	------
SAVANNAH, GA.						
Savannah Electric Co.	1 m., June '03	46,104	26,889	19,215	------	------
	1 " " '02	44,897	22,493	22,404	------	------
	6 " " '03	499,470	294,868	204,602	-----	.....
	6 " " '02	458,679	272,034	1866,45	-----	.....
TOLEDO, O.						
Toledo Rys. & Lt. Co.	1 m., June '03	141,545	71,806	69,739	41,135	28 604
	1 " " '02	122,682	65.142	57,540	37 851	19,686
	6 " " '03	772,178	401,206	370,972	242,070	128,902
	6 " " '02	671,284	352,381	318,903	227,033	91,870
Lake Shore Electric Ry. Co	1 m., June '03	51,541	------	------	.. ..	------
	1 " " '02	41,010	------	------	.. ..	------
	6 " " '03	254,621	------	------	------	------
	6 " " '02	197,507	------	------	------	.. ..

NEWS OF THE WEEK

CONSTRUCTION NOTES

STOCKTON, CAL.—A new loop is to be added to the present street car lines of Stockton, and will be the first of the several extensions to be made by the Stockton Electric Railroad Company.

CHICAGO, ILL.—Application has been made for a franchise permitting the Indiana, Logansport & Chicago Railway Company to enter Indianapolis with its proposed railway. The president of the Crescent Construction Company, which has the contract for building the new road, is quoted as saying that the line will be completed from Indianapolis to Indiana Harbor by December, 1905.

EAST ST. LOUIS, ILL.—The surveyors for the proposed interurban electric railway, from Evansville to East St. Louis, have completed the survey to Belleville. The line was surveyed through Irvington, Ill., 5 miles north of Richview. The surveyors will now survey for a line from Salem to Centralia, Marion County, to connect with the main line, which passes through Irvington.

GALESBURG, ILL.—The Galesburg Electric Motor & Power Company, which recently passed into the control of the McKinley syndicate, has elected new officers as follows: S. L. Nelson, president and manager; E. A. Bancroft, vice-president; Edward Woodman, of Portland, Me., treasurer; H. E. Davison, secretary; Charles Munson, superintendent; S. L. Nelson, of Fort Wayne; Fred Seacord, R. G. Duncan, H. E. Davison, C. Munson, E. A. Bancroft, of Chicago; George L. Price, B. F. Arnold and H. F. Arnold, directors. The company has in contemplation the improvement of the local system, and proposes to build a line to Monmouth. Four new semi-convertible cars for the local lines have been ordered from the St. Louis Car Company. These cars are to be 29 ft. over all, with a 20-ft. body. They will be mounted on Peckham trucks, and will be equipped with Westinghouse motors and controllers.

GALESBURG, ILL.—The Galesburg & Oneida Street Railway Company has been granted a franchise by the City Council to construct a line on Main Street from Third Street to Division Street.

ANDERSON, IND.—Work has been begun on the Indiana Union Traction Company's branch line from Anderson to Newcastle, by Grant & Co., of Des Moines, Iowa, and on the Anderson-Elwood branch line, by T. N. Stillwell & Co. This line will be 15 miles shorter than the present line to Elwood, by way of Alexandria.

JEFFERSONVILLE, IND.—The Louisville & Cincinnati Electric Company has been granted a franchise for an electric railway to run through the county, its ultimate destination being Madison, where it will connect with an electric line from Cincinnati.

INDIANAPOLIS, IND.—Last week the Kokomo, Marion & Western Traction Company completed its line to Greentown. The remaining gap in the line to connect Kokomo and Marion will be pushed to completion by Sept. 1. The Consolidated Company, building between Indianapolis and Crawfordsville, has doubled its force, and now has 125 teams at work. Engineer Mansfield said a few more such weeks and the line will be finished. It is expected the following lines will be open for business in September: The Indianapolis-Northern to Noblesville; the Kokomo & Marion to Greentown; the Indianapolis & Northwestern to Lebanon and Frankfort; the Indianapolis & Greenwood, from Frankfort to Columbus.

INDIANAPOLIS, IND.—The Danville Construction Company has been incorporated, with a capital stock of $100,000, by F. M. Fauvre, J. Chipman, M. B. Wilson and others. The company will build the Indianapolis, Danville & Rockville Railway. Work is to be begun at once under the supervision of J. W. Chipman.

INDIANAPOLIS, IND.—The Indianapolis & Northwestern Traction Company has connected its interurban track with the Indianapolis Traction & Terminal Company's track at Thirty-fourth Street. It is expected to run cars between Lebanon and Indianapolis in a short time.

LAWRENCEBURG, IND.—It is said that a deal is on between the promoters of the Indiana Southern Electric Railway, which has a franchise to haul both freight and passengers, and one of the steam roads leading into Cincinnati, whereby electric cars are to run over the latter's track into Cincinnati by using the third-rail system. The competition of the traction lines has been keenly felt between Aurora and Cincinnati, and this plan is likely to be adopted to meet the traction invasion. Accommodation trains have been abandoned, and a double track to Aurora will soon be completed by the steam road.

MUNCIE, IND.—The Indiana Union Traction Company will build a five-story terminal station building for the interurban lines entering this city. Although the building will be constructed by the Indiana Union, other roads that enter the city will become part owners. The lines are the Muncie & Portland, the Muncie, Hartford City & Ft. Wayne, the Alexandria & Muncie, the Muncie & Newcastle and the Dayton & Muncie.

RICHMOND, IND.—The Dayton & Western Traction Company ran its first cars in Richmond over its new road on Sunday, July 19. As soon as the tracks under the steam railroad are lowered the cars will be run through to Indianapolis.

SOUTH BEND, IND.—The Chicago & Air Line Electric Railway Company has formally accepted the franchise granted it by the Council, and filed a $10,000 indemnifying bond against any loss by reason of negligence during the construction of its line, and also posted the $1,000 forfeit provided in the measure if the system in South Bend is not ready for operation in two years.

SOUTH BEND, IND.—The Indiana Northern Electric Railway Company has obtained a franchise through this city and St. Joseph County to the Laporte County line. The franchise grants right to carry passengers, freight and express matter.

WABASH, IND.—The contract for the building of the interurban railway between this city and Marion has been awarded to J. G. White & Co., of New York. The work is to be begun at the earliest practical date, and be finished and cars running by May, 1904. The length of the line is 20 miles. Contracts for the steel and ties have been placed, and other equipment is now being contracted for.

WATERLOO, IND.—The engineers of the Seagrave line, which is an extension of the Toledo & Western Railway, have surveyed two routes from Auburn to Waterloo, and have decided on the west survey as the more practical. The line will be nearly one hundred and fifty miles long.

LOUISVILLE, KY.—The directors of the Louisville & Cincinnati Interurban Electric Railway Company have elected the following officers: President, George W. Lewman, of Louisville; vice-president, Louis Hartman, of New Albany; secretary and treasurer, John F. McCulloch, of Charlestown township, Ind.

ELKTON, MD.—The Cecil & Kent Light, Power & Railway Company has taken steps to construct the proposed electric railway between Elkton and Chesapeake City. A committee was appointed to make a contract with the Tennis Company, of Philadelphia, to build the road. Judge Edwin R. Cochran, Jr., of Wilmington, stated that work on the road would start not later than Aug. 1, and that the gang of men at work on the trolley road between Middletown and Odessa, Del., would be transferred here to commence work upon the completion of the road in Delaware. The Cecil & Kent Company has completed a traffic arrangement with the City Passenger Railway Company, of Wilmington, for the use of its line from Stanton into Wilmington.

DARTMOUTH, MASS.—The Board of Selectmen of Dartmouth has granted a franchise to the Horseneck Street Railway Company to build an electric railway through the town.

BILOXI, MISS.—The construction of the Biloxi Electric Street Railway has been begun.

HELENA, MONT.—The Butte & Salmon River Electric Railroad Company, with a capital of $2,000,000, has been incorporated by P. B. Moss, the Billings banker, and other Eastern Montana men. The company proposes to build an electric railway from Butte to a point in the Salmon River country, Idaho, at or near the mouth of the north fork, by way of Horse Prairie, in Beaver Head County, Mont., and Lemhi Pass. The line will be 187 miles long. It may be extended to Thunder Mountain.

NEWARK, N. J.—With a view to relieving the delay and inconvenience caused by the congestion of trolley traffic at Broad and Market Streets, the Public Service Corporation has presented to the Board of Street and Water Commissioners two plans, which, taken together, the management believes, will accomplish the object desired. These plans consist of two loops, one of which is to be used principally by cars entering the business district by way of Market Street, and the other by cars entering by way of Broad Street.

ALBANY, N. Y.—The Newburgh, Highland & Poughkeepsie Traction Company has been incorporated. The company will build and operate an electric railway from the easterly terminus of the New Paltz turnpike at Highland west through the village of Highland, Centerville, Lloyd, Ohioville, Put Corners, through New Paltz westerly to the turnpike over the Main Street bridge to Wallkill. The capital stock is $100,000. Among the incorporators are Joseph A. Duffy, Thomas G. Hinds and others of Jersey City, N. J.

BROOKLYN, N. Y.—It is unofficially stated that the Brooklyn Rapid Transit Company, to conform with the new law which compels the abolition of grade crossings of steam roads within the city limits, has decided to elevate the tracks of the Brighton Beach Railroad. This projected improvement will cost fuly $1,000,000. The ine runs over a private way, which the company owns in fee, but the trains pass through the most aristocratic suburban section of the borough.

BUFFALO, N. Y.—The International Traction Company has ordered fifty motor cars and fifty closed smokers. The smokers will be built by the J. G. Brill Company, of Philadelphia, and the motor cars by the Kuhlman Car Company, of Cleveland.

CLEVELAND, OHIO.—The Mansfield & Eastern Traction Company has filed a mortgage for $600,000 to the Central Trust Company, of Cleveland, covering a bond issue for the same amount. The road is being built between Mansfield, Mifflin and Ashland, and will furnish heat and light, as well as operating freight and passenger cars. William J. Pentz is president, and J. W. Galbraith, secretary of the company. The offices are at Mansfield.

CLEVELAND, OHIO.—At a conference of the banking houses interested in the Havana & Jaimanitas Traction Company, of Cuba, held in Cleveland, it was decided to close the option on the steam road operating from Havana to Mariano, and at present owned by an English syndicate. A bond issue of $1,500,000 was also decided upon, to be taken by the underwriters' syndicate. The steam road will be converted into an electric railway.

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EDITORIAL NOTICE

Street railway news, and all information regarding changes of officers, new equipments, extensions, financial changes and new enterprises will be greatly appreciated for use in these columns.

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Fresh-Air Seats the Year Round

A prominent street railway man remarked recently that he believed the demand for open-air seats the year round was on the increase, even in climates where the thermometer occasionally reaches the zero point. It has always been noticeable that on the cable grip cars of Chicago and Kansas City, which are open the year round, there are but few days in each year when seats on the open grip car are not in demand. These are the very stormy or extremely cold days. A perfectly satisfactory type of car will probably never be found. Even in California, with its even climate and with the half-open, half-closed cars generally used there, it frequently happens that the open part is crowded at the expense of the closed, and vice versa. The semi-convertible car, in which the transition from open to closed is accomplished by simply raising or lowering windows of ample size, is probably more popular, both with street railway management and public at present, taking the country over, than is any other single type, and yet even this cannot suit those who wish to ride in the open the greater part of the year. The double-deck car has been extensively discussed in many quarters, but unless there is some decided change of sentiment from that existing at present among street railway managers generally, there will be but little attempt in this country to introduce it. A semi-convertible car with two compartments, one to be kept open except in very cold or stormy weather, the other to be kept open only during very warm weather, perhaps might suit more people than anything else that could be devised. Street railway cars have been undergoing a continuous evolution in the last ten years. Many freaks in car construction have been tried by some companies, while others have conservatively held to the old types of open and closed cars. Just where the evolution will finally land us no one can safely predict.

The Broadway Extension of the Underground

It has been announced that the project of building an extension of the present subway from Forty-Second Street through Broadway to Union Square, and thence to the Battery, through University Place, Wooster Street and Church Street, is now under consideration by the Rapid Transit Commission, and that formal authorization may be expected early in the fall. It is generally conceded that this will be a very valuable public improvement, and that the transportation facilities it will afford are even now needed badly, yet the mere mention that such a plan is contemplated has been sufficient to set in motion an opposition movement. Broadway, throughout the retail district, opened up for subway construction, is not a pleasing prospect even to those who have no material interest in the beauty or prosperity of that section of the city, but to those whose business is centered there such a project means very serious financial loss. The line of the proposed tunnel penetrates the most important retail shopping district of the city. There, too, are located the principal hotels, restaurants, theaters and apartment houses; it is visited daily by hundreds of thousands, and represents an enormous investment in buildings whose value depends largely upon the unobstructed use of the street by shoppers, pleasure seekers and sightseers. A moment's reflection will satisfy anyone familiar with local conditions that the property owners, merchants, hotel men, restaurant keepers and theatrical managers are confronted with a serious problem, for the improvement is badly needed; in fact, it is absolutely essential to the continued prosperity of the city, and yet its execution after the method employed on the original subway, it is feared, would mean great financial loss to the business interests already mentioned.

It has been suggested that a deep tunnel be bored through Broadway and that all further extensions of the underground system adopt this plan instead of the open ditch construction. The chief engineer of the Rapid Transit Commission says that plans have not yet been drawn for the Broadway extension, and, judging from the expressions of public opinion that have already been directed to the Commission, that body will doubtless give the subject careful consideration. It has been suggested that a route through Seventh Avenue might be adopted, but this does not secure any encouragement whatever, and the Commission will be called upon to decide merely whether the same system of subway construction shall be adhered to or a deep tunnel plan substituted. The contractors for the original subway line declare that extensions can be completed much earlier if no radical change of methods is made at this time, and they contend that their experience will enable them to proceed

with the work without causing so much inconvenience and obstruction to traffic as in the original line. But the property owners and business interests of Broadway are jealous of the supremacy of that great artery and they do not intend to take any chances in letting trade get away from them even temporarily. It looks now as if the whole subway controversy would be reopened, and in any event an early decision on the Broadway extension can hardly be expected.

The School of the Motorman

There has been recently a series of electric car collisions that impels us to make comment. Fatalities have, most fortunately, been few, but even minor accidents are distressing, and when preventable cannot lightly be passed over. It is somewhat difficult to generalize as to causes, but the impression is strong upon us that the most fruitful source of collisions is an inadequate understanding of what it means to keep a car under control. Most modern cars for interurban service are equipped with power brakes which are quite capable of doing good work if given adequate chance, and we think that such brakes are usually kept in good working order. That such equipment is not enough to prevent accidents is painfully evident, and it looks as though a better understanding of the brake question were badly needed. To stop a car, particularly a heavy car at high speed, a very large amount of energy must be absorbed, and this takes time even with the very best appliances. It is perfectly possible to have two interurban cars meet in a head-end collision even when each clearly sees the other at a distance apparently great enough to insure safety. It would be a good thing if every superintendent would inaugurate a series of braking tests on his equipment under various conditions as to track, not to see whether his brakes are working properly, but to see how long it takes first-class brakes, well applied, to really bring a heavy and fast car to a stop. Power brakes are better than hand brakes, but neither is good enough unless it has the requisite amount of space on the track ahead. To keep a car under control means considerably more than confining one's self to the legal rate of speed—it means having enough leeway in speed or in space to insure safe stopping. This space may be 50 ft. or it may be 200 ft. or more, and the higher the speed the longer the danger space.

Every road has its own idiosyncrasies, curves, grades, switches and turnouts, where possible obstructions may be met, and it is the business of an intelligent motorman to know for the whole line over which he runs all the possible danger spots and at what speed they can be approached, while yet leaving ample time for stopping if a sudden stop is needed. This is precisely the knowledge which a locomotive engineer must acquire and generally has at his finger tips. To be sure, the engineer works under a carefully carried out system of regulations, of itself generally sufficient to insure safety, but he knows his train and his run besides, and this knowledge is sometimes invaluable. A motorman on an interurban line operates of necessity on a much more flexible schedule, and he has a far less complicated machine to operate, but his mind must be just as alert, and his knowledge of his line just as precise if he is to be rated as skilful. A course in braking and in the finesse of running his schedule is necessary for his complete education, and it is time well spent.

We cannot help citing in this connection the unusual care spent in training the motormen of the Boston Elevated system just prior to the opening of the elevated line proper. To be sure, that line is equipped with a remarkably efficient block system, but a sort of school of the motorman was instituted, and before a man was trusted with a train he was pretty thoroughly drilled in the peculiarities of his train and of the road. It is just this sort of education that would be particularly valuable in fast interurban work, the more so as a motorman has to exercise far more independent discretion than if working in conjunction with a block system of the nature of that used on the Boston elevated.

In more ways than one it pays to train motormen with particular thoroughness. In the mere matter of power consumed, it is a well-known fact that a skilful man can save for the company a material percentage on his daily pay. The experiment of putting on the cars ammeters, or better, wattmeters, has often been tried, and uniformly with the result of showing a very considerable saving in power, due to the intelligent care that could then be given. It has generally been considered that on ordinary street cars, which have to run under all sorts of difficult conditions, the gain hardly pays for the instruments, and such may be the case; but surely in the case of fast interurban lines, where the energy required per train-mile is far greater than on tramways there is a greatly improved chance for gain. We would like at least to see the experiment tried oftener than it is, and feel confident that it would save money. If it does not seem desirable to equip all the cars, a few cars can be equipped and the motormen given turns in running them. While their service can be checked up only while using the cars so equipped, they will be trained in the economical use of current. Moreover, a little healthy rivalry between motormen in the line of saving power for the company would be an excellent thing to cultivate, and we are disposed to think that a percentage on the value of the power saved might prove a powerful incentive to care and economy. For one thing, such a plan would discourage reckless running, such as is sometimes noted on late evening trips, and would be a sort of general education in the fine points of operation.

Many companies find it sound policy to take a lively interest in the welfare of their men, and do much in the way of providing comforts and recreation. This is highly commendable, but after all one can do nothing better for a man than to train him to skill and a keen appreciation of the value of expert knowledge in his calling. A man trained, not to be governed solely by rules and regulations, but by friendly interest to do his best and to cultivate alertness of body and mind, is a man won to a higher plane of intelligence and usefulness. We think that nothing can do more to prevent accidents and to improve the details of railway operation than persistent schooling of the men in every department of the system.

Interurban Railways and Property Valuations in Indiana

An interesting statement, which bears upon the effect of interurban railway transportation on land valuations, is reported from Indiana, in which the State Board of Tax Commissioners will add more than $100,000,000 to the State tax duplicate. This increase is not due entirely to the electric railway construction which has occurred in Indiana during the last year or two. The development of new oil and coal lands have had their effect on the increase in property values, but the vast network of interurban lines has been the greatest factor in the increase. During April all of the land in the State was reappraised for taxation, and the reports show an average increase in the value of suburban property and farm lands served by the electric lines, but this increase is not apparent in localities destitute of electric transit facilities. The appraisers took into consideration the advantages of quick and cheap transportation for the products of the land as well as the social and moral effects in

the way of bringing communities close together and increasing the convenience and multiplying the comforts of life.

Real estate values in Indianapolis, the center of the great interurban system, as well as every other city and town connected with it by interurban lines, have been built up so substantially that indications point toward still greater advance in values. A notable exception is in property in College Avenue, which has been made a trunk line for the entrance of interurban cars from the northeast. A 20 per cent reduction was made in the tax value of property on this street because of the congested condition caused by the heavy cars. This, however, is a residential street, and the very opposite effect is shown in Illinois Street, where the terminal station and office building is being erected. The effect of the terminal station being located on Illinois Street on the value of real estate has already caused a marked advance in values, and it is freely predicted that the locality will become the very business center of the city. Rents for business rooms opposite the site of the new terminal building have advanced more than 50 per cent, and this has been conducive to the enlargment and improvement of business rooms for many blocks in Illinois Street. There has also been a large demand for building sites on the outskirts of the city and for country homes, and this has also been due to the interurban lines that radiate in nearly every direction. During the year ending June 30, 1903, the gross earnings of the thirty-four electric lines operating in Indiana is estimated at upwards of $7,000,000, and their operating expenses at nearly $4,000,000.

Getting the Vacation Traffic

In these active days in the life of the steam railway general passenger agent—when all the craftsmen, from "Everybody's Uncle George" down, are expatiating eloquently in prose, rhyme and photograph on the luxuries and comforts to be had for a consideration, via their respective lines, our thoughts turn to the electric railway manager in the belief that if he will he, too, may reap a harvest in nickels and dimes culled from the vacationist's bulging pocket.

Comments upon the growth of the vacation habit are superfluous—it is with us to stay, as far as we can tell, and both holiday seeker and transportation agent are at one in their desire to get as much out of it as possible. Long excursions at reduced rates, round trips to distant points at little more than the one-way fare, stop-over privileges and other tempting offers fill the air of the ticket offices and the columns of the press. The resulting traffic is evident to the most casual observer.

We well know that summer business pays the bills and creates the profits on many an electric road which has to get along on pretty lean fare in the winter time. Managers are growing more and more acute in stimulating the growth of purely local traffic by park attractions, band concerts, baseball matches, canoe races, etc., but thus far the field of through vacation traffic has received much less attention than it deserves. Analysis of most networks of electric railways shows certain routes which constitute geographical trunk lines between important points in the system of connecting roads. Thus, in Eastern Massachusetts, the new Boston & Worcester Street Railway stands out as a distinctly trunk line in the network of the State, and its through business is bound to be a most important factor in operation. The management of such a road is concerned with far more than local problems. Similarly, through traffic demands attention and offers golden opportunity on many smaller lines the country over, and its neglect is exceedingly hurtful to such roads, and even, to a certain extent, to the advancement of electric railway practice in general.

Several times we have paid our respects to the present inadequate facilities offered by electric roads in the way of through travel. It is certain that radical improvements must be brought about if the full benefit of this kind of business is to be enjoyed. Before vacation traffic can be drawn to roads to stay permanently with them, the service and equipment must be brought up to the best modern standards. Travelers are often capricious in choosing routes to pass over, and it must be recognized at the outset that close attention will have to be paid to details if the summer traffic is to be more and more diverted to electric routes. Comfortable, roomy cars, kept clean and well painted, are the first essential, unless we except well-laid roadbed and track. If a company cannot afford to spend money on its entire system the least it should do is to bring the standard of the trunk lines which it operates up to a high state of efficiency. Attractive rolling stock is a great drawing card. High speed is far less an object with the vacationist than comfort and reliability. Courtesy in employees and willingness to answer reasonable questions is a large factor in the traveler's enjoyment.

Cars should be run on schedule time if human intelligence and skill can accomplish it. There is little incentive for a traveler to perform part of his journey by trolley if he cannot be safe in expecting to make his connections as advertised. A time-table which is not followed is worse than useless; it is a snare and a delusion, as many of us who have attempted cross-country trips know to our sorrow. Unfortunately, many electric roads publish no useful time-table whatever, and the through traveler is practically at the mercy of chance, as far as connecting systems are concerned. Little can be accomplished if the officers of adjacent roads do not get together now and then and see to it that their respective cars meet at the ends of routes to take care of through business. While it is true that it often falls to the traveler's lot to wait for connecting cars in places so favored by nature that time slips away unheeded, there is a seamy side to the question, which anyone knows who has spent half an hour on a July day, with the mercury at 90 degs., in the condensed and ripened atmosphere of a combined Italian fruit store and street railway waiting room, located on a dusty corner between a brewery and a glue factory.

When the service has been made good enough to call public attention to it the enterprising manager can take a leaf from his steam railway brother's book and advertise. Special features of historic or scenic interest along the line can be described in attractive booklets with a few good illustrations to liven up the text, and the many reasons why it is to the tourist's advantage to forsake the hot path of the steam locomotive for the wooded route of the through trolley car may be ably set forth. In fact, a delightful and inexpensive vacation may be taken now in many parts of the country by electric highways and by-ways. It certainly should not be a very difficult matter for some one with the gift of popular writing to publish a sketchy little brochure illustrating the kind of vacation here mentioned, to the lasting benefit of electric railways in the territory described. We do not believe that all the fishing worth trying for is inaccessible to trolley lines, and we know from experience that the most ardent photographer can find plenty of material for his camera on some of the electric roads not a thousand miles from New York. There is no room to doubt that with good service and equipment, judicious advertising and attention to the details of through traffic, the summer business of many electric railways can be greatly increased, to the satisfaction of the manager, stockholders and the traveling public.

NOTES ON THE DENVER CITY TRAMWAY SYSTEM

An emergency line car used by the Denver City Tramway Company, and illustrated in the accompanying half-tone views and drawings, possesses some excellent distinguishing features. It was arranged under the supervision of W. G. Matthews, line superintendent of the company, for use in stringing live trolley wire, and also as a general repair and construction car on overhead work. As shown in Fig. 1 the equipment consists of an old single-truck car body, which was remounted on double trucks with heavy motor equipment, in order to secure greater stability and prevent rocking, which could not readily be eliminated as long as a single truck was used. The seats were removed and replaced on one side by a row of bins for line material. Heavy wire screens were placed on the inside of the windows and doors. These screens not only serve as a protection to the glass but also form a very convenient support for tools and hooks on which coils of wire, rope and miscelleneous material may be hung and still be out of the way of the workmen. By leaving the windows of the car in place the interior of the car is very light, which is not always the case in a construction car.

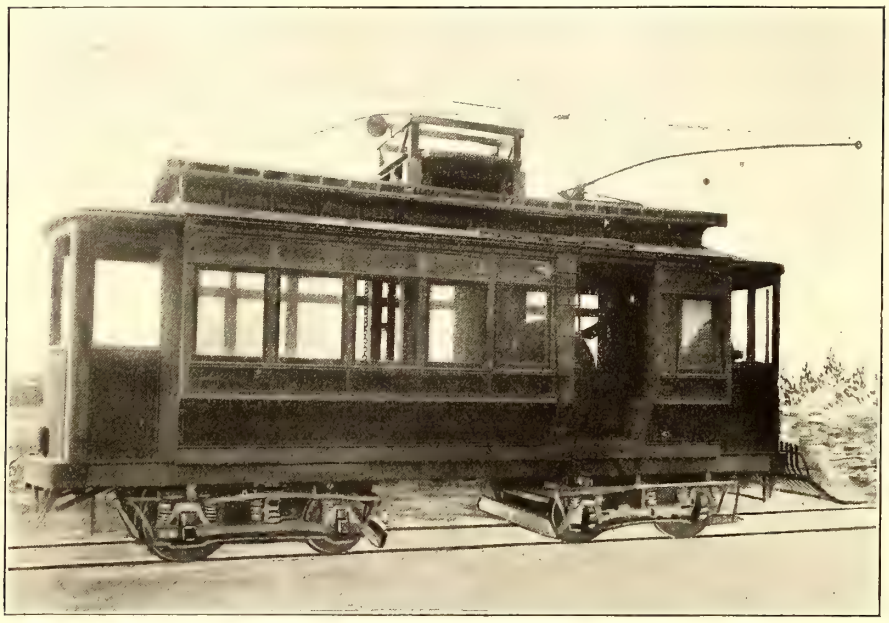


FIG. 1.—EMERGENCY CAR STRINGING LIVE TROLLEY WIRE

In the center of the car, as shown in Figs. 2 and 3, was built an elevating tower or platform with gearing, so that it can be quickly and easily raised to the desired height from the inside of the car. The hoisting gear is indicated in Fig. 3, and the chain belt connecting the crank pinion with the large pulley of the gear may be seen at the right of the tower in Fig. 2. There is a clear space of 27⅝ ins. between the vertical racks of the tower, and when the tower is lowered a tight fit is made with the roof. Access is had to the roof by means of an iron ladder placed on one side of the car, as shown in Fig. 1. An extra latticed roof was placed on top of the car so the men could walk upon it without damage.

The car has the usual number of doors except that on the right side near the front end is one which slides, and when open leaves a clear space 3 ft. wide and 5 ft. 10 ins. high. When the car is not in use this, together with the rear door of the car, is fastened from within, while the front door of the car and that in the front vestibule are locked. The rear vestibule has no doors, but beneath its central window is a panel, arranged to slide up and allow trolley poles to be run part way into the car, and still not projecting far enough to be objectional. A roller on the floor at the foot of this panel facilitates the handling of the poles. By this means two or three poles can be quickly loaded onto the car and carried to the scene of an accident. In the front vestibule is placed a 10-in. x 30-in. sand-box.

When it is desired to string new trolley wire the car is run to the company's store room, where a gangway is provided to connect with the side-door so that a spool of wire can be easily rolled into the car through the door from a platform. The spool is then turned and mounted on a detachable spool frame, as shown in Fig. 2 and in the elevation and plan in Fig. 3. This frame is rigid when placed in position and allows the spool to revolve on an iron axle that turns in babbited bearings, and is secured to the spool by means of square iron plates which fit square holes in the sides of the spool. When not in use the frame can be quickly taken to pieces and stored away, leaving the center of the car clear for other work.

On one end of the axle that supports the spool is an iron wheel about 2 ft. in diameter, upon which is mounted a band-brake that is controlled by a brake lever taken from an old cable grip car. The brake arrangement is clearly shown in Figs. 2 and 3.

When it is desired to string new trolley, if the track is in position, as is usually the case, this car is run to the end of the line and the new wire spliced to the old trolley as shown in Fig. 1. The wire is run off the spool in the direction shown by the broken line in Fig. 3. It runs over a pulley mounted in the roof at the opposite end of the car, and is then carried over a wheel on the tower platform to the trolley arm which is mounted on the front end of the car. The wheel on the tower is supported at one end of a bar that is held by clips to the tower rail, as shown in Fig. 1. When not in use this bar and wheel

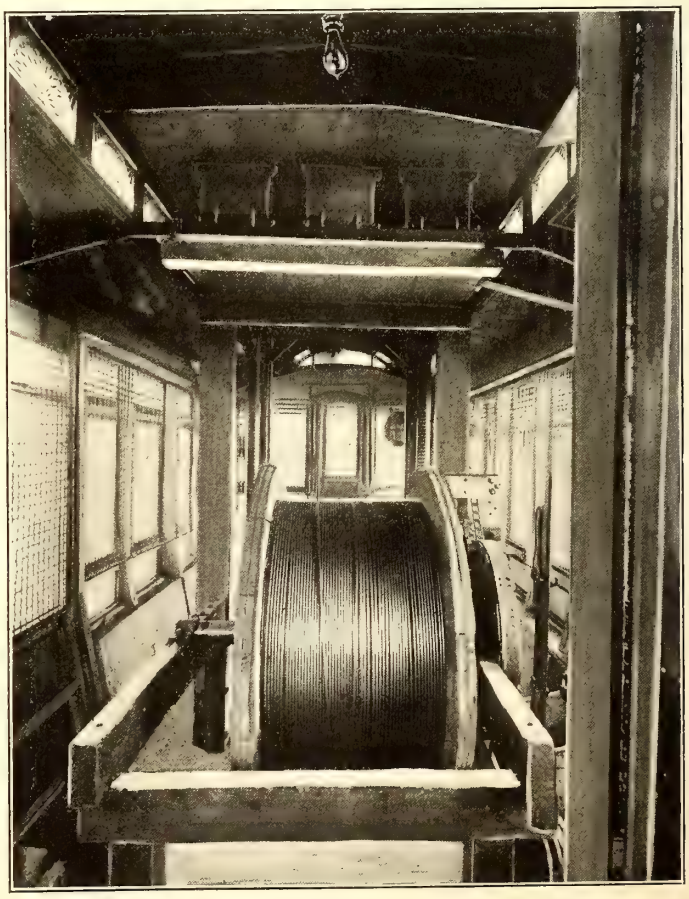


FIG. 2.—INTERIOR EMERGENCY CAR, SHOWING SPOOL OF TROLLEY WIRE READY FOR PAYING OUT THROUGH ROOF

can be removed and carried inside, thus leaving the tower free for other work.

When the wire is connected the car is run backward and the new trolley is paid out, the car motors receiving their current through the new wire itself. With one man to propel the car, another controlling the band-brake on the spool and two men on the platform making temporary connections with span wires, Mr. Matthews says that a mile of live trolley wire can be strung in 40 minutes.





FIGS. 5 AND 6.—TWO VIEWS OF STORE YARD

The company places all its new trolley by means of this car. Although the company keeps two or three repair and wreck wagons in constant readiness at the down-town loop, this line car is very frequently called into service to make repairs in case of trouble on the line, as it can be quickly sent to any part of the system.

Here is an interesting example of an emergency car that can be easily and quickly arranged for service by adapting a discarded single-truck car, such as can be found in the yards of almost every large city system. But very little new material is needed and all the work can be done at only a small outlay in the company's own shops.

DEPARTMENTS AND ORGANIZATION

Upon the retirement of Rodney Curtis as president and general manager of the Denver City Tramway Company, on account of poor health, there took place an entire rearrangement of the organization of the company. This has been largely necessary on account of the election of John A. Beeler to the vice-presidency of the company. Mr. Beeler also assumed the duties of general manager and chief engineer. W. G. Evans, president of the company, has many other business interests, so the details of management are largely left in the hands of the vice-president. The accompanying organization chart, Fig. 4, shows the arrangement of the several departments as they are at present.

STORE YARD

Fig. 5 is a view of the company's store yard, looking south from the entrance, and shows a stock of rails, stone, special track work and miscellaneous supplies. A view of the yard from the opposite end, looking north, Fig. 6, shows a large supply of ties, paving stone and poles. The company believes in keeping constantly on hand a large stock of all materials used in track, overhead and shop work, as Denver is located some distance from the source of supply, and materials could not be obtained, even on rush orders, inside of several days.

The yard is situated a short distance from the company's main shops on South Broadway, and conveniently near the main tracks of two or three steam railroads. Two trolley tracks enter and extend the entire length of the yard, and as the traction system has the narrow gage of 3 ft. 6 ins., a third rail is laid for use in switching the standard-gage freight cars from the steam railroad tracks. It will be noticed from both illustrations that the trolley wire over the two tracks are sup-

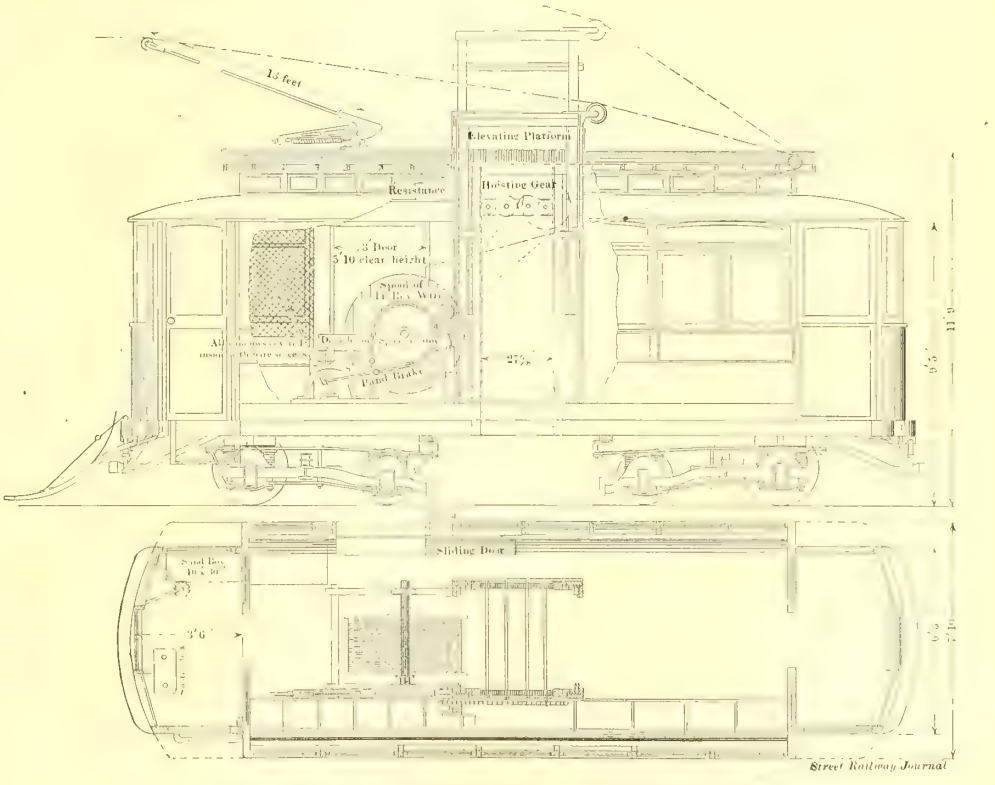


FIG. 3.—PLAN AND ELEVATION OF EMERGENCY CAR

ported by long-span wires from poles placed at the edges of the yard, so as not to take up any of the room in the yard.

At the time the photographs were taken there were stored in the yard 70,000 Texas heart-pine ties, 150,000 basalt paving blocks, 1000 tons of 72-lb. and 65-lb. rails, 1200 30-ft. to 45-ft. cedar poles, 10,000 ft. of 3-in. rough lumber used in track work, and a large quantity of old rails and miscellaneous material. The company's last semi-annual inventory showed that there was stored in this yard and in the store rooms at the shops

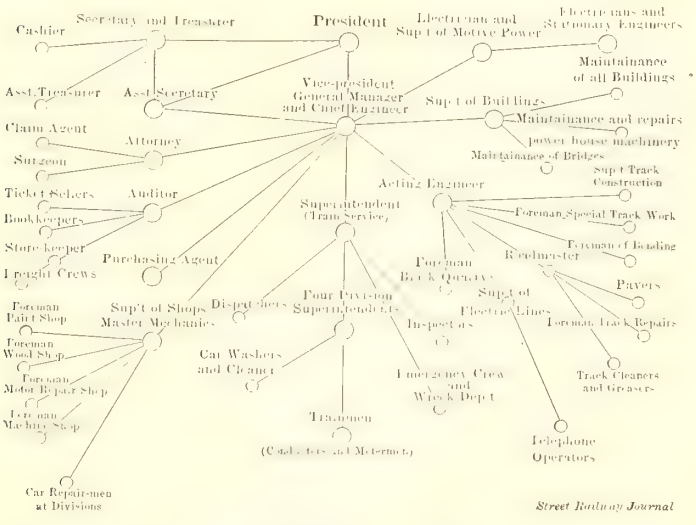


FIG. 4.—ORGANIZATION CHART OF DENVER CITY TRAMWAY COMPANY.

stock valued at over $132,000. It is interesting to add in this connection that the inventoried value came within $50 of the figures carried on the company's books, a very small difference when the great variety and the nature of the stock are considered. W. H. McAloney is superintendent of shops and master mechanic of the company and has supervision of the store yard.

BASALT PAVING BLOCKS

Under the city ordinances the tramway company is required to pave the space between its tracks and for 24 ins. outside with stone paving blocks. As it was found expensive to let the city contractors do this paving the company decided to do the work itself. Accordingly, a lease for twenty years was entered into for a quarry of basalt rock at Golden, about 15 miles west of Denver. A royalty of 5 cents per yard is paid for all stone quarried. Three men are kept constantly employed cutting this stone and shipping it to Denver, where it is stored in the yard, as shown in Fig. 6.

The specifications for the stone require that the blocks be from 4¼ ins. to 4¾ ins. in depth, 3½ ins. to 6 ins. in width, and 7 ins. to 12 ins. in length.

This rock is very hard and has good lasting qualities. It is put down on concrete made of Dykerhauff Portland cement, mixed in proportions of three cement to one of sand for the interstices. This construction is costing the company $2.65 a square yard complete. If the city should do the work it would cost over $4 a yard, and the work would not be as good. Besides there would be an extra expense for inspection and for extra track work. An example of the expensiveness of the city work is shown by some paving that was done some years ago for the company by the city at a cost of $6 a square yard. This pavement was gone in five years and had to be replaced, whereas, the company's own construction shows every indication of lasting for ten years to twenty years. The company has been using its own stone for two years, and during that time has saved enough to pay for the cost of its equipment at the quarry, $1,500, and besides has a large quantity of blocks on hand.

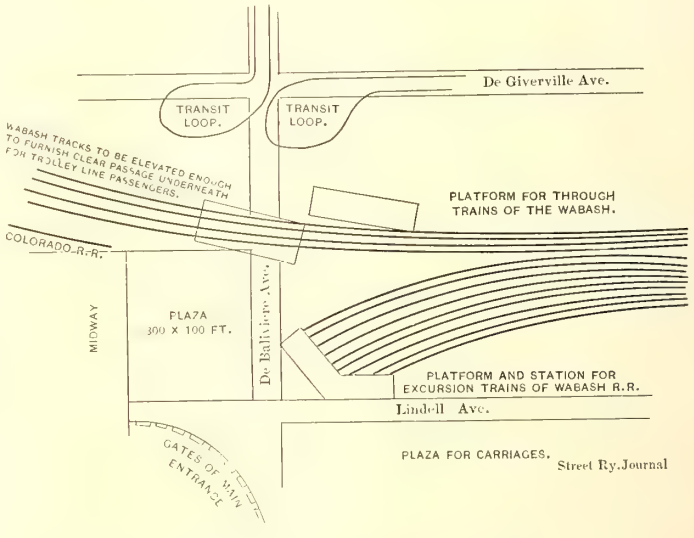
LOCATION OF ST. LOUIS EXPOSITON TRACK TERMINAL FIXED

At a recent joint conference between the World's Fair management, the Wabash Railroad, the St. Louis Transit Company and the Colorado Railroad, terminal track arrangements for the handling of traffic during the World's Fair were finally determined.

The accompanying diagram shows how the tracks will be arranged by the Wabash Railroad Company for steam traffic and by the St. Louis Transit Company for street railway traffic, likewise the plaza arrangement in front of the main gates to the exposition grounds. The street car terminals will be located north of the railroad tracks, and the crowds arriving by the electric railways will pass under the Wabash main tracks to the plaza in front of the main entrance. The Wabash main tracks will be elevated for a short distance for that purpose, as the general scheme is to avoid surface crossing of tracks in any direction.

The St. Louis Transit Company, during the World's Fair season, will abandon its loop at the pavilion in Forest Park south of De Baliviere Avenue, and will establish two World's Fair terminal loops for its cars arriving via Baliviere Avenue and De Giverville Avenue. These loops will be located north of the Wabash main tracks, as already stated, and the street railway passengers will walk through the subway to the plaza in front of the main entrance.

The Wabash will construct arrival and departure platforms for the accommodation of the main or through line traffic, and south of its main tracks the Wabash will locate its World's Fair terminus proper for excursion trains, etc. This will be a "pocket" depot, with ten or more parallel tracks, and the passengers will walk across the plaza direct to the main entrance of the exposition grounds. The carriage and automobile approach to the main gate will be immediately south of the Wabash depot. The Wabash will make arrangements to handle local as well as excursion and through traffic during the World's Fair season, and the local trains will be operated on the shuttle plan adopted by the Illinois Central in caring for the Chicago World's Fair business in 1893.



TERMINAL PLANS FOR THE ST. LOUIS EXPOSITION

The details of the plan shown in the diagram have not yet been worked out, but the conference finally disposed of the main question—the location of the terminals for the steam and the electric lines and the plaza arrangements in front of the main entrance, to provide ample space for egress and ingress at the Fair.

INTERURBAN RAILWAY DEVELOPMENT IN GREAT BRITAIN—I

BY HON. ROBERT P. PORTER

Electrical traction is undoubtedly making headway in the United Kingdom, especially during the last five years, and this statement also holds good when applied to electrical undertakings generally. Since 1896 the capital invested, including debentures and loans, has increased considerably more than five hundred millions of dollars, and in 1901-1902 aggregated $830,000,000. It is extremely doubtful if the United States can show greater increase during the same period. Of course, this includes the capital invested in telegraphs, which has only increased in the period about $10,000,000; in telephones, which has increased about $20,000,000; in electrical supplies, which has increased $150,000,000; in manufacturing, which has increased $130,000,000, and in electrical traction, which has increased $205,000,000, making a rough total of $515,000,000 added to these allied industries in six years. The great actual increase, as will be noted, is shown in electrical traction, and it is of this electrical traction that the present article will treat. According to the figures of Garcke's Manual of Electrical Undertakings for 1901-1902 I find the increase to have been as follows:

NUMBER AND INVESTMENT IN TRAMWAY ENTERPRISES IN UNITED KINGDOM

Year	Number of Companies and Investment		Number of Municipalities and Investment	
1896	17	$30,423,360	..	.....
1897	30	42,765,965	..	.....
1898-9	31	72,030,700	..	.....
1899-0	66	98,152,650	11	$5,847,100
1900-1	75	130,748,295	18	13,744,365
1901-2	125	197,610,915	47	52,597,715

The mileage of electrical tramways and light railways in the United Kingdom in 1901-1902 may be noted in the following table:

TRAMWAYS AND LIGHT RAILWAYS IN UNITED KINGDOM

	Route Mileage	Track Mileage	Number of Cars
Constructed	777	1,252	3,854
Under construction	533	846	777
Authorized and about to be constructed.	927	1,348	....
Total	2,237	3,446	4,611

TUBE ELECTRIC RAILWAYS IN LONDON

	Route Mileage	Track Mileage
In operation	15¾	30½
Authorized and under construction..	36½	72¾
Suspended in 1901 session and partially passed on last session	57½	114
Total	109¾	217¼

The above tables give an approximate idea of the progress and present condition of electric traction in the United Kingdom. Private enterprise, speaking roundly, still seems to represent the largest aggregate capital; namely, about $200,000,000, but the municipalities, if not stopped by the campaigns now so vigorously conducted against municipal trading, will continue to gain on private companies. The municipalities now represent a total expenditure of about $52,500,000, or a trifle more than one-quarter of the capital of private enterprise. It must be remembered, however, that private companies had nearly $100,000,000 in electrical traction in the United Kingdom before the municipalities took much interest in such enterprises. While private companies have about doubled the investment since then (1899-1900) municipalities have increased their capital investment eight-fold. With the exception of the London County Council, which is inaugurating electric tramways, private companies have ascendancy in and around London, and the session just ended witnessed a capital exceeding $250,000,000 knocking at the door of Parliament anxious to embark in electrical tubular railway schemes. The fifty million dollars or more of municipal money has been largely invested in tramway schemes in the provinces, and it is of these and interurban tramways that I now propose to speak.

INTERURBAN TRAMWAYS IN ENGLAND

For a decade or more the immense possibilities underlying the development of interurban electric tramways in England have been fully recognized by electrical engineers and others. Various conditions, however, have combined to retard the realization of these possibilities, and such advance as has so far been achieved in this department of traction enterprise must be regarded as a victory over unusual difficulties. Fortunately, enough has been done to show that the formation of a network of electric tramways over practically the whole of the country is a foregone conclusion. The end is only a matter of time now that the advantages of comprehensive systems of secondary lines are becoming evident to the public. It is, therefore, of practical interest to consider the conditions under which such lines are promoted, constructed, and worked, together with the prospect of more speedy progress in the near (or comparatively near) future.

Speaking generally, the engineering aspects of interurban electric railways are the same in England as in other countries. There are differences, of course, but they are not vital. The conditions which distinguish England in this matter from the rest of the world are at once deeper and more external than those concerned with the actual construction and working of electric tramways. They are partly legislative and partly social; and to discover their true significance it is necessary to trace the history of tramway legislation in England from its commencement.

Previous to 1870 only a few tramways had been built, and these had been promoted under the costly and cumbersome method of submitting a "private bill" to Parliament. To obviate unnecessary trouble, waste of time, and expense, a bill was passed which enabled tramway promoters to apply directly to the Board of Trade for what is called a tramway "provisional order." Such an order is practically a franchise and is provisional only in the sense that it has to be formally confirmed by Parliament before it can be acted upon. This arrangement was embodied in the Tramways Act of 1870, and so far as it simplified and cheapened procedure, the act was fully welcome. In other respects, however, the act was not so well advised, since it established precedents which have hampered electrical enterprise to a degree not fully recognized by those who have not been engaged in the effort of carrying out tramway schemes in England.

When the Tramways Act was drafted the government was in a most zealous reforming mood. The inspiration of this enthusiasm lay in the misdeeds of certain gas and water monopolies, which had taken a short-sighted advantage of the too liberal powers granted to them in former years. There was a strong demand that the public should be protected from similar abuses of power, and as tramways were in essence a monopoly, Parliament was naturally inclined to include protective measures in the act.

This it did in two ways:

(1) By giving each local authority the right of vetoing any tramway scheme within its district, and

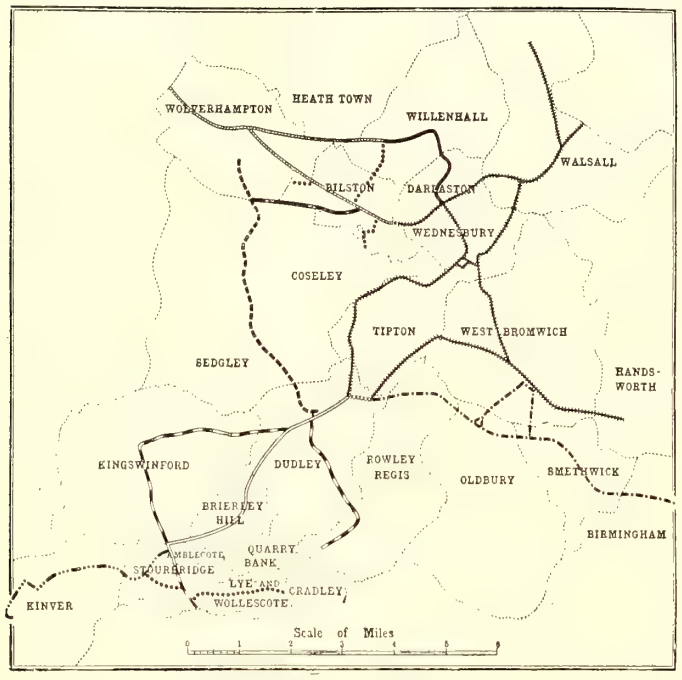
(2) By imposing a tenure of only twenty-one years on tramway concessions, and giving each local authority the power of

purchasing the undertaking at scrap value (otherwise called "old iron" or "marine store" prices) when the period of tenure was at an end.

It is safe to say that the government had no anticipation of the actual effect which these provisions would have on the future of the tramway industry; and it is equally safe to say that the government of the present day has made but slow efforts to improve matters now that the unfortunate incidence of the veto and the conditions of tenure have been felt over and over again. The attempt to regulate the powers of tramway companies in the public interest led to restrictions which were excessive, and so defeated its own intention by retarding the development of an important public service.

HOW TRAMWAYS WERE STRANGLED

In justice to the government it must, nevertheless, be admitted that the full strangling influence of the Tramways Act

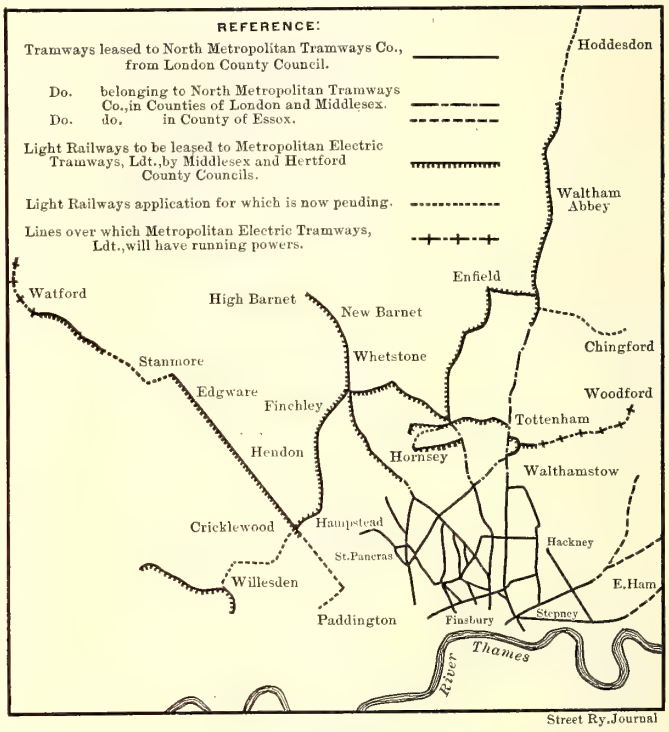


THE EXISTING TRAMWAY SYSTEMS IN SOUTH STAFFORDSHIRE AND ADJACENT COUNTIES

was not felt until many years after 1870; indeed, not until the dawn of electric traction as a commercial possibility. That was about 1890—twenty years after the passing of the act—and close upon the time when numerous tramway orders were expiring. At the same period, moreover, the important movement of municipal bodies in the direction of trading enterprises had already begun and was making steady strides in popular favor. In the coincidence of these three things—one legislative, one industrial and the third social—one finds the causes of the present condition of electrical traction in England.

To understand how this trinity of causes co-operated to produce a single result in putting back the tramway clock in England for several years, all that is necessary is to consider the position of a tramway undertaking which, in or around the years from 1890 onwards, was approaching the end of its period of tenure. Confronted with the fate of expropriation in a few years time at its "then market value" with no allowance for good will or compensation for compulsory purchase, anything like fresh capital expenditure on the undertaking was out of the question, and the efforts of the managers were naturally concentrated on reducing expenses and husbanding revenue so as to meet, as far as possible, the inevitable capital loss through the sale of the undertaking at old-iron prices. The unhappy effect of the limited tenure arrangement was to force tramway undertakings into a premature condition of senile decay. No money (except what was absolutely necessary) was spent on the renewal or rolling stock or permanent way; the cars were even grudged fresh coats of paint, and the conductors their new uniforms and new sets of the brass buttons so dear to the heart of the public. The service of cars was limited as far as possible; extensions were not to be thought of; and, in short, enterprise as it is generally understood would have been a business absurdity.

The last years of a tramway company were, therefore, years of insufficient and inefficient service. The public grumbled, and called upon the tramway companies to electrify their systems—a vain demand when there was no promise of renewal of tenure for even another twenty-one years. As the undertakings would soon fall into the hands of local authorities it



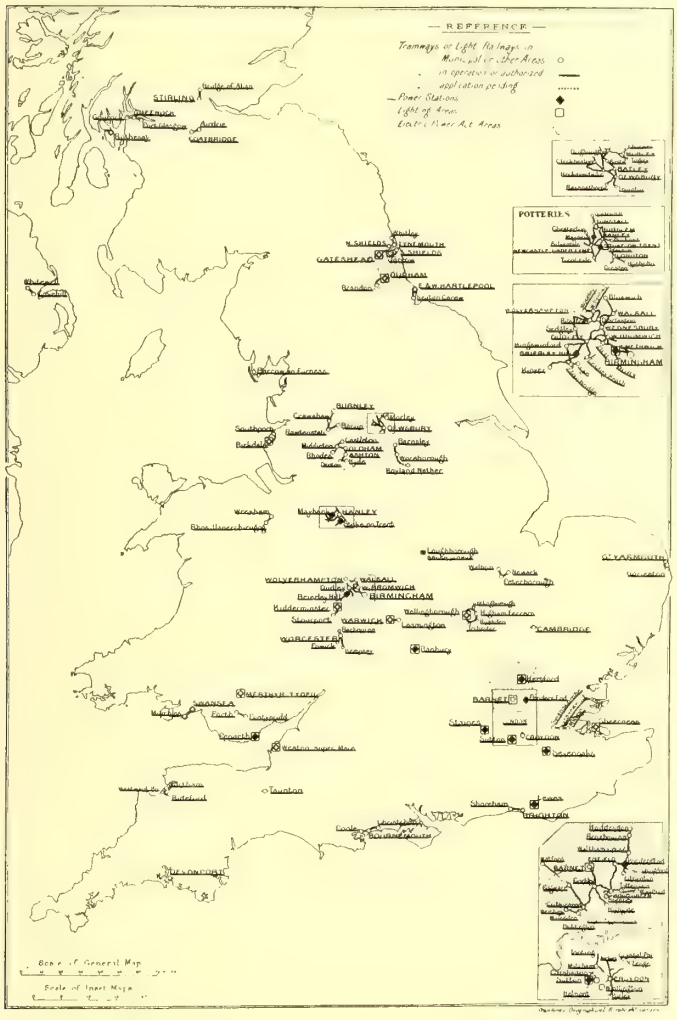
SYSTEM OF THE NORTH METROPOLITAN TRAMWAYS CO., LONDON

was natural that public opinion should turn to them for the reforms which were apparently unreasonably refused by the private companies.

This appeal of public opinion was not made in vain, and it has placed the development of interurban electric traction in a difficult position from which it will probably not emerge for a considerable period. One municipality after another took over its local tramway system when the period of tenure was concluded; and one municipality after another decided to adopt electric instead of animal traction. This latter change was not, however, carried out with anything like rapidity. Even the most progressive of municipalities and those most enamored of trading projects (such as Glasgow) dilly-dallied over the problem of conversion for a quite unnecessary period; and in the hands of the local authorities the progress of electric traction has been extremely slow. Although their new-found sphere of municipal trading was very attractive, they were at that time extremely cautious about embarking public money in speculative enterprises. When the bold few made the plunge the others followed gradually, according to the fashion of municipalities. There was for the time being no inclination to run even the most elementary of risks, and hence the local

authorities did not altogether redeem the electric traction industry of England from the reproach of backwardness.

As far as interurban electric lines were concerned, the part which the local authorities played was for many years practically nil. Each local authority thought only of its own district, as it was naturally inclined to do. Not until the example of other countries was afforded, combined with the successful exploitation of some interurban systems by private enterprise in England itself, did the local authorities begin to realize that



MAP SHOWING UNDERTAKINGS OF BRITISH ELECTRIC TRACTION COMPANY AND ASSOCIATED COMPANIES IN THE BRITISH ISLES.

the conversion of tramways to electric traction did not merely enlarge the carrying capacity of the old systems, but greatly enlarged the area over which the tramways systems should, in the public interest, extend. With horse traction the limits of each local authority were roughly the limits of economical working. With electric traction the parish became a mere item in a comprehensive system, which might extend over a whole county.

It remained, therefore, for private enterprise, in the face of discouraging legislative conditions and the opposing trading ambitions of municipalities, to demonstrate to the public the value of those extensive interurban systems which electric traction had rendered possible.

The efforts of private capital toward this end were directed through two channels. In the first place, old tramway undertakings (those approaching the end of their tenure) were acquired in the hope or the promise that the local authorities concerned would defer purchase until the end of a certain period, or grant a lease to the company. In the second place extensions are promoted as links in a comprehensive system. In both these operations private enterprise was materially assisted by the operation of the Light Railways Act of 1896, a measure about which I shall presently say more, as it introduced a new element of opposition to the extension of interurban systems.

A TYPICAL EXAMPLE

A typical example of the first method of procedure is afforded by the development of interurban tramways in what is known as the Black Country. This region lies to the north and west of Birmingham, and is practically a congeries of towns occupying a total area of about 100 square miles, and containing a population in round numbers of about one million and a half. The population of most of the towns is between 10,000 and 60,000; in the more densely populated parts the adjacent centers of congested population are so close that a stranger cannot easily distinguish where one town ends and another begins, but in the majority of cases a distance of one to several miles separates the densely populated parts. The district is, therefore, one in which the needs of easy, frequent and rapid communication are strongly felt.

Previous to the advent of electric traction these needs were most inadequately met by steam railways and by tramways which were worked in some cases by horse traction, and in others by steam traction. The work which the British Electric Traction Company undertook when it began operations in this district was two-fold. The existing tramway systems were acquired, either outright or to the extent of a controlling interest. As already indicated, their period of tenure was drawing to a close, and it was therefore essential to obtain a renewal of tenure in order to justify the capital expenditure on conversion to electric traction. Consequently, the second operation was to obtain the consents of the local authorities to the granting of leases or other powers to the various companies.

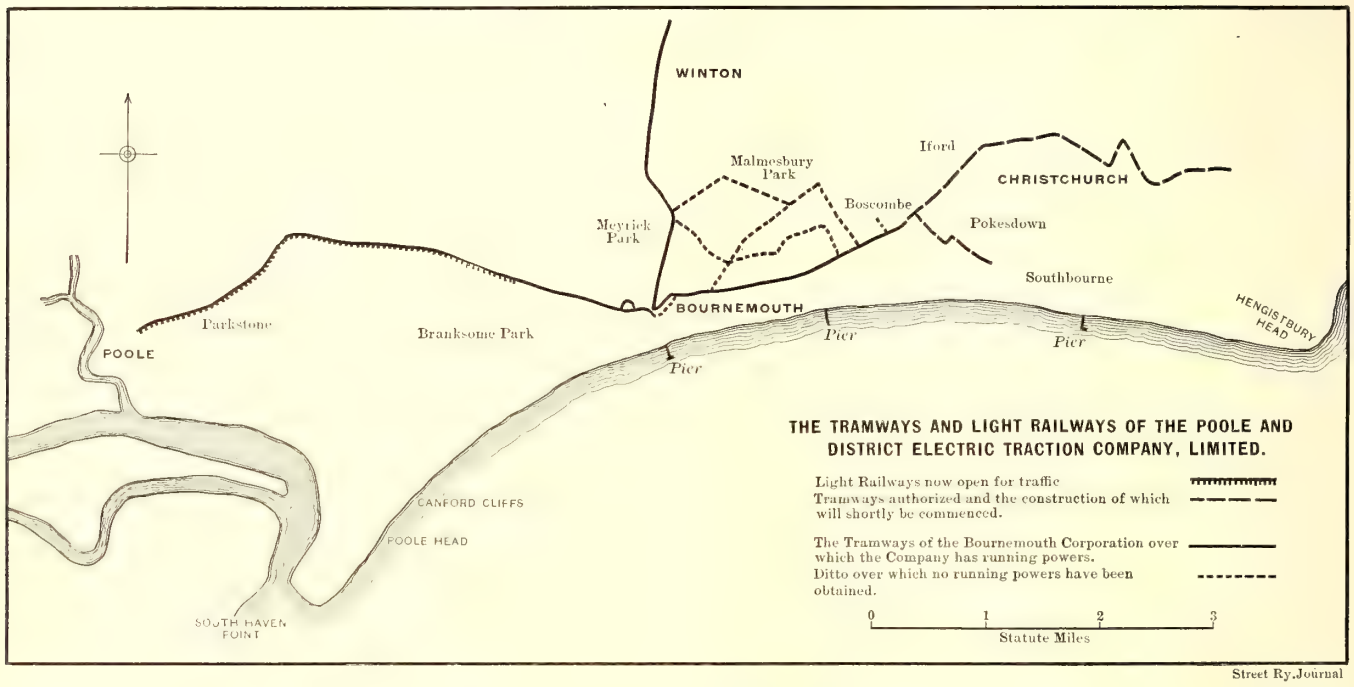
The policy of the company was, when these necessary powers were obtained, to electrify the various isolated systems and weld them together into a single comprehensive system of interurban lines with a uniform gage and under a single control.

Separate agreements had to be arrived at with about a score of local authorities—a circumstance which outwardly gives only a faint impression of the magnitude and difficulty of the negotiations which the British Electric Traction Company has, with almost uniform success, been conducting in this district for the last six years. The word success, however, is applicable only in a relative sense. Delay is inseparable from all negotiations with local authorities; and the realization of the company's clearly defined aim has been deferred for this reason long past the time required from the merely engineering point of view. Some examples of the agreements actually arrived at will illustrate the complicated nature of the financial and other operations which had to be undertaken.

The lines of the South Staffordshire Tramways Company form the nucleus of the Black Country system. They are about 23 miles in length, and traverse the populous districts of Walsall, Wednesbury, Darlaston, West Bromwich and Tipton. The British Electric Traction Company acquired the majority of the debentures of the South Staffordshire Company, but as the latter was a "Statutory" company, working under definite Parliamentary powers, it was unable to go beyond its prescribed sphere and adopt electric traction or to make new agreements with local authorities, or even to sell its undertakings, except to local authorities under the provisions of the Tramway Act. An act of Parliament was, therefore, promoted to grant power to the South Staffordshire Tramways Company to lease its lines to a new company called the South Staffordshire Tramways (lessee) Company, Ltd., formed for that purpose, and also for the purpose of forming a link with the British Electric Traction Company. The lessee company then undertook the labor of making fresh arrangements with the local authorities concerned.

These arrangements are fairly typical of those made when a

local authority adopts the role of tramway owner and a company obtains a lease. The agreement with the Corporation of Walsall binds the corporations to purchase the lines and equipment within the burgh boundary from the South Staffordshire Tramways Company, and to lease the same to the lessee company. An act of Parliament had to be obtained to confirm this arrangement. The West Bromwich Corporation undertook to purchase the tramways within the West Bromwich area, to reconstruct and equip them with electric traction, and thereupon lease them to the South Staffordshire Lessee Company for a period of twenty-one years. Under the agreement with the Darlaston local authority, that body agreed to defer the exercise of its power of compulsory purchase for a period of seven years, and to lease the Darlaston lines to the lessee company upon the expiration of that period.



Street Ry. Journal

THE BIRMINGHAM SYSTEM

Another system which was acquired for reconstruction to electric traction in a somewhat similar way was that of the Birmingham & Midland Tramways, Ltd., whose lines connect Birmingham in a fairly direct route with Dudley. The British Electric Traction Company purchased the majority of the shares of this company, which held two tramway orders dated, respectively, 1881 and 1883. Several local authorities were concerned in this system; and with two of them—Smethwick and West Bromwich—similar leasing arrangements to those mentioned were concluded. With the local authorities of Rowley Regis and Oldbury it was arranged that they should defer to exercise their powers of purchase for a period of twenty-one years from Aug. 11, 1902.

The South Staffordshire and Birmingham & Midland systems converge at Dudley, from which point continuity is maintained by the Dudley, Stourbridge & District Electric Traction Company's system. The British Electric Traction Company purchased the majority of issued shares of the Dudley Company, converted its lines from steam to electric traction, and undertook the necessary negotiations with the local authorities. Several of these bodies agreed to defer purchase until 1921, and the Dudley Corporation retained the right of purchase in 1902, undertaking thereafter to lease the purchased lines to the company.

In addition to reconstructing old steam lines in this part of the county, the British Electric Traction Company undertook certain extensions with a view to increasing the area of operation of the comprehensive system. The general object of its efforts was to obtain sufficient security of tenure to justify the conversion to electric traction of the whole network of lines. Obviously, from the nature of this welding process, any physical break in the continuity of the arrangements would prevent its proper realization. The only hiatus of this kind with which the company has been confronted was caused by the deliberate isolation of the Wolverhampton Corporation. That body has never betrayed any adequate appreciation of the benefits of mutual intercommunication between neighboring tramway systems; and besides refusing to adopt the policy which neighboring local authorities found most consistent with the public interest, that body has placed a physical barrier in the way of intercommunication by adopting a surface-contact system in place of the overhead system adopted on all other lines in the Black Country network. Three of the network lines converge toward the Wolverhampton boundary, but further than that line they are unable to carry their passengers, who must change cars at a merely artificial division line, undergoing an inconvenience which has no compensating benefits. But not even the experience of this comparative isolation has induced the Wolverhampton Corporation to take a business-like view of the situation. It seems to have committed itself at one and the same time to the surface-contact system and the policy of absolute exclusion.

This rough outline of the methods adopted in the Black Country to organize a large system of interurban tramways does not convey an adequate notion of the difficulties—mainly of a diplomatic character—which have to be overcome. Each local authority had to be separately considered, its opinions, its prejudices, and its ambitions, carefully studied. Each of the local authorities, it should be remembered, had the absolute power to veto any scheme of the tramways company for the renewal of tenure, and each of them had to be separately persuaded not to use this power. Could these detailed negotiations have been avoided, I repeat, the uniform electrical operation of this whole system would now be an accomplished fact. The necessity of these negotiations has delayed progress to such an extent that part of the system is still worked by steam, while other portions are only now passing through the reconstruction period.

(To be Continued.)

The last reminder of Boston's old street car system was taken away a few days ago when the long-unused horse car tracks on the Back Bay end of Dartmouth Street were removed.

A COMPARISON OF STEAM AND ELECTRIC RAILWAY RETURNS

BY H. D. EMERSON

To all who are interested, either in the financial results from or the operations of electric railroads, the United States Census Office bulletin, giving the income account of the street and electric railways of the United States for the fiscal year ended June 30, 1902, is of particular interest. This is the first complete tabulated statement of the doings and the earnings of the electric railroad systems of the United States. The development of the business of transporting passengers on railroads whose power is distributed by electricity, has occurred practically within the past decade; and while it has been demonstrated in innumerable cases that at present rates charged the business is exceedingly profitable, no complete summary of the situation, demonstrating conclusively the financial soundness and the certainty of profitable income, has been given us before this report.

The bulletin just issued gives certain extremely interesting and valuable figures and statistics, although the most interesting and valuable figures which it could give are accentuated by conspicuous absence. We refer, of course, to the income account of the individual corporations. If this had been included it would enable us at once to pick out the profitable properties, and eliminate those which are, or will continue to be, unprofitable either through bad location, bad management or bad financiering.

The total of the income account of all the companies is given, and it is given in such form that for the purpose of discussion it may be considered as is a report of a single corporation, for example, the Pennsylvania Railroad. The following table gives the comparative items as given in the report, for all the electric railroads of the United States, a total of 817 companies, operating 16,651 miles of line, or 22,589 miles of track, condensed and rearranged and compared with the report of the Pennsylvania Railroad System for the year ending Dec. 31, 1902. Measured as "track" the mileage does not differ greatly:

	Pennsylvania System	Electric Railroads of United States
Miles of line (not track) operated	10,783	16,651
Gross earnings	$219,849,864	$247,553,999
Operating expenses	*152,220,271	142,312,797
Net earnings	$67,629,592	$105,241,402
Other income	16,254,710	2,950,628
Gross income	$83,884,302	$108,192,030
Charges	39,323,180	*77,595,053
Surplus	$44,561,122	$30,596,977

* Includes taxes.

Two important items are made conspicuous by this comparison, the first being the less proportionate cost of operation of the electric roads, and the second the greater proportion of gross income required to pay fixed charges.

Further, the arrangement of the various items as given in the above table tends materially to deceive the actual situation.

	Pennsylvania	Electric Railways
Gross earnings	$219,849,864	$247,553,999
Operating expenses and taxes	152,220,271	155,391,496
Net earnings	$67,629,592	$92,162,503
Other income	16,254,710	2,950,628
Gross income	$83,884,302	$95,113,131
Charges	39,323,180	64,516,154
Surplus	$44,561,122	$30,596,977

The Pennsylvania report includes taxes with operating expenses, but the electric railroad report includes taxes with charges. Without entering into the question as to which is the proper place to put this item we can arrange them both on the same basis, as shown in the second table.

The disproportion in the cost of operation is reduced under this arrangement of figures, although the percentages of cost of operating expenses to the gross receipts still remains in favor of the electric railroads.

The question of operating expense and the proportion of operating expense to gross earnings, is one which has agitated the minds of the students of railway operations for a number of years past, almost to the exclusion of the consideration of other equally important questions. For a time it was a fad, especially in New York, for financial writers to make final determinations as to the efficiency of the management of a corporation by comparing the operating ratio and the operating ratio alone. But at the present time it is admitted that every railroad property, owing to its location, its construction, the physical and geological conditions of the country through which it passes, and the climatic conditions which must be contended with, has its own particular, economic ratio. And that it is extremely dangerous, and oft-times leads to error to laud one management and condemn another because of apparent discrepancies in operating ratio. In the case in hand, it is a notorious fact that the Pennsylvania Railroad is over-operated; that is, betterments which are properly chargeable to capital account are included in operating expense, which naturally reduces the earnings or profits proportionately. And in the same way it must be admitted that the cost of operation, as shown by the electric lines, is undoubtedly lighter than a conservative audit would show. Unquestionably there are many trolley companies which include in their expense accounts only such charges as are absolutely necessary for the actual operation of the property, and as plant and equipment is all comparatively new, depreciation, or its equivalent, proper natural up-keep, is omitted. If to the total operating expense, as shown in the electric railroad column, be added the proper percentage for depreciation and renewals and repairs of power stations and rolling stock, such amounts as will have to be expended annually in a few years, undoubtedly the operating expense of the electric railroads would be materially increased, so the disproportion in these two items will be materially lessened.

Other income has no particular bearing on the question either way, except as it indicates the financial strength of the corporations. Illustrating this proposition, we can deduct income from the fixed charges, which would leave us approximately $23,000,000 for the Pennsylvania and $75,000,000 for the electric railroads. This latter item, the item of fixed charges, is the all important question in the proposition. The financiering of any corporation should be along such lines as will make the securities of unquestioned merit, and to meet this demand the income of the properties underlying the bonds must be sufficient to prove that, given the minimum probable gross earnings and the maximum possible operating expense, the net earnings will be more than sufficient to meet the fixed charges. In the case of the Pennsylvania there is no question as to its ability to earn, even after a material decrease of gross receipts, its charges and have a surplus left for its stock. In the case of the electric railroads the proposition is not as clear or as positive. In making up the table above the figures have been used as given in the income account for the year ending June 30, 1902. But in another table the census report gives the interest charges on the outstanding indebtedness as $43,500,000, as against $38,000,000, as included in the table above. This would make an increase in the total charges per annum of $7,500,000, and would reduce the surplus after charges to $23,000,000. Of course, in figuring this way it must not be for-

gotten that the Pennsylvania Railroad is the product of the ablest engineers and the ablest financiers working in harmony for a matter of fifty years, and that undoubtedly mistakes have been discovered and errors have been rectified. On the other hand, our electric railroads are really developments of the last decade, and it may be said without animus that a majority have been built by inexperienced engineers and financed by amateurs, and some are undoubtedly over-capitalized.

And this brings up the question of capitalization. The capitalization, as reported for the electric railroads, amounts to $2,300,000,000; divided $1,315,000,000 stock and $992,000,000 funded debt. The Pennsylvania Railroad Company has at the present time $300,000,000 stock and $140,000,000 bonds, but to this latter should be added at least an equal amount representing the indebtedness and outstanding securities of subsidiary corporations. The total amount of capital issued against all of the various Pennsylvania Railroad subsidiary companies is, of course, much larger than these figures would indicate, and undoubtedly approximates somewhere near the billion-dollar mark, but for the purposes of comparison they should be eliminated, because held by the Pennsylvania Railroad Company or its subsidiary companies, or as in the case of guaranteed rentals of leased lines or guaranteed stocks are represented by the charges included in the table above. As far as the public is concerned the Pennsylvania Railroad Company, in effect, could distribute to its stockholders at least three-fourths of the surplus income shown above, or, say, a dividend of 10 per cent on its present outstanding capital stock of $300,000,000, and still have a surplus left. On the other hand, the electric railroads last year could have paid out $30,000,000, which is a little over 2 per cent on the outstanding stock. But if we deduct the fixed charges, as shown in the report, as indicated for the present year, the surplus earnings applicable to stock account is equal to 1.8 per cent thereon. This showing, however, of 1.8 per cent for all of the stock issued against the trolley lines of the United States, after deducting all of the charges, is most excellent, when comparing an industry of under ten years growth with a corporation which has been over half a century in building.

Included in the total of the 800 odd companies are many which are not at the present time earning their fixed charges, and their obligations included in the general summary undoubtedly materially reduce the surplus applicable to the profitable corporations. It is inevitable that reorganization, either by means of foreclosure or amicable adjustment of capital stock, will cut down the total bonded indebtedness of the electric railroads and diminish the outstanding securities. When, in the course of the next two or three years, these necessary financial readjustments and the new scientific expert management which is being acquired by many corporations increases profits, trolley line and electric railroad securities should take a place second only to the securities of the great trunk lines of the United States, which are the best managed, strongest, most profitable and most stable corporations in the world.

TICKETS AND TRANSFERS USED IN DENVER

The Denver street railway system uses a large number of tickets and several distinct transfer slips. Each ticket is of special design and also has a distinct color so that it may be easily recognized. Several styles of tickets used on these lines are represented in the accompanying illustrations. They may be classified and described as follows:

(1) Half-fare ticket, sold at 2½ cents each in books of ten and twenty, for children under 12 years of age; good on all lines and at all hours.

(2) Straight 5-cent fare ticket, sold in books of fifty and one hundred; used as convenience and also purchased to some extent by residents who make presents of the books to their friends and visitors.



FIG. 11.—EMPLOYEE'S TICKET

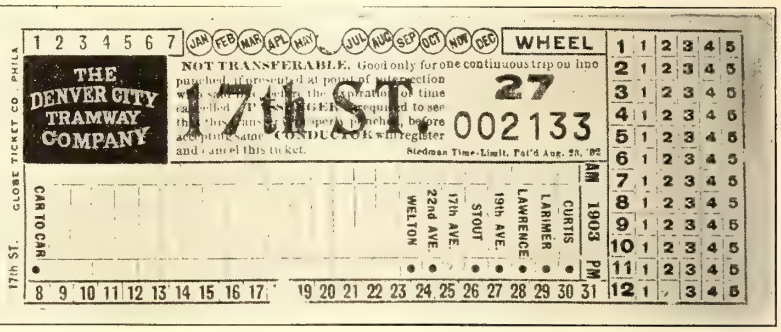


FIG. 12.—TRANSFER ON DENVER SYSTEM

(3) United States Army tickets, purchased by quartermaster's department, at Fort Logan, at full rate, and given to soldiers.

(4) Special ticket for various uses.

(5) Policeman's ticket, issued to chief of police.

(6) Special limited ticket, good between 6 a. m. and 7 p. m. on week days; purchased at full rate by employers and presented to their employees.

(7) Complimentary ticket, issued in books of 100; books not renewed oftener than once a month.

(8) Commutation tickets, purchased at 5 cents, and good for transferring to and from the Cherrelyn car line, south of Denver (known as the line where the horse rides down hill on the car).

(9) Trainmen's wives' tickets, issued gratis every month, in books of sixty tickets, to each motorman and conductor who has wife or housekeeper dependent on him; month and year punched before issuing; can be used any time during the month.

(10) Employees' tickets, issued in books of sixty-two, for two rides each day of month; used principally by shop men.

(11) Employees' Tickets.—There are several classes of these tickets, and they are issued in blocks to foremen and superintendents, who punch the day and hour and issue them to their men for transportation between their work and their homes. White tickets are good only in the morning, and pink tickets only in the afternoon. A heavy red numeral, printed on each ticket, indicates the department (track, line, etc.) to which the men belong. The company found that the use of passes or badges was abused by such employees and record was kept of the traffic. By the use of these tickets an accurate record is kept of the traffic, and as they are issued with a limit of time necessary for the employee to reach home, or to leave home and reach his work, the men are not so apt to loiter or spend time at saloons before going home.

(12) New Form of Transfers.—Formerly the transfers were punched so that they were good for 30 minutes after time of punching. Now the conductors punch the maximum time limit, allowing not more than 20 minutes from the time the car is due at the transfer point. The name of the car line is printed on the ticket in red ink, and all the lines to which transfers are

given are arranged in alphabetical order for the convenience of the conductor in punching the transfer line. Blocks of these transfers are issued each morning to the conductors at the barns, the month and day being stamped beforehand. The conductor punches the transfer line in the a. m. or p. m. column and the minutes after the correct hour. These transfers have proved very popular and quite satisfactory. At first on the back of the ticket was printed instructions and advice to the passenger, but the company has now sold the privilege of using the back of the transfers to the "Seeing Denver" concern,

The elimination of losses in units of time, fuel, brain energy —in short, every possible leak in operation, is thus a problem of tremendous importance. Success or failure in its solution appears in the declaration or passing of dividends at semi-annual and even quarterly times of coupon shearing. The opportunities of watchfulness in this direction are so extensive that time and space permit only suggestions of what may be done with one instrumental method, that of the card system in street railway work.

Reference has been made before in these pages as to the



SPECIMENS OF TICKETS USED ON DENVER TROLLEY LINES

which is distinct from the tramway company. Under the new arrangement the net cost to the tramway company of printing the transfers is but one-third what it was formerly.

THE CARD INDEX IN ELECTRIC RAILWAY WORK

The reduction of operating expenses by the employment of labor-saving methods and devices is to-day receiving attention in every industrial field which can rightly claim to be progressively worked. The results of such improvements in business machinery are well exhibited in those spheres of activity which are carried on by transactions in small units, and which are susceptible to detailed analysis in quantities not too large for the imagination readily to grasp. Especially is this true in manufacturing industries.

Broadly considered, an electric railway system is but a vast machine for the manufacture of transportation, capable of turning out an enormous product in passengers carried per week, and operated by the concentrated energy of many individual units. Its revenues are to a great extent functions of the 5-cent piece, and its expenses, when properly dissected, resolve themselves into even fractions of a cent per unit output or per car-mile.

value of the card catalogue in indexing engineering literature. By extending the idea to small and large envelopes, classified alphabetically or decimally, clippings and notes can be found when needed, almost in the space of a dozen seconds. A vast amount of information strays into and out of a manager's office each week. Much of it is worth keeping. When information is wanted in street railway work it is usually needed at once, and if the particular item required is hidden away in a non-indexed bunch of papers or overlooked note book, many minutes are usually the price of forthcoming, if, indeed, it is found at all. Thus, at ten minutes before six some evening the manager calls for an editorial which appeared a few weeks back in the leading morning paper, in regard to an extension which he is to discuss at seventy-thirty before the City Council, it is in his hands inside of a half-minute if it was filed in proper season in an indexed envelope covering that extension; but if it was not so filed, a weary quarter or half-hour is in store for the manager's secretary, who finally locates it, securely tucked away in a box marked "miscellaneous."

A former employee of the company is arrested for forgery in another city. Certain facts regarding his habits are requested from the general manager by long-distance telephone. In less time than it takes to write it the superintendent of transportation has the man's record card upon his desk, and is

dictating a letter to confirm his quickly-furnished information.

The coal bill of one of the outlying power stations suddenly begins to increase. Immediately the question of output and previous coal consumption, both in total and per kilowatt-hour, arises. The superintendent of motive power turns to his card cabinet drawer and the history of that station for months back is at his finger tips. No nerve-wearing efforts to remember just where the particular items sought are hidden away, no loss of clerk's time in hunting for the elusive figures, no loss in keeping the station records while the record book is being consulted —all these time and energy-wasting methods are relics of the past.

The purchasing department receives a dozen quotations on thirty barrels of oil. Before the contract is awarded the price per barrel, delivery and terms of payment of each bidder in a proposition made by him three months before are wanted. The card index immediately locates the awarded previous contract, and specifies the numbered compartment in the filing case which contains the original proposals.

A damage suit is instituted against the company by persons claiming to have been injured on one of its cars in a collision with an express wagon three weeks before. The claim department at once requires full information as to the number of passengers carried on the trip when the accident happened, the addresses of witnesses, weather, speed of the car—in brief, every possible fact bearing upon the event. The reports of the various motormen, conductors, inspectors, police officers who saw the accident, and even photographs of the street where the casualty occurred, may be invaluable to the company's defense, and their speedy collection is but a matter of seconds, if they are properly filed and indexed on the card system. Not many years ago a Boston car ran away on a moderate grade, dashing into a market, and more damage suits were instituted against the company, it is said, than the register showed passengers on the car. The importance of having detailed records in accessible files could be instanced in hundreds of cases where the opportunity to mulct the company has been thought too good to be lost by the not always over-scrupulous general public.

Another instance of the usefulness of the card system appears in the filing of photographs and lantern slides. During periods of new or reconstruction it is always desirable to make liberal use of the camera when possible, and the proper putting away of plates and prints is an important consideration if they are to be promptly found when wanted. It is easy to forget just what phases of the work have been photographed as well. On large roads it is sometimes the practice of prominent officials to give illustrated lectures, when requested, at various gatherings of church organizations and other social bodies, and the same treatment in indexing may as readily be given to lantern slides as to plates.

The cost of new work, especially in the engineering department, is often an uncertain quantity when details are considered. The comparison of original estimates with actual construction cost is so instructive that every means of analysis which can throw light upon how the details worked out on the ground is extremely valuable. In a large company the field of usefulness in this direction is well nigh inexhaustible. The causes of change from original design and the resulting effect on expenses in construction, the amounts paid for labor and material, the times which each part of the work required for completion and any unusual circumstances present are all amenable to the best methods of filing data by which the card system can effect economy in time, work and expense.

On many roads it is necessary to keep track of the length of service of the uniformed employees, in order to correctly award the increased pay and uniform service stripes which mark the length of the different periods of employment by the company. The task can be done with the utmost ease by providing a card for each employee concerned, which gives the date of his enlistment in the ranks, and by its color indicates either the year in which he was employed or the year in which his next period expires. The use of cards alphabetically arranged has been in considerable use for some time in the employment offices of different street railway companies, and experience has demonstrated the advantages of being immediately able to examine applicants' records when new men are under consideration.

The application of the card system to the operation of electric railway car and machine shops is bound to grow in favor as the all-around usefulness and wide scope of the method become recognized. Records of painting and car repairs, renewals of wheels, lamps, brake-shoes, tire turnings, mileage, carpentry and blacksmith work may be kept absolutely up to date and constantly at hand for immediate consultation. In the electrical department breakdowns of car equipments, generators, feeder and transmission system, the insulation of underground cables, special tests and investigation, may all be usefully and conveniently classified in this way.

In the traffic department there is scarcely any limit to the flexibility of indexing records, which may, if care is not used, become in detail minute to a burdensome degree.

It is upon this possibility of flexibility that the danger of overdoing the applications of the card system depends. It is difficult to know just where to draw the line, but a sound, general principle is to make the fact which is filed as far as possible its own index, as it is usually a waste of time to copy data once properly classified. The danger does not lie so much in widely applying the index as in carrying each card catalogue too far in one particular direction. It is safe to say that no single method of classifying can apply to all kinds of data, and that note-books have their proper place, but even these should preferably be made up of removable leaves alphabetically or decimally arranged. Nor should a company, whose cards are printed to satisfy its own operating conditions, feel that improvements in the cards are not constantly in question.

If the possibilities of excessive indexing are kept in mind the three great advantages of card systems are irrefutable. The fact that in every department information may be kept up to date at all times, coupled to the remarkable certainty and speed with which the requisite data may be obtained at low or reasonable cost, render the card system one of the most efficient mechanisms of modern industrial life, and its extended applications to electric railway work are only questions of time and appreciation. In shop, drafting room and office it is bound to become, in some form or other, an indispensable piece of furniture.

THE PROJECTED LINE BETWEEN ITHACA AND AUBURN, N.Y.

The plans for building the proposed interurban electric railway between Ithaca and Auburn, N. Y., have progressed to the point of taking out a charter for the road under the title of the Ithaca & Auburn Electric Railway Company, capitalized at $1,000,000. The preliminary work has been going on for months, and it is said that even the system of power distribution has been worked out. Unofficially, it is said that the main generating station will be located at Lake Ridge, and that sub-stations will be built at Auburn and Ithaca. A company, to be known as the Ithaca & Auburn Construction Company, is to be organized to build the road, and the work of construction will be under the direct supervision of A. P. Colegrove, of Philadelphia. The road will enter Auburn at Genesee Street, making connections with the local lines. Entrance to Ithaca will be made by way of Tioga Street.

The officers of the company are: Isaac P. Hazard, of Poplar Ridge, president; Dexter Wheeler, of Poplar Ridge, vice-president; Edwin B. Mosher, treasurer; Sherman Collins, of Ithaca, secretary. An executive committee consists of Sherman Collins, chairman; Isaac P. Hazard and Edwin B. Mosher.

MINOR CAR REPAIRS

BY A. O. CARPENTER

In car repairs there are usually several right ways of performing the work. They may be all equally good, judging from the mechanical standpoint, in strength and cost, but vary only in the question of the time. Where other reasons have equal weight the decision between two methods ought to be governed by the time in which the work can be performed.

The following notes in regard to the practice on the old "West End" shop will be of interest in this connection:

A large portion of the injuries to car bodies are caused by blows upon the ends or corners of the vestibules, due to collisions, and naturally the guard rail suffers. In its repair there

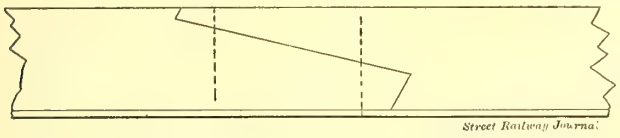


FIG. 1.—BOSTON METHOD OF REPAIRING GUARD RAILS

is a slight deviation in Boston from what is usually considered standard practice.

A long scarf joint, while very neat, is lacking in longitudinal strength. If the belt rail is to be repaired a ship splice is used, but, as shown in Fig. 1, one of the parts is made much wider than the other so as to give as much end to end contact as possible. Repaired in this way the new piece is almost as well able to resist an endwise blow as the original rail. Of course, this is not as neat as the standard scarf joint, but neatness cannot well be urged as against strength and durability.

In Boston dashers suffer severely. The narrow streets and short curves make it impossible to use projecting buffer beams. Hence, dents and dimples are constantly on the list of repairs. It has been found, however, that by using jack screws or hydraulic jacks these can be taken out without removing the dashers from the car, and usually without any necessity for repainting beyond a simple touching up. When a dasher is straightened by heating several days are required for repainting even when the work is hurried. The time and cost of removal and the cost of painting is saved by the use of the jack, and the delay to a car amounts to hours instead of days. The saving in money is considerable on a large road, and on smaller roads with a limited number of cars the advantage is often greater.

On some of the roads now forming a part of the Boston elevated system there are many cars which were built without diagonal bracing. They belong to a time when the need for diagonal strength was not greatly felt, but new conditions have brought out the need for this strength. All the cars are now being fitted with vestibules. When these are in place a slight blow, for example, from a loaded truck breaks or takes a splinter from a vestibule corner post. The repair is, of course, simple and quickly and easily made. The car is apparently uninjured, and upon inspection it is usually found that the windows and end doors work perfectly, that is, all except the outside door diagonally opposite the injured post on the other end of the car. This, perhaps, refuses to be shut by three-sixteenth of an inch, and it has to be taken off from the stile.

This is almost a daily occurrence, and shows, of course, that the car body is "out of square" to that extent. No one would have suspected any damage to the frame as there was no other sign of injury, and such slight distortions passed unnoticed until the introduction of vestibules.

The lesson is one that should be studied by those who are building large, heavy cars, depending upon the cross-framing alone to hold them square. Blows upon corners which do not seem to be of any great force will cause trouble at vestibule doors. Probably, when the frame is once distorted and the joints broken it will yield to the next blow much more easily.

One of the important principles upon which all work is conducted in the Bartlett Street shops is to "save the use of the rolling stock." Every car is needed and every car, as far as possible, should be earning money. The cars are kept in the shop the shortest possible time, and in making repairs that method is selected which will produce the strongest and most durable job in the least time.

In building new vestibules which are to be applied to all old cars standard lengths cannot be exceeded. Buffers cannot have a greater projection than heretofore, nor is it possible to move the dasher forward so as to have a straight front. The upper part of the vestibule then projects because the dasher cannot be moved sufficient to accommodate the brake handle, and on top of it a wide bottom board or shelf is used to form a base for the vestibule. Blows from the overhanging loads of trucks and market wagons frequently split this board. Usually lag screws can be so placed as to hold the parts together and save the renewal of an expensive piece of timber. Of course, no one likes a lag screw or would recommend its use; yet a lag screw, properly driven home in a hole of the right size, makes one of the best known connections for wood. The "rub" comes in getting the hole to fit the "wire" of the screw and in giving the screw just the right number of turns. One or two turns too much and a wire nail is about as good as a lag screw.

Much of the original designing for the old West End Company, and a great deal of that for the Boston Elevated, has

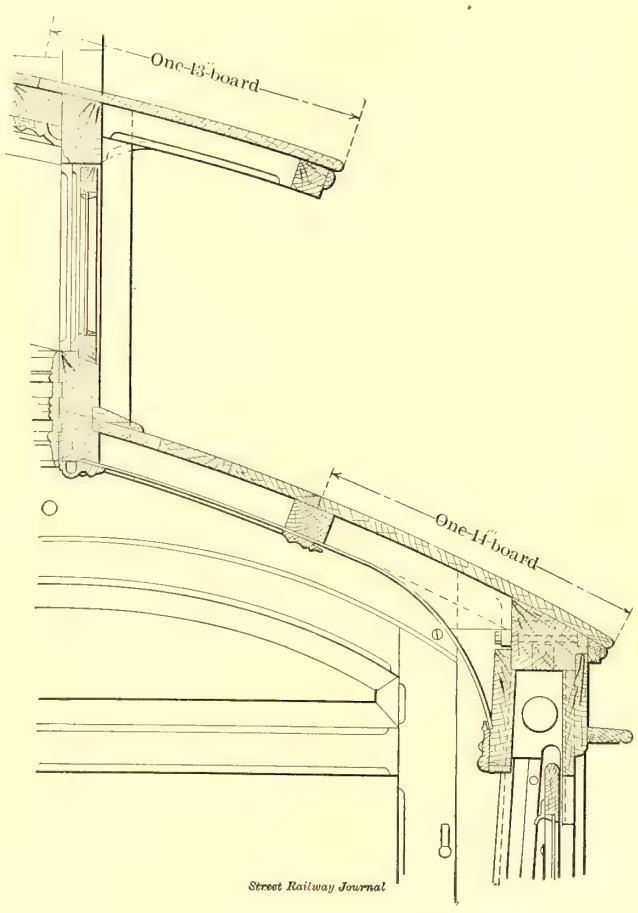


FIG. 2.—CROSS SECTION SHOWING ROOF BOARDS

been made with a view to making repairs easy and economical. Some of the peculiar details are simply the result of long experience. Those who have built cars for this system will remember the stress that is always laid upon the finish at the edges of both the upper and lower deck. The roof board, in such cases, projects, and the half-round moulding covering the canvas is placed under it instead of on its edge, see Fig. 2.

This engraving shows a cross-section of the raised roof as well as a section of the lower deck and the plate.

In many of the common systems of finish the roof board is flush and the half-round covers it, forming a finish at the edge of the roof. This looks neat, but there is a vertical joint exposed to the water, and if the external paint is cracked the water finds its way into the bare canvas, and so on to the wood of the frame. In the case of the main or lower deck the water gets an easy passage to the heads of the post. A little decay at this point soon ruins the whole structure.

By adopting the arrangement shown in Fig. 2 the roof board projects, and the edge of the canvas is held under it by the half-round moulding. A drip is formed and nearly all the water drops clear without passing under the joint. From the same engraving it will be seen that the water table is formed with an edge so moulded as to give a drip and prevent the water from following the under side. The value of these details is shown by the complete freedom which the cars have from decay in and about the head of the post.

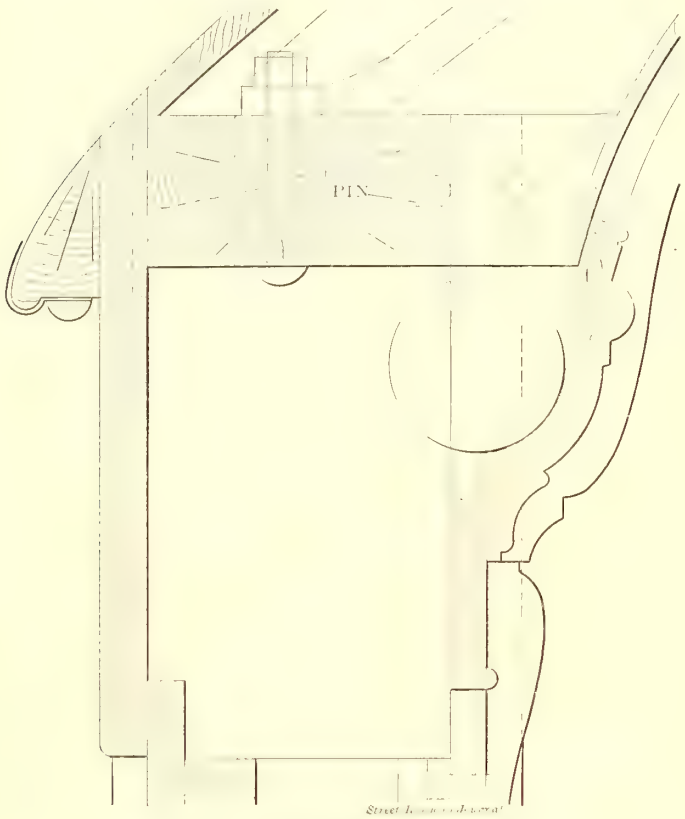


FIG. 3.—COMMON FORM OF DRIP.

In Fig. 3 we have another form of drip which has been extensively used and has some good features. As long as the canvas is intact the water is carried away so as to drip outside the joint. Its defective feature is that the roof board does not come down to the drip without a joint.

One of the common troubles with electric cars is the entrance of the water at the end vestibule sash in the roof. It was a serious matter with the old horse car, but is worse with electric cars on account of the higher speed. When water goes through the inside finish at this point it reaches the whole end frame, including the corner post. Making the end sash on each side in the roof stationary would be an effective remedy. On surface cars of the Boston Elevated the hood is given an unusual cross projection so that the opening is 14 ins. back from the edge of the upper deck. Another notable departure from common practice followed in Boston is the use of wide boards at the edges of the roof. This is properly a precautionary measure by which water is kept away from the framing if the canvas should become damaged.

Another notable feature of these cars is shown in Fig. 4. It is the absence of corner plates. Although much advocated by some builders they are not always an unmixed blessing. When badly bedded moisture enters behind them and the whole corner of the car is destroyed beyond repair. Not only is the post spoiled, but the plates and headpiece become spongy. For this reason a plain bracket has proved safer than the more elaborate plate with its numerous pockets for water.

To argue against brass or bronze for the trim of both open and closed cars puts one in the "way back class." He who advocates malleable iron is set down as penurious or old fogy.

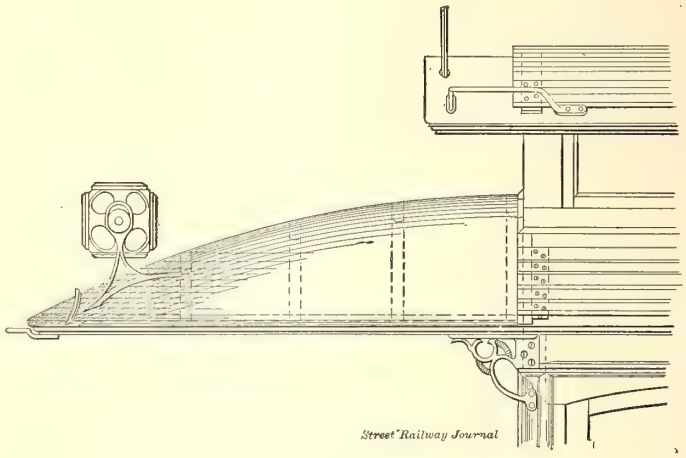


FIG. 4.—ELIMINATION OF CORNER PLATES.

When a large number of cars is to be kept in order brass or bronze is, in more than one way, expensive. In the Dudley Street shops the preference is decidedly in favor of malleable iron, and with the best of reasons. At the end of the season, when open cars go into the shops for repairs, the bronze trim looks not better, if not worse, than the painted iron; often it is very much worse. Most of the trim must come off and go to the brass shop for refinishing. To get each piece back upon its own car, in its original place, is out of the question. Screws do not fit, and those portions secured by wood screws are not nearly as firm as when they were first set. These seat braces are especially apt to work loose. Each time the pieces come off larger sizes of screws are needed, but the holes in the metal put an end to larger screws after a few changes.

Painted malleable iron trimming does not need to be disturbed. When painted it is as neat as bronze and very much cleaner. Since it is never removed the car is, in the end, much stronger. The cost of putting the malleable trim in shape at the end of a season is a small item compared with that of refinishing bronze, and, as there is a considerable advantage in first cost and a less liability of theft, it must be confessed that the arguments in favor of iron are strong and appeal with special force to roads having many cars.

EXPANSION OF THE INDIANA UNION TRACTION COMPANY

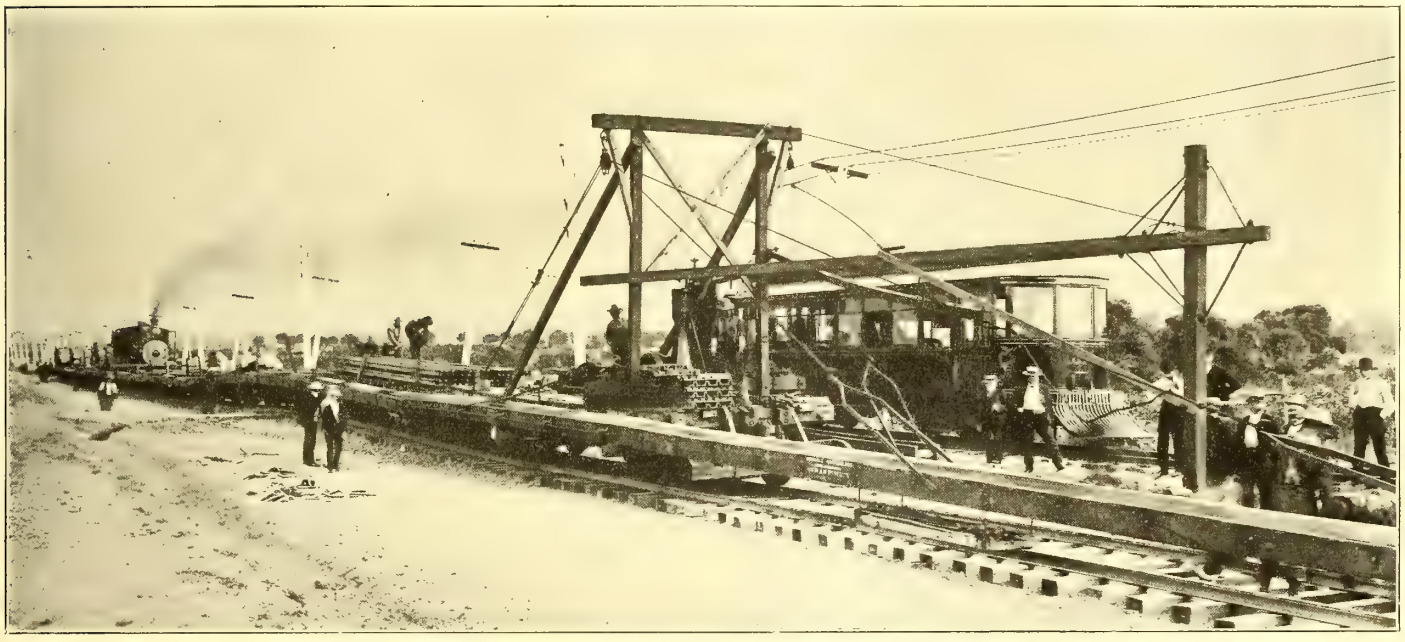
From the press reports received from various points in Northern Indiana and Chicago, it is evident President George F. McCulloch, of the Indiana Union Traction Company, is carrying on negotiations which mean an extensive addition to that company's large network of interurban lines and an ultimate entrance of that network to Chicago. Indeed, many who are in a position to know believe that in the course of a few years the Indiana Union Traction Company will operate the greater part of the Interurban mileage in a territory between Indianapolis on the south and Chicago on the north. There are several roads by which the Indiana interurban network might enter Chicago. Two of these, the Calumet and the Chicago Electric Traction, are in receivers' hands, and it is understood that several offers have been made for the purchase of them recently.

TRACK-LAYING MACHINE

An interesting scene along the route of the Denver & Northwestern Railway is shown in the accompanying illustration, reproduced through the courtesy of "The Rocky Mountain News," of Denver. In the foreground is seen a Roberts track-laying machine in operation on the new Moffat Short Line. Back of the machine stands the Denver City Tramway Company's new private or chartered car, illustrated in the STREET RAILWAY JOURNAL, of June 20, 1903. A party of Denver out-of-town guests, at the invitation of W. G. Evans, president of the tramway company, made a trip over the Northwestern line and stopped at the track-laying scene, a short distance beyond Arvada, to inspect the operations. The machine had been in operation only two or three days, but was proceeding at a speed of between 1 mile and 1½ miles a day. Later it is expected the speed of the machine will exceed 2 miles a day.

In laying a mile of track over 300 tons of material is handled by the machine, and placed directly at the point where it is needed and where it will require the minimum amount of handling by laborers.

Among those in the party were S. M. Perry, president of the Denver & Northwestern Railway; John A. Beeler, vice-president and general manager of the Denver City Tramway Company; Charles J. Hughes, Jr., attorney of the Denver City Tramway Company; United States Senator Henry M. Teller; Edgar G. Cross, of Philadelphia; Mr. Nicholson, of the Nicholson File Company, Providence, R. I.; Charles D. Kinney, an Ohio traction man, and several officials of the Moffat Short Line and the Colorado-Utah Construction Company, which is building the railroad. The party rode the length of the electric line and inspected the coal mines at Leyden.



TRACK-LAYING MACHINE EMPLOYED AT DENVER

COST OF POWER AT NEWCASTLE-ON-TYNE

At the eighth annual convention of the Incorporated Municipal Electrical Association of Great Britain, A. E. L. Rossignol presented a paper regarding the cost of power. Mr. Rossignol is the general manager and engineer of the Newcastle Corporation Tramways, and the data given was obtained in connection with the erection and operation of the Corporation's power station.

The table given below, which was embodied in Mr. Rossignol's paper, is quite interesting, as the division of the items is more comprehensive than most tables of similar character:

Total cost per kw-hour for generating energy:*

	Cost in pence.	
Total Charges for Fuel:		
Capital charges on cost of land for siding	0.003	
Capital charges on cost of bunkers and siding	0.010	
Capital charges on cost of automatic weighing	....	
Capital charges on cost of machine and stokers	0.006	
Annual charges for maintenance and repair of above	0.002	
Cost of fuel used	0.140	
Labor and energy handling coal trains, and cost of terminal charges	0.008	
Labor and energy for stoking	0.018	
Labor and energy for disposing of ashes	0.007	0.194
Total Charges for Steam Plant:		
Capital charges on cost of boilers	0.017	
Capital charges on cost of feed arrangements	0.007	
Capital charges on cost of superheaters and economizers	0.003	
Annual charges for maintenance and repair of above	0.011	
Labor and material for cleaning boilers and flues	0.007	
Cost of feed-water used	0.010	0.055
Total Charges for Electric Plant:		
Capital charges on cost of engine and dynamo plant	0.068	
Capital charges on cost of switchboard and connections	0.007	
Capital charges on cost of battery and booster	0.031	
Annual charges for maintenance and repair of above	0.021	
Labor running engines	0.035	
Oil waste and stores	0.020	
Storekeeper and clerking work	0.006	0.188
Total Charges for Condensing Water:		
Capital charges on cost of surface condensers	0.007	
Capital charges on cost of pumping station and pipes	0.024	
Annual charges for maintenance and repair of above	0.006	
Labor running pumping station	0.009	
Energy for running pumping station	0.010	0.056
General Charges on Undertaking:		
Capital charges on cost of land for power station	0.034	
Capital charges on cost of foundations for power station	0.027	
Capital charges on cost of buildings for power station	0.089	

* This estimate of cost is based on an output of 7,000,000 kw-hours per annum.

Labor charges on cleaning and maintenance of above	0.007	
Engineering superintendence of plant	0.040	
Management and office expenses, if run as a separate concern	0.035	
Rates, taxes and other charges	0.069	0.301
Total charges of all kinds	0.794	0.794
Depreciation and reserve fund	0.086	0.086
Total cost per kw-hour	0.880	0.880

DISTRIBUTION SYSTEM FOR SWITCHING YARDS

One of the most serious problems in the electrical equipment of a suburban division of a trunk line steam railroad is that of the supply of current to the motor car or locomotive in the switching yards. The third rail is generally recognized as the ideal method of current distribution on straight track, but the danger of a complicated third-rail system in a switching yard, such as would be required if this method of distribution was employed in such places, has made most engineers loath to recommend it. On the other hand, an overhead system has, perhaps, as serious objections. An electric locomotive to accomplish the work required of a switching engine would need

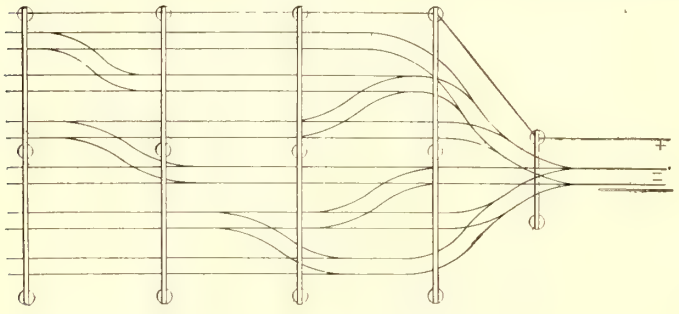


FIG. 1.—BOYNTON TRACK CIRCUITS.

from 1500 amps. to 2000 amps., at from 500 volts to 700 volts, and the size of the conductors required for this current would necessitate a very heavy overhead superstructure, which would probably have to be little if any lighter than if they formed girders for a roof covering the entire yard.

To overcome these two objections the system illustrated in the accompanying engravings has recently been made the subject of a patent by Edward C. Boynton, formerly assistant chief electrical engineer of the New York, New Haven & Hartford Railroad Company. Mr. Boynton, it will be remembered, took a very active part in third-rail construction work at Nantucket, Hartford and New Britain, and his solution of the switching

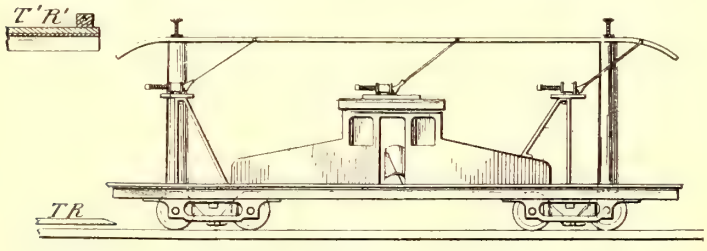


FIG. 2.—CURRENT COLLECTOR ON LOCOMOTIVE

problem is certainly interesting. He recommends the erection throughout the switching yard of posts which will carry transverse girders or I-beams at right angles to the main direction of the tracks, and which will be parallel and distant from each other about 70 ft., as shown in Fig. 1. The I-beam, or the lower girder in case a truss is used, as described, is the contact surface from which the current is taken into the locomotive. The current collector is an elongated skate supported at two or three points from the frame work of the locomotive, as illustrated in Fig. 2. The height of the I-beams over the track in a switching yard or terminal which is not used for freight cars would be about 16 ft. or 17 ft., which would be ample to clear the highest passenger car. If freight cars are used the height would have to be about 21 ft., which would clear a man standing on a freight car. The contact or rubbing surface between the skate and the I-beams as arranged would be about 40 sq. ins. to 50 sq. ins., as the skate is made long enough to stretch between two overhead conductors.

The system as outlined and as illustrated involves the use of an electric locomotive of considerably greater length than that heretofore employed. This length could, of course, be reduced by placing the overhead conductor supports nearer together, but Mr. Boynton believes in using the supports about 70 ft. apart, and this spacing would not require the locomotive to be of greater length than an ordinary Pullman car. Except in cases where two electric locomotives are coupled together, there is no serious objection to having the skate longer than the distance between the locomotive buffers.

When the locomotive passes from the switching yard to the straight track the overhead skate can be hauled down and current taken from the third rail, or, if preferred, current can still be taken by the skate from an overhead trough, as shown in T^1 R^1 in Fig. 2.

PROGRAMME OF THE ACCOUNTANTS' CONVENTION

The following programme has been adopted for the convention of the Street Railway Accountants' Association of America for the Saratoga meeting:

Wednesday, Sept. 2, 1903.—In Convention Hall, Grand Union Hotel. 10 A. M., sharp.
- Annual address of the president.
- Annual report of the executive committee.
- Annual report of the secretary-treasurer.
- Paper: "Freight and Express Accounts," by Irwin Fullerton, General Auditor, Detroit United Railway, Detroit, Mich.
- Appointment of convention committee on nominations.
- Appointment of convention committee on resolutions.
- Replies to questions.

Thursday, Sept. 3, 1903.—10 A. M. sharp.
- Paper: "Car Maintenance Records," by S. C. Stivers, New Jersey & Hudson River Railway, Edgewater, N. J.
- Paper or address by a representative of the United States Census Bureau.
- Report of the committee on a standard form of report for electric railways. Chairman, William F. Ham, Comptroller Washington Railway & Electric Company, Washington, D. C.
- Replies to questions.

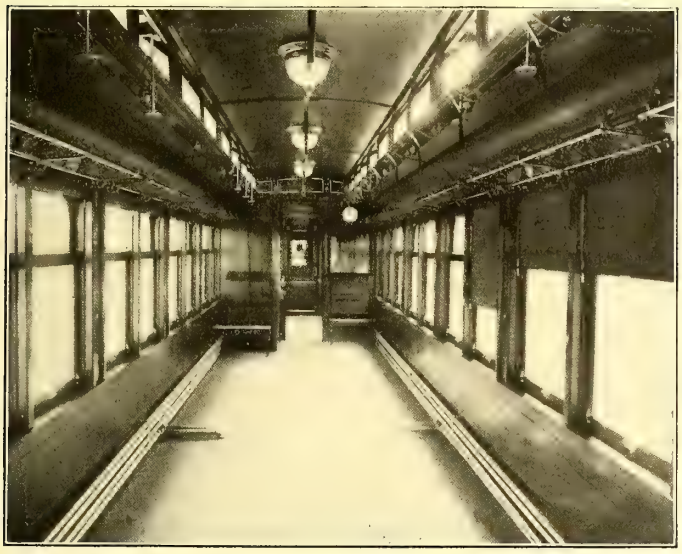
Friday, Sept. 4, 1903.—10 A. M. sharp.
- Paper: "Advantages and Disadvantages of Bag or Envelope Receiver System of Conductors' Deposits," by F. R. Henry, Auditor St. Louis Transit Company, St. Louis, Mo.
- "Comparison of the Municipal Tramways Association of Great Britain, Proposed Standard Classification and Form of Report with the American Standard," by C. N. Duffy, Secretary Chicago City Railway, Chicago, Ill., Chairman committee on standard classification.
- Report of committee on resolutions.
- Report of committee on nominations.
- Election and installations of officers.
- Adjournment.

The association has adopted a rule that members desiring replies to special questions may either ask them verbally or give them to the secretary. This is an opportunity for members not personally present to obtain replies to questions, and will be found of great convenience.

The extent to which the people who have undertaken to solve the traction problem, and who have not solved it, are responsible for the discomforts and accidents suffered by street railway patrons is a matter which will probably demand attention from an intelligent public after a while.—Chicago Inter-Ocean.

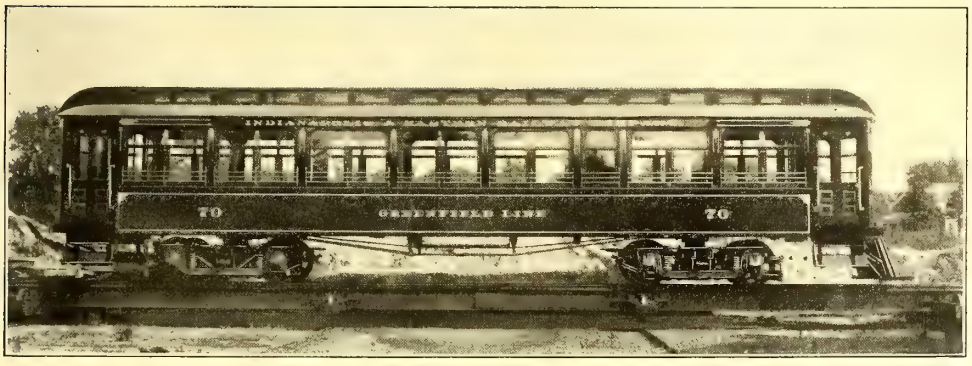
SUBURBAN CARS FOR INDIANA

The accompanying cuts illustrate the exterior and interior of a car built for suburban service by the G. C. Kuhlman Car Company. The Indianapolis & Eastern Railway Company, which controls an electric railway over 34 miles long, has recently placed a number of these cars in service on its Greenfield division.



INTERIOR SUBURBAN CAR

The total length of these cars is 53 ft., and the width over all 8 ft. 8½ ins. The car bodies have "V" ceilings extending to the bottom edge of side sills, and roofs of "Monitor" type with steam coach ends extending over vestibules. Full width vestibules are at both ends, and the car sides have 7½ sets of double Pullman windows.



COMBINATION CAR FOR SUBURBAN SERVICE.

The forward end of the car is used as a smoking room, and is divided from the regular passenger compartment by a glass and wood partition running across the fourth window post, leaving seats for sixteen passengers. The seats in the smoking room are of rattan and those in the passenger room of frieze plush. The latter compartment seats forty-two passengers.

The general finish of all sash, doors, panel work, mouldings, etc., is of Mexican mahogany, with narrow marquetry inlaid work on pier window posts and ventilator rails. The body doors are also relieved with marquetry work. The headlinings are of three-ply veneered wood, painted in light green and relieved with gold and silver decorations. Trimmings are of heavy bronze of modern design. The interior finish of these cars is of the new design used only by the Kuhlman Car Company, there being no shop moulding to collect dust or dirt. Eight large holophane glass globes admit light to each car. The cars are heated with Peter Smith hot-water heaters, the heater proper being placed in the front vestibule.

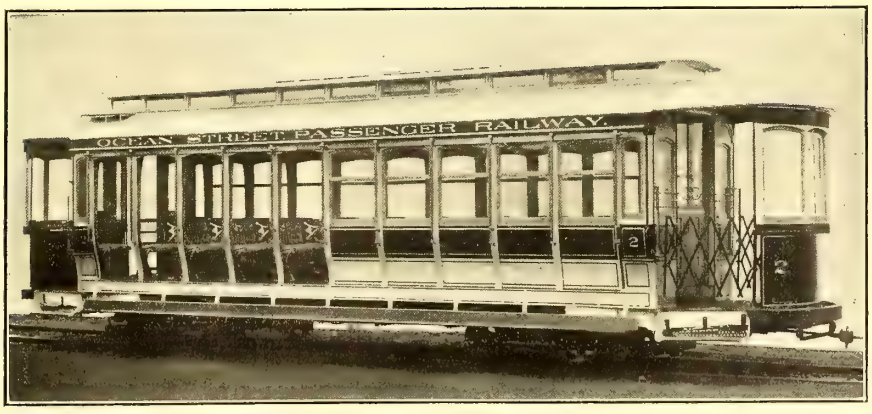
CONVERTIBLE CAR AT CAPE MAY

The J. G. Brill Company lately sent the handsome convertible car shown in the accompanying illustration to the Ocean Street Passenger Railway, of Cape May, N. J. Last year a car of this type was placed in commission by this company, and has given such satisfactory service as to warrant a second order. The cars run along the beach from Cape May Point to Sewell's Point, and, as Cape May is a winter as well as summer resort, the cars are used all year.

The car illustrated is shown partly open and partly closed. Only a few minutes are required to convert the entire car. The operation of sliding the windows and panels into roof pockets is well known and need not be described. Attention may be called, however, to a slight change in the window system. Instead of the sashes being connected with a toggle joint, as has been the practice heretofore, the system of the builders' semi-convertible car is used, which is simply that the lower sash is raised alone till the top is abreast of the top of the upper sash, when they automatically connect, the upper sash riding on the lower into the pocket.

The cars have a bright, attractive interior, finished in natural ash, with ceilings of decorated birch. The spring cane seats have reversible backs, of spindle construction, and afford seating accommodation for forty passengers. Portable vestibules of the builders' make are furnished at either end, and are well adapted for use with this type of car. Other furnishings of the same make are angle-iron bumpers, radial drawbars, brake handles and "Dedenda" gongs.

The general dimensions are as follows: Length over end panels, 28 ft. 4 ins.; over crown pieces, 37 ft. 4 ins.; from end panels of over crown pieces, 4 ft. 6 ins.; width over sills, 7 ft. 2¾ ins.; over posts at belt, 8 ft. ¾ in.; centers of posts, 2 ft. 7 ins.; sweep of posts, 5 ins.; lower sash, 23 ins. x 28⅝ ins.; upper sash, 16 3-16 ins. x 28⅝ ins.; side sills, 4¾ ins. x 7 ins.; with steel plates on outside, ⅝ ins. x 7 ins. The cars are mounted on "Eureka" maximum traction trucks.

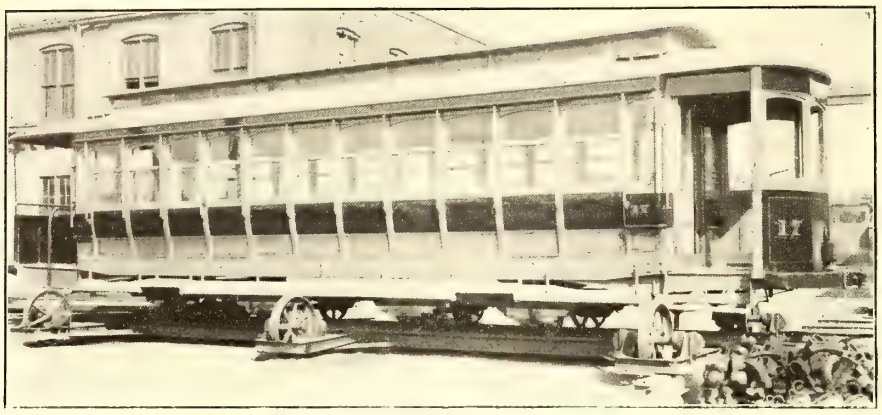


CONVERTIBLE CAR FOR CAPE MAY.

wheels, 33 ins. and 20 ins.; wheel base of 4 ft., and 4-in. axles. Each truck is equipped with a 30-hp motor. Total weight of car, trucks and motor, 25,360 lbs. This type of car has been found particularly serviceable for all the year resorts.

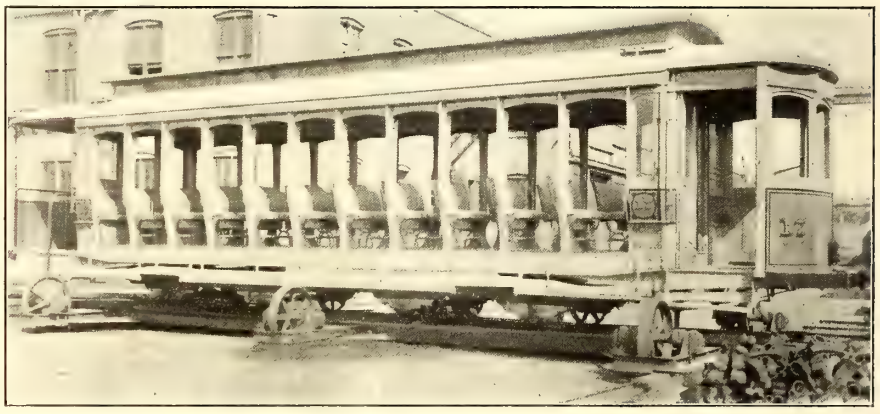
CONVERTIBLE CARS FOR BAY CITY, MICH.

The American Car Company, of St. Louis, lately completed ten convertible cars of the Brill patented type for the Bay Cities Consolidated Railway. Situated on the south shore of Saginaw Bay, in Northeastern Michigan, Bay City and Bay Cities, north, south and west, are exposed in winter to severe storms and low temperature, which will put these cars to a thorough test as to heat retaining qualities. However, cars of this type have been in use for several winters at Benton Harbor, not far distant, and it is, therefore, known that they are quite as capable of keeping warm as cars of solid side construction. Bay City has a population of nearly 30,000, and is at the center of a group of good-sized towns. It is an important railway point, a busy manufacturing place, and an excellent field for electric railway operations.



CONVERTIBLE CAR—ENCLOSED

These cars are powerfully constructed and fully equal to the double service which is required of them. The builders claim that the firmness of the upper structure is proved by the fact that the windows and panels do not stick nor bind, and always retain their original easy movement. The double corner posts, the strong setting of the side posts and the assistance of the Brill patented round-corner seat-end panels give a firm support to roof. The length over end panels is 30 ft. 8 ins., and over the vestibules, 42 ft. 4½ ins.; from panels over vestibules is 4 ft. 8½ ins. Width over sills and sill plates is 7 ft. 5½ ins., and over posts at belt, 8 ft. 1 in. From center to center of posts, 2 ft. 7 ins.; sweep of posts, 3½ ins. Thickness of corner posts is 3¾ ins., and of side posts, 3⅜ ins. The side sills are 4¾ ins. x 7 ins., plated with ⅝-in. x 8-in. steel. End sills, 4¾ ins. x 7 ins. The interiors are handsomely finished in natural ash with birds'-eye maple ceiling, giving a bright, attractive appearance. Each car is furnished with sand-boxes, alarm gongs, brake handles, draw-bars, etc., of Brill patented make. The trucks are the "Eureka" maximum traction, with 33-in. drivers and 20-in. pony wheels. They are equipped with 45-hp motors.



CONVERTIBLE CAR—OPEN

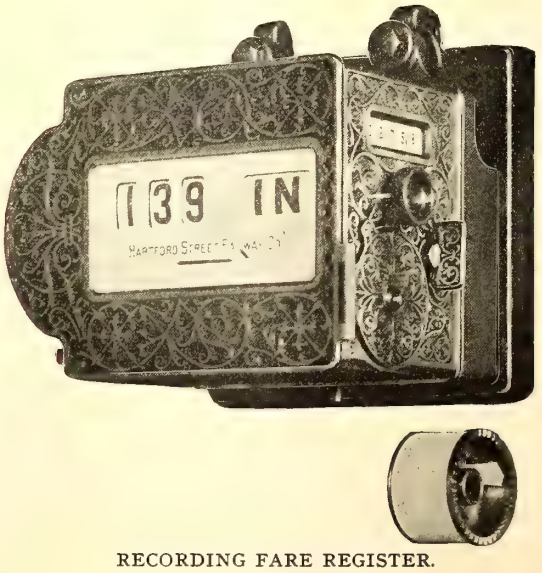


INTERIOR CONVERTIBLE CAR

A NEW RECORDING FARE REGISTER

The accompanying illustration shows a register which has just been put on the market by the Recording Fare Register Company, of New Haven, Conn., a company which has recently been organized, principally to exploit this machine. The register, however, is not a new one, although it has not been manufactured for general sale before. It has been in constant service for the last six years on the line of the Hartford Street Railway, of Hartford, Conn., and has been found so successful on that line that all of the cars of that system have been equipped with the device.

Externally the register is very similar to the ordinary fare register except that the totalizer shows to the right. Internally, however, and in its mechanism the register differs entirely from the ordinary fare register. It carries a cylinder on which is wound a strip of paper on which the register records its own trip sheet, giving a complete record of all fares collected on each half-trip, the number of the register and the direction of each half trip. One of these cylinders is shown underneath the



RECORDING FARE REGISTER.

register in the accompanying cut. No extra work is required of the conductor in securing this record, as the numbers and direction marks are stamped automatically on the cylinder when the face numerals are returned to zero in the usual way. The record is removed at the end of the car-day by the inspector and forwarded to the auditor, and the aggregate totals of each half trip on this record must agree, of course, with the totalizer or permanent continuous statement in the register.

In addition to the recording register the Recording Fare Register Company also handles a full line of electric railway supplies.

OVERHEAD MATERIAL OF THE ST. LOUIS TRANSIT COMPANY

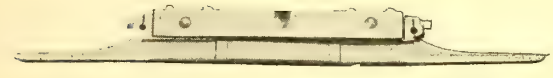
The St. Louis Transit Company employs considerable overhead material of its own manufacture which has several features which will no doubt be of interest to other companies. The trolley wire insulating hangers employ wood for insulation. Various parts of the straight line and curved hangers are shown in Figs. 1 and 2.



FIG. 1



FIG. 2



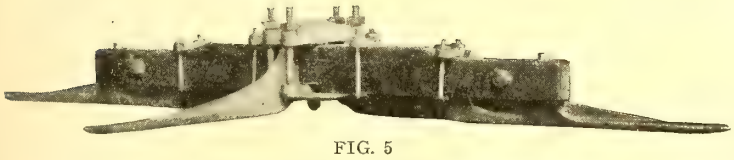


FIG. 5

OVERHEAD MATERIAL ADOPTED BY ST. LOUIS TRANSIT COMPANY

The wood is locust, and soaked in warm linseed oil. The wooden insulating bolt consists of a cone-shaped piece of locust bored out and countersunk to receive a common bolt, and having a wooden plug fitting into the countersink over the head of the bolt. This is slipped down into the brass hanger shell, and a brass cap put on the top of the hanger to hold the bolt in. This brass cap is not threaded, but simply has its sides bent in, and there is a lip on the hanger which prevents the cap coming off after this operation. Views of the parts from various angles are shown which will give a good idea of the general construction. Front and back views of the solid crossing are shown in Figs. 3 and 4. This crossing has detachable approaches, so that the wire does not have to be cut or taken out of the ear if the crossing is renewed. Each approach is fastened to the crossing by two bolts. In Fig. 5 is shown the section insulator and insulated crossing which this company uses. These are also furnished with detachable approaches.

METHOD OF SUPPORTING TROLLEY WIRE

St. Louis, July 25, 1903.

Editors Street Railway Journal:

It may be of interest to some of your readers to learn of the method of supporting No. 0 round trolley wire that is in practice by the overhead department of a prominent city traction system. Slots or grooves, 4½ ins. long, are made on both sides of the wire just above the horizontal diameter. These slots are made deep enough on a No. 0 round trolley so that a No. 3064 Detroit trolley clamp can be used the same as if the trolley was a regular grooved or figure 8 wire. For making the slots the overhead department has adopted a machine originally designed for splicing 500,000-circ. mil aluminum cable. Special dies were prepared for forming the slots. When it is desired to put up some new trolley wire this machine, which operates by oil pressure, is mounted on top of the emergency or line car. It is supported on slides so that after the car is stopped under the span wire, adjustment may be made to bring the press directly under the span. The oil pump for operating the press is connected to the cylinder of the latter by flexible pipes. By forcing oil into the press cylinder the slots are formed by the dies, the pressure being estimated at about 2 tons. By using this method the slots can be placed exactly where wanted, and a perfectly smooth under-running surface is provided for the trolley wheel. Two city lines have been equipped as here described, and after several months' use show no signs of failure or tearing out at the ends of the slots. This method may appeal to traction companies who can use considerable No. 0 round trolley, as it has the advantage of employing standard and comparatively inexpensive trolley clamps.

Engineer.



FIG. 3

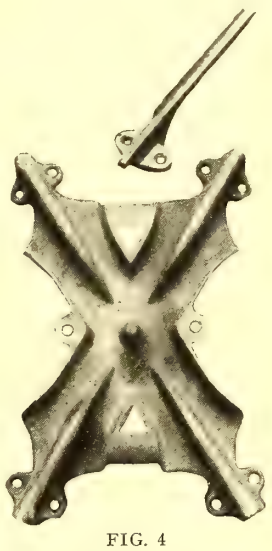


FIG. 4

Big increases over last year's business have been made by the St. Louis & Suburban and the St. Louis Transit Companies, according to figures filed with the City Register. For the quarter ending June 30 the Suburban Company made 74,465 trips and carried 4,451,164 passengers, while for the corresponding quarter last year 65,074½ trips were made, with a total of 4,022,909 passengers carried. The report of the Transit Company shows that it made 1,367,454 trips, in which 38,421,172 passengers were carried during the period which ended June 30, while for the same period last year 1,296,544 trips were made, with a total of 33,269,842 passengers carried.

The Pacific Electric Railway Company has put on sale a new mileage book of 500 miles that will permit holders to ride on interurban lines of the Huntington-Hellman syndicate on a basis of 1¼ cents per mile.

IMPROVEMENTS OF ST. LOUIS & SUBURBAN RAILWAY

The St. Louis & Suburban Railway Company is rapidly pushing to completion a series of improvements that will enable it to furnish better service to the public, and to reduce the running time on many of its lines. These improvements extend to all departments of the service, from power distribution to new cars, and will aggregate an expenditure of $1,250,000.

In order to care for increased traffic the capacity of the Hodiamont Avenue power house will be increased. New storage batteries are to be installed, the capacity of the boiler room is to be increased and new engines are to be put in. The storage batteries are now on the ground ready to be installed, and some of the other apparatus has already been received. The output of the plant will be increased to 8000 hp when these improvements are completed. The sub-stations, too, are to receive attention. The Brentwood station, on the Meramec Highlands line, will be remodeled and a rotary converter installed, and it is possible that a sub-station will be built to serve the Florissant line, which runs from Wellston Park to Florissant, a distance of 11 miles.

The improvements that are being made to the track extend to nearly all lines, and include the relaying of entire lines, partial reconstruction in some cases, and the elimination of curves and grades wherever possible. The last of the track work on the main line, which runs from Fourth Street and Elm Street to Suburban Park, is now under way. Nine-inch rails have been laid on Locust Street. The track from Vandeventer Avenue to the suburban right of way, a distance of 50 yds., has yet to be laid, and then the relaying of the main line will be complete.

The Meramec Highlands line is being improved from Sarah Street to King's Highway, on Manchester Avenue, with 9-in. rails, but as it is necessary to grade the streets from building line to building line, the work is progressing slowly. None of the new steel has been laid. The south side of the street has already been cut down and the old south track replaced. Another improvement will be made in the Meramec Highlands line by eliminating the double curve on Sarah Street, a short distance north of the Wabash tracks. This curve is dangerous, and it is so sharp that two long cars cannot pass there. For this reason the company has been unable to operate the large cars on the Meramec Highlands line. With the improvements to this line the company will be able to run cars on schedule time, which cannot always be done at present. The schedule time for making the run from Meramec Highlands to the intersection of Fourth Street and Elm Street is 96 minutes. Larger cars will also be run on this line.

The company also expects to make improvements that will eliminate the loss of time in rounding the curves on Thirteenth Street and Fourteenth Street, but what those improvements will be has not been announced.

The St. Louis Car Company is building fifty new cars, each with a seating capacity of fifty-two, for the company, and in order to have shed space for them the car houses at Hodiamont Avenue, which were burned down last spring, will be rebuilt. The car house on Manchester Avenue will also be reconstructed. A steam heating plant and an air plant for the purpose of cleaning cars will be added to the Manchester Avenue and the Hodiamont Avenue car houses.

It is expected that by Nov. 1 the work now under way will be finished, and then the company will turn its attention to the question of terminal facilities at the Exposition. Just what arrangements the company will make to get to the World's Fair has not been decided.

A new line of cars has been opened in Boston between Jamaica Plain and Park Street Subway, via Center Street and Huntington Avenue.

CONVENTION ANNOUNCEMENTS

The latest bulletin regarding the twenty-second annual meeting of the American Street Railway Association, issued Aug. 1, announces the following list of papers to be presented at the Saratoga Convention:

Steam Turbines.

Electric Welded Joints.

The Evils of Maintenance and Champerty in Personal Injury Cases.

Train Orders and Train Signals on Interurban Roads.

Freight and Express on Electric Railways.

The Manufacture and Distribution of Alternating Currents for City Systems.

Comparative Merits of Single and Double-Truck Cars for City Service.

The Right of Way.

There seems to be a general impression that all of the space available for exhibits at the Saratoga Convention of the American Street Railway Association has been assigned, and that those exhibitors who have not yet secured room there cannot be accommodated. Frank M. Cozzens, chairman committee of exhibits, Saratoga Springs, N. Y., states, however, in a recent letter that owing to the large amount of exhibit space available at the Grand Union Hotel, it is still possible to accommodate manufacturers who have not yet secured space, if they make prompt application.

MORE NOISELESS CROSSINGS FOR ST. LOUIS

The St. Louis Transit Company is making a practical experiment at Fourteenth Street and Olive Street with Chief Engineer C. A. Moreno's patent noiseless crossing. For several days General Track Foreman P. J. Conolly and a large force of workmen have been engaged in putting in a new frog equipped with the noiseless surface blocks of wood at the intersection of each cross track. This double crossing was described and illustrated in the Street Railway Journal May 9. At Eighth Street and Carr Street a single set of these blocks has been in use for several months, and this preliminary experiment has increased the Transit Company's confidence in Mr. Moreno's invention. As traffic is very heavy over the lines passing Fourteenth Street and Olive Street, the company is confident that the crossing will stand the strain of any ordinary service.

A peculiar dispute between a street railway company and a town has just been settled at North Andover, Mass. It seems that the Boston & Northern Street Railway Company completed a line through North Andover late last fall, and soon after it was open for traffic the North Andover Selectmen had a conference with the road officials, at which the claim was made that the street railway company had not lived up to the terms of the franchise regarding the care of the streets. The railway officials claimed that the franchise had been lived up to. After much controversy the Selectmen revoked the company's franchise and the town brought suit against the Boston & Northern to recover the bond of $500 given by the company as a guarantee that the conditions of the franchise would be lived up to. Meanwhile the street railway company applied to the Supreme Court for an injunction restraining the town maintaining barriers in the company's tracks. Judge Braley declined to issue the injunction and referred the case to a master. James C. Gillis, of Salem, was appointed, and the road consented to a settlement of the case whereby the town is to grant a new franchise, the master to adjust the whole matter. It is probable that it will be at least two months before the line is in operation again.

FINANCIAL INTELLIGENCE

Wall Street, August 5, 1903.

The Money Market

As was generally expected the money market developed a decidedly lame tone this week. This was only natural in view of the developments, all of which were favorable, and while rates for time contracts show no material changes the supply of lendable funds has been increased considerably, and lenders find it extremely difficult to place their funds except at liberal concessions. The principal influence was the payment of notes by the Pennsylvania Railroad amounting to about $40,000,000, of which $35,000,000 were held in this city. In addition, the influx of currency from the interior continued on a large scale, the net gains by the local banks for the week being in excess of $6,000,000, not including the $3,371,400 new gold from the Klondike and Australia. The large gains in cash were reflected in an exceptionally good bank statement, which showed the local institution to be in a much stronger position than for some time past. Some stress was laid upon the failure to reduce the loan account, but on the other hand the reserve on all deposits increased $5,144,675, bringing the total surplus reserve up to about $10,000,000 larger than it was in the corresponding period of last year. Deposits were over $1,000,000 in excess of loans, and during the past three weeks the banks have increased their cash holdings by over $20,000,000.

Money on call has been in an abundant supply at rates ranging from 2½ to 1 per cent, but the character of the stock market has been such as to warrant only a limited demand. In time loans there was practically no demand for funds except for the long dates, and even at a reduction of 2¼ per cent in the rate to 5¼ per cent the inquiry was extremely light. A good demand existed at 5 per cent for over the year funds, and while lenders were not disposed to do business on that basis, the indications are that further concessions will be made before the close of the present week. In some instances loans have been made at 5 per cent, but the collateral offered consisted of high grade stocks.

There have been no important changes in money rates at the leading European centres. At London call money continues to rule around 1½ per cent, while the discount rate remains unchanged at 2⅜ per cent. Discounts at Paris and Berlin are unchanged at 2¼ and 3¼ per cent respectively.

The Stock Market

In marked contrast with the great excitement that attended the dealing on the Stock Exchange during the greater part of last week, business in the forepart of the current week dwindled to insignificant proportions, and it became evident from this fact, as well as from the gradual improvement in values, that urgent liquidation had run its course. The Street, however, was somewhat disappointed by last Saturday's bank statement, showing an approximate increase in loans of $1,000,000, whereas all indications pointed to a large decrease, and operations for the bull account were materially restricted on that account, even though crop accounts were generally favorable. Railroad earnings continued highly satisfactory and both monetary and foreign exchange conditions were as auspicious as could be desired. Toward the close of the week fresh liquidation in some of the specialties, like Virginia Carolina Chemical and United States Realty, which eventuated in two more failures of Stock Exchange houses, unsettled the entire market, and accompanied by a pronounced increase in the volume of trading, prices weakened decidedly, so much so in fact that many stocks not only reached the bottom figures of the present year, but the lowest on record also. An incident of the week that contributed to the late unsettled condition of the general share speculation was the announcement made by the Consolidated Gas Company of its intention to issue $6,500,000 new stock.

For a time the local traction shares, including Brooklyn Rapid Transit, Manhattan and Metropolitan Street Railway, were firm and in better demand, the basis for which was contained in reports of current large earnings, it being maintained that the Brooklyn Rapid Transit is earning at the rate of 4 per cent on its stock, and that those of Manhattan are increasing at the rate of $4,000 per day. The Metropolitan Street Railway submitted the statement of gross earnings for July, showing a total of $1,858,501, an increase of $116,187, or 6⅝ per cent, over the corresponding period of last year. However, these stocks were subsequently affected by the more or less demoralized condition of affairs of the general market and closed weak and depressed.

Philadelphia

The market showed fair strength until a week ago, but on July 29, under pressure of considerable liquidation, particularly in Rapid Transit and U. S. Steel, prices fell off. There was considerable talk of inside selling in the former stock, but it developed on Tuesday that the sales were for the account of Talbot J. Taylor & Co., which firm had 4000 shares of Rapid Transit. Altogether about 8000 to 9000 shares of this stock were dealt in on the local Exchange during the week ending August 4 at a loss of from 13½ on July 29 to 11½ on August 4. The other transit properties showed only slight losses during the week. Union Traction was forced down 1 point to 43, while Philadelphia Traction remained practically steady at 94½. The other tractions have maintained their respective positions during the week. American Railways closed at 44, United Gas Improvement at 83¼, and Railways Company General at 3.

Chicago

The Chicago market has been very dull during the past week, the principal exceptions being Chicago City, which dropped in price from 175 to 165, Metropolitan Elevated preferred, which fell from 55¼ to 51, and Metropolitan Elevated common, whose quotations changed from 18 to 16½. There have been no new developments in Chicago City, and the liquidation in that stock was attributed to holders who were tired of the delays by the city authorities in the renewal of the franchise grants. Metropolitan Elevated was affected by the announcement made right after the directors' meeting on Monday that the dividend on the preferred stock would be passed. After this announcement the stock went off 3 points from 53 to 50, but recovered later to 51. Chicago Union Traction common and preferred and the other elevateds were very quiet, and remained at about the same figures throughout the week.

Other Traction Securities

The Boston market was quiet during the week, but reflected the general market tendency to lower prices, a tendency which was stimulated to a considerable extent by the enormous liquidation in coppers, in which Boston investors are largely interested. The Elevated lost 3 points during the week, dropping from 139 to 136. Massachusetts Electric common fell from 22 to 21, and the preferred from 79 to 78½. West End remained stationary at 90, with very few transactions recorded. The Baltimore market has been very quiet, with the exception of transaction of about 2000 shares in United Railways & Electric on July 29. The price has continued stationary at 10¾, and the income bonds have remained from 62⅜ to 62¾, and the 4's at 92⅞ to 92¾ during the week. Other transactions reported are City & Suburban first 5's at 112, City Passenger 5's at 106, and Knoxville Traction 5's at 101. Off the New York curb there have been sales of Interborough at 98½, Syracuse preferred at 76, and New Orleans Railway 4's at 82½ to 82⅞. Among the other traction securities quoted on the New York curb are New Orleans common at 10⅛, New Orleans preferred at 36, and United Railways at St. Louis preferred at 64½. North American was pressed for sale, as one of the firms whose failures were announced in New York during the past week was long of the stock and the price has fallen to 73. There was comparatively little trading in Cincinnati last week. Detroit United was the most active issue, about 700 shares selling at between 71½ and 69½, the former the closing figure. Toledo Railways & Light Company ranged from 23 to 24 on sales of 465 shares. Cincinnati Street Railway was quiet at 132½. There was some little trading in bonds; Toledo, Bowling Green & Southern 5's brought 98; Mansfield Railway & Light 5's, 101; Northern Ohio Traction 4's, 60, and Cincinnati, Dayton & Toledo 5's, 84½. Stock of the Northern Texas Traction Company was listed in Cleveland last week and caused some little interest, owing to the remarkable showing of the road. It had been in operation only nine months and already is paying a dividend besides piling up a surplus for depreciation.. Several small lots of this stock brought 28¼. Cleveland Electric was firm at 74 on sales of 300 shares. Syracuse Rapid Transit preferred sold at 75 for a small lot. Syracuse Rapid Transit 5's brought 90, and Northern Ohio Traction 5's 69. There are plenty of offerings at low prices, but very few buyers.

Security Quotations

The following table shows the present bid quotations for the leading traction stock, and the active bonds, as compared with two weeks ago:

	Closing July 21	Bid Aug. 4
American Railways	44½	44
Aurora Elgin & Chicago	17½	17½
Boston Elevated	138	136
Brooklyn Rapid Transit	46½	42⅞
Chicago City	180	165
Chicago Union Traction (common)	4	3½
Chicago Union Traction (preferred)	30	30
Cleveland Electric	74	b73
Columbus (common)	101	85
Columbus (preferred)	103	100
Consolidated Traction of New Jersey	65	a67
Consolidated Traction of New Jersey 5s	104	104
Detroit United	69¾	b65
Elgin, Aurora & Southern	b52	b52
Lake Shore Electric	b10½	b10½
Lake Street Elevated	6¼	5¾
Manhattan Railway	131½	132
Massachusetts Electric Cos. (common)	22	21
Massachusetts Electric Cos. (preferred)	81¾	78½
Metropolitan Elevated, Chicago (common)	20	16½
Metropolitan Ellevated, Chicago (preferred)	63	51
Metropolitan Street	116⅛	117
New Orleans (common)	11¼	10⅛
New Orleans Railways (preferred)	39½	36
North American	82	73
Northern Ohio Traction & Light	18	18
Northwestern Elevated, Chicago (common)	20½	—
Philadelphia Rapid Transit	15	11⅜
Philadelphia Traction	95	94½
St. Louis Transit (common)	19½	18
South Side Elevated (Chicago)	97	96½
Syracuse Rapid Transit	b29½	b29½
Syracuse Rapid Transit (preferred)	b75	b75
Third Avenue	111½	113
Toledo Railway & Light	20	23
Twin City, Minneapolis (common)	95½	93
Union Traction (Philadelphia)	44	43
United Railways, St. Louis (preferred)	69½	64½

a Asked. b Last sale. * Ex-dividend. † $10 paid.

Iron and Steel

The weak feeling in the iron market, to which reference was made in the issue of July 25, seems to have passed, and, although not reflected to any great extent in prices, there is a better tone. There is less pressure on the part of the foundries to sell and many believe that the bottom of the market has been touched, although it is probably too soon to look for any thing like a rapid recovery. Quotations are as follows: Bessemer pig, $18.75 to $19; Bessemer steel, $27 to $27.50; steel rails, $28; girder rails, $33 to $33.50.

Metals

Quotations of the leading metals follow: Copper, 13 to 13¾ cents; tin, 28¼ cents; lead, 4⅛ cents; spelter, 5⅞ cents.

DEAL IN LONG ISLAND TROLLEY LINES

Control of the New York & Queens County Railway Company, of Long Island City, which owns the New York & North Shore Railway, and the Long Island Electric Railway, and operates from Long Island City to Astoria, Steinway, North Beach, Dutch Kills, Flushing, Jamaica, Far Rockaway, Queens and other villages in Queens County, has passed into the hands of the United States Mortgage & Trust Company, which is known to be acting for outside interests. In some quarters it is stated that the Belmonts are behind the purchase, while other advices say that the Pennsylvania Railroad is behind the deal. From the diversity of the interests connected with the Mortgage & Trust Company it is impossible to form anything like a definite idea as to the identity of the purchasers. It is expected that formal announcement of the deal will be made soon, and it is thought that with this announcement will be made public plans for the development of the system on extensive lines, including the construction of new lines for which the company now holds franchises, and the construction of a tunnel, or tunnels, to connect Long Island City with New York.

TOLEDO COMPANY SEEKING AN EXTENSION OF ITS FRANCHISES

The Toledo Railways & Light Company, of Toledo, Ohio, has presented to the Council of that city an ordinance requesting the extension of its franchises for an average period of eighteen years. In return for the grant the company agrees to give six tickets for a quarter and universal transfers. The ordinance also carries with it the right to handle baggage, express and mail matter. The best paying lines of the company are covered by franchises which expire in seven years. The longest running franchise is twelve years, and the average life of all grants is about eight years. At present a portion of the system is operated under the old Robinson grants, which provide six tickets for a quarter, and in consequence no transfers are given to these lines. The general sentiment is that the company should make a more liberal proposition. Mayor Sam Jones, of Toledo, is a disciple of Tom L. Johnson's three-cent fare heresy, and maintains that the people should take nothing less than three-cent fares and universal transfers.

PROPOSED Y. M. C. A. STREET RAILWAY WORK IN TENNESSEE

The organization of Y. M. C. A. street railway branches in Tennessee has been taken in hand by the Tennessee State Committee of the Young Men's Christian Association. S. W. McGill, State secretary of the Y. M. C. A., has taken the first step in this project by writing to Percy Warner, president and manager of the Nashville Railway & Light Company, and to the Memphis Street Railway Company, laying before them what has been accomplished along similar lines in other parts of the country, and suggesting that they establish like organizations among their employees.

The State Committee has proposed to Mr. Warner that the Nashville Railway & Light Company secure rooms near or in the company's transfer station, stating that for about $5,000, to be furnished by the company, such rooms can be adapted to the purposes of the organization contemplated. It is estimated that the annual running expenses will be about $1,500. The railway company will be asked to furnish the money to suitably equip the rooms and to contribute $50 monthly. The fee for membership will be only $3. In addition to these payments, the Association will solicit funds from outside sources.

In the quarters to be furnished by the company there will be reading and recreation rooms, educational classes, including business courses, and the office of the proposed benefit society. A savings bank for the use of the company's employees is also being considered.

Should the Young Men's Christian Association be successful in Nashville and Memphis it will endeavor to form branches later on in other cities, such as Knoxville, Chattanooga and Jackson.

MONEY PAID FOR LOS ANGELES TRACTION

It is reported that the Los Angeles Traction Company has been purchased by Southern Pacific interests, and that E. H. Harriman has an arrangement with H. E. Huntington whereby the latter will control all the street railways in Los Angeles. Whether or not the purchaser is the Southern Pacific, it is positively known now that on July 13 checks and drafts amounting to $1,515,000 were placed to the credit of the Hook interests, in the Merchants' National Bank, of Los Angeles, and that several days later deeds were recorded transferring all of the traction company's property to the Union Bank of Savings, of San Francisco. The amount of money just passed is in final payment of the purchase price of $1,750,000.

It will be remembered that Senator W. A. Clark, of Montana, was reported at one time to have bought the traction company, but his option no sooner expired than his real backers in the venture stepped in and saved his equity. In connection with this purchase, it is now stated that Harriman has agreed to turn the traction property over to Huntington in return for a large block of stock in the Pacific Electric Railway Company, or in a holding company that may soon be organized. Under the terms of this arrangement, it is understood that Huntington thus acquires control of the famous Sixth Street franchise, which cost somebody $110,000 (for 2 miles), as well as the traction franchise to Pasadena, and the interurban line of the California-Pacific Railway Company, now in operation to San Pedro. Until all details of the purchase have been arranged the Hooks will continue to operate as heretofore.

THE INTERNATIONAL ELECTRICAL CONGRESS OF 1904 AT ST. LOUIS

Arrangement have been made for holding an international electrical congress at St. Louis next year, in connection with the Universal Exposition. The date selected is the second week of September, 12-17. The advantage of that period is that it offers the most convenient compromise between hot weather, on the one hand, and the terminating limits of fall vacations, on the other. If the date were set earlier, the weather at St. Louis might be found uncomfortably warm. If the date were postponed, it might be difficult for electrical workers on vacation to meet their fall engagements. Moreover, the week selected immediately precedes the great scientific congress appointed by the St. Louis Exposition, which convenes during the third week in September. Since many distinguished visitors and guests will attend the scientific congress, it is the more probable that a good attendance can be secured for the electrical congress immediately preceding.

The international electrical congress will, according to the present plan, comprise three distinct features: namely, first, a chamber of delegates appointed by governments; second, the main body of the congress divided into sections; third, conventions simultaneously held by various electrical organizations in the United States. The last international electrical congress was held at Paris in 1900. The next preceding was Chicago in 1893. The representatives in the chamber of delegates are nominated by the various foreign governments and by the United States. The chamber of delegates considers and votes upon such international questions as units and standards. There are various questions involving units and standards which might properly occupy the attention of a chamber of delegates next year.

The sections which have been proposed for the main body of the congress are:

General Theory—Section	A	Mathematical. Experimental.
Applications	"	B	General Applications.
	"	C	Electrochemistry.
	"	D	Electric Power Transmission.
	"	E	Electric Light and Distribution.
	"	F	Electric Transportation.
	"	G	Electric Communication.
	"	H	Electrotherapeutics.

It is expected that prominent electrical men in various parts of the world will be invited to contribute special papers on subjects in the various sections and their sub-divisions.

Several of the prominent electrical organizations of the country have already taken steps to hold their conventions in St. Louis during the electrical congress week, and it is understood that the subject will be brought up at the Saratoga meeting of the American Street Railway Association. It is hoped by those interested in the Congress that the Association will make arrangements for holding its 1904 meeting at St. Louis coincidently with the Congress on Electric Transportation. It is also expected that the following bodies will complete arrangements to this effect: The American Institute of Electrical Engineers, the Electrochemical Society, the National Electric Light Association, the Association of Edison Illuminating Companies, the Pacific Coast Electrical Transmission Association, the American Electrotherapeutic Association. Some plan is expected to be made whereby a joint meeting or meetings may be held between each section of the congress and the particular national organization interested in that subject. In this manner, mutual advantages in membership, discussion and publication ought to be secured.

The transactions of the congress should form a very attractive and important publication, not only as associated with the St. Louis Exposition, but also indicative of the world's progress in electromagnetism and its applications. The congress arrangements are in the hands of a committee of organization consisting of thirty-three members, all active representatives of American electrical progress. Prof. Elihu Thomson has been elected president. No other man in the country is so well fitted for the post, since he has united for many years the support of scientific, industrial and inventive electrical interests.

The vice-presidents include Prof. H. S. Carhart, of the University of Michigan, whose work is so well known in connection with electrical standards of e. m. f.; Mr. C. F. Scott, the retiring president of the American Institute of Electrical Engineers; Mr. B. J. Arnold, the incoming president of the same organization; Prof. W. E. Goldsborough, the active director of the Department of Electricity at the St. Louis Exposition, and Dr. W. S. Stratton, the director of the National Bureau of Standards.

Meetings of the executive committee and of the advisory committee have already been held. The work of preparing for the congress is already in progress. The general secretary of the congress is Dr. A. E. Kennelly, Harvard University, Cambridge, Mass., to whom all correspondence should be directed.

THE DELAY ON THE NEW YORK SUBWAY

Chief Engineer Parsons and Contractor McDonald, of the New York rapid transit subway, have publicly announced that the subway will not be ready for the operation of trains before April 1, 1904. The persistency with which the work was rushed before the recent labor troubles led to the belief that the road would be ready by Jan. 1, 1904, but the continued delays, owing to strikes among the men, have seriously handicapped the contractor. The work of excavating is not so far behind that it could not be rushed to completion by the first of the year, but the stations and the power house are far behind the schedule of completion originally set for them. The men at work on the power house went out in March, and a month later the men on the stations went out. A short strike would not seriously have retarded the work, but a cessation of activities for five months is more than the contractors could possibly overcome in the short time that remains this year. The work of laying the rails is progressing satisfactorily, and it is expected that by Jan. 1 the track will be laid complete between the Postoffice and Harlem Bridge, on the East Side, and to the Washington Bridge, on the West Side.

THE ACCIDENT ON THE BOSTON & WORCESTER ROAD

The investigation as to the responsibility for the accident on the Boston & Worcester Street Railway, which occurred Saturday, July 25, at Shrewsbury, Mass., so far as it has been made public, has brought out nothing to show that the management of the company was in any way to blame. Leon B. Downs, the motorman, and Daniel F. Daly, conductor of the car which was on the track over which another car had the right of way, were arrested a few days after the accident by direction of Assistant District Attorney George S. Taft, of Worcester County, and were held for examination in $1,000 each. They are charged with manslaughter.

The Railroad Commission started out to investigate the cause of the accident at once. It sent one of its inspectors to get evidence and gave a hearing in Boston Friday, July 31. The hearing was continued to August 2. General Superintendent Arthur C. Ralph, of the Boston & Worcester Company; the assistant general superintendent, Edward H. Richards, and George C. Rappleyea, motorman of one of the cars in the collision, were the only witnesses examined. The crew that are under arrest were represented by counsel and Chairman James F. Jackson announced that the commission would be glad to get a statement from them.

It developed at the hearing that the main purpose of the inquiry is to learn the entire method of operation of the cars on this line with particular reference to the methods employed to insure safety of operation. President William M. Butler told the commission that his road has the most perfect system for safe operation of any road built and he will introduce evidence at the continued hearing to bear out his statements. The commission appears to rely upon its own inspector's report, together with a report of the evidence submitted at the inquest on the death of the one passenger who was killed, which it gets from the county, for the most of its information as to the responsibility for the accident.

The investigation by the State police, who arrested Daly and Downs, shows that the crew ran by a regularly scheduled meeting point without getting instructions to do so from the despatcher. Telephones are provided at the turn-outs for communication with the despatcher's office and the printed rules of the road forbid a crew to go by a scheduled meeting point without getting instructions. The crew, who had relieved another crew but a mile away from the accident, stated that they had seen a car go by while they were waiting for their own car to come, and they supposed it was the one they were to meet. On the day of the accident the cars were off the schedule on account of trouble with the power, but the officials state that the crew knew that the scheduled meeting places were the same. There is a single track line with long turnouts between Worcester and South Framingham, and double tracks the rest of the way.

The accident has caused much comment throughout Massachusetts, because the Boston & Worcester line is the most advanced example of street railway construction in the State, being longer and running at a higher speed than any other line. It has caused an outbreak of agitation against fast time on trolley lines. Suits for amount aggregating many thousand dollars have been brought against the company because of the accident, although many of the claims for injuries have been settled. The payment of $1,000 in one case where the patient did not go to a hospital is reported.

CLEVELAND COMPANY TO APPLY FOR FRANCHISE RENEWALS

The Cleveland Electric Railway Company has started an active campaign in its fight to prevent the building of three-cent fare lines in Cleveland. The company is preparing to ask the Council for extensions to its street railway lines on the following streets: Doan Street, from Superior to Quincy Street, 3 miles; Seneca Street, from Scranton Avenue to Jefferson Street, one mile; Rhodes Avenue, from Detroit Street to Denison Avenue, 3 miles; Denison Avenue, from Pearl Street to Lorain Street, 3 miles. On all of these streets the company already has lines, hence the asking for extensions. The Seneca Street, the Rhodes Avenue and the Denison Avenue routes are the same that Mayor Johnson has planned for three-cent fare routes, and for which bids were opened two weeks ago. The new lines would cross existing lines at numerous points, and would provide new short routes to and from different portions of the city. These advantages the railway company proposes to offer at the existing conditions, six tickets for a quarter and universal transfers. The company is now securing consents of property owners for the new lines. The advantage that the old company has over the new aspirants for the franchise is that by it people will be carried to all portions of the city for practically four cents, whereas the three-cent fare companies can offer the reduced rates only over certain short routes, and a passenger going to another portion of the city would have to pay an additional four cents; or seven cents for an unlimited ride, as against four cents to the old company. Another point in favor of the old company is that the courts have recently decided that consents of property owners can be bought and sold, and can be withdrawn when given. To protect its system, the present company can afford to bid higher for consents than can the bidders for three-cent fare routes. Altogether there is every indication that the old company is preparing to make a stronger fight than ever against the threatened encroachments of the three-cent fare people.

CONTRACT FOR BONDS ON THE NEW YORK SUBWAY

The Interborough Rapid Transit Company has recently awarded the contract for the rail-bonds required for the contact-rail in the subway to the Mayer & Englund Company, of Philadelphia, for its Protected rail-bonds, which company also received the contract to supply the rail-bonds for the traffic rails. Four bonds will be used at each joint, two under the joint plates and two under the base of the rail. An interesting feature in connection with the application of the two bonds to the base of the rail is the special hydraulic tools that will be supplied by the rail bond maker for this work. The holes for the bond studs will be cut through the rail base by a 100-ton hydraulic punch, designed expressly for this purpose. The bond terminals will then be placed in these holes and compressed by a hydraulic compressor of 35 tons indicated power. As the cutting punch produces a tapered hole, with the large diameter at the top, and the copper in the bond terminals is compressed into the holes against the small end, the contact obtained under the 35 tons pressure exerted is stated to be unusually good and entirely moisture proof.

STREET RAILWAY PATENTS

UNITED STATES PATENTS ISSUED JULY 21, 1903.

[This department is conducted by W. A. Rosenbaum, patent attorney, Room No. 1203-7 Nassau-Beekman Building, New York.]

734,010. Rocker Side Bearing; Frederick B. Townsend, Chicago, Ill. App. filed May 11, 1903. The combination with a bottom plate of a reciprocating top plate, a pair of interposed rockers and a longitudinally arranged spring and followers mounted in and carried by the reciprocating top plate, the bottom plate having stops to engage the followers.

734,098. Electric Switch; John J. Ruddick, Newton, Mass. App. filed Oct. 15, 1900. A box applied to a trolley wire and containing switch mechanism from which a tappet projects into position to be struck by the wheel to throw the switch.

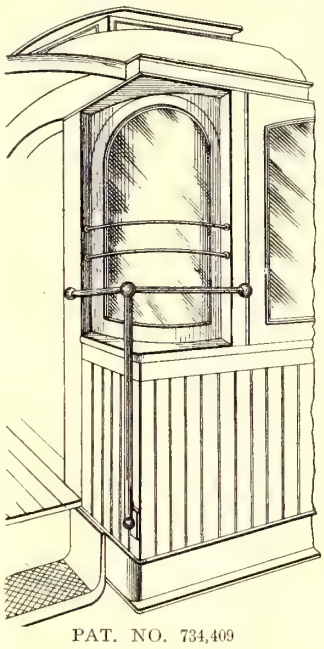
734,113. Car Wheel; Herbert Bacon, Boston, Mass. App. filed Oct. 30, 1902. A car wheel presenting at its face spaces or pockets and having connected therewith non-metallic retaining plates, and fibrous material packed in said spaces or pockets behind the plates to thereby lessen the noise of cars running on elevated structures.

734,181. Car Fender; Frederick R. Keith, Randolph, Mass. App. filed March 25, 1903. Details.

724,200. Device for Decreasing the Noise upon Railroads or Other Rolling Machinery; George W. Stevens, Boston, Mass. App. filed Oct. 31, 1902. Soft tread wheels running in contact with the car wheels and the railway track.

734,253. Street Car; John A. Brill, Philadelphia, Pa. App. filed April 23, 1902. An open car provided with two steps, one of which is situated below the flooring and within the body of the car.

734,259. Switch Actuating Mechanism; John H. Fitch, Ludington, Mich. App. filed Feb. 16, 1903. Relates to means for moving the switch from the platform of a moving car.



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734,362. Car Fender; John D. Price, Cleveland, O. App. filed Aug. 4, 1902. The construction is such that should an obstruction be lying on the track in a position too low to be caught by the forward member, a rear part will be automatically thrown down into position to catch it.

734,409. Car Construction; Antoine B. Du Pont and George J. Kobusch, St. Louis, Mo. App. filed April 6, 1903. A window located in and forming part of the corner of the car.

734,411. Car Fender; Hans P. Eskelsen, Port Clinton, Ohio. App. filed May 16, 1903. A car fender formed of a plurality of spring members, is normally held above the roadbed by the retractile tendency of the springs, and when required for use may be readily depressed by the motormen by means of a foot lever.

734,435. Cable Grip or Clutch Device; Ludwig Schuler and Joseph Ericson, Telluride, Col. App. filed March 26, 1903. Details of construction.

734,442. Trolley; Harry Spurrier, Montreal, Canada. App. filed Oct. 2, 1900. Comprises means for automatically causing the trolley wheel to turn and meet the curves of the trolley wire simultaneously with the turning of curves in the rails by the car.

UNITED STATES PATENTS ISSUED JULY 28, 1903.

[This department is conducted by W. A. Rosenbaum, patent attorney, Room No. 1203-7 Nassau-Beekman Building, New York.]

734,556. Shoe Brake; Charles W. Hoch, Brooklyn, N. Y. App. filed April 22, 1903. A sudden stopping and derailing device operated by means of a lever from the car platform.

734,560. Car Seat; John S. Johnson, New York, N. Y. App. filed Feb. 2, 1901. Details of construction of a reversible car seat.

734,566. Brake Shoe; John J. Kinzer, Pittsburg, Pa. App. filed Feb. 27, 1903. Consists of an inclosing casing of sheet metal bent into integral back, side and end walls, a sheet-metal lug fixed to the back of the casing, and a filling of frictional material.

734,567. Brake Shoe; John J. Kinzer, Pittsburg, Pa. App. filed Feb. 27, 1903. A modification of the preceding patent.

734,568. Brake Head; John J. Kinzer, Pittsburg, Pa. App. filed Feb. 27, 1903. A brake head having a curved body and face presenting a bearing for a brake shoe, which is substantially continuous throughout the length of the body to thereby strengthen an attached brake shoe.

734,587. Car Fender; Americus Miesse, Lima, O. App. filed Jan. 5, 1903. Fenders provided at each end of a car are so mounted that in whichever direction the car is moved a fender is projected in front while the fender in the rear is retracted; means are also provided to prevent the retraction of the fender at the forward end when the car is moved backward a short distance.

734,609. Wheel; Henry H. Porter, Jr., Chicago, Ill. App. filed Dec. 24, 1901. The wheel is provided with a movable flange disk which is concentrically mounted upon a shaft, and means for moving said disk about its shaft to protrude it outside the edge of the tread of the wheel whereby the wheel may run upon railway tracks as well as on smooth surfaces.

734,611. Car Replacer; William H. Pritchard, Indianapolis, Ind. App. filed Jan. 22, 1903. A car replacer having a longitudinal central depression or channel, wings arched longitudinally, and each having a diagonal offset, the wings having a downward lateral slope from said offset to the channel.

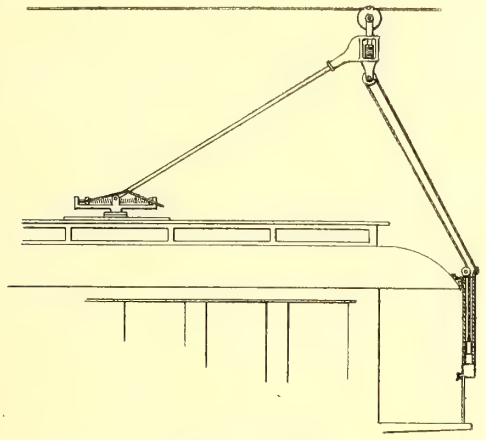
734,723. Switch Lock; Herman H. Louis, Newburg Hamlet, O. App. filed Feb. 13, 1902. Details.

734,745. Brake Shoe; James B. Perry, Buffalo, N. Y. App. filed Dec. 29, 1902. A brake shoe provided with a filling capable

of producing high friction, retaining walls engaging the sides and ends of the filling, and retaining lugs upon the floor of the cavity, embedded in the filling and beveled so as to retain the same in place.

734,830. Car Fender; Delos B. Dibble, Detroit, Mich. App. filed Dec. 8, 1902. In combination with a car fender, a dropping fender hinged to the front edge thereof, means upon the car platform for operating the dropping fender and a rigid hinged connection between the dropping fender and the means for operating it, whereby the dropping fender may be positively operated in both directions.

734,920. Trolley Catch; George W. Maxwell, Los Angeles, Cal. App. filed Mar. 25, 1903. The trolley cord is attached to



PAT. NO. 734,920

the dash board at one end and runs over a pulley near the top of the pole, thence downward to a suspended weight in a casing attached to the dash board, thereby permitting the pole to rise and fall with the irregularities in the wire. When the trolley wheel leaves the wire the dog is released which grips the cord, thus preventing it from running and thereby holding the pole stationary.

PERSONAL MENTION

MR. THOMAS FARMER has resigned as superintendent of motive power of the Detroit United Railway Company, of Detroit, Mich.

MR. MANSFORD J. FRENCH, who has been acting as the construction engineer for the Oneida Railway Company, of Oneida, N. Y., has resigned from the company to accept a position with the Cleveland Electric Company, of Cleveland, Ohio.

MR. WARREN H. BICKNELL, formerly general manager of the Aurora, Elgin & Chicago Railway, has assumed charge as president of the Lake Shore Electric Railway, of Cleveland. Mr. Bicknell will also become director in the company.

MR. ROBERT A. BYRNES, formerly New York representative of the Ohio Brass Company, has accepted the New York agency of the Northern Engineering Works, of Detroit, Mich., the large manufacturers of hand and electric cranes for power stations and other purposes. Mr. Byrnes will have headquarters at 120 Liberty Street.

MR. F. L. DAME, for the last two years general manager of the Union Electric Company, Dubuque, Ia., has accepted the position of engineer of the local company's committee of the General Electric Company. It is expected that Mr. Dame will assume his new duties with headquarters at Schenectady, N. Y., about the middle of August.

PRIVY COUNCILLOR RATHENAU, one of Germany's leaders in the electrical industry and managing director of the Allgemeine Elektricitaets Company, of Berlin, is coming to the United States to study electrical progress here. It is also reported that he will resume the negotiations with the General Electric Company, relative to a closer business connection, which were recently conducted in Berlin and were broken off without a result being reached.

MR. C. A. DENMAN, a well-known electric railway operator of Toledo, Ohio, has been appointed superintendent of the Richmond Street & Interurban Railway Company, of Richmond, Ind. For nine years Mr. Denman was connected with the Consolidated Railway Company, of Toledo. Subsequently became general manager of the Toledo, Bowling Green & Southern Railway, and later of the Toledo & Maumee Valley.

MR. HENRY A. EVERETT has taken summer quarters on the Detroit River, a short distance above Detroit. In addition to giving his personal attention to the management of the Toledo Railways & Light Company, of which he is president, Mr. Everett is temporarily managing the affairs of the Detroit United Railway. Mr. J. C. Hutchins, president of that company, was married a short time ago, and is now in Europe on a wedding trip.

MR. J. A. EMERY has been elected general manager of the properties of the Birmingham Railway, Light & Power Company, of Birmingham, Ala., to succeed Mr. D. A. Belden, who resigned some weeks ago to become president of the New Hampshire Traction Company. Mr. Emery has been with Ford, Bacon & Davis, who are rebuilding the Birmingham system, for five years. He is a technical man and well posted on the work required. He has been in Birmingham for a year and is very popular.

LORD RIBBLESDALE, George Gibb, general manager of the Northeastern Railway; Sir David Barbour, Sir J. Dickson Poynder, and Sir Francis Hopwood, comprising the sub-committee of the Royal Commission on London Street Traffic which was appointed last month to study American street railway systems, will sail for New York September 18. On their arrival at New York, President Vreeland, of the Metropolitan Street Railway system of New York, whom the Commissioners have already met in London, will give them the benefit of his experience. The Commissioners will visit Boston, Chicago, and elsewhere with a view to the adoption in London of any of the valuable features of the street railroads in these cities.

MR. HORATIO BIGELOW, who was recently appointed general superintendent of the Montville Street Railway Company and the Norwich Street Railway Company, of Norwich, Conn., has had several years of practical experience in developing the traction and light properties of Stone & Webster. In 1902 he was appointed assistant to the chief engineer of the Seattle-Tacoma Interurban Railway, after spending several years in the engineering department of the Seattle Electric Company. Later on Mr. Bigelow was sent to Porto Rico to act as manager of the Ponce Railway & Lighting Company. He resigned from Stone & Webster's employ last June to accept the present position which his extensive experience well qualifies him to fill.

MR. DAVID YOUNG, expert street railway adviser with Brown Brothers & Company, of New York, and formerly general manager of the North Jersey Street Railway Company, expects soon to sail for England to make a general inspection of the London tramways in which Brown, Shipley & Company, the London branch of Brown Brothers, are interested. Mr. Young has recently been in San Francisco and Chicago in the interest of his employers. In San Francisco he made a critical examination of the Union Railroads and acted as a member of the board of arbitration chosen to adjust the questions of an operating agreement with the men and of an increase in salary. In Chicago Mr. Young made a thorough inspection of the properties in which Messrs. Brown Brothers are interested.

COLONEL N. H. HEFT, who for several years has been the head of the electrical department of the New York, New Haven & Hartford Railroad Company, severed all connections with that company July 27, when he resigned as president of the Stamford Street Railroad Company. Colonel Heft, according to report, intends to spend a few months resting in Europe. Colonel Heft will continue his interest in the Stamford & New York Railroad Company, of which he is president and which has recently completed a line from Stamford to Portchester. This line, unlike the Stamford and Meriden systems, of which Colonel Heft has also been president, is not controlled by the New York, New Haven & Hartford Railroad Company, but by Colonel Heft and associates.

MR. NEWTON W. BOLEN, the retiring superintendent of the Central and Flatbush Division of the Brooklyn Rapid Transit Company, of Brooklyn, N. Y., was tendered a complimentary dinner Monday, July 28, by his associates in the company in token of their appreciation of him as a man and as one of the executive heads of the company. Handsomely engrossed resolutions and a floral horseshoe were presented to Mr. Bolen after the menu. On the top of the horseshoe was inscribed in red letters upon a pure white background "With Success." Mr. Bolen has been in the employ of the Brooklyn Rapid Transit Company since its formation, and this term of service added to his former connection with companies now a part of the Brooklyn Rapid Transit system, makes twenty-four years' of street railway service in Brooklyn. Mr. Bolen leaves the Brooklyn company to become superintendent of the first district of the railway department of the Public Service Corporation, which controls all of the electric light and street railway companies in Jersey City, Newark and vicinity. The Central and Flatbush division of the Brooklyn company has been divided since Mr. Bolen's resignation. The Flatbush part has been placed in charge of Mr. Kennedy, who is superintendent of the Greenwood division, and the central division has been placed in charge of Mr. Seibert, who now has charge of the Ridgewood division.

NEWS OF THE WEEK

CONSTRUCTION NOTES

BIRMINGHAM, ALA.—The Birmingham Railway, Light & Power Company has been granted a franchise to lay tracks on Nineteenth Street from its line on Avenue B to the power station to the right of way of the Alabama Great Southern Railroad.

BIRMINGHAM, ALA.—It is reported that the Birmingham Railway, Light & Power Company is figuring on the construction of several new lines, one of which is to reach Boyles, the suburb where the Louisville & Nashville Railroad is building new shops. Another is to come via North Birmingham to Thomas, giving a through ride from the city to Boyles, and from Thomas to the same place. The company is also figuring on a 2-mile extension from Bessemer to Jonesville.

MOBILE, ALA.—Herbert C. Wright and associates are petitioning the General Council for a franchise for an electric street railway over certain streets in Mobile. The parties are strangers here, and nothing is yet known as to their financial responsibility. The issue of the franchise is uncertain.

MONTGOMERY, ALA.—The declaration of incorporation of the Hayneville Railroad Company has been filed. The company is capitalized at $75,000. The incorporators of the company are: W. P. Russell, W. L. Haigler, E. H. Pritchett, T. R. Meriwether, G. M. Williams, W. B. Brigham, C. W. Garrett, W. Brewer and W. T. Houghton.

HOT SPRINGS, ARK.—The Interurban Railway & Power Company is anxious to interest capital in a scheme it has for developing water-power and operating an electric railway and lighting system. The company has secured a 50-year charter in Arkansas, with rights of eminent domain for the lake and a right of way for a car line. The Suachita River is to be dammed four miles from the city limits. W. L. Stebbins gives an estimate of 20,000 hp at ordinary flow, yet says it is safe to figure on a delivery in the power house of not less than 6000 hp at low water. All surveys, maps, etc., have been made.

LOS ANGELES, CAL.—The Pacific Electric Railway Company has begun extending its line along the coast from Devil's Gate to Alamitos Bay, a distance of about a mile.

LOS ANGELES, CAL.—The Supervisors have granted to J. D. Burkhart a franchise for an electric railway on Santa Fe Avenue from the south city boundary to Slauson Avenue. Burkhart has been running a dummy line along Santa Fe Avenue to the Coursing Park for years.

LOS ANGELES, CAL.—Grading has begun on the Brand line to be built between this city and Glendale by the Los Angeles & Glendale Electric Light Railway Company. Ten miles of double track will be laid. Outside the city limits the road will occupy the center of a 100-ft. boulevard, which is being built by L. C. Brand and other property owners of Tropico and Glendale.

LOS ANGELES, CAL.—It is stated that the Whittier branch of the Pacific Electric Railway Company, now under construction, will be extended through the La Habra Valley to Riverside, where Mr. Huntington has recently acquired heavy interests in street railway systems. From the valley to Riverside is about 30 miles, and the proposed route runs 3 miles north of Fullerton, 1½ miles north of Placentia and a little south of the Fullerton oil wells.

LOS ANGELES, CAL.—Pending the settlement of a suit between the Los Angeles Railway Company and the city of Los Angeles involving the right of the company to construct and operate a street railway on San Pedro Street south of Thirtieth Street and on South Park Avenue from Jefferson Street to the city limits, the City Council has granted the company permission to run its cars over the disputed right of way, provided it will give a $10,000 bond to remove the tracks if it loses the law suit.

LOS ANGELES, CAL.—The Scheller franchise in the First Ward has been sold by the City Council to the Los Angeles Railway Company for $10,000. The route of the franchise covers Avenue 20, from Pasadena Avenue to Dayton Avenue, thence to Marmion Way to a point about 1225 ft. north of Avenue 45; also beginning at Marmion Way and Avenue 45 and following Avenue 45 southward to Pasadena Avenue, thence eastward to Avenue 50, to Monte Vista Street, to Avenue 61, thence over Piedmont Avenue to Pasadena Avenue; also beginning at the intersection of Dayton Avenue and Avenue 26, and running northwest on Avenue 26 to Huron Street, and on Huron Street to a point about 475 ft. distant.

MADERA, CAL.—Articles of incorporation of the Madera Railway Company have been filed. The company has a capital stock of $50,000 divided into 5000 shares at $10 each. The directors are: J. C. Campbell, R. W. Campbell, A. C. Towne, J. H. Tate and F. C. Drew. The purpose of the company is to build, equip and construct a railway from the Gowan Station to Knowles Spur, a distance of 2 miles. The principal place of business is San Francisco.

POMONA, CAL.—The Pacific Electric Railway Company has purchased a franchise for a street railway in this city. A bond for $10,000 has been executed to insure the faithful performance of the contract.

REDLANDS, CAL.—The San Bernardino Valley Traction Company reports that it hopes to begin work at once on a proposed extension on Olive Avenue.

HARTFORD, CONN.—The Railroad Commissioners have approved plans of the Hartford Street Railway Company for extension of lines on Capitol and Huyshope Avenues, and of the Stamford Street Railway Company for an extension from Stamford to Springdale. The requirements are that trolley wires shall be suspended at least 18 ft. above the surface of the street; that the poles shall be 5 ft. from the nearest rail, and that double-truck cars shall be equipped with an effective system of power brakes.

NEW HAVEN, CONN.—Newspaper advices say that the New York, New Haven & Hartford Railroad has contracted for a dam at Borden, Conn., to hold 30,000,000 gallons of water, to furnish power for the electric roads in the vicinity of New Haven.

STAMFORD, CONN.—A decision of Judge Elmer in the Superior Court, just handed down, granting a charter to build an electric railway from Montowese, a small town a few miles north of New Haven, to Wallingford, 5 miles further north, closes the last gap in the electric railway line from New York to Boston.

ATLANTA, GA.—The Georgia Railway & Electric Company has begun work on its proposed line between Atlanta and Marietta. A new bridge will be erected over the Chattahoochie River.

WALLACE, IDAHO.—The electric railway for which Herman J. Rossi obtained a franchise is in process of organization. It is contemplated to build the line from Wallace to Gem, Blackbear, Mace and Burke on one branch, being seven miles long; also to build from Wallace to Osburn, Kellogg and Wardner, being a branch thirteen miles long; also to build from Wallace to Mullan, a distance of seven miles. At present it is intended to build the Burke branch this fall and commence on the balance as early as possible in the spring. The capitalization will probably be $300,000, divided into 30,000 shares of the value of $100 each.

JOLIET, ILL.—F. E. Fisher, general manager of the Fisher Construction Company, which is building the Joliet, Plainfield & Aurora Railroad, says that grading for the first ten miles of this road, between Joliet and Plainfield, has been finished, and that the culverts and bridges are practically all in. Most of the ties are distributed and five miles of the rail laid and the balance of the rails necessary to complete the next ten miles have been shipped from the mills. Gravel for ballasting will be obtained from the Elgin, Joliet & Eastern Railroad, with which a track connection has been made. Mr. Fisher says that the first ten miles between Joliet and Plainfield will be in operation by Sept. 1. Grading between Plainfield and Aurora is about to be begun. Construction work on this road has been very rapid.

MOLINE, ILL.—At a recent meeting of the Dixon, Rock Falls & Southwestern Electric Railway Company G. T. Shaw, of Dixon, president of the DeKalb & Southwetsern Electric Railway, formerly known as the Northern Illinois Electric Railway, was elected president. The other officers were elected as follows: A. C. Stanley, vice-president; R. L. Leitsch, secretary; O. E. Maxson, treasurer, and H. L. Sheldon, attorney, all prominent business men of Rock Falls. A surveying party under A. M. Shaw has been sent out near Geneseo, and the work of surveying and securing the right of way is being pushed along rapidly.

MONMOUTH, ILL.—The Western Illinois Traction Company has commenced work on the Galesburg line. The officers and promoters of this company are: W. B. Young, president; G. W. Gale and W. W. McCullough, vice-presidents; W. H. Woods, treasurer, all of Monmouth, except Mr. Gale, who is from Galesburg. The company was incorporated June 4, capital stock $500,000. The total cost of the road will be about $400,000. A $50,000 guarantee bond assures that cars will be running to Galesburg by January, 1904, also 1½ miles street car line in this city. The power house and main offices will be in Monmouth.

MT. VERNON, ILL.—The certificate of incorporation of the Southern Illinois Electric Railway Company has been filed in the County Recorder's office at Belleville. The company is capitalized at $50,000. The company will build from East St. Louis through St. Clair, Clinton, Washington, Marion, Jefferson, Hamilton and White counties to a point at or near Maumee, on the Wabash River. The incorporators are: John R. Piercy, George F. Ward, Samuel Casey, Louis G. Pavey, Samuel T. Maxey and Albert N. Johnson, of Mt. Vernon.

BLUFFTON, IND.—There are both rumors and indications that the Muncie, Hartford City & Ft. Wayne Railway will not be built into Ft. Wayne, but that it will have its terminus in this city, where it will connect with the Kokomo, Marion & Western Railway, which is building from Kokomo through Bluffton and Decatur to Lima, Ohio. Ft. Wayne will be reached by way of Decatur and by an interurban road that is building from Dayton to Ft. Wayne. This change is due to the fact of the purchase of the line by the Union Traction Company.

CHESTERTON, IND.—The Town Trustees have granted a fifty-year franchise to the Chicago, Indiana & Michigan Traction Company. The franchise permits the construction of electric lines on any street in the town.

DANVILLE, IND.—The Town Board has granted an amended franchise to the Indianapolis-Danville-Rockville Electric Railway which calls for the use of three streets, provides that work shall begin Aug. 1 and be completed and in operation in one year. The power house and car house are to be erected within half a mile of the city. A bond of $5,000 has been filed to insure compliance with the terms of the franchise.

ELWOOD, IND.—The Union Traction officials are planning for the new car houses and shops which will be located in North Anderson. Architect Jeckel is making the plans for the new buildings. The company will probably be ready to receive bids in a very few days.

INDIANAPOLIS, IND.—A novelty in interurban railway construction in Indiana will be introduced by the Indianapolis & Martinsville Railway on its extension from Martinsville to Bloomington by the building of a tunnel through the hills in the northern part of Monroe County. This range of hills in Monroe County is over 200 ft. in height, and the tunnel will be about 1,500 ft. in length. It will be constructed through solid sandstone, and will necessitate an expenditure of between $75,000 and $100,000.

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Non-Combustible Cars in Tunnels

According to the published accounts which have reached us of the recent disastrous and deplorable accident on the Metropolitan Underground Railway, of Paris, the loss of life was considerable, and unless steps are taken to assure the public that there is no danger of the repetition of such an occurrence, many people will refrain from patronizing an underground road of this character. This is the first serious accident which has occurred on any of the electric underground roads in Europe, a fact which should be borne in mind in any public discussion of the unfortunate event in Paris this week. Both in London and in Paris this immunity from accidents has been accompanied with a density of traffic exceeded in few places in the world. Nevertheless, the destruction by fire of a train of cars in the subway indicates that the danger from the use of combustible cars is by no means imaginary, and must be reckoned with in every installation of this kind.

Electricity in the transportation service is, in many respects, a much safer servant than steam, and it is, perhaps, the very fact that electrical engineers are so accustomed to the handling of large current that familiarity with electricity has bred in them a sort of contempt for it. That this is not true in all cases, however, was shown last year by the extended discussion on the subject of "combustible vs. non-combustible cars" reproduced in the STREET RAILWAY JOURNAL, in which such authorities on transportation subjects as George Westinghouse and C. T. Yerkes defined very clearly their position in regard to the importance of using fire-proof material in subway car construction.

A conflagration on a surface car is not particularly serious, as passengers can easily leave the car in case of a disaster of this kind. With elevated railways the difficulty of abandoning a train is, perhaps, a little more difficult, but nowhere near so serious as it would be in the case of an underground road. Nevertheless, the Manhattan Railway Company, as has been described in these pages, has paid especial attention to the thorough protection against fire of its cars by the use of a lining of asbestos board under the car floor.

The protection on underground roads should be most complete. In London, up to within recently, the cars on the tube railways were hauled entirely by electric locomotives which were, of course, fireproof. With the introduction of motor cars, however, on the Central London Underground Railway the precaution was taken of constructing the cab of steel with a uralite or asbestos lining, and finishing it throughout so as to be incombustible. Equal, if not greater, care has been taken for protection against fire in the case of the new subway cars for New York City, and the New York public can feel safe against a repetition in that city of the Paris horror, which startled the world last Monday.

The New York Subway Cars

The most conspicuous feature of the new subway cars, which are being built for the New York subway, is the precaution taken by the Interborough Rapid Transit Company to guard against accidents through fire, collision or derailment that might destroy the coaches or endanger the lives of passengers. For this reason the cars were built unusually strong, and were designed especially with the view of withstanding heavy impact. The plans for the electrical features were also made to provide against the possibility of fires from defective wiring, faulty insulation and improper installation of apparatus. A careful examination of the cars which have already been received in New York for operation in the subway confirms the opinion expressed by the company's engineers some time ago that in these particulars, at least, they would represent the highest degree of the car builders' skill. The management has appreciated from the beginning the importance of this feature of the equipment, and is entitled to praise for the attitude it has maintained throughout the investigation conducted by its engineers with a view of determining the best methods, materials and forms of construction for insuring safety to patrons. A careful study of car construction in European cities, especially with reference to tunnel operation, was undertaken at an early stage, and an earnest effort was made to avoid the defects which have been revealed in former installations. The New York subway management has profited by the experience of the London and Paris companies, and those who are best qualified to judge say that such a disaster as the Paris conflagration could not be repeated in this city. Not only has

every effort been made to insure safety by employing fireproof material, including a copper sheathing for the car body, but the tunnel construction and equipment show marked advance. Moreover, the lighting service is entirely independent of the power supply for the operation of the trains.

In this connection it is worthy of note, too, that other companies are constantly striving for a higher standard of car construction, although their operating conditions are much more favorable than the subway company's, and that they have aided materially in solving many vexatious problems. As a result, it must be admitted by every intelligent observer that, in spite of the hubbub raised by calamity howlers every time a fire is discovered in or near an electric car, the art is constantly advancing and that great improvement has been made in the last few years in this important department. Recognition of the needs of the service is much more general, too, and under the circumstances better work and more satisfactory results may be looked for.

Two Memorable Strikes

The labor troubles which have caused the street railway managers of Connecticut so much annoyance and financial loss during the last year are now happily terminated, and it is to be hoped that the experience gained will have a wholesome effect upon employees, and serve to restrain them from engaging too readily hereafter in such disturbances. In the conflict just closed the union has been forced to admit defeat—grudgingly, it is true, and only after the company affected had successfully operated its property several months in spite of the organization—and the workingmen who persisted in standing out for the union terms now find themselves deserted by their leaders, without occupation and with no prospect of employment in railway work.

The formal raising of the "boycott" at Waterbury on Monday marked the ending of a series of strikes in two of the most important manufacturing cities of Connecticut—Bridgeport and Waterbury—in both of which the strikers were worsted.

The Waterbury strike lasted 210 days, and was marked by violence and bloodshed, destruction of property, boycotting and intimidation, culminating in murder. The trouble was precipitated by the discharge of the president of the union for cause, after three warnings had been given him, but later other demands were made by the men, and one condition was insisted upon—recognition of the union, which the company firmly and flatly refused to entertain. An effort was made to call out the employees of the company and allied corporations throughout the State, but this failed utterly, and merely raised a storm of indignation against the perpetrators of this outrage.

The Bridgeport strike was marked by violence from the beginning, but did not last as long. It was noteworthy, also, because of the attitude of Mayor Mulvihill, who openly aided the strikers until his action brought a severe rebuke from other members of the city government, and he was practically forced into the background in spite of his official position. The stand taken by the business interests on this occasion had a wholesome effect, as it showed what could be done by a few resolute men who would insist upon having their legal rights respected and protected.

In this connection the attitude of the management of the properties is deserving of commendation. During the long struggle they maintained the same position, and although at times the pressure brought to bear upon them was almost irresistible, they did not swerve from their purpose for a moment. Their loss, reckoned in dollars and cents, was great, and they were hampered in the development of their property and the execution of plans for improvement in the service, but the result justified the sacrifice. With the defeat of the union they announced their determination to put into effect the concessions which they offered when the strike was threatened, thus showing a disposition to deal fairly, of their own volition, with their employees, which cannot fail to win the respect and confidence of the entire community.

It is fortunate for all concerned that these labor troubles are at an end. The lesson was a hard one, and its application entailed much annoyance, inconvenience, financial loss and hardships. Let us hope that it was not in vain, and that its influence will be felt wherever there may be an inclination to follow blindly the irresponsible agitators who have brought so much suffering and strife into Connecticut during the last year.

Fixing Responsibility for Trolley Accidents

A 5-year-old child, while attempting to cross the Bowery after dark, was run down and killed by an electric car a short time ago. The crowd which quickly gathered at the scene of the tragedy, headed by the victim's father, attempted to wreak vengeance upon the motorman, who was saved from the fury of the mob only by the prompt action of the police. This incident may be taken as a fair example of the attitude of the public in times of excitement. There was nothing in the accident, as reported, to indicate that the motorman was at fault or that he did not exercise reasonable care and watchfulness; no charge is made of reckless operation, but the blame for the deplorable accident was laid upon the motorman by the parents and their sympathizers, although they did not witness the tragedy.

According to the report of the accident there was no sympathy expressed for the motorman, but he was held as responsible for the calamity as if he had run over the child willfully or through gross carelessness. Nevertheless, we know of many cases where an accident of this kind, in which the motorman was entirely blameless, has so affected him that he has abandoned his position entirely, and in nearly every case the result of such an accident on the nerves of a motorman are such that the effect lasts a very long time. Even the possibility of causing serious injury to a child by his car is enough to give a terrible shock to the average man after he has had a narrow escape. The result is that runs past school houses and through the densely crowded streets of the tenement districts of our large cities are disliked by all motormen largely for this reason. Yet the children themselves seem to take great delight in jumping in front and away from a car in mere bravado, to see the motorman put on the brakes and to "give him a scare," while the parents of these children seem to exercise no restraining influence over them.

The prominence given this affair has directed attention to the conditions that obtain in the densely populated sections of large cities, like the lower East Side in New York and the poorer districts of the West Side in Chicago. The streets through which trolley cars pass are used as the playground for the little ones, parents evidently trusting to a kind Providence and a watchful motorman to see that no harm comes to them. Even an occasional fatality does not seem to impress parents with a sense of their own responsibility as the natural and legal guardians of their offspring. In spite of warnings and tragedies the children continue to play in the streets, day and night, and the wonder grows that there are so few serious accidents.

In fixing responsibility it seems that all these circumstances should be taken into consideration. Gross carelessness on the part of parents in failing to keep the little ones out of danger really constitutes contributory criminal negligence, and while undoubtedly it would be hard to fix responsibility upon them under the circumstances, a strict sense of justice would sustain such a decision. All that a motorman can do is to keep a sharp lookout and exercise special care in running through crowded streets, but parents can and ought to do more. They should not permit their children to play unattended in such thoroughfares. If they persist in neglecting such necessary precautions the legal as well as moral responsibility rests upon them.

Some Economic Features of Power Transmission

The increasing complexity of the interurban networks in various parts of the country brings constantly before the engineer the necessity for a careful study of the conditions of economy in power transmission. Glance at a map of the electric roads in any region where they are well developed, and there is at once apparent the great practical difficulty of supplying power. However judiciously the power stations for individual roads may be located, the supply of the network of roads, considered as a unit, will almost always be found to exhibit conditions that do not make for economy. The natural tendency is to go in at once for power transmission and to feed the whole system from one or more well-located stations. But save in the case where hydraulic power can be well utilized, the planning of such a general system of electrical distribution is one of the most puzzling tasks by which the engineer can be confronted. It resolves itself into the following problem: Given a network of electric railway lines covering, say, a thousand square miles, required the number and location of the stations and sub-stations that will give the minimum cost of power per car-mile. As a general problem the data are always insufficient for a complete solution; as a special problem, one can sometimes get a fairly satisfactory result. The natural tendency nowadays is to locate one station as near as may be to the center of load, and transmit the power at high voltage to the sub-stations. As an economic question the first thing here to be considered is the working efficiency of such a system from which to determine the cost of power. It is easy enough to estimate this efficiency as a matter of theory, but data on the performance of complete transmission systems have until very recently been sadly lacking.

At the recent Institute meeting Professor Goldsborough, in connection with a discussion of the storage battery in sub-stations, presented the results of an efficiency test on the complete transmission system of a typical interurban system in which eight sub-stations, at distances of 11 miles to 33 miles from the main generating station, are fed by a 16,000-volt transmission system. The whole plant is modern and represents recent practice as fairly as any single system could. Now, this plant, under continuous test, yielded some highly interesting figures. On a daily load of about 25,000 kw-hours, the net efficiency of the transmission, reckoned from the low-tension bus-bars in the generating station to the direct-current bus-bars of the rotaries, averaged 73.5 per cent. That is, for each kilowatt delivered from the rotaries, 1.36 kw must be generated at the transmission station. Add to this extra amount of power the extra charges for interest, maintenance and depreciation of the transmission plant, and without having the data available for an exact computation, it will probably turn out that the cost of 1 kw-hour, delivered to the line via the sub-stations, is more than double the cost of the kilowatt-hour delivered to the bus-bars of the generating station. In the particular case under consideration the capacity of each of the sub-stations is rather small, and there is a fair chance that the installation pays as against separate generating stations instead of sub-stations, but double the capacity of the whole affair and the chance of recouping the lost power in cheaper generation would be none of the best. We could point out some instances in which it is quite certain, as certain as anything can be without examination of the books, that money is lost on every kilowatt of transmitted power, quite apart from the danger of putting all one's eggs in a single basket.

In cases of transmission like that investigated here the use of the storage battery is almost a necessity. Without it any accident to the main plant may paralyze a hundred miles or more of road, and the battery is more reliable and less of a luxury than it was a few years ago.

Another consideration that should be given great weight in planning such a plant is the gain that may be made in feeder copper by increasing the number of sub-stations. Under certain circumstances this may be large enough to in part offset the heavy expense of the transmission proper. If ever there is worked out any device for obtaining direct from alternating current which does not require attention there will be a revolution in electrical distribution for railway purposes, and the saving in copper can be effected where it is most needed—in the feeder system. At present the transmission lines are all additional expense, replacing no feeders in the ordinary case, but if one could multiply the sub-stations without increasing operating charges for labor, the feeder charges would get down where they belong. Of course, multiplication of stations would somewhat increase the total cost of apparatus, but one could well afford this in view of the saving in labor. Again, the most desirable thing is to increase the voltage on the working conductor, but in the absence of any thoroughly satisfactory way of doing this attention may well be directed to the feeders. And most of all it should be realized that the economy of the system, as regards power, is not so much in the cost of generation as in the cost of power at the motor terminals. There is such a thing, to drop into Yankee vernacular, as "saving at the tap and spilling at the bunghole"—and it is rarely commendable.

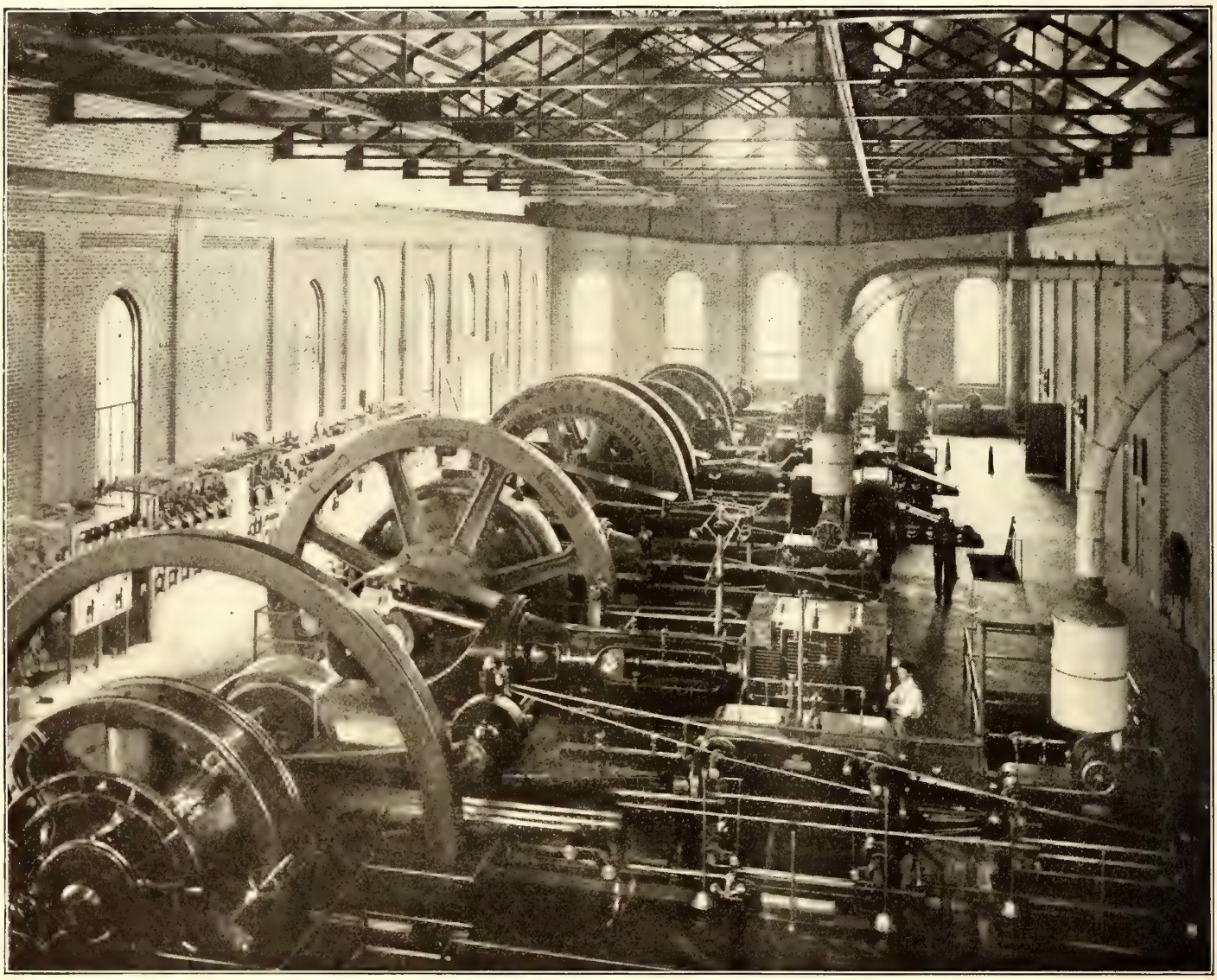
The Standard Form of Report

The adoption by the National Association of Railroad Commissioners at its Portland convention of the standard form of report, presented and adopted at the Detroit Convention of the Street Railway Accountants' Association of America, must prove very gratifying to the members of the latter body as well as to the committee of the Accountants' Association, which presented that report to the Association of Railroad Commissioners. The form was adopted by the Railroad Commissioners without change, but previous to this action had been very carefully gone over at a meeting of a joint committee of the two associations at Boston, at which the form of report was very thoroughly discussed and deemed acceptable. It might be interesting to state in this connection that at the Portland Convention of the National Association of Railroad Commissioners the fact was brought to light that in addition to the States which had previously adopted the standard classification of the Accountants' Association of operating and constructing accounts, the States of Pennsylvania, Virginia and Vermont had also fallen into line. These States now require reports from electric railroads within the State to be filed in accordance with the standard classification. This shows a gratifying improvement in the direction of uniformity.

A COMBINED RAILWAY, LIGHTING AND ICE PLANT AT HAMPTON, VA.

A noteworthy example of a combined railway, lighting and ice-making station is the Hampton (Va.) plant of the Norfolk, Portsmouth & Newport News Company. For some three years the electric railways in Newport News and between that city and Hampton, Old Point Comfort and Buck Roe Beach have been operated from this station, power and lighting have been supplied at all the points along the line, and a very profitable business has been developed in the sale of manufactured ice. The plant is run condensing, and as the condensed steam can well be utilized as the source of supply for water for freezing, and as the fresh water for boiler feeding, except a portion obtainable from driven wells, has to be metered from the town's public water supply, surface condensers are employed. From the standpoint of engineering design there are a number of interesting features. A duplicate set of steam mains has been provided, the feed piping is also practically in duplicate, mechanical stokers are fitted to the boilers, and special apparatus for handling coal and ashes has been installed. The main engines generally are equipped with independent condenser units, and the condensing water intake is the special feature. Architecturally, the building is a massive, dignified structure, in keeping with the character of its contents, and it is a conspicuous addition to the town of Hampton.

The plant was built by the Newport News & Old Point Railway & Electric Company to operate a trolley line from Old Point Comfort to Newport News through Hampton, and to supply electric power and lighting in the region. It is now a part of the property of the Norfolk, Portsmouth & Newport News Company. It is located on low ground on the bank of Herbert's Creek, which flows into Hampton Roads, and rests on piles driven over the entire building site. The power station is 105 ft. x 151 ft. in plan, and stands 155 ft. from the bulkhead line on the creek. It is planned to accommodate 2625 kw in generating machinery and two 40-ton refrigerating machines. The freezing ice is done in an adjacent building, 40 ft. x 86 ft. This building is to be extended 62 ft. when the full refrigerating capacity is installed. Besides these and one or two small buildings the station includes an ice storage, 25 ft. x 70 ft., arranged to be doubled in width when necessary.



INTERIOR OF POWER STATION AT HAMPTON, VA.

The foundations for the station have been made in an interesting manner. Twenty-foot piles, spaced both longitudinally and transversely on 3½-ft. centers, were driven in the soft earth of the site; they were tied together in the transverse rows by 12-in. x 12-in. timbers tree-nailed on top of them, and a double layer of plank flooring was laid across the timbers. On this pile-supported floor, which is at mean low tide level, so that the piles are always wet, were started the wall and column footings and the brick foundations of the chimney. The entire area of the building was then filled in around the footings with concrete 3½ ft. deep, forming the floor of the engine and boiler room basements. The finished concrete surface is 1½ ins. thick, composed of 1 part Toltec Portland cement and 2½ parts crushed granite, passing a ¼-in. ring, floated and trawled to an

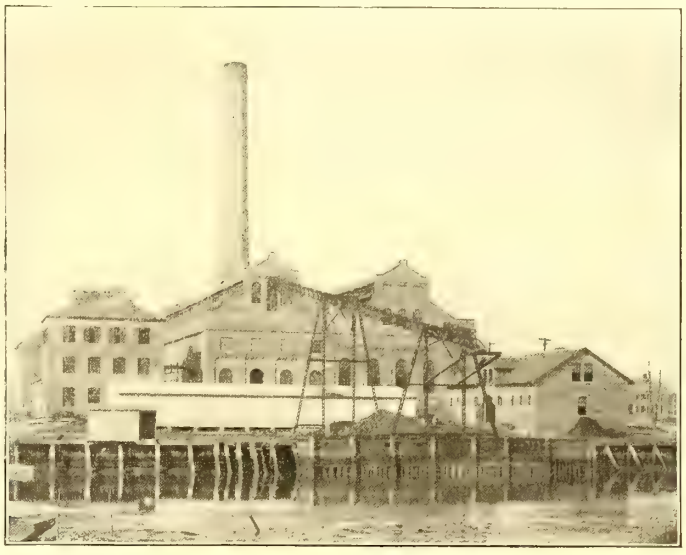
even surface and cut into blocks 4 ft. sq. and finished with a dust coat of 1 part sand and 2 parts cement. The rough concrete underneath is 6 ins. thick, and is composed of 1 part cement, 3 parts sand and 5 parts broken stone, passing a 1½-in. ring.

The building is a red brick structure and stands at the back of a broad lawn a considerable distance from the street. It is of the usual class with engine and boiler rooms side by side, separated by a partition wall, the roof, which is covered with slate, has two ridges corresponding to the two sets of trusses spanning the two rooms. A view of the station from the creek, reproduced to show also the coal hoist and trestle, is given among the accompanying illustrations. The engine room is 58½ ft. wide, the boiler room, 46 ft., and the engine room runs the full length of the building, 170 ft. From the end of the boiler room, however, a room for the refrigerating machinery has been partitioned off. It extends across the entire boiler room and is 34½ ft. deep. It is 24 ft. in height, and in the space over it a coal bunker has been provided, the transverse partition wall being continued to the roof. It is to this bunker that the coal trestle leads. The boiler and engine floors are on the same level, and the lower chords of the roof trusses are 27 ft. above them. In the basements there is a clear headroom of about 9 ft., and a noteworthy fact in this regard is the well-lighted and clean aspect they present, even after the comparatively long use they have had. This is due to the provision of numerous windows around the exterior sides of the basements, openings in the engine room over the condensing units and a light, smooth cement floor. The floor of the engine room is of pine boards laid diagonally, the walls of both rooms are the unpainted bricks, the underside of the room over the engine room is of wood sheathing on timber purlins, while the slate over the boiler room is fastened to angle-iron purlins. The engine room is served by a 20-ton traveling crane, made by the Reading Crane & Hoist Works, carrying two 10-ton trolley hoists. It runs the entire length of the building on rails supported by the outside wall at one end, and by the 16-in. partition wall at the other, the walls having pilasters on 13-ft. centers, corbelled out at the top to form the base for the rail. The roof carries a monitor over each room the length of the building, with swinging sashes in each side, guarded in turn by louvers on the outside. The partition wall between the engine and the boiler rooms has two doorways in it, one opening into the boiler room and the other into the ice-machine room, the floor of which is 5 ft. below the general floor level.



VIEW OF BOILER ROOM

Coal is delivered to the station ordinarily by boats. It is scooped from the boats by a ½-ton hoisting tub and hauled in the tub up an inclined trestle bridge to the coal bunker, where it is dumped into a weighing hopper on the weighing floor above the bunker, and then chuted into the coal storage space below. The trestle bridge consists of a latticed-box girder, of 3-in. x 3-in. x ⅜-in. angles and 3-in. x ⅜-in. flat members, supported at the wharf by the end wall of the power station and at a mid point. The latter and the support at the wharf are each a bent of four members, two vertical and two inclined, each made up of two 8-in. 11.25-lb. channels latticed together. The end of the bridge projects 19 ft. over the water at a point 20 ft. above dock level, and the bridge has an upward inclination to the power house, a distance of 170 ft., of over 11 degs. The trolley over which the tub is suspended is hauled by two 7-16-in. steel-wire ropes wound around drums direct-connected to a 20-hp railway motor on the weighing platform, and the trolley rails are two 6-in. 10.5-lb. channels fastened to the girder bridge at 5-ft. intervals. The coal handling plant was furnished by the G. L. Stuebner Iron Works, of Long Island City, N. Y.; a branch track of the railway passes underneath the bridge, and coal can thus be readily handled from the company's own cars.

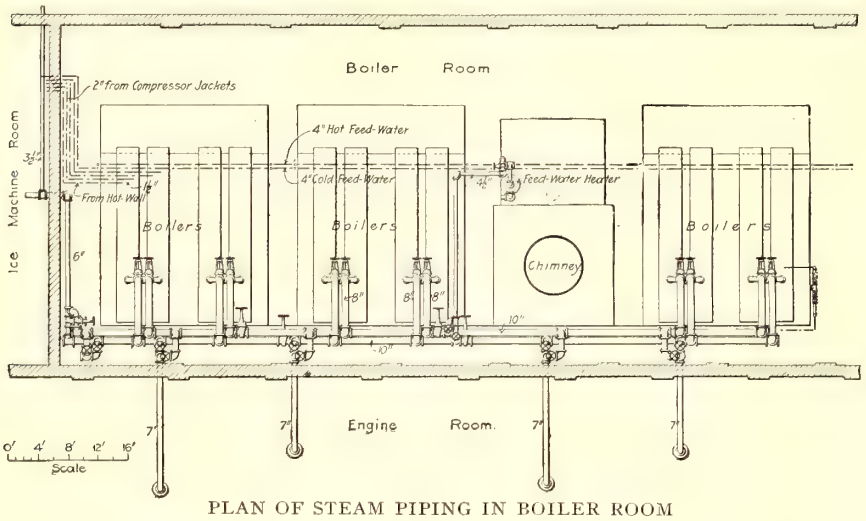


EXTERIOR OF STATION

The coal bunker has a capacity for about 400 tons, and it occupies part of the floor space above the ice-machine room. The floor is level and has a concrete finish, supported by brick arches between 15-in., 42-lb. I-beams on 3-ft. 2-in. centers. The coal passes into the boiler room through a short chute in the transverse partition wall, falling into a hopper car. The chute has a mouth about 3 ft. x 4 ft. in size, and its discharge end is about 5 ins. sq. It makes an angle of 35 degs. with the horizontal.

The boiler room, through the center of which rises the chimney, contains two batteries of two boilers on one side of the stack, one battery of two on the other side and space for a fourth battery. Each boiler is of 250-hp capacity on the basis of 12 sq. ft. of heating surface per horse-power, and are of the water-tube type with two steam drums. They were built by the Aultman & Taylor Machinery Company, and are fitted with Murphy furnaces. These project 6½ ft. in front of the boilers proper, leaving a space of 11 ft. between them and the outer wall. Across their

fronts is laid the tracking for the hopper cars, and the coal loaded into the car from the chute is pushed opposite the furnace whose hopper requires filling. The hopper car is provided with a chute under control of a gate. The ashes from the furnaces fall into an ash hopper immediately below each furnace in the basement, and by means of a double-lever gate in the bottom of the hopper they are dumped as desired into an ash car of 20-cu. ft. capacity, running on tracking which leads to an area at the front of the building, where they are lifted upon construction cars of the railway company.

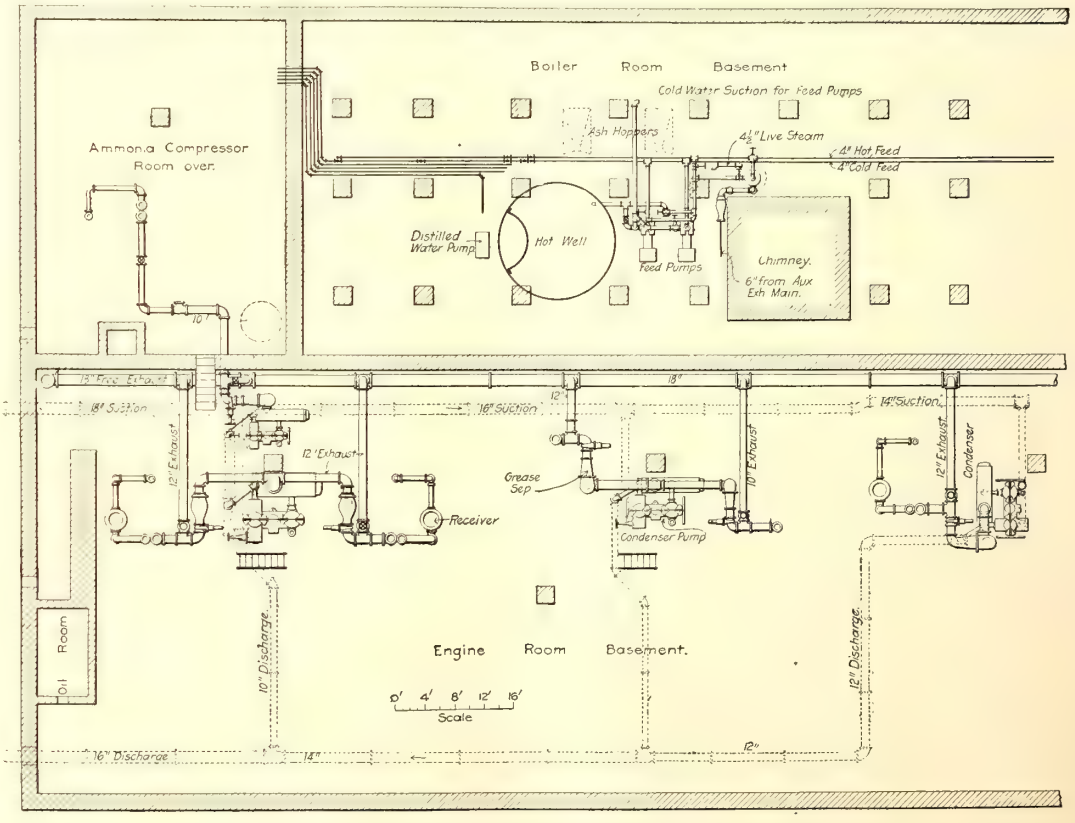


PLAN OF STEAM PIPING IN BOILER ROOM

The smoke from the boilers is conducted in a firebrick-lined brick smoke passage to the chimney, leading in opposite direction from the two groups of boilers. The smoke duct spans the space between the boilers and the partition wall and is 8 ft. above the floor, leaving a passageway behind the boilers the length of the boiler room. It is 5 ft. sq. inside, and the two ducts meeting at the chimney have a total area equivalent to that of the stack. The chimney is of brick, 8 ft. inside diameter and 175 ft. high above the boiler room floor, and 188.5 ft. above the plank foundation flooring. It is square for a short distance above the power house roof and hexagonal above. It has an inner shaft of firebrick, 75-ft. high, above the smoke flue, the lower half 9 ins. thick and the upper half 4½ ins. The outer shaft is hexagonal in section on both outside and inside peripheries, and the walls are 3 ft. 2½ ins. thick at the bottom and 13 ins. at the top. It is offset for a change of thickness every 25 ft. It has a light cast-iron cap in eight sections, riveted together, and the part a short distance below the cap, enlarged for decorative purposes, is reinforced by a ¾-in. x 2½-in. wrought-iron band imbedded in the brickwork.

The steam piping is arranged with duplicate steam headers supported overhead back of the boilers. Each boiler has two leads rising from the top of the cross-connection on the steam drums, passing upward in long sweep bends and dropping into the top of the headers. Each lead has one valve, located close to the boiler outlet. A single supply pipe to each engine is passed through the partition wall, and in the boiler room it has two short curved connections with the top of the two headers, each connection fitted with a valve, which is thus also in the boiler room. The piping is of extra strong wrought-iron, the flanges of the Chapman cast-iron pattern with corrugated copper gaskets. The headers are supported by roller-bearing brackets, and, being above the boilers, all condensation is drained directly back into the boilers. The headers are provided with valves to isolate each battery when necessary. Condensation of high-pressure steam lines is in general returned automatically to the boilers by means of the Holly system.

The engine supply pipes sweep downward in long bends without valves in the engine room to a vertical steam separator in each case, of the De Rycke type, close to the throttle valve. The two valves controlling the flow from the headers in the boiler room to each engine supply are arranged to be handled, by means of extended stems, in the engine room. The exhaust piping is all confined to the engine room basement. It passes from the low-pressure cylinder of each engine first through a horizontal De Rycke grease separator, and then enters the surface condensers, which are operated in connection with a vertical crank and fly-wheel pump, which employs a steam cylinder, driving both the circulation water plunger and the air pump, the steam cylinder being located between the other two. It was built by the Conover Manufacturing Company, of New York. The exhaust steam escapes to the atmosphere when the condensers are out of commission, and the exhaust branches

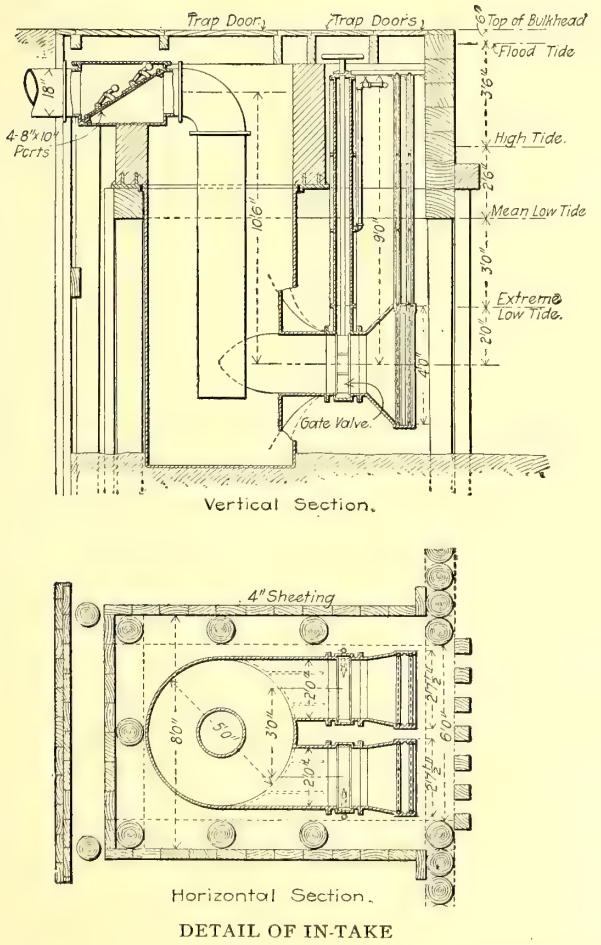


PLAN OF POWER STATION, HAMPTON, VA.

are equipped in the usual way with back-pressure valves to act as relief valves on the failure of any condenser. When it becomes necessary to clean the extractors by draining to a sewer connection, the engine corresponding is run non-condensing. The exhaust main rests on roller bearings on the engine room floor basement, and extends the length of the

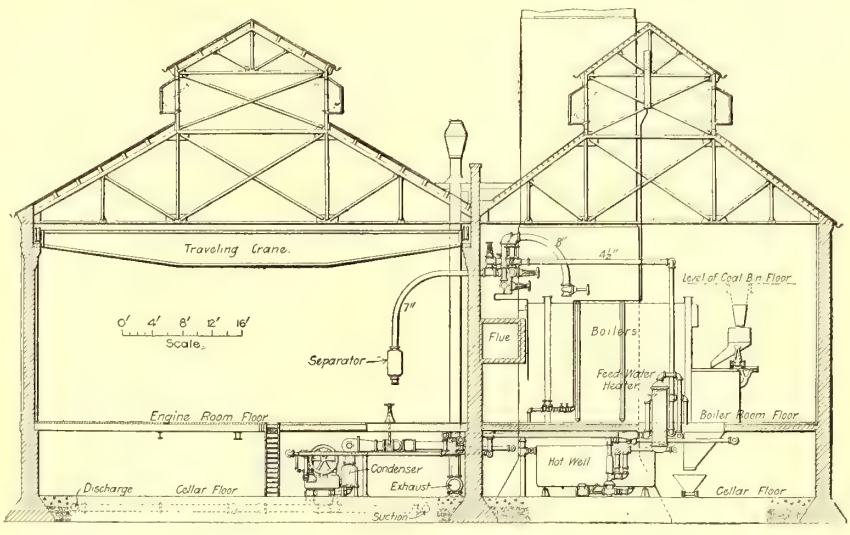
building. At each end it connects with an exhaust riser capped with exhaust head. The exhaust main and risers are of iron-riveted pipe.

The salt water from the creek, which is really an arm of the bay, is used for condensing and is taken from an injection pipe, 18 ins. in diameter, which leads the water from an in-take at the wharf line; it is discharged through a pipe 16 ins. in diameter, which empties into the creek 100 ft. below the in-take. The pipes are of cast-iron and buried in the filling between the foundation flooring and the basement floor. The piping is, of course, reduced in diameter as the various connections to condensing units are made. An accompanying illustration shows the general construction of the condensing water in-take. It consists of a cast-iron chamber provided with screened inlets and a central outflow pipe, the whole enclosed in 4-in. sheathing and protected by a bulkhead of 16-in. piling driven closely together. The cast-iron chamber is a cylinder, 5 ft. in diameter, of ¾ in. thickness of metal, with the top open and two circular inlets, 2 ft. in diameter, projecting from near the bottom. To the front of each of these inlets are bolted, in succession, two castings, one containing a gate, controlling the inflow of water and the other holding wire screens. In front of these the opening in the pile bulkhead is protected with 6-in. x 6-in. vertical timbers spaced 6 ins. apart. There are two screens to each inlet, the first of 3-16-in. wire with a 1½-in. mesh, and the second of No. 12 brass wire with a ¼-in. mesh. The screens



DETAIL OF IN-TAKE

are mounted on small channel-iron frames and slide in iron guides, so as to be removable. The gate valve has an inside screw and may be raised and lowered by means of an extension bonnet. To each valve opening is connected a 1-in. pipe, connected with both the town water supply and the boiler feed pumps, by which the in-take can be flushed when necessary. The gross area of the screens, which are placed below the level of extreme low tide, is nearly three times that of the inlet pipes. The outflow pipe, which starts below the inlet pipes, is 18 ins. in diameter, and its entrance into the horizontal



CROSS SECTION OF POWER STATION

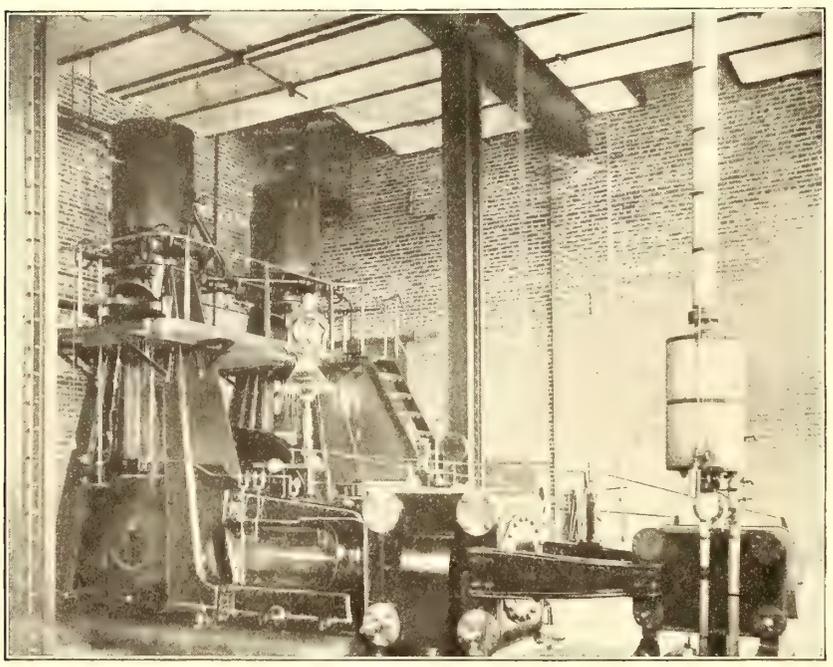
suction pipe to the condensers is controlled by a check valve, preventing a back flow into the in-take. The check valve has four ports, which have a total area of 25 per cent greater than that of the suction pipe. The cast-iron chamber was sunk in place, but is supported in a fixed position by suspension from two cast-iron beams carried on piling.

The water from the air-pump side of each condenser is delivered into a hot-well resting on I-beams on the basement floor under the boiler room. The discharge from each pump, which is 6 ins. in diameter, is connected into a header, also 6 ins. in diameter, parallel with the free exhaust header, and a 6-in. pipe passes from the water header to the hot-well. This is 16 ft. in diameter and 6 ft. deep, and is divided into compartments by a baffle plate, as indicated in the accompanying illustrations. To the smaller compartment the condensed steam is delivered, and such oil and impurities as rise on the surface are drained to waste through an overflow pipe in the larger compartment. From the smaller compartment the water is taken for the freezing cans and from the larger the water for boiler feeding. Besides the condensed steam, water is continually brought to the well from the cooling jackets of the compressor of the ice machine, and also, under the action of a float to maintain a constant water level, cooling water is taken from the town supply for the distilling apparatus in the ice plant.

The boiler-feed pumps, of which there are two 10-in. x 6-in. x 12-in. Blake steam duplex pumps, are connected to draw water either from the hot-well or a fresh supply, two-thirds of the latter coming from two driven wells 300 ft. from the station, and the rest through meters from the town supply. The pumps deliver into either one of two feed headers carried across the boilers, one header for a cold supply to the boilers and the other for a hot supply. For the latter they pass the water through a closed feed-water heater of the Wheeler type, which receives exhaust steam from the various pumps and an engine in the engine room driving an exciter dynamo. The cold water supply to the station is metered, and, with the exception of the feed-pump suction, is conducted through the cold-feed header, which ordinarily acts as a distributing main for all fresh cold water supplies for drinking, fire protection and cooling purposes. The live steam for the auxiliary machinery is taken from the steam headers in the boiler room, brought into the boiler room basement at the auxiliary feed-

water heater and carried along the basement ceiling, the required branches to the condenser pumps and the exciter set passing through the partition wall. The exhaust steam of the auxiliaries is collected in a similar way, and at the feed-water heater is fitted with a grease extractor for cleaning it before reaching the feed-water tubes.

The generating equipment in the engine room comprises three alternating-current machines, aggregating 1300 kw, and two railway units with space for a third, giving a total of 1325 kw. The smaller of the two railway sets consists of a tandem-compound Rice & Sargent engine, built by the Providence Engineering Works, with 14-in. and 28-in. cylinders and 48-in. stroke, and a direct-connected 325-kw, 550-volt continuous-current dynamo, run at 100 r. p. m. The second railway unit employs a 22-in. and 38-in. x 48-in. cross-compound Corliss engine, made by the St. Louis Iron & Machine Works, and a 500-kw, 550-volt Westinghouse generator, driven at 90 r. p. m. The third railway generator, yet to be installed, is to be of the vertical type, of 500-kw capacity. A steam pressure of 135 lbs.



ICE MACHINE

to 140 lbs. is carried at the boilers, and a vacuum of 27 ins. of mercury in the exhaust pipes.

Three alternating-current General Electric, 60-cycle generators furnish current at 3450 volts. One unit of 700 kw is direct connected to a horizontal McIntosh & Seymour cross-compound engine, of 23-in. and 46-in. x 42-in. cylinders, operating at 120 r. p. m., and the two others, of 300-kw capacity, are driven by tandem-compound Rice & Sargent engines of 14-in. and 28-in. x 36-in. cylinders, running at 150 revolutions. For furnishing exciting current there are three General Electric 125-volt continuous-current sets, one steam driven and two motor driven. The steam unit consists of an 8-in. x 6-in. marine engine, coupled to a 15-kw dynamo. One of the motor sets has a 60-hp induction motor connected to an Edison bipolar machine, and the other a 20-hp induction motor coupled to a four-pole dynamo.

The switchboard was furnished by the General Electric Company. There are two railway generator panels and a third for the unit, to be installed, the panel equipment, including indicating lamps, an indicating ammeter and a circuit breaker; there is a totalizing railway panel, having a recording wattmeter and indicating ammeter and voltmeter, and there are five railway feeder panels, each with a single-pole, single-throw switch, an ammeter and a circuit breaker. The exciters are all controlled from one panel, having three three-pole switches, three rheostat wheels, three ammeters and one voltmeter. The three alternating-current generator panels and four feeder panels for the general alternating-current supply are all provided with oil-break switches. There is also a totalizing panel, located between the groups of the generator and the feeder panels, this carrying in addition to a recording wattmeter a ground detector and an indicating ammeter and an indicating voltmeter.

The company also furnished a considerable number of arc lamps, and for this purpose has adopted the series-alternating constant-current system. There are four feeders for this service, all controlled from the one panel, and in addition there is a panel with a recording wattmeter for the lighting load. In connection with the arc lighting system there are four transformers, wound for a primary pressure of 3120 volts, and a secondary of 6.6, and each of twenty-five lights capacity with 6.6-amp. constant current. For general power distribution over distance two 250-kw transformers are used, with a third as a spare, each having a transforming ratio of 3 to 1, so that the transmission pressure is about 10,000 volts. The high-voltage line is carried into Newport News for local distribution there at 3120 volts, and it was designed to carry 600 kw with a line loss of 5 per cent. It is 5 miles long, and comprises two No. 1 conductors and one No. 4. Power and lighting are furnished at Buck Roe Beach and at Old Point, 200 kw to the latter, which is 5 miles distant from the station, at a pressure of 3120 volts. The railway system, including that of Newport News, is supplied directly from the Hampton station. One feeder of 500,000-circ. mil cross-section is carried into the city, and at three intermediate points three 0000 feeders are connected into the trolley line. In the other direction for the lines to Old Point and Buck Roe Beach three 0000 feeders leave the station.

The ice plant is operated by a 40-ton compressor machine in the ice-machine room. It was built by the Frick Company, of Waynesboro, Pa., and consists of a 100-hp horizontal tandem-compound engine, with cylinders 14 ins. and 28 ins. in diameter and 28-in. stroke, and a double-cylinder vertical ammonia compressor. As already stated, space is reserved in this room for a duplicate unit. It is operated condensing, its condenser being located in the engine room basement. The ammonia piping, together with auxiliary steam and water piping, is carried across a space about 16 ft. wide to the ice plant, which is a detached brick building with a frame roof. It consists of a single-story portion, 61 ft. long, containing the freezing tank, and a three-story portion, 28 ft. x 42 ft. in plan, containing the distilling apparatus and incidental machinery. The ammonia condenser is located on the top story, and is of the coil-pipe type, cooled by salt water drawn from the creek. For this purpose there is an M. T. Davidson simplex pump, 7 ins. x 7 ins. x 10 ins. in size, in the basement. In the third story is also the distilling apparatus. The condensed steam in the hot-well in the boiler room basement is lifted to this point by means of a Gould triplex pump alongside the well, direct-connected to a 1-hp, 110-volt General Electric motor. The water is skimmed and reboiled by steam in the usual way. The reboiled water is cooled in pipe coils in the second story of the ice plant, and for this purpose fresh water from the town supply is used, the drain from this going, as needed, to maintain a supply in the hot-well. The distilled water is then passed in succession through seven charcoal filters in the first story, each filter 3 ft. in diameter and 5 ft. high, and then through an International cloth filter. It is stored in a tank, from which the cans are filled, and is cooled by the ammonia gas returning from the

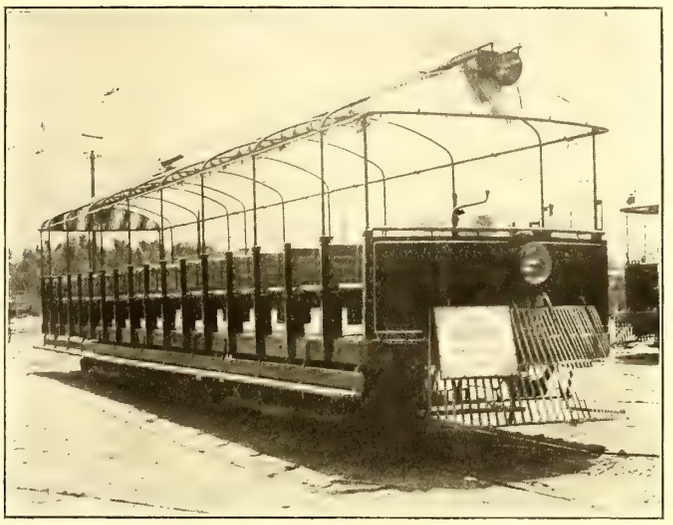
freezing tank after its expansion, the gas passing through a submerged coil in the tank. The liquid ammonia receiver is also located in the first story. The plant has a capacity of 40 tons of ice daily, and is operated during ten months of the year. It is an important branch of the business, and the company has built box cars for hauling the ice to distant points, chiefly to Old Point Comfort. In a separate building there is 1000 tons ice storage, so that sudden demands, as happens when some ship requires a supply, can be readily met, and the plant can be run steadily meanwhile at best economy.

On the basis of some records made some time ago it was found that 3.31 lbs. of coal were burned per kilowatt-hour. The cost of the electrical output on the bus-bars was 7 mills per kilowatt-hour, as follows: Labor, $.0017; coal, $.0044; water, $.00033; repairs, $.00016; supplies, $.00045; total, $.00704. For a period of ten months the average horse-power developed was 527,666 ecp per month; the auxiliary apparatus, 98,550 hp; ice plant, 102,000 hp; total, 728,217 hp. This gives an average of 994 hp per hour.

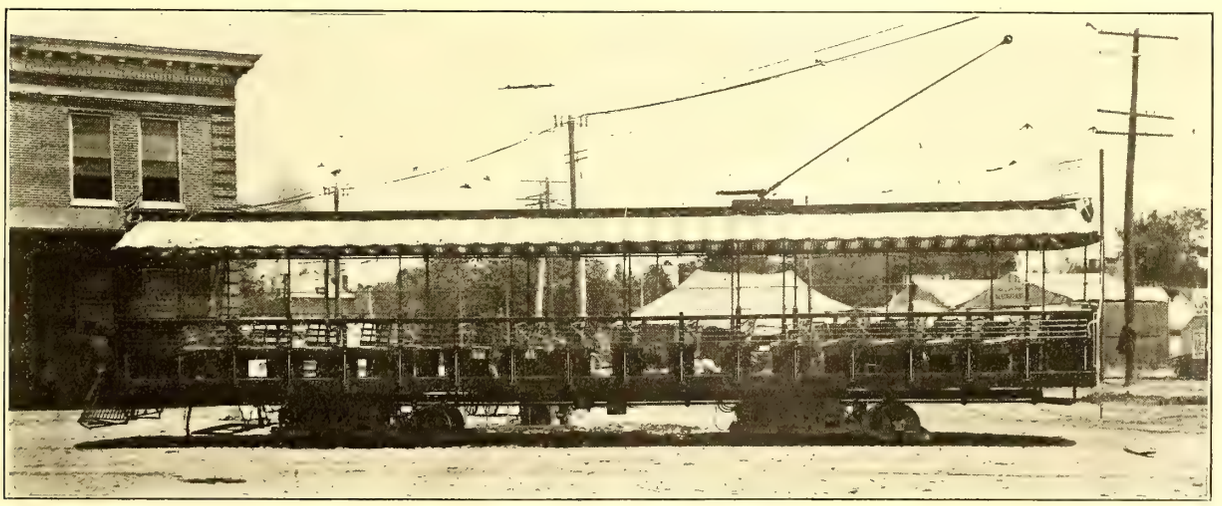
R. Lancaster Williams, of Richmond, Va., is president of the Norfolk, Portsmouth & Newport News Company, and William J. Payne, formerly president of the Newport News & Old Point Railway & Electric Company, is first vice-president. The general manager of the system is E. C. Hathaway, of Norfolk, Va., and the general superintendent of the division supplied by the power station is H. H. Carr. The plant was designed by Samuel B. Thompson for James F. Heyward, railway expert, of New York, who had charge of improvements made at the time the plant was built, and the architect was Henry Brauns, of Baltimore. E. W. Norris is chief engineer in charge of the station.

A NOVEL CAR FOR PLEASURE TRAFFIC AT ST. LOUIS

The St. Louis Transit Company has recently built in its own shops a number of open cars which are proving extremely popular for summer travel to Croeve Coeur Lake. This car seats ninety-six people on its sixteen benches, and is 47 ft. over all. The novel feature about the car is that it has no roof. During the daytime an awning of canvas is used, as seen in the accompanying illustration. In the evening this awning is rolled up next to a center-board, which carries the trolley base, so that the car is entirely open. The car is equipped with two



END VIEW OF PLEASURE CAR



SIDE VIEW OF OPEN CAR FOR PLEASURE TRAFFIC

an expensive car to build and can be turned out of the shops very rapidly. In fact, some of these have been turned out in as short a time as three weeks. Being purely a summer travel car and having so little work about the roof, there is not the necessity for time and care in building that there would be with a more elaborate car for continuous service. The popularity of the car is due, of course, to the fact that it is entirely open. The management of the company likes it because of its large carrying capacity and low cost. In providing for the extra heavy travel that occurs during a few days of the year to Croeve Coeur Lake the matter of idle investment in rolling stock is important, and this type of car provides for this extra heavy travel with about as low an investment as possible.

The scheme of collecting "through" fares which has been adopted by the Hartford & Springfield Street Railway Company, operating between Hartford, Conn., and Springfield, Mass., might well be adopted by other interurban lines in New England and other parts of the country. In Hartford the company operates over the lines of the Hartford Street Railway Company, and in Springfield it operates over the lines of the Springfield Street Railway Company. Two 5-cent fares are collected while the cars are in Hartford, and one 5-cent fare is collected in Springfield by the Springfield Street Railway. Between Hartford and Springfield three 5-cent fares are collected. To save passengers the annoyance incident to the collection of so many fares the Hartford & Springfield Company collects all their fares at once if a passenger is going through from one city to the other, issuing a destination ticket such as steam railroads use.

No. 34 Lorain motors on maximum traction trucks. It is not

INTERURBAN RAILWAY DEVELOPMENT IN GREAT BRITAIN—II

BY HON. ROBERT P. PORTER

In my last article I referred to the legislation in Great Britain covering tramway and interurban electric railway construction, and quoted one or two examples of the difficulties in the way of carrying on new work.

The problem of reconstructing and welding several isolated tramway systems into a group of interurban lines is attended with, perhaps, greater difficulties than the promotion of an extensive system of lines, in what might be called, from a tramway point of view, a virgin district. Nevertheless, the obstructiveness of local authorities and of railway companies has in both cases to be dealt with; and the same qualities of diplomacy and enterprise have to be displayed in both instances. The main advantages of promoting tramways in a new district are a certain freedom in the choice of route and an opportunity of developing the system gradually with the growth of traffic and population, stimulated by the constructed lines. Against these advantages there is the disadvantage that virgin districts of a profitable nature in England are few and far between. Most parts of the country which do not possess tramways of some sort are equally lacking in people to make use of them.

LONDON SUBURBAN TRAMWAYS

One conspicuous exception to this latter rule is the suburban or semi-rural district around London. The prominence given to the promotion of "tubes" in London itself has rather obscured the significance of the extensive tramway systems which are growing up in the outlying districts, partly as feeders to the tubes themselves. The London United Tramways System, however, radiating westward from Shepherd's Bush and Hammersmith, is now well known; and over the wide extent of northern London a system similar in nature and extent promoted by the British Electric Traction Company is on the eve of actual development. Whatever may or may not be done about locomotion within the administrative area of London, and whether the County Council decides to take over the operation of all the tramways or not, these two systems must remain an important factor in London transportation. Extending, as they do, into areas outside the county of London, and dealing, as they do, with other local authorities—many of them unwilling to come under the authority of the London County Council—contracts have been brought about which will practically keep these systems intact for twenty-five years, and in some cases for a longer period. If, therefore, good business judgment continues to be shown in handling these properties—and both enterprises are just now in most capable hands—we may reasonably expect two of the largest tramway systems in the world, probably each carrying in the neighborhood of 500,000,000 passengers annually. It may be advisable to examine the reason for this belief. First take the London United Tramways, Ltd., and we find the following mileage:

	Miles	Feet	Inches
Authorized lines	40	0	0.00
Extension, session of 1901	14	7	3.40
Proposed extension	21	6	9.74
Proposed extension — Hammersmith Bridge, Barnes, Mortlake, Richmond.	3	5	1.00
Total route length	80	3	4.14

This well-planned system of tramways, on its present 16 miles of operated route, carries 40,000,000 passengers annually. The estimate is 300,000,000 when the entire system has been completed, an estimate, in my opinion, far below the realization when a quick, cheap and up-to-date electric traction railway has been installed.

NORTH LONDON TRAMWAY SYSTEM

Of far more interest for the present article is the North London Tramway System promoted, as I have said, by the British Electric Traction Company. This latter system, of which a map was published last week, is interesting as being the first example of an interurban system promoted by a company in association with a County Council. Here, we have a total route mileage, as now planned, of about 120 miles, 56 miles of which are being worked. The system, as planned, will comprise both tramways and light railways, so-called and constructed, I suppose, because of the advantages of organizing under the Light Railway Act, but all will ultimately be operated as electric traction. The operating lines of this company now carry annually 165,000,000 passengers, a number of which will be easily doubled when their entire system is completed and electric equipment substituted for horse-power.

As the conditions of this association have many attractive features, and are likely to become to some extent a precedent, they may be briefly reviewed. It is clear, in the first place, that a County Council, by having certain powers of supervision over a very large area, is able to take a much more comprehensive view of the traction question than a local authority. When, as in the case of the Middlesex County, the County Council is the road authority, it is natural that it should want to retain direct control over the use and maintenance of the roads. At the same time, the County Council is not a body fitted by its constitution to undertake the development of a speculative trading enterprise such as interurban tramway or light railway promotion.

Therefore the Middlesex County Council, in deciding to promote a large system of electric road lines in the county, decided at the same time to leave the working of them, with the associated commercial risks, in the hands of a company. Procedure under the Light Railways Act (referred to hereafter) was followed in each case, and powers were obtained for about 50 miles of line, as shown on the map.

The agreement between the County Council and the company runs as follows. It may be mentioned that the neighboring County Council of Hertford is also a part to the agreement:

"The cost of constructing these lines, including the necessary road widenings and the acquisition of sites for power stations and depots, is borne by the County Councils, who have agreed to grant leases of the system to a company known as the Metropolitan Electric Tramways, Ltd., for terms of thirty and forty-two years, respectively, the cost of the machinery, equipment, plant and rolling stock being borne by the lessee company. The conditions of these leases provide that, after payment of a moderate rate of interest to the Councils and to the company on their respective expenditure, the net profits shall be divided, in the case of Middlesex, in the proportions of 45 per cent to the Council and 55 per cent to the company, and in the case of Hertford in the proportion of 40 per cent and 60 per cent to the company. The leases also provide that the company's expenditure is to be limited to material which becomes purchasable by the Councils at the expiration of the respective terms at a price which will represent their value as part of a going concern."

By this last clause the company avoids the expenditure of a large amount of money on permanent way and improvements, for which a comparatively small return would probably be obtained at the termination of the leases. It will be observed that the tenure of the leases is much longer than the average (which is twenty-one years). This longer tenure, together with the equitable financial arrangements, will enable the company to conduct its operations in a spirit of liberal enterprise, free from the narrow restrictions which are so common in the arrangements with local authorities. To the County Council the agreement means complete control of the public roads and a sound security that the public money expended will receive its due interest and thus not prove a burden on the rate payers.

LEASING FROM THE LONDON COUNTY COUNCIL

From the map of the Middlesex system, shown last week, it will be noticed at three points the projected lines connect with the existing horse tramway lines of the North Metropolitan Tramways Company. This juxtaposition brings them in touch with a more complicated problem than that of making arrangements with the Middlesex County Council for a system of new lines. Part of the North Metropolitan lines lie within the Middlesex County and the remainder (constituting much the larger portion) within the County of London. The latter part now belongs to the London County Council, being leased to the North Metropolitan Tramways Company until 1910. The former part belongs to the North Metropolitan Company, as well as being worked by it.

The bulk of the North Metropolitan shares have now been acquired by the Metropolitan Electric Tramways, Ltd., which is an associated company of the British Electric Traction Company. This amalgamation will enable the Metropolitan Electric Tramways, Ltd., to electrify the existing lines in Middlesex, and to work them in conjunction with the lines which are about to be constructed. An extensive system of lines would thus be formed, reaching from the borders of the densely populated area of London proper, through suburban areas to what is almost open country. The public usefulness of this system would plainly be much increased were it to be worked in harmony with the lines within the London County area. But the lease of these lines expires in 1910; the conversion from horse to electric traction is thus impracticable; and the policy of the London County Council as regards the fate of these lines is as yet unknown. For these reasons it is impossible to say whether inter-communication between the neighboring systems will be effected when both are electrically worked. The public interest, of course, points emphatically to the unification as regards working arrangements of all the lines shown in the map. As regards the traffic itself they are practically one system.

The actual negotiations with the Middlesex County Council extended over several years, and were not unattended with the difficulties natural to complicated arrangements pledging the policy of a public body for many years to come. But it may be said that the Middlesex County Council displayed a very clear appreciation of the public advantage of interurban lines under a single enterprising control, and was much more amenable to the conditions of a business arrangement than the average local authority. If all public bodies had given the evidence of the same statesmanlike intelligence and public spirit, there would be less complaint of the stunted growth of tramways in England.

DIFFICULTIES OF COMBINING

The history of such undertakings as the Black Country system illustrate the difficulties involved in arranging inter-communication facilities between neighboring systems owned respectively by companies and local authorities. The municipal systems occupy for the most part the areas of densely populated towns, and their owners have naturally a tendency to regard them as self-contained, and, therefore, superior to connections with outlying systems. From the present state of municipal opinion with regard to private enterprise it seems utopian to expect the initiative of better things from local authorities themselves. The necessity for free inter-communication between neighboring tramway systems is already a truism among electric traction companies; but local authorities, not being business organizations, do not treat the question on the same broad commercial lines. There seems every reason to anticipate that the local authorties will not, save in rare cases, be readily induced to arrange running powers with tramway undertakings touching their borders. The public interest, nevertheless, demands it, and points to the necessity of altering the state of the law in order to achieve it. When two neighboring railway companies do not agree to running powers for which there is a clear public necessity, Parliament can enforce mutual working arrangements. Now that extensive tramway systems of a nature similar in character to railway systems are being built up, common sense requires Parliament or the Board of Trade should have the same power to force inter-communication where various tramway systems are contiguous. For such action, moreover, there is already a precedent in the tramway world, apart altogether from the example afforded by railway legislation. I refer to the case of Bournemouth. At the present time an interurban system of tramways is under construction in and around that fashionable health resort. That system is the outcome (partly indirect) of the endeavors of the Poole & District Electric Traction Company to obtain powers for certain lines of tramways within the boundary of Bournemouth itself, with a continuation westward to the harbor of Poole, and eastward to the small town of Christchurch. No fewer than three times did the Corporation of Bournemouth appear in successful opposition to the company's applications. The ground of opposition was that Bournemouth being a quiet home for invalids did not want electric tramways. However, the repeated efforts of the company gradually influenced the views of the corporation, and they followed up their appearances as opponents by themselves promoting the previously unwanted lines. Meanwhile the company had obtained powers for the Christchurch and the Poole lines. Following the usual course, Parliament approved the application of the Corporation in preference to that of the company, as far as the lines in Bournemouth were concerned.

If no running powers had been arranged between company and corporation, the condition of things would have resulted in two lines being worked, shuttle fashion, up to the boundary of Bournemouth, while the Bournemouth system itself would, as it were, revolve on its own axis. The need of free interconnection was too obvious to be overlooked, and the Corporation obtained its order on the express condition that the company should have running powers over certain lines necessary to the inter-connection. Similar powers were granted to the Corporation in respect of the lines of the company.

Such a case should go far to facilitate the Board of Trade in its efforts to form junctions between the network of tramways under the two kinds of control. But any movement in that direction must come from public opinion, awakened to the advantages of interurban systems when working in harmony with each other. The awakening will probably be slow, as in most cases public opinion, even when thoroughly wide-awake and in earnest, is not very rapid in its action. But it appears to be impossible that local authorities can continue for an indefinite period to shut the gates against companies which may justly claim to be in a position to offer important benefits to their citizens.

PAROCHIAL SPIRIT MANIFESTED

The parochial spirit of municipalities has been evinced in their dealings with each other, perhaps more strongly in their relations with companies. Next-door neighbors are not always the best of friends; and municipalities are in this respect very human. The natural pride of each of them in their municipal achievements has an obverse in a natural jealousy of the achievements of others. There is no necessity to dwell on this well-known aspect of municipal life, but it must, at least, be referred to in order to explain why municipalities have not done much to develop isolated tramway systems into interurban networks. The old familiar difficulties of getting several local authorities to work harmoniously together in a drainage or water scheme are experienced again in connection with tramways. They are, indeed, exaggerated beyond their usual intensity, because questions of profit on municipal outlay are involved in mutual traction and enterprise. In this matter also, local authorities are conspicuously human.

One of the most striking examples of the failure of munici-

palities to come readily to a working tramway agreement was afforded by Salford and Manchester. These two towns—numbering about 700,000 souls together—are really a single town; the boundary line is purely artificial, and it is a common saying that you cannot walk two steps in Manchester without treading on Salford. In such a situation it would be the height of folly to have two isolated tramway systems. The Corporations were in this case the tramway owners, and they readily enough admitted that free inter-communication was an immediate practical necessity. Time after time, however, they vainly endeavored to arrange the terms of running powers. Manchester's proposals were objected to by Salford as inequitable; Salford's proposals were objected to by Manchester on similar grounds. Committees were formed by each Corporation, reports were drawn up, discussed, submitted to the neighboring Corporation and rejected. The press took the matter up, and for more than two years the Corporations discussed the matter without coming to any settlement. In the end Manchester decided to apply to Parliament for the necessary running powers.

The Corporation of Glasgow is experiencing considerable difficulty in making the necessary arrangements for the extension of its municipal system of tramways to the neighboring shipbuilding center at Clydebank. Leeds and Bradford, which are only 8 miles apart, are debarred from inter-communication because they could not agree to adopt the same gage for their municipal tramways. Leeds chose 4 ft. 8 ins. and Bradford 4 ft. These cases show how difficult it is for municipal bodies, whose sympathies are inevitably directed to a single special area, to carry on enterprises which, to be properly conducted, must ignore local boundaries and spread freely in all directions. They show, also, how little in the way of interurban tramway development may be expected to arise out of the initiative of the local authorities.

In addition to this criticism "by results" there are many objections to be urged on the grounds of inexpediency and of principle, to any local authority carrying trading operations in the areas of neighboring authorities—as must be done if municipalities are to become promoters of comprehensive systems of electric lines. Whether the rate payers of A should be taxed to provide tramways of B, and whether the pennies paid by the public to B should be applied to relieve the rates of A—such are the questions that are opened up as soon as a local authority trades beyond its border. And all the arguments against municipal speculation within the limits of each area become emphasized when the area is overstepped.

Experience seems to indicate very clearly that in the majority of cases the municipal control of a tramway system implies an obstacle to the development of that system to become part of an extensive interurban system.

OTHER RESTRICTING INFLUENCES

Although municipal obstruction (both direct and indirect) has been a powerful deterrent to the growth of large tramway systems, it is not the only restrictive influence. In England, as in America, the steam railways have done their best to crush all projects for tramways running parallel for any material distance with their lines. The opportunity for effective opposition was placed in their hands by the Light Railways Act of 1896. This act has in other respects proved a good friend of the electrical traction industry, although it has not realized all the hopes which were entertained on its first appearance. As no definition was given in the act of a light railway, the simple and rapid procedure under the act was largely taken advantage of by tramway promoters in seeking powers for interurban lines. Its provisions were more favorable to free enterprise than those of the Tramways Act of 1870, but as the old act was not definitely repealed, the Light Railway Commissioners felt obliged to interpret the new act in the spirit of the old. Hence, the power of the municipal veto remained active under the Light Railways Act, although that act did not specially grant the power of veto; and the principle of limited tenure remained, although the act contained no definite instructions on that point.

The situation was so anomalous, and was productive of such frequent disappointment in the case of thoroughly sound schemes, that the revision of the Light Railways Act has become almost imperative. At the present moment the government possesses a new Light Railway Act, which will be put before Parliament for consideration "at the earliest opportunity." That may be this year, but more probably it will be next year. As the provisions of this new act are still private, it is impossible to guess how far they will assist the progress of electrical traction. Nevertheless, the president of the Board of Trade has publicly stated that the proposed act contains an acceptable compromise on the crucial question of the absolute veto hitherto possessed by the local authorities. That is at least one step in the right direction, and as such is something for which to be grateful. But unless a more radical reform than that is effected by the bill, it may prove ultimately to be a stumbling block by containing just sufficient progressive qualities to give the appearance of improvement, yet not sufficient to make it anything like permanently useful in the cause of progress.

THE LIGHT RAILWAYS ACT

The particular clause in the Light Railways Act which gives the railway companies a lever for opposition reads as follows:

"If the Board of Trade, on such consideration, are of opinion that by reason of the magnitude of the proposed undertaking or of the effect thereof on the undertaking of any railway company existing at the time, or for any other special reason relating to the undertaking, the proposals of the promoters ought to be submitted to Parliament, they shall not confirm the order."

"Submitted to Parliament" means that the scheme shall be embodied in a private bill passed through all the expensive process of Parliamentary treatment. The railway opposition is then considered "on its merits" in theory only, since the natural tendency of Parliamentary committees is to protect the vested interests of the railway companies. In actual practice, scheme after scheme has been rejected by the Light Railway Commissioners on the ground of railway opposition. Only in certain cases was the procedure by private bill either feasible or successful; and for a time it seemed as if the attitude of the railway companies to tramway competition was about to prove as serious a stumbling block to the construction of electric traction systems as the obstacles interposed by reactionary municipalities.

Fortunately, there are signs of change in the attitude of the railway companies. From their first natural feeling of uncompromising opposition they are apparently passing to a better comprehension of the true functions of the tramway in relation to the railway. How long a time will elapse before they fully realize that the interurban tramway is complementary to, much more than competitive with, the heavy steam railway, I do not hazard a prophecy. But the course of recent events undoubtedly shows that the hostility of railway companies to the tramway innovation is sensibly weakening. In many instances it has become modified to the level of toleration, and in two significant cases it has been transformed to active co-operation. As these cases may prove to be the turning point in the career of interurban tramways as regards their association with railways, it is interesting to state their main features.

One of the cases refers to the London & North-Western Railway Company, and the other to the Midland Railway Company—the two most important railway companies in England. The former company has made arrangements with the Dudley, Stourbridge & District Electric Traction Company, Ltd., whereby the tramway company runs special cars to Dudley station in connection with the railway excursions from Birmingham. This is a direct recognition of the value of a

tramway system as a feeder to a railway, even in a district which is already well provided, in the ordinary sense, with railway facilities. Negotiations are also in progress for the association of the tramway and the railway in goods and parcels traffic; and if the working details of that matter can be settled, we shall have an example of a large tramway system co-operating in every department of traffic with a railway undertaking of the first magnitude.

The case of the Midland Railway is even more striking. Some time ago a group of private interests promoted a system of light railways in the neighborhood of Burton-on-Trent, which is in the territory of the Midland Railway Company. That company appeared before the Light Railway Commissioners and successfully opposed the light railway scheme on the ground that the proposed lines would compete directly with the "Midland traffic proper," as the chairman of the Midland expressed it. The commissioners, in rejecting the proposal, stated that they did so with regret, as they felt that the lines, if constructed, would prove of real public benefit.

On the strength of that opinion, the promoters of the light railway afterwards approached the directors of the Midland Railway Company, with the result that at the last half-yearly meeting of that company the shareholders were asked to sanction the promotion of the light railway system which their company had previously opposed on the ground of competition.

It is intended to work the light railways so that they will not interfere with the steam railway traffic—which means that the Midland Railway Company has duly recognized the electric tramway as an ally, even though it should traverse the same ground as an existing railway. It is, of course, possible that these instances of co-operation may prove to be exceptions to the general rule of antagonism, but they more probably indicate that the railway companies will in time regard the progress of interurban electric tramways with equanimity if not with pleasure. The contention of the tramway interests is, of course, that the character of the traffic catered for by the tramway, with its frequent service of single cars with numerous stops along the road, is essentially distinct from the railway traffic proper, where large trains of cars are run at comparatively infrequent intervals with comparatively few stops. The one, in short, is short-distance traffic in which frequency of service is the main thing, and the other long-distance traffic in which speed is the main thing.

The influence of tramways in developing surburban and rural districts, moreover, can no longer be overlooked by the railway companies. The chairman of the Wirral Railway Company recently gave expression to an opinion on this subject which may be regarded as another sign of the times. He said that although their line certainly suffered to some extent from tramway competition, he fully expected that it would ultimately benefit from the increased population brought into the district by the tramways.

All these things tend to the reduction of the violence of the railway opposition which has appeared as an additional serious menace to the development of interurban electric tramways. They show, in addition, that English railway companies are more amenable to the influence of innovations than they are generally understood to be.

THE ENGINEERING POINT OF VIEW

From the engineering point of view, interurban tramways differ in some respects from Continental and American lines of the same character. As I have already said, these differences are not vital. Nevertheless, they do affect the prosperity of the English tramways to a certain degree. They are mainly due to the narrowness of the roads, which involves expensive road widenings and the use of single lines with loops. The necessity of single lines, in conjunction with the comparatively congested nature of the vehicular traffic on narrow town roads, prevents the adoption of a very frequent service at high speed over many portions of the tramways. For that reason many of the calculations based on the results attained by Continental or American street railways were not borne out by the results actually obtained on English roads. The carrying capacity per route mile was naturally less than with a continuous double line on an open road.

To some extent this drawback may be averted in future by building light railways on tracks of their own through open fields. But at present the legislative conditions governing the purchase of land for such purposes are not by any means favorable. They are practically the same as those relating to the case of railways, but the proportion of capital expenditure involved is apt to be too large in proportion for a tramway company. What is wanted is power to compulsorily purchase a strip of land of the necessary width. If that were possible, the change might facilitate the construction of interurban lines in many districts where the difficulties arising from the congestion of the street traffic are considerable.

Double-decked cars are peculiar to England, and their use has arisen partly from the necessity of combining a large carrying capacity with a comparatively short wheel base (so as to prevent cars blocking the street traffic by their length) and partly from the persistent popularity of the double-decked car with the English public. Small single-deckers have been tried on English tramways, but have not proved a success.

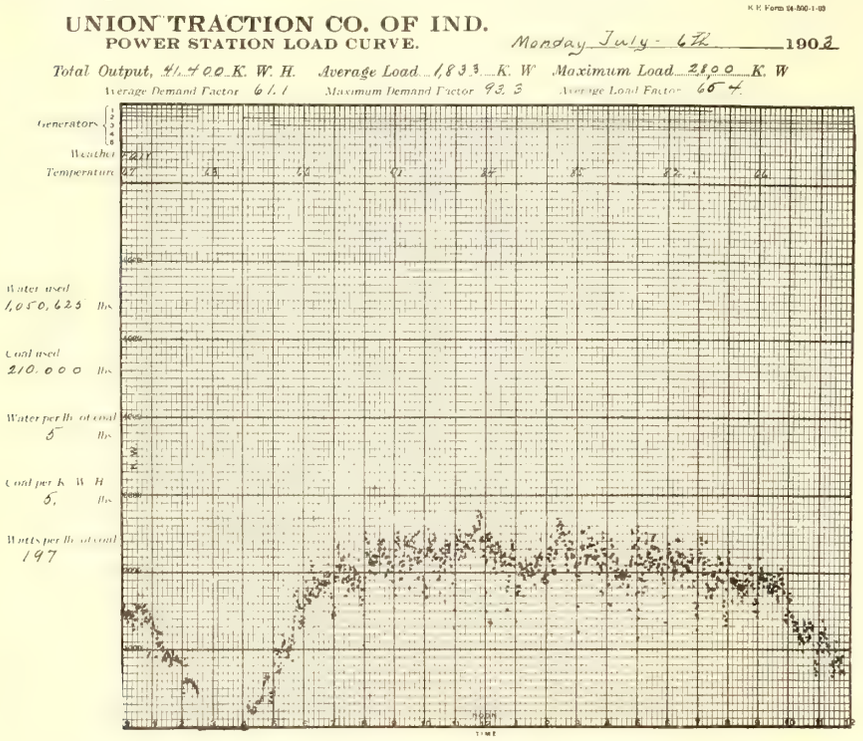
According to the latest available figures the number of route miles of electric tramways and light railways constructed and under construction in the United Kingdom is 1720, while 1396 miles in addition are fully authorized to be built or converted. These figures, however, convey only a faint impression of the actual condition of electric traction enterprise in this country. Every town of any great size already possesses, or is on the point of possessing, its electric tramways, and from each of these centers we may confidently expect new lines to radiate along the highways of traffic until they link themselves up with neighboring centers. For reasons already stated, this process of growth will be slower under municipal control than where the enterprise is in the hands of joint stock companies. But under any circumstances it is inevitable, and it is not likely to cease until every town and village in the kingdom is placed in direct communication by this means with its neighbors.

ST. LOUIS TRANSIT COMPANY TO RENT POWER

The plans of the St. Louis Transit Company, previously mentioned in these columns, for the erection of a large steam turbine generating station in East St. Louis before the opening of the World's Fair have been abandoned and a contract entered into with the Union Electric Light & Power Company, of St. Louis, for the rental of power to the amount of about 9000 kw, to carry the heavy load during the World's Fair next summer. The St. Louis Transit Company's power houses are capable of supplying about 29,000 kw at present. The Union Electric Light & Power Company is building a large station at Levee Street and Ashby Street, which is on the St. Louis river front, a few blocks north of the Eads Bridge. In assuming this contract the Union Electric Light & Power Company purchased the two 5000-kw Curtis steam turbine units, with 6600-volt three-phase generators ordered from the General Electric Company by the St. Louis Transit Company, and also the twenty-four Stirling boilers of 500 hp each that had been ordered. This relieves the St. Louis Transit Company from the necessity of building a station for several years at least. Owing to the high price of labor and material at St. Louis just now, previous to the World's Fair, and the necessity of great haste in the building of a new power station, it would have been expensive work the coming six months, and it is felt that the decision to rent power is a wise one.

POWER STATION LOG OF THE INDIANA UNION TRACTION COMPANY

The Indiana Union Traction Company has adopted a power station log sheet which is of unusual form, as it contains the original record of the power station load made by a recording wattmeter, and has information regarding the daily operation of the plant in condensed form. Several sheets of this log are reproduced herewith. The log sheet is cross-ruled for the plotting of the load curves of the station. The sheet is put in a new form of recording instrument designed by employees of the company, and the load in kilowatts is recorded by a dot once each minute, as the log sheet passes through the instrument. The sheet, therefore, contains a much more accurate record of the power station output than is usually obtained by readings taken by switchboard attendants. The log sheet is printed upon tracing paper, so that after the other data regarding the performance of the station for the day are entered with the pen, blue prints can be made and sent to the various officers of the road.

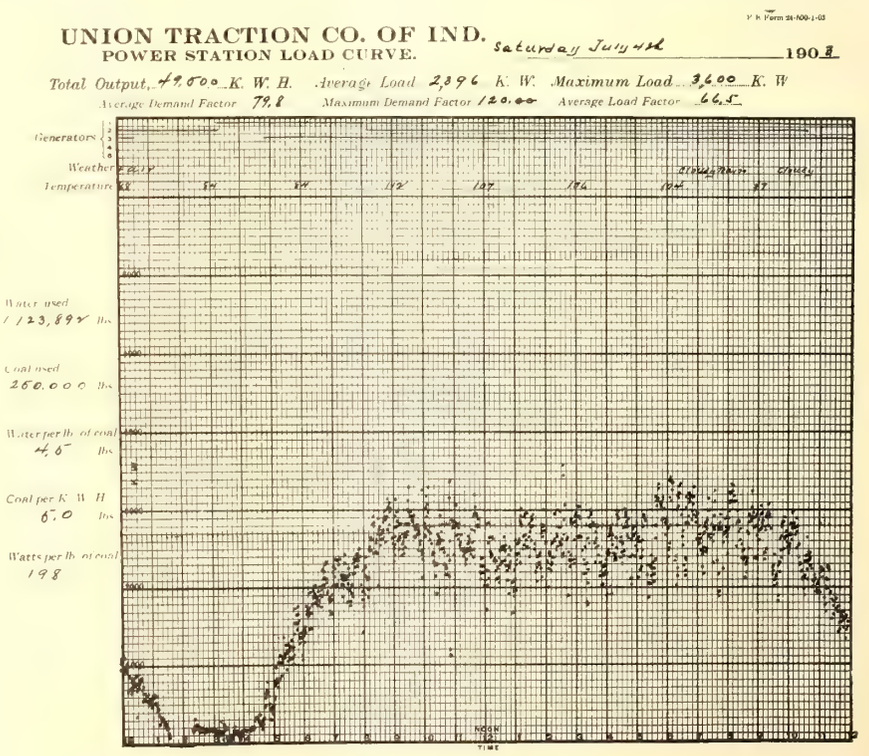


The log sheets reproduced here are of interest, not only for their form, but as showing the regular daily performance of the Indiana Union Traction Company's large station at Anderson. As will be seen the log sheet gives the total output in kilowatt-hours, the average and maximum loads in kilowatts, the average demand factor, which is the relation of the average load to the capacity of the generators operated; the maximum demand factor, which is the relation of the maximum load to the capacity of the generators operated, and the average load factor, which is the relation of the average load to the maximum load. On Saturday, July 4, for example, the average load was 79.8 per cent of the rated capacities of the three 1000-kw generators which were in operation. The maximum demand was 120 per cent of the capacity of these generators, the average load was 66.5 per cent of the maximum load. The number of generators in operation and the hours they are in operation are indicated at the top of the log sheet, opposite the numbers of the respective generators, by straight lines drawn between the hours that the respective generators are operated. The temperature is noted every three hours, and also the weather, from hour to hour, if there are any changes. At the side of the sheet is given the water used, coal used, coal per kilowatt-hour and watts per pound of coal. Coal used cannot be determined exactly from day to day, although total coal for a period of time would be known accurately.

The character of the load on this company's power house on different days is well shown by the sample log sheets reproduced. Thus, Saturday, July 4, is a holiday, upon which the load was naturally larger than usual. The company operates from this station over 100 miles of interurban line, and 50 miles of local city line in several cities.

The reason for the high and low loads on the even hours is due to the fact that it happened that a number of cars are at terminal points and sidings on the even hours, and are either standing still or starting just about that time. Indeed, the load record on these power station logs, to the experienced eye, tells whether cars were operated on time or not, or whether the schedule in some was broken up so that terminal points were not made on the even hour.

We are enabled to reproduce these log sheets through the courtesy of Albert S. Richey, electrical engineer of the Indiana Union Traction Company.



The Cleveland Electric Railway Company, of Cleveland, Ohio, has placed in operation an observation car which will be operated over all parts of the city system, affording patrons an opportunity of seeing all places of interest. The starting point is at the Public Square, at 9 a. m. Regularly thereafter until 7 p. m. cars leave at intervals of two hours. Each trip will be over a different route. A charge of 25 cents per trip is made, and it is part of the duties of the conductor in charge to announce all points of interest as they are passed. Thus far the experiment has proved exceedingly profitable and the car has been filled on nearly every trip.

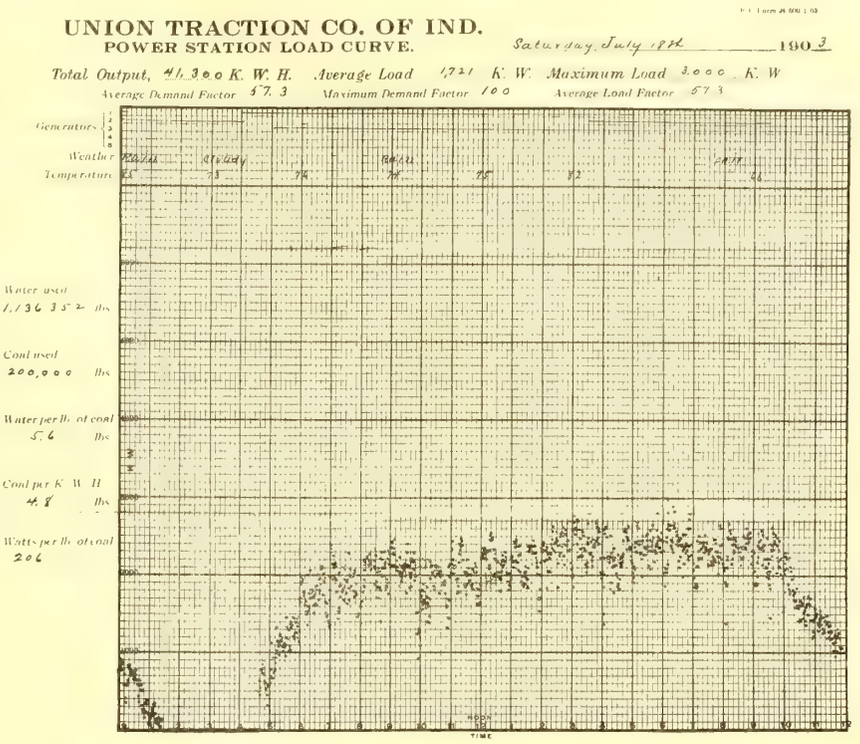
NEW WORK IN OMAHA

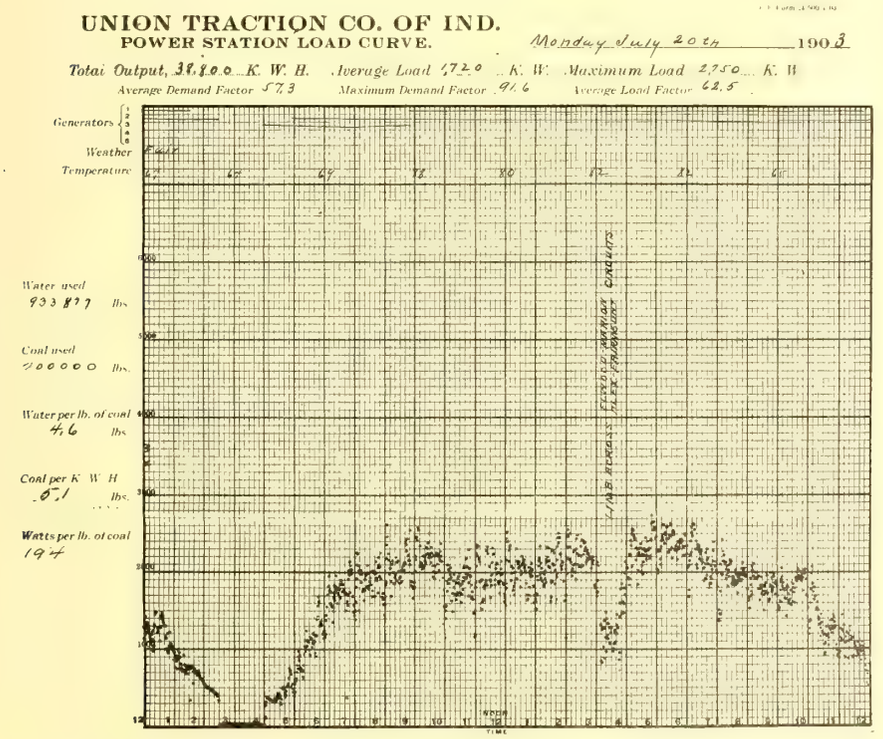
All the street railway properties in the city of Omaha, Neb., are now owned by the Omaha & Council Bluffs Street Railway Company, which, on Dec. 22, 1902, purchased the Omaha Street Railway Company and the Metropolitan Cable Railway Company. In addition the Omaha & Council Bluffs Street Railway Company has leased for a period of ninety-nine years the properties of the Council Bluffs Street Railway Company, the Omaha, Council Bluffs Railway & Bridge Company and the Omaha, Council Bluffs & Suburban Railway Company. The latter three properties are situated in the city and suburbs of Council Bluffs, It. It is thus seen that the new company operates all the street railways in Omaha and South Omaha, Neb., and Council Bluffs, Ia. The company owns 90 miles of track and leases 32 miles.

The company is now operating an old power station at Twentieth Street and Nicholas Street, in Omaha, and also a station in Council Bluffs. In order to handle the entire system from one plant the company has designed and is now building a new power plant at the foot of Jones Street, on the Missouri River front. This site is three-fourths of a mile from the center of the city of Omaha, which is approximately at Sixteenth Street and Farnam Street. The new station is designed for a total capacity of 6000 hp, and it is hoped that it will be completed by April 1, 1904.

The initial order for generating equipment consists of three 1000-kw General Electric railway generators, direct-connected to 1500-hp, horizontal cross-compound condensing engines, made by the Fulton Iron Works, of St. Louis. These engines will have cylinders 26 ins. x 54 ins. in diameter by 60-in. stroke, and a speed of 80 r. p. m. The generators are 525-575-volt, 1730-amp. machines, and have a guaranteed overload capacity of 50 per cent at 575 volts for 2 hours and 100 per cent momentary overload. In addition to this new generating equipment there will be moved to the new plant an 850-kw railway generator, driven by a cross-compound Allis engine, that is now operating in the old station. The General Electric Company will also supply the switchboard, which will consist of four generator panels, two blank panels and twenty feeder panels.

In the boiler room there will be installed six Babcock & Wilcox water-tube boilers in three batteries. These boilers will generate steam at 150 lbs. pressure, and have superheating coils designed to superheat at 80 degs. The boilers have a total capacity of 3145 hp. They will be equipped with Green traveling-link grate stokers, 11 ft. 9 ins. long, with 106 sq. ft. of grate surface to 500-hp of boiler capacity. Space will be provided for an additional installation of two similar boilers.





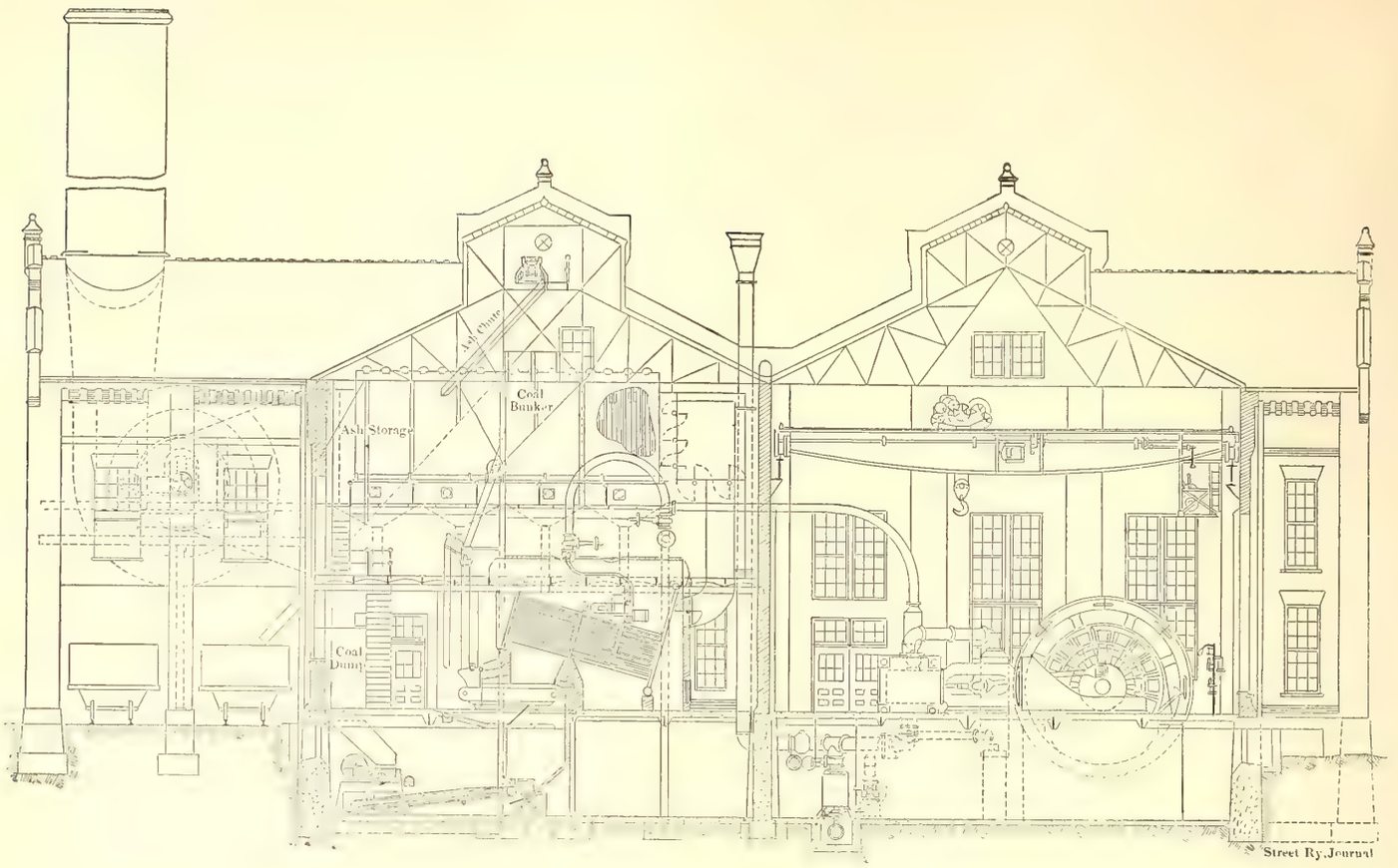
A coal and ash conveyor of the McCaslin overlapping gravity type, manufactured by John A. Mead & Company, will be placed in the boiler room. The conveyor will be electrically driven, and will have a speed of 35 lin. ft. to 40 lin. ft. per minute. There will also be placed a coal crushing mechanism and a cross conveyor to carry the coal to the main conveyor.

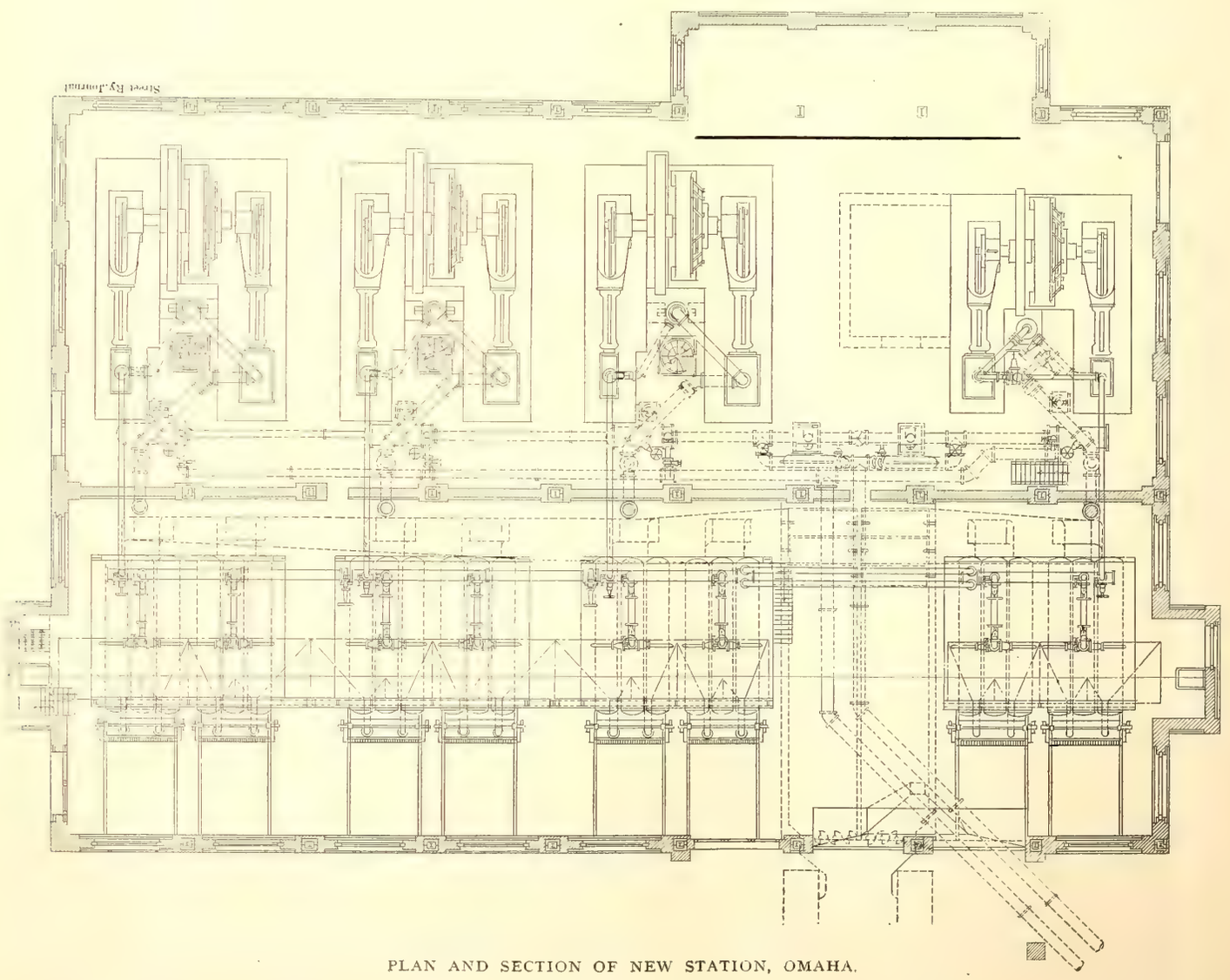
Although a coal conveyor has been provided it will be seen from inspection of the plans that this coal conveyor is not absolutely necessary to the operation of the plant. If the conveyor was not in operation coal could be shoveled by hand directly from the cars to the place in front of the boilers instead of passing down the chute to the coal crushers.

The building is on a wedge-shaped piece of property, located between the Union Pacific and the Burlington tracks. There is room in this space for forty cars of coal, which can be kept as a reserve.

The Green Fuel Economizer Company will install a fuel economizer of fifty-two sections, each of fourteen tubes, the total heating surface being 9464 sq. ft. The same company will install two induced-draft fans with stack and connections. The fan will be of the steel-plate type, with blast wheel 18 ft. in diameter and 5 ft. wide, the inlet diameter being 122½ ins., and the outlet being 104 ins. by 64 ins. The steel stack will be 45 ft. high, and have a diameter of 10 ft.

The general dimensions of the power station will be 189 ft. long by 115 ft. wide. A longitudinal wall will divide the building into an engine room 60 ft. wide and a boiler room 55





PLAN AND SECTION OF NEW STATION, OMAHA.

ft. in width. An addition to the boiler room, 58 ft. x 36 ft. in size, will contain the induced-fan equipment. An electric traveling crane will span the engine room. The plans for the new power station have been prepared by Lichter & Jens, of St. Louis, the consulting engineers for the company, and the work is being supervised by W. A. Smith, treasurer and general manager, and R. A. Lerssler, secretary of the company.

Upon the completion of the new power house the old generating station in Omaha will be shut down and used as a general repair shop, the other shops of the company then being centralized there.

During the last winter the company has placed in service twenty single-truck closed 20-ft. Jones cars, equipped with General Electric 57-motors, mounted on Peckham trucks. Twenty new single-truck open Jones cars, 30 ft. over all, with similar equipment, are now being placed in service. During this month (June) the company expects to receive ten double-truck interurban cars, made by the American Car Company. These cars will have 34-ft. bodies, and will seat forty-eight passengers each. They will be equipped with Peckham trucks, Christensen air brakes and arc headlights. Each truck will be provided with a General Electric 67-motor.

The company has just opened a new interurban line to the village of Florence, where the city waterworks of Omaha are located. This line is a 3½-mile extension from the terminus of the North Twenty-Fourth Street line. It is built with 60-lb. T-rail, single track with turnout. During the present summer the company will probably extend its Thirteenth Street line to South Omaha, the new work consisting of 3700 ft. of double track. About 8000 ft. of double track will also be built on South Twenty-Fourth Street, giving the company still another route into South Omaha.

A general policy in reconstructing track has been followed by the company during the last few months in order to get a perfect roadbed. On paved streets a 73-lb. girder rail is used, and on unpaved streets a 60-lb. T-rail. Ohio Brass bonds are used throughout. About 30 per cent of the system still consists of old track. On most of the overhead system No. 0 trolley is used, there being some No. 00. The company is now putting up 6½ miles of 500,000-circ. mil stranded weather-proof, triple braid copper feed wire, to connect the Council Bluffs power station with the Omaha feeder system.

The people of Brooklyn, or at least some noisy, disgruntled individuals, are again crying out against the 10-cent fare charged by the Brooklyn Rapid Transit Company for a ride from Manhattan or Brooklyn to Coney Island. The courts have already decided that the company has the right to charge 10 cents, but the kickers are still pressing their demands for a single fare. In an exceedingly sane editorial utterance the "Brooklyn Times" upholds the company's refusal to accede to the demand, and expresses indignation at the annoyance that has resulted to the company from the crusade. The "Brooklyn Eagle" also has tried to point out the fallacy of asking a 12-mile ride for 5 cents. In an editorial defending the company, and in which it calls attention to the sound utterances of the "Times" on the subject, the "Eagle" says: "But we are prepared to go further than the 'Times,' and to say that a 10-cent fare to Coney Island is not only legal but is just; that it cannot only be legally exacted, but that it ought to be exacted as a fair price for what it secures. When the public is wrong, it is very wrong. When it is unjust, it is very unjust. In such case, the duty of newspapers to withstand the public until the public gets right is plain. And it is not one to be avoided. * * * A railroad, with the law on its side, can rightly charge the worth of what it gives. The Brooklyn Rapid Transit Company gives really more than 10 cents worth of travel to Coney Island, and is justified in charging and getting the dime which it obtains."

THE CRITICAL SPEED OF STEAM TURBINES

Berlin, Germany, July 24, 1903.

EDITORS STREET RAILWAY JOURNAL:

In one of your recent numbers you referred to the great difficulties which the dynamo builder encounters when designing generators for use in connection with steam turbines. These difficulties occur in arranging the generators for the peripheral speeds (1500 r. p. m. to 3000 r. p. m. and higher) which must be used in turbine construction for the sake of steam economy, and the necessity for direct-coupling the generator to the turbine shaft. The latter difficulty can hardly be avoided in large units, as all methods of speed reduction at high speeds are either impractical at all or give too low an efficiency.

On account of the necessity for high speeds of the rotating parts of the generator, centrifugal forces enter of a hitherto unknown magnitude. By using material of sufficient strength, however, a reasonable degree of safety may be obtained even at these high speeds, but there is another difficulty which must be overcome.

It will seldom or never be possible to locate the center of gravity of the rotating part in the center of the shaft with mathematical exactness even with the most careful balancing. On account of this eccentricity of the revolving masses the resulting centrifugal force tends to bend the shaft. This bending increases with the speed of rotation and the eccentricity of the center of gravity. In general, this condition may be met by using a sufficiently strong shaft, and it does not become dangerous until the so-called "critical speed" is reached. As the flexure of the shaft increases with the centrifugal forces impressed upon it, and as the centrifugal force increases with the flexure, the bending tends to increase toward infinity, that is, until the shaft is broken.

The following is a simple formula for finding the required number of revolutions (n) for breaking or infinite speed:

$$n_{\infty} = 300 \sqrt{\frac{1}{d}}$$

in which d stands for the flexure of the shaft (expressed in cm.), caused by the weight of the rotor.

To attain sufficient safety the dynamo constructor must only use one-half of the value given, that is, the actual speeds must be $< 0.5\ n_{\infty}$ and $> 1.5\ n_{\infty}$.

From this the great importance will be seen of a method of quickly finding the critical speed value up to a certain degree. This method consists in the exact balancing of the rotors, and this latter is a point which is often not given enough care.

The following requirements for balancing will be found satisfactory:

1. That the complete mounted rotor should be supported at the journal bearings and not at any other points when being balanced.

2. That the rotor be supported at the bearings on cylindrical surfaces, which are cut with absolute exactness in order that there shall be no unevenness of surfaces which would introduce errors when testing.

3. That the shaft be revolved between stationary points.

4. That the rails for the support of the testing apparatus be placed throughout their entire length on foundations which are free from vibration.

By following these requirements it is possible to reduce the radius of gyration to 1/300 mm. There is, however, a certain element of danger in the armatures of dynamos. Assuming that the apparatus is mounted correctly, yet owing to the great centrifugal force the shifting of a winding now and then can hardly be avoided. This, of course, will shift the center of gravity, which shifting may easily have important effects on the armature. As a matter of fact in spite of the most careful selection of the proper running speed in comparison with the critical speed, nearly all wire-wound armatures will give

trouble. This is particularly true with direct-current machines, which, in addition to an armature, also have a commutator as a rotating element.

The following methods are suggested for safely running high-speed turbogenerators:

1. Secure greatest possible difference between the actual running speed and the critical speed.

2. Use alternators in preference to direct-current machines whenever possible, or better still—

3. Use non-synchronous generators.

This latter machine possesses the advantage of having an armature carrying absolutely no wire. In fact, this form permits the use of speeds up to 3000 r. p. m. and 4000 r. p. m. In the Moabite central station of the Berlin Electricity Works there has been running for several months a non-synchronous 1800-hp turbogenerator using wattless current, and it has given no trouble in the direction mentioned.

Franz zur Nedden.

FENDERS IN LIVERPOOL AND BERLIN

Boston, Mass., Aug. 10, 1903.

Editors Street Railway Journal:

One of the most practical devices found by the writer in a recent examination of European street railways was the plow life guard used by the Liverpool Corporation, a fender whose perfect record might have seemed incredible but for an examination of official reports and careful inquiry elsewhere. The general manager in his annual report for 1901 states that "its principal features are that it is dissociated from the spring movement of the car, which insures its running with a fixed minimum clearance from the road surface. It is of the plow shape, and is so designed to shear a body clear of the car wheels. Three cases have occurred in Liverpool, and numerous ones throughout the country, in which persons have got under the type of guard designed to pick up, and have become entangled with the under carriage of the car in such a way as to render it necessary to raise the car before the body could be removed. Such a result is rendered practically impossible with the new guard." In his report for 1902 the manager reports "that although since its introduction twenty-one persons have been actually under cars fitted with this guard, all have been pushed out of danger without anything approaching serious injury, medical assistance not being required in any of the cases." To illustrate the value of the improved fender, this spring a bicyclist was knocked down by a car, but both he and his wheel were pushed off the track uninjured and he rode away. Last December a bicyclist ran into and was knocked down by a car equipped with an old fender, and was killed, going under the car, the life guard failing. Of the persons knocked down in Liverpool a large proportion have been children.

It will be seen from the illustrations that the plow guard consists of boards entirely surrounding the wheels, making it effective on curves, where many other kinds of fenders fail or are worse than useless. To prevent the collection of snow inside at the rear, each nose is hinged so that it can be lifted by a chain on the rear platform and allow the snow to escape through the opening left. Rubber hose forms a blunt point to the plow, and belting around the entire bottom of the boards projects to within 2 ins. of the track. The principle of the guard is not new, of course. It would be interesting to know if it has been perfected in other cities besides Liverpool so as to be absolutely unfailing. The illustrations show the guard as applied to single-truck cars; when the writer left Liverpool it was about to be fitted to the double-truck cars. In view of the constant fatalities in American cities, especially of children, a trial of the guard in this country would seem very desirable. There is nothing patented about it to hinder its use. The average and maximum speeds of cars in Liverpool seem quite as high as in many large cities in this country.

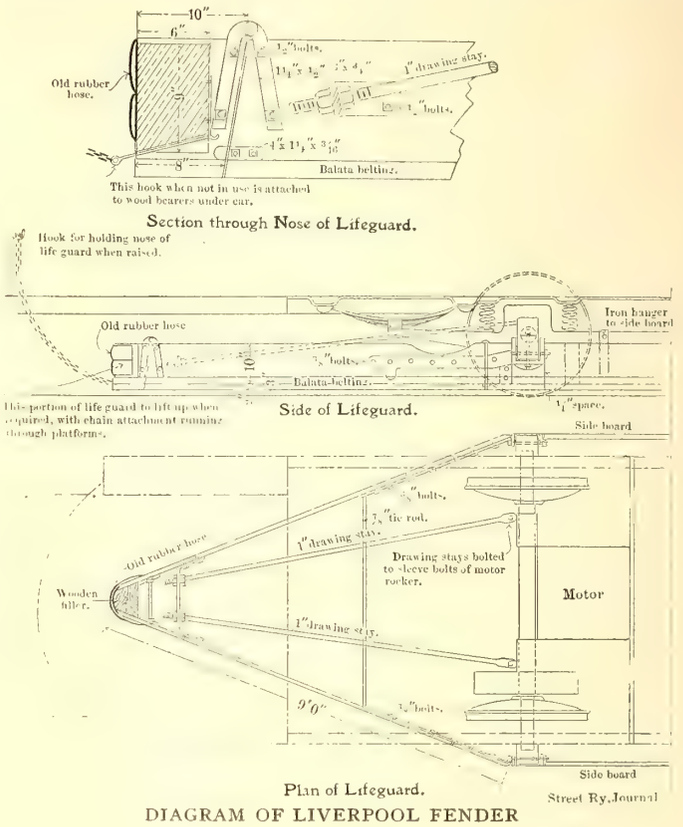
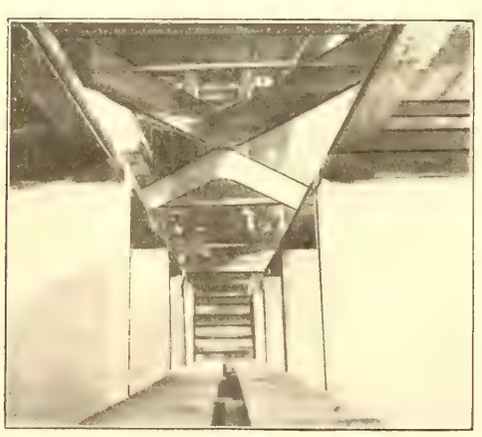
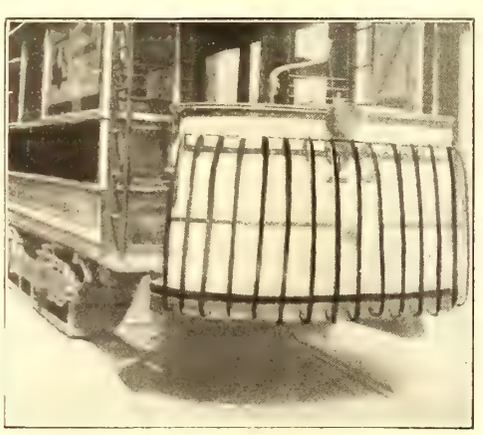


DIAGRAM OF LIVERPOOL FENDER



VIEW OF LIVERPOOL CARS FROM PIT SHOWING FENDER



LATE TYPE OF BERLIN FENDER

It is important, of course, that a person lying on the track should not be struck by anything projecting down from the car before being pushed aside by the plow guard, so the Liverpool brake shaft is short, and there is no coupling under the platform. The front end of metal steps is also filled in with wood with rounded corners to reduce the chance of injuring any person struck by it. This last is also done in Berlin, where the wheels of both single and double trucks are also surrounded with boards with a 2-in. clearance only above the track and pavement, or even less at times. Some of the Berlin cars have had rods around the dashers for persons struck to get hold of. This construction is not now in great favor, and steel ribs are being tried on the dashers in various ways, extending down over the bumpers in order to break the force of a blow against

any one hit by a car, as shown in one of the illustrations herewith. In addition a straight pilot board is used in front of the wheels. Every car also carries a jack, a saw to use on the wheel guard, crowbar and wooden blocks.

JOHN P. FOX.

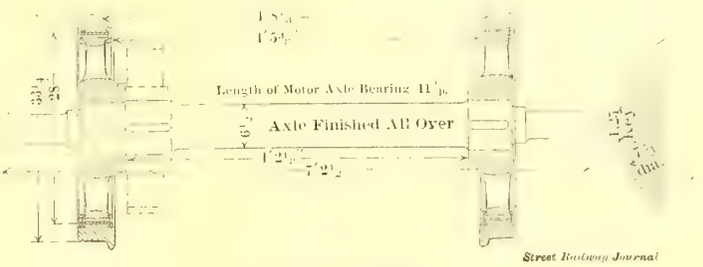
MOTOR TRUCKS FOR THE NEW YORK SUBWAY

The design of the motor trucks for the subway equipment of the Interborough Rapid Transit Company has been decided upon, and all the details of construction have been worked out. The plans, which were recently approved by the engineering department, are here presented for the first time. It will be noticed that these trucks differ materially from the Manhattan type, and also in many respects from those of other electric railway lines. This is due to the character of service in which they will be employed, as the requirements of high speed, quick braking and rapid acceleration for the heavy trains it is intended to operate will be much more exacting and of an entirely different character from the experience thus far obtained on established electric roads.

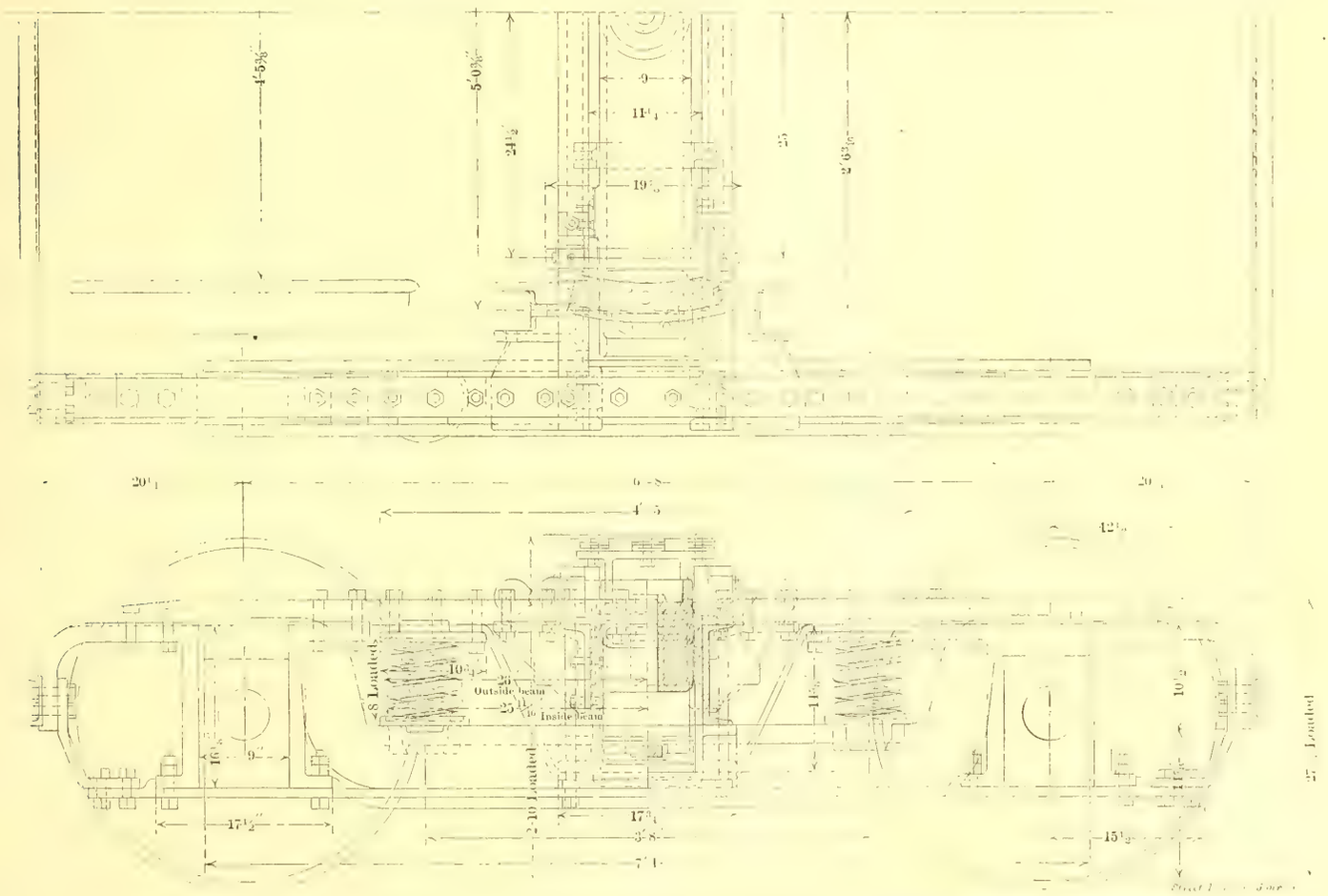
The first order calls for 350 motor trucks, which are now being built at the Baldwin Locomotive Works. Half of these trucks will carry Westinghouse No. 86 railway motors, and the other half General Electric No. 69 railway motors, the rating of which is 200 hp. Nose suspension will be employed in all cases, but the general arrangement will be different, according to the type of motor to be employed. Both styles of motor suspension are illustrated in the accompanying cut, making a detailed description of this feature unnecessary.

The principal dimensions of the trucks and other data here appended are taken from the specifications, which are very complete. The trucks used have a wheel base of 6 ft. 8 ins., and will be built for standard gage track, the distance between backs of wheel flanges being 4 ft. 5⅜ ins. The height of the truck center plate above the rail is to be 30 ins. when the car body is loaded with 15,000 lbs., and 32 ins. without passengers. The weight of the trucks complete, without motors, will be about 11,500 lbs., and the estimated weight to be carried on the center plate is 25,000 lbs. The weight of each motor is 6500 lbs., and the extra weight, due to the torque of one motor on the truck transom, is 3000 lbs.

In the construction of these trucks the side frames will be of wrought-iron machined on four sides, 2½ ins. x 4 ins., and the side truss will also be of wrought-iron. The end frames are of steel channels securely bolted to an extension on the pedestals. The pedestals are of wrought-iron forged, machined on faces and sides for journal boxes, on bottom and edges for pedestal caps and on top where joined to side frames. The pedestals are lipped over the sides of the side frames, as shown, and securely bolted to the frames. Pedestal caps are to be wrought-iron, each made in one piece, forged as shown, and fitted to the pedestals. They are to be securely bolted to all pedestals and to the center brace. The transom is to be of rolled steel channels resting in side frame castings and securely bolted. Equalizing bars are to be of wrought iron, 1¼ ins x 6½ ins., made in one piece and without welding. They will be machined on top edges for spring seats, and formed with bearings on

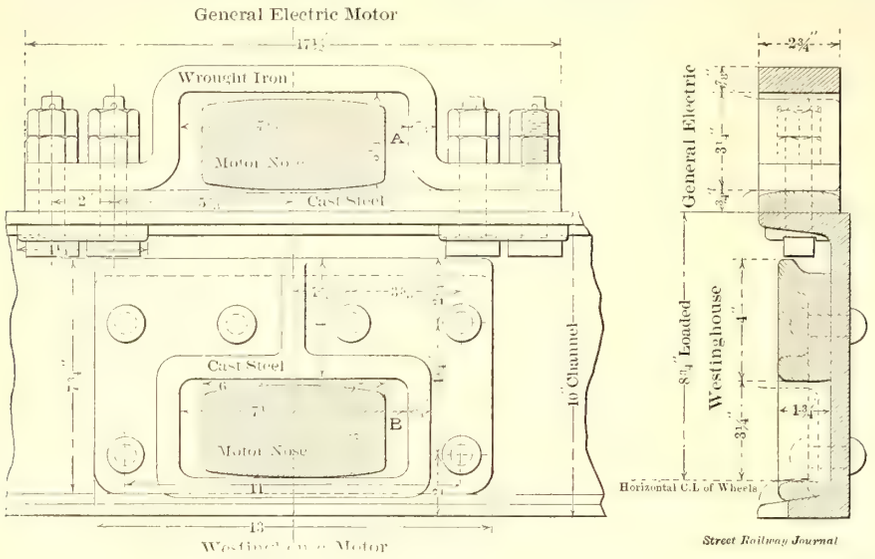


HUB AND AXLE



GENERAL PLAN AND ELEVATION OF TRACK ADOPTED FOR RAPID TRANSIT SYSTEM, NEW YORK

boxes. The bolster is to be of cast-steel with center plate, elliptic spring cap and chafing surface cast as part of bolster casting, all of which will be machined, while the side bearing



SECTIONS OF MOTOR SUSPENSION

castings will be cast separately, machined and provided with adjustable cap plates. The spring seats are to be securely bolted to the tie-strap, and the bolster spring seat bearing machined to fit the swing hanger. Duplicate elliptic bolster springs, 30 ins. long, with nine leaves, of crucible steel and bands of wrought-iron, will be used, while the equalizing springs are to be of open-hearth steel of the double-coil helical pattern, resting in cast-spring seats on equalizers and in caps on side frames.

The general arrangement of the brake rigging is shown in the accompanying illustration. Brake hangers, levers, rods, equalizing beam and all the other parts are to be forged of iron. The brake head is to be of the M. C. B. standard pattern of cast-steel, attached to hangers and levers with turned case-hardened iron pins. The brake-shoe adopted is the "Diamond S" type, made by the American Brake-Shoe & Foundry Company. The equalizing brake lever guides are to be of cast-steel, machined to fit the end frame channel and securely bolted to it.

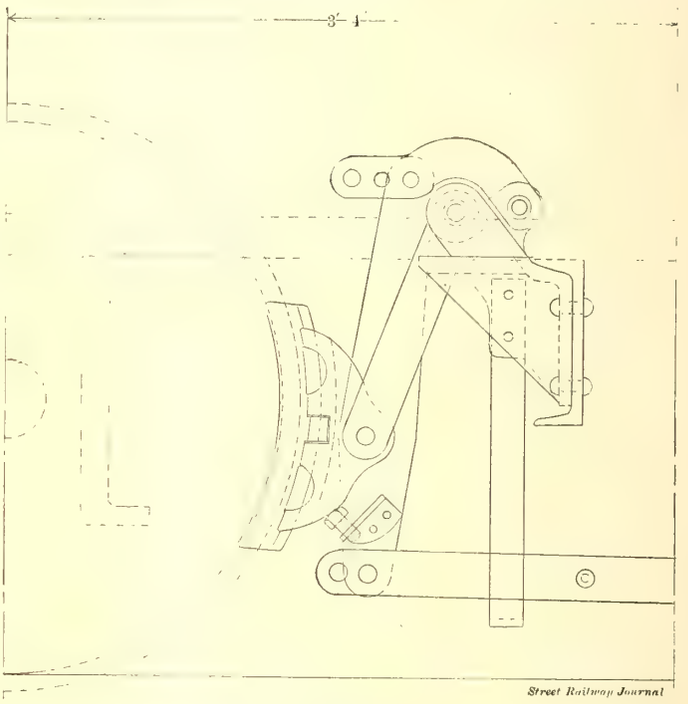


DETAILS OF WHEEL CONSTRUCTION

Single-coil helical brake release springs are to be employed.

The wheels and axles for the trucks are made by the Standard Steel Works. The wheels are to be of cast-steel, 33¼ ins. in diameter, steel tired and of M. C. B. standard tread, 2⅝ ins. x 5¼ ins. All wheels are to be pressed on axles and provided with key. Details of construction of wheels and axles are clearly illustrated in the accompanying cuts. The diameter of the axle at center is 6½ ins., at gear seat 7 13-16 ins., and at wheel seat 7¾ ins. Provision is made that axles are to be turned on collars, journals, dust guard bearings, wheel seats, gear seat, motor bearings and axle centers, and that key seats are to be milled in wheel seats and gear seats. The gears, which are of cast-steel in one piece, are to be forced on before the wheel and provided with key.

The specifications provide that the journal bearings shall be of Damascus bronze. They will have ¼-in. freedom between collars and journal, and are provided with M. C. B. slides, which are rounded on the top to insure that the brass does not tip. Provision is made in fitting the boxes to the pedestals so that there will be a perfectly free movement of the boxes in the pedestals. The wearing parts of the brake rigging (levers, pins, etc.) are all case



BRAKE RIGGING

hardened, and so fitted that the brake parts will not rattle when brakes are applied.

This truck was designed by George Gibbs, consulting engineer, and W. T. Thompson, master mechanic, of the Interborough Rapid Transit Company.

OBSERVATION CARS ON MONTREAL STREETS

The "Seeing Montreal" service of observation cars, which has been arranged for the present tourists' season, has begun operations. Some months ago A. W. Batchelder, general manager of the observation car services which operate in Boston, Washington and other American cities, came to Montreal and made a contract with the Montreal Street Railway, by which the latter will furnish the necessary cars. These cars, as many as necessary, will leave from opposite Dominion Square, at 10 o'clock every morning and 2 o'clock every afternoon, proceeding through the city 2 hours,

CONVENTION ANNOUNCEMENTS A. S. R. A.

The provisional programme for the Saratoga meeting of the American Street Railway Association has been prepared by Secretary Penington, and is as follows:

Wednesday, Sept. 2, A. M.
2:00 P. M. Registration.
First Session.
Address of welcome, by Mayor Knapp.
President's address.
Report of the Executive Committee.
Report of the Secretary-Treasurer.
Presentation of papers.
8:00 P. M. Excursion to Saratoga Casino upon invitation of the Hudson Valley Railroad Company.

Thursday, Sept. 3.
10:00 A. M. Session.
Presentation and discussion of papers.
1:00 P. M. Excursion to the works of the General Electric Company at Schenectady, upon invitation of the General Electric Company.

Friday, Sept. 4.
10:00 A. M. Session.
Election of officers and any unfinished business.
1:00 P. M. Excursion to Lake George on train drawn by electric locomotive, upon invitation of the Hudson Valley Railroad Company.
8:00 P. M. Banquet in the Ball Room of the Grand Union Hotel.

The titles of the papers to be presented were published last week, but the authors were not given. They have since been announced as follows:

The Right of Way, by Herbert H. Vreeland, of New York.

Comparative Merits of Single and Double Track Cars for City Service, by John I. Beggs, of Milwaukee.

The Manufacture and Distribution of Alternating Currents for City Systems, by Richard McCulloch, of Chicago.

Freight and Express on Electric Railways, by J. B. McClary, of Birmingham.

Train Orders and Train Signals on Interurban Roads, by T. E. Mitten, of Buffalo.

The Evils of Maintenance and Champerty in Personal Injury Cases, by Michael Brennan of Detroit.

Electrically Welded Joints, by William Pestell, formerly of Worcester and now of J. G. White & Co.

Steam Turbines, by W. L. R. Emmett.

The Saratoga committees are as follows:

LOCAL COMMITTEES.

ENTERTAINMENT COMMITTEE.

Hon. A. B. Colvin, Chairman—President Hudson Valley Railway Company, and Vice-President Niagara, St. Catharines & Toronto Railway Company, Glenn Falls, New York.
Hon. John W. Herbert, President Niagara, St. Catharines & Toronto Railway Company and Vice-President Hudson Valley Railway Company, New York.
Edgar S. Fassett, General Superintendent United Traction Company, Albany, New York.
W. M. McFarland, Acting Vice-President Westinghouse Electric & Manufacturing Company, Pittsburg, Pennsylvania.
G. Tracy Rogers, President Binghamton Railway Company, Binghamton, New York.
Hon. George E. Green, Vice-President Binghamton Railway Company, Binghamton, New York.
Hon. J. Ledlie Hees, President Fonda, Johnstown & Gloversville Railway, Fonda, New York.
Herbert H. Vreeland, President Interurban Street Railway Company, New York, N. Y.
Edward G. Connette, Vice-President Syracuse Rapid Transit Railway Company, Syracuse, New York.
T. J. Nicholl, Vice-President Rochester Railway Company, Rochester, New York.
James O. Carr, Secretary Schenectady Railway Company, Schenectady, New York.
Thomas R. Kneil, Superintendent of Schools, Saratoga Springs, New York.

RECEPTION COMMITTEE.

Hon. A. P. Knapp, President Village of Saratoga Springs.
Hon. Edgar T. Brackett, State Senator.
W. M. Probasco, Westinghouse Electric Company.
J. R. Lovejoy, General Electric Company.
C. B. Thomas, President Business Men's Association.
Carleton H. Lewis, Police Commissioner.
H. L. Waterbury, Chairman Board of Directors Business Men's Association.
Jonathan Marshall Colcord.

LADIES' RECEPTION COMMITTEE.

Mrs. A. P. Knapp, Chairman	Mrs. C. B. Thomas,
Mrs. A. B. Colvin,	Mrs. F. A. Burd,
Mrs. W. M. Probasco,	Mrs. T. R. Kneil,
Mrs. J. R. Lovejoy,	Mrs. J. M. Colcord,
Mrs. D. M. McFarland,	Mrs. H. F. Thomas.
Mrs. D. C. Moriarta,	

EXHIBITS COMMITTEE.

F. M. Cozzens, Chairman,	W. B. Eddy,
M. E. Varney,	Elmer E. Durkee.
W. S. Robertson,	

INFORMATION COMMITTEE.

F. M. Waterbury, Chairman,	F. J. Resseguie,
W. L. Thompson,	E. A. Burd.

OLD HOME WEEK BY TROLLEY

Old Home Week is a festival quite peculiar to New England towns. During that period former residents return to visit relatives and friends, and every one endeavors to have as pleasant a time as possible. This year the Concord, Maynard & Hudson Street Railway Company, of Maynard, Mass., took a prominent part in the festivities by introducing



DECORATED CAR USED IN CONCORD

a novelty which added greatly to the success of the celebration. This novelty took the form of a trolley trip by night on special cars through the towns operated by the company. The attractively decorated float, shown in the accompanying illustration, was one of the principal features of the trip through the specially illuminated towns and villages, and attracted much attention. The company used for this purpose one of its ordinary flat construction cars, decorated by its superintendent, John W. Ogden. The result of a little work brought the company many extra dollars during the celebration. It was acknowledged by the festival committee and citizens that with the aid of the electric railway Old Home Week was a success that it could not have otherwise been.

During July, on Tuesday afternoons, the East St. Louis & Suburban Railway Company charges half-fares for all trips on its suburban extensions to arouse interest in the country in the neighborhood of East St. Louis. The cheap rates benefit persons who have many children and to whom the question of car fare is a big item. The scheme of "free rides" was evolved by General Manager L. C. Haynes. The rule took effect July 7. On all rides out of East St. Louis the conductor gives the passengers a ticket for every fare collected on the outgoing trip. On the return trip the tickets are good for fares. General Manager Haynes thinks that the reduced rate will cause many people to take the ride along the scenic electric road between East St. Louis and Edwardsville.

PLANS OF THE HOLLAND SLEEPING CAR

The Holland Palace Car Company, of Indianapolis, which has been organized for the purpose of conducting a sleeping car business on electric interurban lines, now has nearing completion, at Wilmington, Del., at the shops of the Harlan & Hollingsworth Company, two sleeping cars intended for service on the electric interurban lines of Ohio and Indiana. These sleeping cars differ radically from the Pullman sleeping cars used on steam roads, but are arranged to serve as parlor cars during the day and as compartment sleeping cars at night. The accompanying engravings, Figs. 1 to 4, show a sample section of the Holland sleeping car as built in the rough at the car shops, for the purpose of determining the appearance of a section built according to these designs and to determine certain matters of detail before building the regular cars. It will, of course, be understood that the section is somewhat crude in many respects, and does not have the finish or the attention to details which would be seen in a regular car.

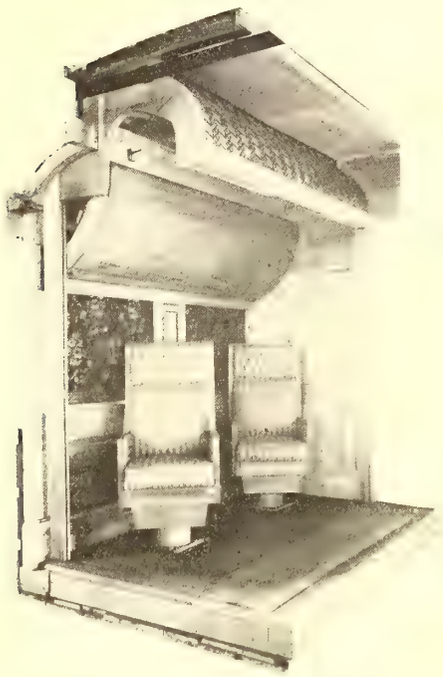


FIG. 1.—READY FOR DAY USE

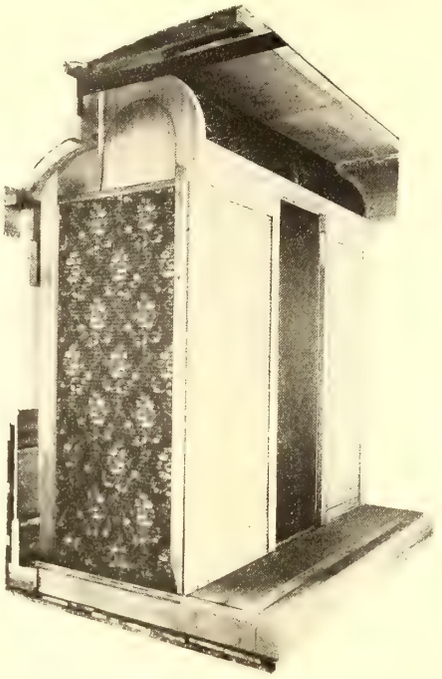


FIG. 2.—READY FOR NIGHT USE

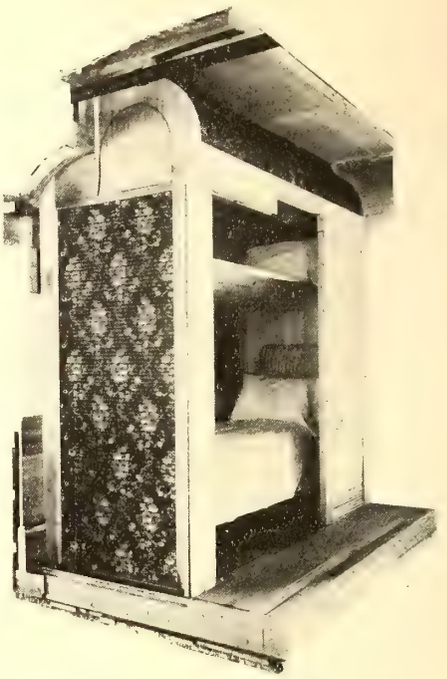


FIG. 3.—PARTITION REMOVED TO SHOW BERTHS

Fig. 1 is of the section made up as a parlor car for day use. There are two revolving chairs. The upper berth is folded up as in an ordinary sleeping car. Fig. 2 shows a section made up for sleeping. Fig. 3 shows the section made up, with the exception that one of the partitions has been lowered to show the berths. Fig. 4 was taken to illustrate the amount of dressing room between the berth and the sliding partition which forms the compartment.

All of the partitions which go to make up a compartment are made on the same principle as the roll top of a roller top desk. These partitions all slide down between the double floors in the day time. The car has a second or false floor built on top of the regular floor, as seen by Figs. 1 to 4. Entrance to the berths is through an opening guarded by a portiere. The berths are 27 ins. wide, which is the width of an ordinary steamer berth. This allows 15 ins. between the berth and the partition of the compartment. Partitions when down are flush with the floor. The plans have been modified somewhat since the sample section was built in order to get better ventilation. In the two cars which are being built there will be an opening of several inches next to the floor when the berths are made up. Cushions for the lower berth are obtained from the bottoms and backs of the revolving chairs. Taken all together, it is a decided innovation in sleeping car construction, and no doubt will attract much interest.

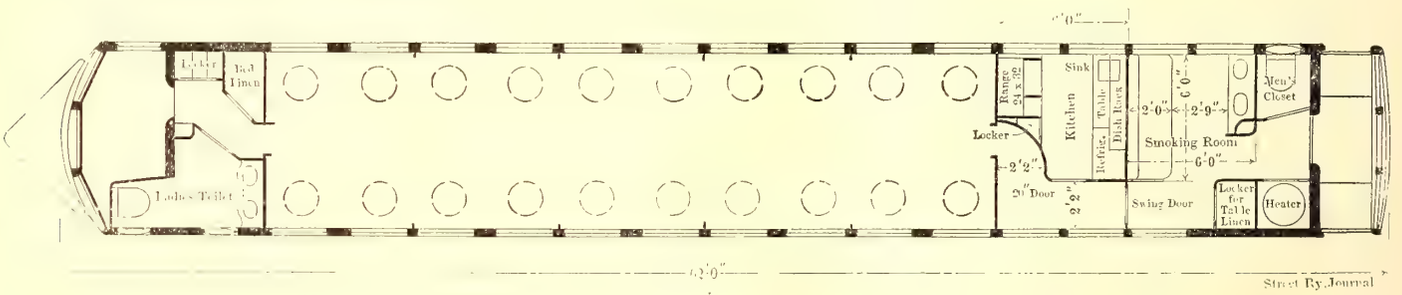


FIG. 5.—PLAN WHEN CONVERTED TO DAY USE OF CAR WITH KITCHEN

Fig. 6 shows plans with dimensions of the two cars now being constructed, which it is expected will be placed in operation soon.

Fig. 5 is the plan of a somewhat longer car, containing a kitchen in addition to the sleeping compartments. It is expected to build this car as soon as the first two cars have been given a trial.

The cars are mounted on M. C. B. trucks, and will be equipped with four 150-hp Westinghouse motors for each car. This is an enormously heavy equipment, and the company intends to provide for the most severe requirements at the start. If advisable, the motors can be omitted from one pair of trucks.

Among the small comforts provided will be electrically-heated curling irons in the ladies' toilet and electric cigar lighter in the smoking room, and electric fans in the main compartment of the car.

It is expected to charge $2 per night for berth and $3 for a compartment. Just where the first two cars will be put into

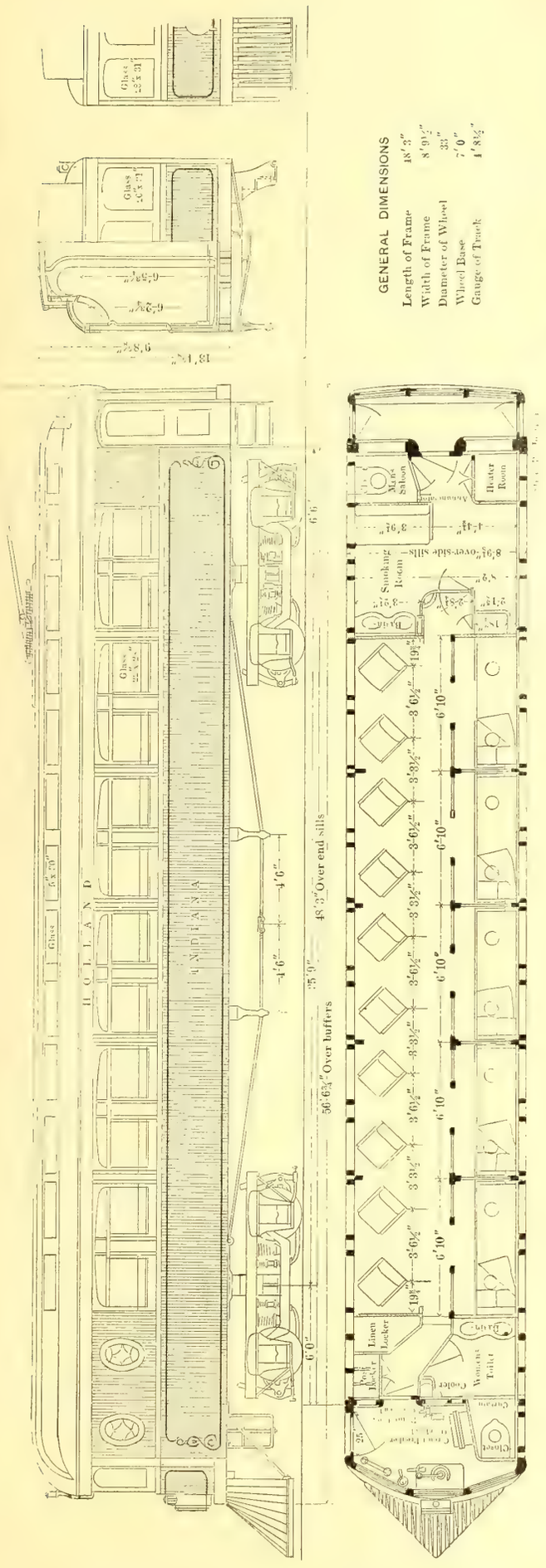


FIG. 6.—SIDE AND END ELEVATIONS AND PLAN OF OHIO SLEEPING CAR, WITH GENERAL DIMENSIONS

service is somewhat doubtful. It was expected at first that they would be operated between Columbus, Ohio, and Indianapolis, Ind., over the tracks of the Columbus, London & Springfield, Dayton & Western, Richmond Street & Interurban, and the Indianapolis & Eastern Railways. Owing to the limited capacity of a subway on this route, however, which will not allow the passage of a full-sized interurban car until the subway is changed, some other route may have the honor of operating the first sleeping car. There seems to be little doubt but that some of the lines of the Appleyard syndicate of Ohio can make use of these cars as soon as they are ready.

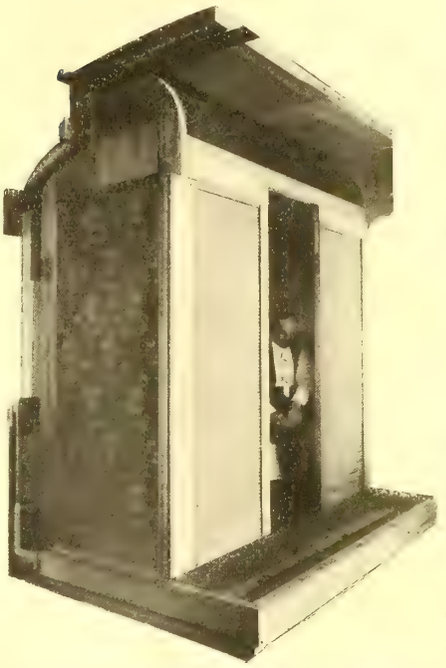


FIG. 4.—PARTITION DOOR OPEN, SHOWING ROOM ALLOWED FOR DRESSING

The Holland Palace Car Company expects to conduct the sleeping car business on very much the same lines as the Pullman Company conducts it on steam railroads. Owing to the number of different lines that must be operated over in the majority of cases where it is desirable to have a sleeping car route, a company independent of any one railroad for operating the sleeping cars would have many points in its favor. The Holland Palace Car Company has offices in the Lombard Building, Indianapolis. The officials are: Harris F. Holland, president; Amos K. Hollowell, vice-president; Joseph W. Selvage, secretary and treasurer; A. L. Wheeler, assistant secretary and treasurer; James E. McCullough, general counsel.

AGREEMENTS MADE IN TORONTO FOR THE OPERATION OF FREIGHT CARS AND THE ENTRANCE OF CARS OF SUBURBAN LINES

The city of Toronto has recently entered into an agreement with the Toronto Electric Railway for the entry of the various radial railways into the city over the Toronto Company's tracks. The agreement provides for the carrying of passengers, package freight and express in the cars of suburban lines run over the Toronto system to points in the city to be designated by the city engineer, the necessary permission to be given for connecting the tracks of the city with suburban lines. This new agreement is of special importance because the street railway system is operated by the company under a thirty-year franchise grant, which provides that the property can be taken over by the city at the expiration of the grant at an appraised value. A summary of the conditions under which the company operates was published in the STREET RAILWAY JOURNAL of May 2, 1903.

Under the terms of the new agreement the city engineer is, from time to time, to recommend to the Council the route or routes to be taken by cars carrying light or package freight and express traffic, and every such route is to be subject to the approval of the City Council. Cars are not to be run upon any other route or routes than those approved by the city engineer and adopted by the City Council. Provisions and regulations for the service, which, among other things, shall define the kind,

character, capacity and state of repair of the cars, and the nature, character and quantity of the light or package freight and express traffic to be carried, and the hours of operation, together with the speed, are to be recommended by the city engineer and adopted by the City Council. In order to secure the company against the whims of changing administrations the City Council may only vary the kind, character and capacity of the cars every five years. Even then the variations must not unreasonably affect the cars in use.

For the purposes of both passenger and freight traffic the company is given permission to connect its tracks with the tracks of any suburban electric railway at the limits of the city, and to receive cars on their arrival at the city limits, and operate them over the route so designated to the St. Lawrence Market, and to such other points as the City Council may deem necessary and designate. The suburban cars are, of course, to be operated within the city limits by the Toronto Company, and the company's usual fares are to be collected from passengers. All fares collected within the city are to be entered on the company's books, and the percentage provided for in the agreement governing the city and the company is to be paid to the city. The company is also to charge for freight and express traffic a rate at least proportionate to the mileage the freight is carried. All receipts from freight are to be added to the gross receipts of the company, and the city is to be entitled to a percentage thereon, as provided for percentages upon passenger receipts under the agreement governing the city and the company.

The company may, with the consent of the City Council, acquire station grounds within the limits and connect its tracks therewith. The location of all new tracks and works upon the streets, however, is to be subject to the direction and supervision, and is to be done to the satisfaction, of the city engineer. Provision is made that work not meeting the requirement of the engineer may be done over by him and charged to the company.

The city agrees to assist the company to secure any steam railroad crossings that may be necessary, but the company is to be responsible for damages or court actions that arise.

If at any times it be necessary, in the opinion of the city engineer, to purchase or expropriate any private rights of way for the purpose of the freight traffic, the City Council may, if it approve thereof by by-law, purpose or expropriate such rights of way, and the company is to construct and operate its lines thereon as part of its system. All such construction and operation is to be subject to the terms of the agreement governing the city and the company, and such right of way is to remain vested in the city.

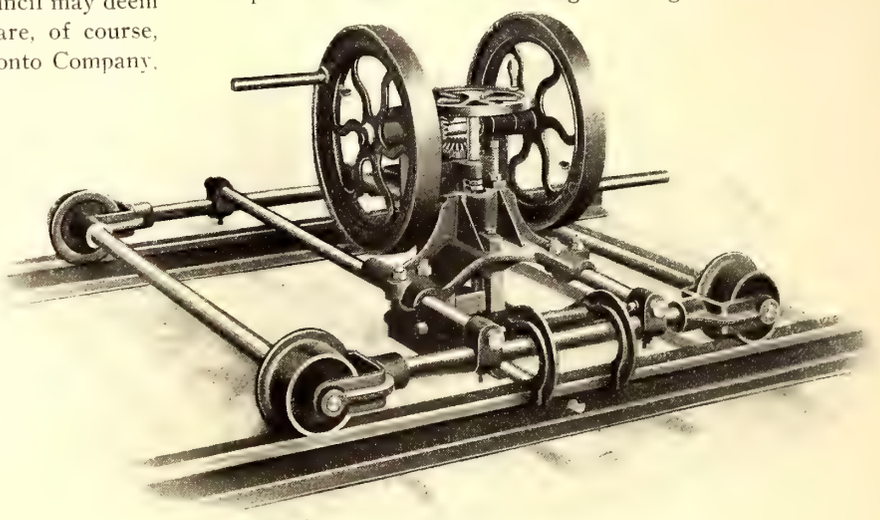
Further, the company agrees to arrange for bringing into the city the cars of any new lines that may be built, the existing terms to apply in any such cases. In the event of connection being made by the company with the Metropolitan Railway, which operates the only independent line in the city, an agreement is to be entered into providing that no fare greater than that charged within the present or any future limits of the city shall be charged between any point in the city and Mount Pleasant Cemetery.

All disputes and differences that arise under the new agreement are to be referred, under the Arbitration Act, to a judge of the County Court of the County of York, to be agreed upon by the parties hereto, and in default of such agreement to a judge of the High Court, to be appointed by the Chief Justice of Ontario. Appeal from the award may be made to Court of Appeal for Ontario, the decision of which court shall be final.

It is further provided that the arbitrator or the Court of Appeal may direct the manner and time in which default or neglect of contract shall be remedied. If the arbitrator of the Court of Appeal will not make such a direction, or will not order specific performances of the agreement, the arbitrator or the court is to determine and set forth the rights of the parties and the manner and time in which default or neglect shall or ought to be remedied. If default or neglect be not remedied in the manner or time so directed or determined, all rights under the agreement shall, at the option of the city, wholly cease.

TRACK DRILLING MACHINE

Experienced electric railway engineers agree that to insure good contact it is best to put in the rail-bonds immediately after drilling the rails. To quickly and neatly accomplish this work the Ludlow Supply Company, of Cleveland, Ohio, has recently brought out the hand-power machine illustrated in the accompanying cut. The manufacturer states that many of these machines are now in use, giving very good service.



HAND TRACK DRILL

PERSUASIVE METHOD ADOPTED IN CINCINNATI

The Cincinnati Traction Company has abolished the practice of suspending employees for violations of the rules. At a recent meeting of the Traction Employees' Mutual Protective Association Superintendent Robert E. Lee, of the company, announced that after Aug. 1 all employees would be placed on their honor for strict observance of rules and the maintenance of discipline. It is the purpose of the company to lift its employees to a higher standard. As pointed out by those who advocate the merit system of discipline, the management at Cincinnati holds that the suspension of a man is unduly severe because of the indirect suffering it sometimes inflicts on an entire family. Then, too, enforced idleness often results in bad associations, for "an idle man is the devil's workshop." Hereafter any employee violating a rule will be called before the superintendent. A moral sermon will be delivered to the man, and if he persists in disobeying the rules he will be dismissed from the service with no hope of re-employment by the company. It is the intention to make the employees feel that they have more than a passing interest in the welfare of the company. Hereafter promotion to inspectors and division superintendents will be made by advancements from the ranks. By this plan the company hopes to make the men feel that there are prospects of advancement, and that with attention to duty and ability to fill more responsible positions advancement is certain to come.

FINANCIAL INTELLIGENCE

WALL STREET, Aug. 12, 1903.

The Money Market

The feature of the money market this week has been the decided strength which prevailed in the time-loan department. Short-time funds which, a week ago, were practically unlendable at 3½ and 4 per cent, now command 4½ and 5 per cent, while the rate for over-the-year money has risen from 5¼ to 6 per cent, with only moderate amounts obtainable at the high figure. The strength is due largely to the preparations making by the local institutions to meet the demands soon to be made upon them for crop-moving purposes. For this reason the banks are not offering time loans in large amounts, preferring to put their surplus funds out on call at the present comparatively low rates, namely, 1½ and 2 per cent. The demand from stock commission houses is not large, but the inquiry from mercantile sources is reflected in a further advance in the rate for prime names to 5¾ and 6 per cent. Another important factor is the material falling off in the receipts of currency from out of town, indicating the growing demand for funds at the leading interior cities. For the week ending August 10, the receipts were the smallest for any week since April 11, while the shipments from New York were the largest recorded in several months. A very important factor, and one which, in all probability, will exert a great influence in the money market in the near future, is the declining market for sterling exchange. Europe has been a heavy purchaser of stocks in the local market, and the heavy offerings of bills against these purchasers has already brought the demand rate down to 485.15 or about 40 points away from the gold importing rates, and it appears now as if the regular autumn movement of gold will begin earlier than usual. The discount rate at London remains firm at 2¾ per cent. At Paris the rate is unchanged at 2⅛ per cent, but at Berlin the rate is slightly higher at 3¼.

The Stock Market

It now looks as though the long-expected and much-desired change for the better in the stock market has at last come about. Confidence in the stability of security values, which has long been absent, is slowly but surely returning, and while this has not yet been made manifest by any wholesale buying of stocks, it has become evident in purchases by "bargain hunters" and large financial institutions, who have found too tempting the handsome returns on the investment which many stocks now yield. The absence of further "troubles" in the financial world, which the speculative and investing public were made to fear by reason of the recent failures on the Stock Exchange and the alarming rumors that have until very lately been in circulation in Wall Street, has been one of the chief causes for the growing optimism; still there are other considerations that have served to bring about the more cheerful feeling. Chief among these are the promises of a plentiful harvest, particularly as applies to corn, the declining tendency of foreign exchange, which has brought the rates to within striking distance of the point at which gold could be imported from Europe at a profit; the general ease of the local money market; continued excellent railway earnings, and the more tranquil conditions prevailing in the field of labor. All these have led to an improvement in share values, following the severe slumps that took place in consequence of last Saturday's disappointing showing of the loan account of the New York City banks, and as, at this writing, it is expected that the forthcoming exhibit of the Clearing House institutions will be much more favorable than the last, especially in view of the larger disbursements now being made by the Government on pension and other accounts, the prospects are that the improvement, which has already carried prices well above their extreme low level of the recent depression, will go further. The so-called "big" people, who have, for a considerable time, maintained an almost stolid indifference to the course of stocks generally, now appears to be aggressively arrayed on the bull side, and this fact is likely to be made apparent before long in a pronounced upward movement in prices.

This feeling of optimism has been communicated in no small degree to the local traction group, and such stocks as Manhattan, Metropolitan Street Railway, and Brooklyn Rapid Transit seem destined to play no insignificant part in the rally which now appears practically certain to be continued indefinitely. All these companies are now loaning more money than ever before, and the permanency of the rates of dividend now being paid by most of them is beyond question. Some interesting developments in connection with the recent change of ownership of the Queens County Electric Company are expected in the not distant future, many usually well-informed people believing that it will ultimately transpire that the Pennsylvania Railroad has secured control of the property. It is also surmised that the same interest has been a large buyer of the shares of the Brooklyn Rapid Transit Company at the prevailing low figures, and that sooner or later it may likewise turn up in control of that system.

Philadelphia

The Philadelphia Traction market during the latter part of the week ending August 8 was characterized by liquidation and falling prices. The United Gas broke to 80, Philadelphia Company to 37¾, Union Traction to 42½, Philadelphia Traction to 94¼ and Rapid Transit to 11. The transactions were, however, on a narrow scale, and the weakness seemed to be due more to neglect than to liquidation. With a relief in the pressure at New York, the market responded to the advance and the United Gas rose to 83 and the Philadelphia Company 38. According to reports, the Philadelphia Company has increased its gross earnings during the first six months of 1903 $878,000, and its surplus available for dividends on the common stock $128,295. The preferred on an odd lot sold as low as 43¾ during the week. The Philadelphia traction stocks followed the general course of the market. Rapid Transit was well supported on Aug. 11 at 11¾, Union Traction closed at 42⅜ and Philadelphia Traction at 94. An estimate of the Philadelphia Rapid Transit earnings over operating expenses for its first year of operation is $7,867,780, which, after payment of taxes, licenses and fixed charges will have a surplus of about $250,000 for the year. American Railways closed at 43, in spite of the fact that its gross earnings for July show an increase of about 15 per cent over those of July, 1902.

Chicago

The Chicago market has been quiet during the week with little net changes since the last issue of this paper. Chicago City has remained stationary at 165, Union Traction common at 3½ and the preferred at 30. Every indication points to a favorable outcome of the meeting of the Union Traction stockholders on Aug. 18, at which the new plan for the reorganization of the company is to be acted upon. It is stated that enough proxies approving the plan proposed have been received to assure the success of the whole scheme. Metropolitan Elevated has shown an advance of from 16½ to 18 in the case of the common and 51 to 55 in the case of the preferred, in spite of the passing of the dividend on the preferred stock. It is known that the expenses during the first part of the year were very high and the delay in completing the down-town terminal has prevented as good a showing as would otherwise have been made. With this structural work completed, the company should be in a position to show much better earnings Lake Street Elevated shows a fall of a point from 5¾ to 4¾ as the result of the week, while the South Side Elevated closed at 97 instead of 96½ a week ago.

Other Traction Securities

The Boston stocks have moved within very narrow limits during the past week, the elevated going down to 134 on Aug. 4, but closing at 135½. Massachusetts Electric common closed at 21 and Massachusetts Electric preferred at 80. Baltimore United Railways & Electric has remained stationary at 10½, while incomes have varied between 61½ and 62½ and the 4's between 92½ and 93. Other sales on the Baltimore Exchange include City and Suburban of Washington 5's at 112, City Passenger 5's at 106 and small lots of Charlestown Railway 5's at 104¼ and Baltimore Traction 5's at 112. On the New York curb, the most important changes have been in Interborough Rapid Transit, which sold down to 90 on Aug. 11, as compared with 98½ a week ago. The stock closed offered at 94. New Orleans common closed at 9 as compared with 10⅛ last week, and New Orleans preferred closed at 30. The final sale of Twin City, on Aug. 11, was 91 instead of 93 on Aug. 4. Trading in Cincinnati last week amounted to almost nothing; less than 500 shares of traction stock changing hands. Toledo Railways & Light led in the selling, three lots going at from 22 to 23½, the former the closing figure. Detroit United had a range

of from 67½ to 70¾, closing at 68. Cincinnati Street Railway sold at 131 to 132 on small lots. Miami & Erie Canal dropped to 5 for one small lot. Columbus, Delaware & Marion, Zanesville Railway, Light & Power and Mansfield Railway, Light & Power bonds all sold at 101 for amounts aggregating $28,000. There were slight declines all along the line in Cleveland. A block of 100 Detroit United came out at 67½ a price 2½ points higher than the extreme low figure recorded in the local market some months ago. Lake Shore Electric preferred, a 6 per cent cumulative issue, sold at 45, a decline of 4⅛ from last previous. Northern Ohio Traction & Light broke to 18, a new low point. Northen Texas Traction was the single exception to the rule of falling prices. It sold at 29½ and 30 compared with 28, the price of last week. Cleveland & Southwestern preferred sold at 64½. Cleveland Electric gave away two points, selling at 72.

Security Quotations

The following table shows the present bid quotations for the leading traction stock, and the active bonds, as compared with last week:

	Closing Bid	
	Aug. 4	Aug. 11
American Railways	44	43
Aurora, Elgin & Chicago	17½	b17½
Boston Elevated	136	135½
Brooklyn Rapid Transit	42⅞	41
Chicago City	165	165
Chicago Union Traction (common)	3½	3½
Chicago Union Traction (preferred)	30	30
Cleveland Electric	b73	72
Columbus (common)	85	—
Columbus (preferred)	100	102
Consolidated Traction of New Jersey	a67	64
Consolidated Traction of New Jersey 5s	104	103½
Detroit United	b65	65½
Elgin, Aurora & Southern	b52	b52
Lake Shore Electric	b10½	b10½
Lake Street Elevated	5¾	4¾
Manhattan Railway	132	130⅞
Massachusetts Elrectric Cos. (common)	21	21
Massachusetts Electric Cos. (preferred)	78½	80
Metropolitan Elevated, Chicago (common)	16½	18
Metropolitan Elevated, Chicago (preferred)	51	55
Metropolitan Street	117	111
New Orleans (common)	10⅛	9
New Orleans Railways (preferred)	36	30
North American	73	71¾
Northern Ohio Traction & Light	18	18
Philadelphia Rapid Transit	11⅜	11¾
Philadelphia Traction	94½	94
St. Louis Transit (common)	18	17
South Side Elevated (Chicago)	96½	97
Syracuse Rapid Transit	b29½	25
Syracuse Rapid Transit (preferred)	b75	72
Third Avenue	113	111½
Toledo Railway & Light	23	21
Twin City, Minneapolis (common)	93	91
Union Traction (Philadelphia)	43	42⅜
United Railways, St. Louis (preferred)	64½	64½

a Asked. b Last sale. * Ex-dividend. † $10 paid.

Iron and Steel

The pig iron market continues unsettled, and although the steel manufacturers will need a large tonnage to replenish their now depleted supply, do not seem to indicate any great tendency to buy. Consumers of iron and steel are influenced largely by the course of the stock market, and until this improves it is thought by many that the present condition in the iron market will prevail. Quotations are as follows: Bessemer pig, $18.75 to $19; Bessemer steel, $27 to $27.50; steel rails, $28.00; girder rails, $33 to $33.50.

Metals

Quotations of the leading metals follow: Copper, 13 to 13⅛ cents; tin, 28.6 cents; lead, 4⅛ cents; spelter, 5⅜ to 5⅞ cents.

WATERBURY STRIKE SETTLED

The strike of the employees of the Connecticut Railway & Lighting Company at Waterbury and its suburbs, which was begun Sunday, Jan. 11, 1903, was settled Sunday, Aug. 9, the company agreeing to take back part of the strikers at once at the old wages, to give employment to the others as soon as practicable, and to treat with a committee from the men regarding future grievances. The official conditions under which the settlement was made are not available, but from the published statement of Manager Sewall, of the company, no concessions beyond those made months ago were offered by the company. From unofficial sources, it is said that the company agreed to take back sixteen of the old men at the old wages at once, and to give the remainder employment as soon as places can be found for them. The ex-president of the union and nine strikers who were acquitted of the charge of being implicated in an assault on a non-union conductor and a motorman are not to be reinstated, however.

From the very first day of the strike there were many exciting conflicts between the union and non-union men and between the strikers, the police, and later the militia. For days the Waterbury police were utterly unable to cope with the situation, which by Feb. 1 had become so serious that Governor Chamberlain called out sixteen companies of the State militia, under command of Brigadier General Russell Frost, to maintain order.

When the troops arrived at Waterbury they were greeted with yells and hisses by a great crowd of strikers and their sympathizers, and from then until they were recalled the troops had the most strenuous kinds of duty to perform. Four days after the militia arrived order was established to a certain extent, and the following day, through the efforts of Mayor Kilduff and others, a conference between the representatives of the strikers and the company was held in the Aldermanic Chamber. The conference was without result.

On that day the troops left the city, and after that the strike dragged along until Feb. 27, when the most exciting incident of the strike, the killing of a policeman, accurred. At the same time a non-union motorman was beaten into insensibility, but did not succumb to his injuries. The killing of the policeman created the most intense feeling, and rewards aggregating $19,400 were offered for the apprehension of his murderer or murderers.

March 14 Judge Emery, in the Superior Court, granted an injunction forbidding the unions from interfering with the business or the railroads.

ARE INTERURBAN ROADS IN INDIANA TO BE CLASSED WITH STEAM LINES?

The suit for an injunction and damages brought against the Indiana Union Traction Company by the property owners in College Avenue, Indianapolis, is assuming far greater importance than was anticipated by the aggrieved citizens, or at first by the defendant company. Already the citizens of other Indiana cities and towns using interurban roads are manifesting great interest in the action to determine the status of the electric roads, and it is quite evident that if the status is declared, by the courts of last resort, to be commercial, the interurban electric railway will, perhaps, receive a serious setback.

The Indiana courts have repeatedly held that a commercial railroad is an additional burden on the streets, though a street railroad is not. The question to be decided in this case is whether an interurban, carrying freight and passengers, running heavy cars and trailers, and connecting widely separated towns, is a commercial road in the light of previous decisions concerning steam railroads. As to the matter of damages it would seem that the character of the motive power would make no difference. That College Avenue property has been seriously injured in its sale and rental value by reason of making it a thoroughfare for heavy interurban cars is recognized by the tax authorities in reducing the assessment thereon 20 per cent. If the interurban can be made to compensate for this damage in rendering streets undesirable for residence purposes, or can be compelled to provide for themselves avenues of entry such as steam roads are compelled to provide, the decision would be sufficiently sweeping to revolutionize present admirable arrangements so far as the public is concerned. It is given out, fearing the issue, that the Union Traction Company will compromise with the complaining citizens by settling with them out of court and agreeing that the Indianapolis & Northern cars will not be brought in over College Avenue. Traction men, however, do not all take the view that a compromise will be advisable. They say the issue will be raised sooner or later, and it may as well come now as several years hence. It is certainly an important question, touching as it does the rights of the interurban and the convenience of the people.

A carload of horses was shipped over the interurban railway between Montpelier and Indianapolis, Ind., a few days ago. The sender, a well-known breeder of race horses, expressed himself as pleased with the handling of the horses, and said that hereafter, whenever possible, he would ship his horses on the interurbans in preference to the steam roads.

RICHMOND STRIKE DYING OUT

The strike of the employees of the Richmond Passenger & Power Company, which has been the cause of much disorder and bloodshed in Richmond and Manchester, is now on its last legs. The financial assistance received by the strikers from other labor organizations has been very slight, and many of the men are now begging for reinstatement. All of the company's lines are in operation, giving regular service. With the exception of the labor boycott, which, however, is gradually decreasing, traffic is back to normal conditions.

A few rocks are thrown at cars occasionally, but no other disorder is reported. The company has offered a large reward for the conviction of the dynamiters, which seems to have put a stop to this nefarious practice.

MEETING OF THE AMERICAN RAILWAY AND MECHANICAL ASSOCIATION

Members of this Association should remember that the convention commences one day earlier than that of the American Street Railway Association. The first meeting of the Railway and Mechanical Association will be held on Tuesday, Sept. 1, 10:30 a. m. An invitation was extended to Hon. Edgar T. Brackett, State Senator of New York State, to deliver the address of welcome to the Association and the invitation has been accepted.

The meetings on Sept. 2, 3 and 4 will be called to order at 10:00 a. m. The papers to be read are as follows:

Shop Kinks, by H. H. Adams, of Baltimore.

Type M Control, by W. O. Mundy, of St. Louis.

Improvements in Street Car Motors, by E. W. Olds, of Milwaukee.

Care and Maintenance of Car Bodies, by C. F. Baker, of Boston.

Shop Practice, by Alfred Green, of Rochester.

The Use and Abuse of Controlling Mechanism, by D. F. Carver, of Jersey City.

NOVELTIES IN EXPOSITION BOOTHS

In marked contrast to the old-time sheds and shelters under which, for a generation, those who exhibit at fairs, conventions and expositions have entertained visitors and descanted on the merits of their inventions and appliances, are the novel and convenient creations of the professional booth builder and decorator. He must have above all, imagination; and if he lack boldness, originality, and, withal, a sense of harmony, he cannot succeed in these days of strenuous competition in the arts as well as the crafts.

The Allen-Baker Company, which makes a specialty of just this class of work, has made arrangements this year to construct a number of the principal booths for exhibitors at the Saratoga Convention, and its services will be found very convenient for those who have not the time to undertake the work themselves, or who wish especially attractive headquarters. The company's headquarters for this class of contracts is at 10 North Market Street, Boston, where Mr. Allen, the president of the company, personally superintends all exposition work. The company will have a staff of artists and workmen at Saratoga Springs next week; but it is better to write the company at Boston.

STRIKE IN LONG ISLAND CITY

About one-third of the employees of the New York & Queens County Railway Company, of Long Island City, went on strike Sunday, Aug. 9. The extra schedule which is in force on Sundays and holidays, to care for the immense excursion traffic, was seriously interfered with, but in no other way did the company suffer. In fact, the strike petered out so quickly that by Monday it had been declared off, and the fomentors of the trouble, in the shape of three extra men, were seeking reinstatement. It seems that the three men just referred to called upon General Manager Fuller, of the company, early Sunday morning, and asked for recognition of "the union." Mr. Fuller told them that Sunday was not the proper time to make demands, and that on Monday he would willingly give hearings to all who had grievances. They returned to the car houses, and after a conference with the other extra men, it was decided not to take the cars out. A few of the regular men, it seems, threw their lot in with the "extras," but the majority remained faithful to the company. The police prepared at once for disorder, but not an act of violence was reported.

CONVENTION OF THE INCORPORATED MUNICIPAL ELECTRICAL ASSOCIATION OF GREAT BRITAIN

The eighth annual convention of the Incorporated Municipal Electrical Association of Great Britain was successfully held this year, the meetings being divided between Sunderland, Newcastle-on-Tyne, and Middlesbrough. The first meeting took place in Sunderland, Mr. J. F. C. Snell, president of this year, occupying the chair. An official welcome was extended to the association by the Mayor and Aldermen, who stated that in Sunderland they have invested something like a half million of money for the electrical equipment of tramways and power. Mr. Snell then read his presidential address, after which the following papers were read and discussed:

1. Statistics of Electrical Supply, by Alderman J. P. Smith, J. P. (member of Council), ex-Mayor and chairman of the electricity committee, Barrow-in-Furness.

2. The Possibilities of Future Economies in Electrical Illumination, by Mr. W. A. Chamen (past president), chief electrical engineer, Glasgow.

A substantial luncheon was then provided by the Mayor and Corporation of Sunderland in the Town Hall, after which special cars took the delegates to various stations and sub-stations in the city and vicinity. After these had been inspected the delegates proceeded to the new harbor now being constructed by the River Weir Commission, where tea was served by the Corporation. On Thursday, July 16, the association met at Newcastle, where the delegates were welcomed by the Right Worshipful the Mayor of Newcastle-on-Tyne, Sir William Stephenson, who, in a very interesting speech, remarked that he thought it was rather an anomaly that he should be chosen to welcome the delegates of the Municipal Electrical Association when he himself was the chairman of the Newcastle & Gateshead Gas Company. He believed, however, that there was plenty of room for both electricity and gas, and all they wanted was a fair fight. Papers were then submitted by the following and freely discussed:

1. The Sphere of Utility of a Power Company, by Alderman G. Pearson, J. P. (honorable solicitor), chairman of the Bristol electricity committee.

2. Electrical Traction as Applied to the Newcastle Tramways, by Mr. A. E. Le Rossignol, chief electrical engineer and general manager, Newcastle Corporation tramways. This paper contained a table of costs of operation of the Newcastle tramways which was published in the last issue.

3. The Management and Working of Boilers, by Mr. Horace Root, chief electrical engineer, Tunbridge Wells.

In the afternoon a visit was made to the corporation tramways power house, and visits were also arranged to the works of Messrs. Parsons at Heaton, Messrs. Holmes & Co., Messrs. Scott & Mountain, Messrs. Clarke, Chapman & Co., and the North Eastern Marine Works and other places. In the evening the association smoking concert, in conjunction with the local section of the Institution of Electrical Engineers, was held, which was well patronized and fully enjoyed by the members, though perhaps the musical portion of the entertainment was not given as much attention as would be desired by the artistes. On the following day the meeting was convened at Middlesbrough at the Council Chamber, Town Hall. The following papers were read and elicited interesting discussion:

1. Methods of Stimulating Demands, by Councillor J. E. Panton, M. D., member of council, chairman of the Bolton electricity committee.

2. The Financial Improvement of Electricity Supply Works, by J. A. Jeckell, chief electrical engineer, Coventry.

Luncheon was served to the delegates in the crypt of the Town Hall by invitation of the Mayor and Corporation of Middlesbrough. After luncheon, brakes were largely taken advantage of to drive to the following list of works, which were visited: Messrs. Bolckow, Vaughn & Co., Ltd.; Messrs. Dorman & Long, Ltd.; Messrs. The North-Eastern Steel Co., Ltd.; Messrs. Sir B. Samuelson & Co., Ltd., and N. E. Railway Company's dock installation. On the return from these visits special cars were provided for Stockton in order to visit the Imperial Tramways Company's 3-phase power house and the Stockton Corporation Electricity works, which concluded the ordinary meetings of the convention. The annual general business meetings of the association was held on Saturday. the following officials were elected for the ensuing year:

PNEUMATIC SLIPPER BRAKE

In the STREET RAILWAY JOURNAL of Aug. 1, a detailed description was presented of the Hewitt & Rhodes pneumatic brake. Through an oversight omission was made of the fact that the manufacturers of this brake are Estler Brothers, of London, Eng., who state that this brake is being used with much success.

STREET RAILWAY PATENTS

UNITED STATES PATENTS ISSUED AUGUST 4, 1903.

735,083. Switch Operating Device; G. E. Fry, Allegheny, Pa. App. filed Aug. 28, 1902. The switch point is moved by the car wheel which strikes a lever first set into position by an electric magnet.

735,237. Trolley Wheel; R. and R. W. Fox, Parkersburg, W. Va. App. filed May 20, 1903. The boxes of the axle have curved surfaces, which slide in the cheeks of the harp, permitting the wheel to tilt.

735,246. Car Brake; S. H. Graden, Parkville, Mo. App. filed Dec. 19, 1902. A triangular block is thrust under the wheel and bears against both the wheel and the rail.

735,340. Surface Contact Electric Railway System; W. M. Brown, Johnstown, Pa. App. filed Dec. 18, 1902. The magnet carried by the car sometimes picks up iron objects from the roadway; these are removed by a stronger magnet in the roadbed, located just ahead of a crossing, or siding rail, to thus prevent short circuiting due to such iron pieces coming in contact with the rail.

735,416. Electric Signaling Apparatus; H. W. Souder, Tamaqua, Pa. App. filed March 25, 1902. A system capable of being operated by a number of cars following one another in the same direction, and affording information to each motorman of the fact that one or more cars are ahead of him.

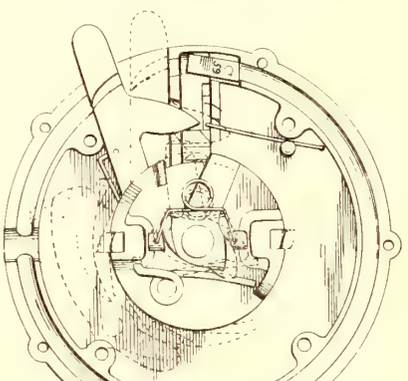
735,417. Electric Signaling Apparatus; H. W. Souder, Tamaqua, Pa. App. filed Aug. 30, 1902. When the circuit closer is operated on the entrance of a car to a block, the distant signal is first actuated, whereupon if that signal be in good working order, the home signal is set; thus the motorman knows on entering the block that the distant signal is properly set.

735,419. Trolley Contact. H. W. Souder, Tamaqua, Pa. App. filed Sept. 25, 1902. A bar having teeth is arranged each side of the wire in a position to be struck by the trolley wheel to close a circuit.

735,426. Brake Shoe; J. S. Thompson, Chicago Heights, Ill. App. filed April 14, 1903. A brake shoe having a backing composed of two rods, diagonally arranged, and attached to an insert in the face of the shoe.

735,534. Derailer; M. P. Layton and J. W. VanDoren, Minonk, Ill. App. filed Sept. 16, 1902. The derailer can be placed on a siding or switch, and as cars are admitted into the siding it will not interfere with their movement, but in case the cars are started in the opposite direction, they will be derailed.

735,535. Car Fender; R. C. Layton, New York, N. Y. App. filed Jan. 5, 1903. A rectangular frame across which a net is stretched, one side being hinged to the dash and collapsible braces supporting it from above and below.



PATENT NO. 735,672

735,576. Railway Switch; J. M. Payne, Spokane, Wash. App. filed Jan. 9, 1903. A projection from a car platform will throw the switch point.

735,584. Surface Contact Railway System; W. B. Potter, Schenectady, N. Y. App. filed April 23, 1902. Positive and negative feeders lead from the power station, the latter being grounded at a single point located at the end most distant from the station.

735,612. Single Link Strain; L. Steinberger, New York, N. Y. App. filed Jan. 29, 1903. The single link has an eye through which a tube passes, the two parts being insulated from each other, and surrounded by a sphere of insulation.

735,613. Suspension Fixture; L. Steinberger, New York, N. Y. App. filed Feb. 2, 1903. A fixture adapted to serve either as a turn-buckle, a strain, or a hanger for a span-wire clip.

735,626. Radial Swing Truck; B. R. Van Kirk, Philadelphia, Pa. App. filed April 13, 1903. The object is to arrange the pivot of the equalizing beam, so that it can swing freely.

735,639. Axle Locking Device for Trolley Harps; A. J. Wiggin, Kennebunk, Me. App. filed Feb. 7, 1902. A spring place on the fork embraces the square end of the axle.

735,672. Trolley Retriever; A. W. Knutson, Canton, Ohio. App. filed Jan. 17, 1903. Details of construction of a spring drum and pawl and ratchet mechanism.

PERSONAL MENTION

MR. T. R. GABLE has been appointed general traffic manager of the freight and passenger departments of the Los Angeles-Pacific Railroad Company, of Los Angeles, Cal., with headquarters in Los Angeles.

MR. H. F. TATE, Western manager of the National Conduit & Cable Company, had a sad bereavement lately in the death of his 12-year-old daughter, Beatrice, who was killed at Williamsport, Pa., by a train.

MR. GEORGE S. PRATT has resigned his position as general sales agent of the Niles Car & Manufacturing Company, and is spending a short vacation at Westport Harbor. It is understood that Mr. Pratt will re-enter the railway field again in a few weeks.

MR. B. HASKELL, formerly superintendent of motive power of the Pere Marquette Railroad, has been appointed general manager of the Franklin Mill & Foundry Company, of Franklin, Pa. This is the company which is making the Tripartite steel pole for overhead electric railway construction.

MR. JAMES R. ATCHISON, for five years superintendent of the power department of the Los Angeles Railway Company, of Los Angeles, Cal., has resigned to take up more remunerative power work in San Francisco. On August 1, Mr. William Jennings was appointed acting superintendent.

MR. JOHN DUNN, for a number of years superintendent of electrical construction for the Cleveland City Railway Company, of Cleveland, Ohio, has been appointed city electrician of Cleveland by Mayor Tom L. Johnson. Mr. Dunn resigned from the Cleveland City Company at the time of the consolidation of that company with the Cleveland Electric Railway Company.

MR. ERNEST GONZENBACH has been appointed electrical engineer for the Youngstown & Southern Railway, which is to be a third-rail road, extending from Youngstown to East Liverpool, Ohio. Mr. Gonzenbach is well known as the electrical engineer who laid out the Albany & Hudson Railway, and later as electrical engineer for the Aurora, Elgin & Chicago Railway. He has already assumed his duties. The Youngstown & Southern will be designed for heavy service.

MR. WILLIAM PESTELL has resigned as superintendent of motive power of the Worcester Consolidated Street Railway Company, of Worcester, Mass., to become connected with J. G. White & Company, of New York. Mr. Pestell's experience in the railway field dates from the pioneer days. In turn since 1890 he has at different times been connected with the Sprague Company, Naumkeag Street Railway, the Lynn & Boston Company and the Massachusetts Electric Companies.

MR. H. H. VREELAND, president of the Metropolitan Street Railway Company of New York, has just returned from a two months' trip to Europe, where he visited Great Britain, France and Belgium. Much of Mr. Vreeland's time, however, was spent in London, where he looked over the rapid transit problem in that city, and incidentally had several long conferences with the Parliamentary committee that is engaged in trying to work out the solution of the transit problem in that city. Mr. Vreeland has arranged to have a commission of the Royal Commission on London Street Traffic, which is to start for the United States Sept. 18, to make a special study of conditions in New York, and he will make arrangements for entertaining the members.

MR. FRED D. SAMPSON, manager of the Electric Railway, Light & Power Department of the Charlotte Electric Railway, Light & Power Company, Charlotte, N. C., sails on the Kaiser Wilhelm II. for a short visit to his old home in England, Aug. 25. Mr. Sampson has been connected with the Charlotte company since 1895, and prior to that time was connected with the General Electric Company, the Lake Roland Elevated of Baltimore, the Brooklyn Heights, and the Twin City Rapid Transit companies as electrical engineer. Under Mr. Sampson's supervision the Charlotte property has been entirely remodelled and rebuilt. The company now operates twelve miles of track and twenty cars, besides controlling the lighting, power and gas interests of the city.

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Indiana and Ohio Joined

Last week witnessed the completion of the last connecting link between the interurban electric railway network centering at Indianapolis and that of Southern Ohio. The completion of this bit of track between Richmond, Ind., and Eaton, Ohio, by the Dayton & Western Railway Company has made possible the operation of through interurban cars between the capitals of the two greatest interurban railway States of the Union.

The distance from Indianapolis to Columbus is 188 miles, which makes possible the longest trolley ride in one general direction now available in the United States. To this, however, might be added the distance from Columbus east to Newark, 38 miles, and the distance from Indianapolis, southwest to Martinsville, 30 miles, which would make a trip of 256 miles in the same general direction. To those who have been actively engaged in interurban construction in Indiana and Ohio this joining together of two great networks, one of Central Indiana and the other of Southern Ohio, has been worked up to so gradually that it seems but a natural outcome for all this activity. To those who have not followed the interurban development of the past five years, the map showing the networks which are connected, which accompanies the article on the opening of the interstate connection, elsewhere in this issue, is a revelation. Our interurban friends in Ohio, however, promise that soon there will be important additions to the through east and west line already established, and that before many months a ride by electric car from Indianapolis to Pittsburg will be possible. It is intended soon to give a sleeping car service over the new interstate route from Columbus to Indianapolis. This is one of those routes regarding which we have previously spoken, where a night's journey on an electric sleeping car would be far preferable to the interruption of a day's business to make the journey on a steam railroad. It is on such routes as this that interurban sleeping car service should pay.

Shocks from High-Voltage Locomotives

Electric locomotives or cars on which voltages more dangerous to life than the common 600-volt direct-current are few as yet, but with the introduction of alternating current their number will increase; and it is in order to call attention to one element of danger in their operation which cannot be too carefully guarded against. It is a danger for which prevention is easy, but is nevertheless a real one, and has already resulted in at least one serious accident in this country. We refer to the possibility that a locomotive may run onto a portion of track covered with sand or dirt, so that there is a partial insulation between the wheels and rails. In such a case, if the locomotive is running on a grounded circuit, using the rails as a return, there is an excellent chance for employees to receive serious shocks in attempting to board the locomotive, because there is likely to be a dangerous voltage between the locomotive frame and ground. Shocks from this cause have not been unknown in street railway practice, but the voltage is usually not dangerous to life on a street railway system, and there is considerable insulating wood in the make-up of a car. On an electric locomotive, using high-tension electric current, and having a steel frame, however, a shock of this kind is almost certain to be attended with disagreeable consequences. Although the possibilities of a shock from this cause are apparent, consideration is not usually given to the danger, so that we feel justified in uttering this warning. One obvious remedy is to omit the sand boxes from such a locomotive's equipment, and furthermore, if the locomotive is ever to operate on dirty rails, it should be equipped with a set of brushes for brushing the rail in advance of the wheel.

Overhauling According to Mileage

There are several methods in vogue in electric railway repair shops for determining the frequency with which the trucks and motors under a given car shall be entirely overhauled. One method is to do this at certain regular intervals of time, varying from one to six months or a year, according to the severity of the service, and the thoroughness of the overhauling. Another plan is to keep watch of the armature bearings and other wearing parts of an equipment, and overhaul the equipment only when the wear on the bearings makes it necessary. The most common way is to see that all the bearings on an equipment are in such condition when the equipment is sent out of the shop that they will outlast the armature bearings. The time that the equipment can run is then determined by the amount that the armature bearings can wear without letting the armature rub on the pole pieces. The clearance between the arma-

ture and the pole pieces is kept track of by motor inspectors, and whenever this becomes dangerously small the equipment is taken out for overhauling, as it is necessary to renew armature bearings, and other parts are renewed, if necessary, at the same time. A third method is to overhaul motors and trucks after they have made a given mileage. In such cases, of course, it is necessary for the shop foreman or master mechanic to know from day to day just what mileage each car has made since it was overhauled. Such records are not difficult to keep, by the thorough systems in use on some roads, though they would be expensive on roads where very few records are kept.

Of the three methods, the two latter seem by all means the most logical. Of course, where a car is overhauled according to the time it has been out of the shop, it is assumed that the mileage of all cars is approximately the same, which may or may not be correct. Such a system, unless it takes account of conditions, in character of service and equipment, of course, might lead to either unnecessary expenditure for overhauling or to neglect; but it is only fair to assume that the master mechanic who overhauls equipment by the mileage system takes all these things into account. It is also fair to assume that he will make extensive trials of the amount of mileage an equipment can make safely before establishing the standard mileage which would determine the frequency with which cars should be over hauled. Overhauling, according to the observed wear on bearings or on other parts, is theoretically the most perfect of the three methods, because by it the full amount of safe wear is obtained from armature bearings, and there is no bringing in of cars for overhauling sooner than is necessary. The only practical flaw in this method is that inspectors may not always notice defects or unsafe amount of wear. With trucks brought in after a certain mileage, or after a certain period of time, such defects would be remedied in the overhauling, whether they were noticed by the inspectors or not. The relative advantages of these methods might well be made the grounds for an extended discussion among master mechanics and shop men.

Limited Service on Interurban Lines

Various kinds of limited service are being given by interurban lines, and it is not always possible for a passenger to enthuse over it after a shake-up and shake-down experience with it, but it is difficult to refrain from enthusiasm over the magnificent high-speed service that is being given by the Indiana Union Traction Company between Muncie and Indianapolis. It is a revelation to the uninitiated to find an interurban electric road that maintains its roadbed and other equipment in such shape as to permit speeds of from 50 miles to 60 miles per hour being maintained continuously over long stretches, and even the experienced interurban railway man knows that the construction and the traffic conditions which make such things possible are as yet few in interurban practice. To the traveling man, who is used to a rain of soot and cinders when the weather is such as to require open windows on fast steam trains, the possibility of being carried over the country at the same speed and smoothness by this limited electric service as on the limited steam trains, and without the dirt, comes as a welcome relief. The traveling man can only say: "Let it be extended until it covers the whole country."

It is sometimes considered by railway managers, both steam and electric, that the fast limited trains are justified mainly from an advertising standpoint, and do not pay from a purely operating standpoint. There is, of course, such a thing as overdoing the fast limited car business on an interurban line. There are very many lines where there is really no object in such a service; but on the whole, limited service is likely to grow more and more common. To give it in a satisfactory manner requires an excellence of roadbed, equipment and operating organization not found everywhere. In fact, it is found at present, as before said, on only a few roads. The place for limited service is naturally between the larger towns, and the experience in Indiana would seem to indicate that there are enough traveling men and other passengers willing to pay a higher rate of fare for limited service, so that the service is justified from other than an advertising standpoint. To one who is watching the development of the interurban road in Indiana and Ohio it is evident that the limited service that is being given by some of the companies in these States is a stepping-stone to an entirely different class of service from that which interurbans were originally built to give; namely, high-speed through service between the larger towns. Heretofore the interurban line has been essentially a line for local traffic. Even if equipped to make high speed between stops, the stops, either for passengers, or on account of the physical restrictions, have been too frequent to permit of a high-schedule speed. The Indiana Union Traction Company, in conducting the service just referred to, for nearly two years past has been fortunate and foresighted in having a track over which, by efficient operating methods, it could run both local and high-speed limited trains. It is thus able to cater to the business, both between the larger and the smaller towns, and is able to secure practically all of the travel, both for the longer and the shorter distances covered by its lines. This could not have been done if the road had been planned, as are many of the Eastern trolley lines, with a single track, and for local service only. This fact is one which might profitably be borne in mind by some of these roads, that traffic will come to the fast line, if the line is there to take it.

It now looks as if electric traction was to take another step, and offer frequent high-speed service between cities located over 75 miles apart, something which has not heretofore been attempted, but which has been discussed in a somewhat vague and indefinite way. The Indianapolis & Cincinnati Traction Company, if its present plans are carried out, will probably be one of the first to try this experiment. This line, which is being built from Indianapolis to Cincinnati by way of Rushville, Ind., has been laid out with the intention of making it essentially a high-speed road, catering to through business between those two cities. The main idea has been to build a road to handle the through business. There has been considerable speculation as to the amount of business a high-speed electric line between the larger Eastern cities, especially between New York and Philadelphia, would secure; but the present appearances are that the first experiment of this kind will be tried between some of the smaller Western cities.

The Passing of the Horse

It is not easy to realize the thoroughness of the change from animal to mechanical traction without resort to the gloomy pathway of statistics. Of about 23,000 miles of tramway track in the United States, only a minute fraction over one per cent is now operated by horses or by the long-eared, mighty-heeled mule. A horse railroad seems an anachronism, a survival from a geologic period long past, chiefly known by fossil remnants cast up along the shores of back alleys, wherein prehistoric frankfurters are cached. And yet the remains of animal traction are even more singular in their nature and distribution than the catastrophe that has swallowed up most of the species. To be precise, there were, as reported at last accounts, 259.1

miles of track in the entire country operated by animal traction. Of that amount, the proud Empire State can boast nearly one-half, 115.17 miles, to be exact, in so distinguished a case. Of the other States, California is a bad second with 42.37 miles, and Kansas, butt of the silk-stockinged politicians, is third on the list with a beggarly 21.63 miles. The rest are scattering—very scattering. Between the three States just mentioned there is so complete and grinding a monopoly of out-of-date equipment that less than 80 miles is left for the rest of the country, and of that, 12 miles is in far-away Hawaii. There are a few small horse (or mule) roads in the South and Southwest, but in the Middle West and the East they have been pretty thoroughly exterminated. New England has but a single small specimen left, which ought to be bought up and preserved by some of the patriotic orders to show posterity the methods of the ancients.

Strange to say, the last refuge of animal traction is found in cities. Boston cherished a mangy mile or so for several years for the exclusive patronage of the exclusive Back Bay, and then the tracks were taken up and the street left to somnolent decay. But New York is the home of the only considerable band of horse roads that remains. The metropolis has nearly all of the quantity credited to the State, more than California combined with Kansas and a few Southern States thrown in for good measure. The old fogy who, in his declining years, longs again to scent the mildewed straw of his boyhood conveyance must come to New York. The antiquarian, hoping to find a museum piece for his collection of out-worn vehicles, must come to New York. New Yorkers howl for rapid transit—and ride to the ferry in horse cars; they turn up the nose of scorn at the pretensions of the Chicago Three-Million Club, and harbor five times as much horse railroad as the whole of Illinois. It is indeed curious that local conditions and local prejudices have so marked the metropolis as a conserver of curios. Some of the down-town cars are well worthy a place beside the ancient bronze chariot recently acquired by the Metropolitan Museum of Art. There are specimens in that collection of far less well-authenticated antiquity. New York, in its determination not to harbor the trolley, has fostered some curious freaks; it has been the scene of more than one fruitless experiment in mechanical traction, but its hundred-odd miles of horse car track is a strange anachronism.

Joking aside, it is a very singular thing that so great a proportion of the remaining horse railroad should exist in a single city, and that the second largest in the world, where the density of traffic is so great as to justify almost any expenditure. One is not surprised at finding little one-mule lines in small Southern towns, where travel, at its best, can hardly keep one car in paint and wheel grease, but it is a shock to think of conditions nearer home. Yet this condition cannot long continue, and a few years at the most will see the last horse car landed in the scrap heap and the last horse out of its weather-beaten traces. If our friends of the automobile are right in their predictions, the horse will soon, too, be freed from use in pleasure vehicles, and from the business traffic, at least, of the cities. If the present speeding of Red Devils continues and increases, it is safe, also, to predict that no one will drive a horse, even in the country, unless he has to, and then only at dead of night, or over precipitous mountain roads that no automobile dare attempt. Even now there are large districts where pleasure driving is practically abandoned, and the residents cut across lots to get running water between themselves and the pursuers. With all these modern improvements, what is to become of our old friend, the horse? Is he to be kept exclusively for horse shows, in which he even now is only a subsidiary feature, for hunting the ferocious anise-seed bag, and for supporting, in their wobbling through space, the gold-laced and the sabred minions of the National Guard? There are, in fact, ribald and mendacious scoffers who have insinuated that the most important function of the metropolitan horse-car lines is to furnish mounts for certain organizations which patriotism forbids us to mention. Or, possibly, the French savant who has been studying dwarf horses may bring the breed to so convenient a size that we may see fair automobilists in the Park with lap-horses. But, however this may be, we live in hope that the horses now enslaved before the bob-tail cars of our down-town lines may soon be released from their antediluvian burdens, and join the great majority of the equine kind.

Automobile Registration

The registration, numbering and licensing of automobiles is now in active process in Massachusetts at the hands of the State Highway Commission. We believe that this is a most commendable step, and that the action of Massachusetts and other States which require owners and drivers of motor vehicles to qualify as to their capacity for running such conveyance is bound to result in greater security to life and property than has previously been enjoyed.

The use of motor vehicles by irresponsible persons lies at the bottom of many a collision and runaway. In fact, we are disposed to regard the automobile as a far greater sinner in this respect than the often unjustly condemned trolley car, and welcome the placing of proper restrictions upon the use of electric, steam or gasolene carriages operated by ignorant or careless drivers. Certainly if the safe operation of modern electric cars over a prescribed and limited path demands a trained and authorized man at the controller, there can be no doubt that the automobile chauffeur should all the more be required to show good cause for being allowed to scorch over the width of roads and highways at his own sweet will.

Cases are rare when an electric car figuring in an accident escapes identification. It is equally important that all motor-driven vehicles be marked with a plain number, so that the occupants can be later made to give an account of themselves in case the instinct to run away overcomes their courage to face the consequences of a casualty. Chauffeurs who keep within the law have nothing to fear from registration, and much to enjoy in the lessened chances of being made the scapegoats of others' iniquities through instances of mistaken identity. The frequency of arrests and fines for over-speeding which are at present swelling the coffers of the treasurers of the towns throughout the country which have speed regulations, is pretty good evidence that a registration law is badly needed, and there is ground for belief that the unjust complaints which have so often been unreasonably made against the trolley car will be lessened in number when the full force of the automobile regulations is felt. At the time of the teamsters' strike in Boston last year the very small part which street cars play in the traffic congestion of that city was mentioned in our columns, and if we apply the same reasoning to the highways, there can be no doubt that the better control of automobiles on the public roads will result in noticeably improved operating conditions on both high and moderate-speed electric railways. We do not begrudge the chauffeur his place on the highway, but we do object to the trolley's bearing the brunt of that unfair criticism which rightfully belongs to the reckless operator of the Purple Terrors that have banished security from many of the roads and streets of this country.

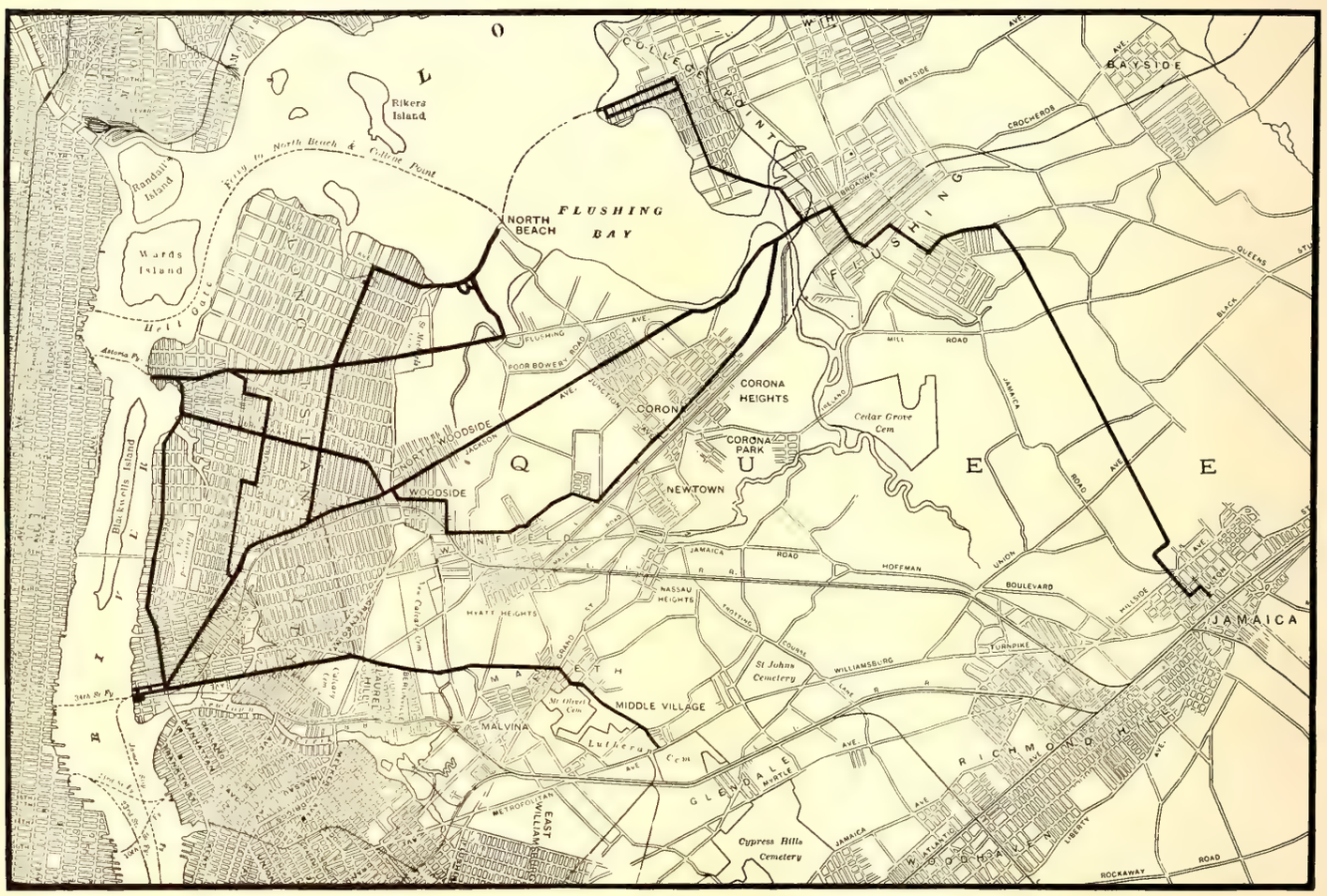
RAILWAY DEVELOPMENT IN QUEENS COUNTY

The recent transfer of ownership of the control of the New York & Queens County Railway, as announced in these pages, has called attention to the large system which is separated from Manhattan Borough only by the East River and from Brooklyn only by Newtown Creek. Whether any large interests now identified with steam or electric railroading are associated with the United States Mortgage & Trust Company in its purchase of the property, as was originally surmised, has not been announced, but the fact makes an examination of the territory served by the company at present, of interest.

The district which now comprises the Borough of Queens in the city of Greater New York contains an area of 127.69 sq. miles, or 41.6 per cent of the total area of Greater New York, while its population in 1900 was only 153,000, or 4.7 per cent of the total population of the city. The borough is in many respects eminently situated for residential purposes, a large part of it being directly across the East River from Manhattan Island, from Thirty-Fourth Street to Ninety-Second Street. The soil is sandy, and the situation between the Atlantic Ocean and Long Island Sound insures an equitable climate, with cool summers and moderate winters. It was the belief of many of the most astute real estate operators fifty years or seventy years ago that land in the territory now situated in Queens Borough would soon become very valuable and be directly in the line of future residential growth. Following out this idea a number of capitalists purchased large tracts in that region, among them the Astors, who established the town of Astoria, and the Steinways, who gave the name of Steinway to the territory purchased by them. It was believed at that time that the greater part of travel between down-town New York and its residential districts would be by steamboats, which had then been recently developed, and as Queens has an extended water frontage the transportation facilities by water are exceptionally good. But with the invention of the steam locomotive and the consequent rapid development of surface transportation methods during the following decades, the East River proved to be a barrier instead of a highway. The elevated railroads in New York, probably, more than any other one factor, or more than all the others together, directed the trend of population in another direction, viz., directly north on Manhattan Island. The result is that the early real estate scheme of the last century failed dismally, and the population of Queens Borough, although showing a remarkable recent growth, has developed much more slowly than that of other parts of the present city of New York.

The achievement of the engineering skill, which in the elevated railways did so much for Harlem during the middle of the last century in the way of land transportation, now, however, promises to exercise an equal transformation in the Borough of Queens. As stated in the articles by Mr. Wheatly during the early part of this year on the passenger traffic problem of Greater New York, two important physical connections are under way between Long Island City and Manhattan Borough. One of these is the four-track tunnel which is being built by the Pennsylvania Railroad between Thirty-First Street, Thirty-Second Street, Thirty-Third Street and Thirty-Fourth Street in New York and Long Island City. As this tunnel will connect Long Island City with the Rapid Transit subway in New York, it will make this suburb as easy of access as any section of the upper part of Manhattan Borough.

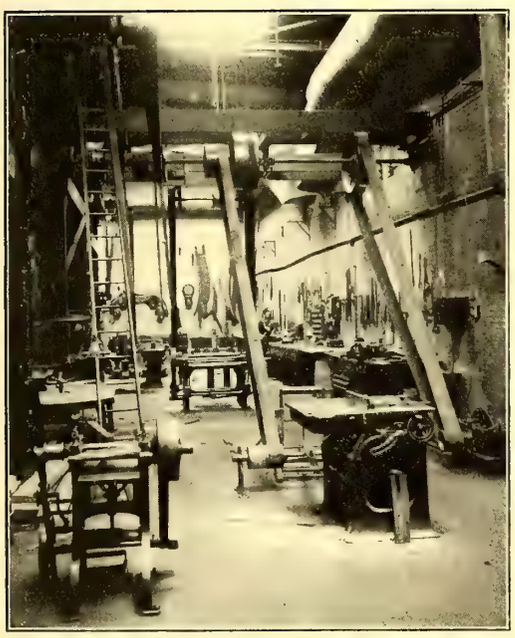
The other connection is the Blackwell's Island Bridge, which will extend from the corner of Second Avenue and Fifty-Ninth Street to a point near Jane Street and Jackson Boulevard in Long Island City. This is very near the junction of what is known as the Dutch Kills line, and the Jackson Avenue line of the New York & Queens County Railway.



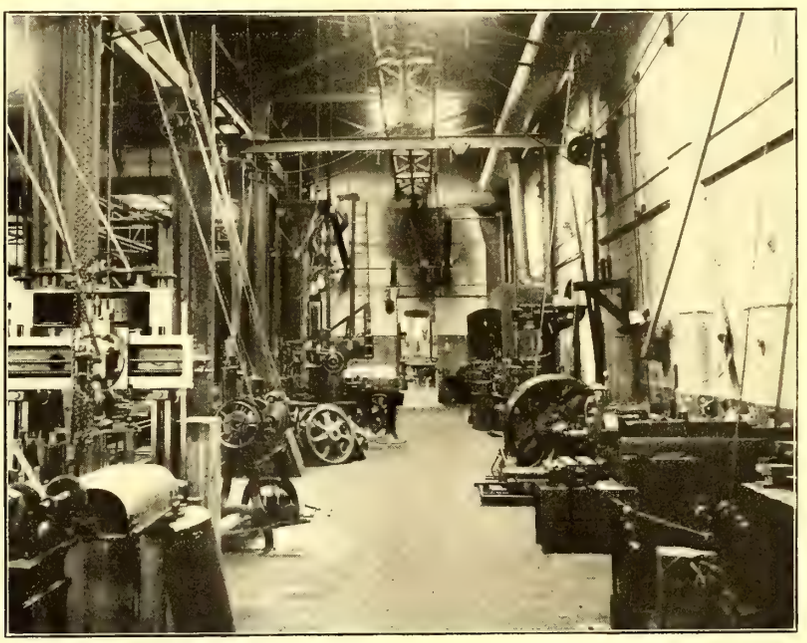
MAP SHOWING SYSTEM OF THE NEW YORK & QUEENS COUNTY RAILWAY



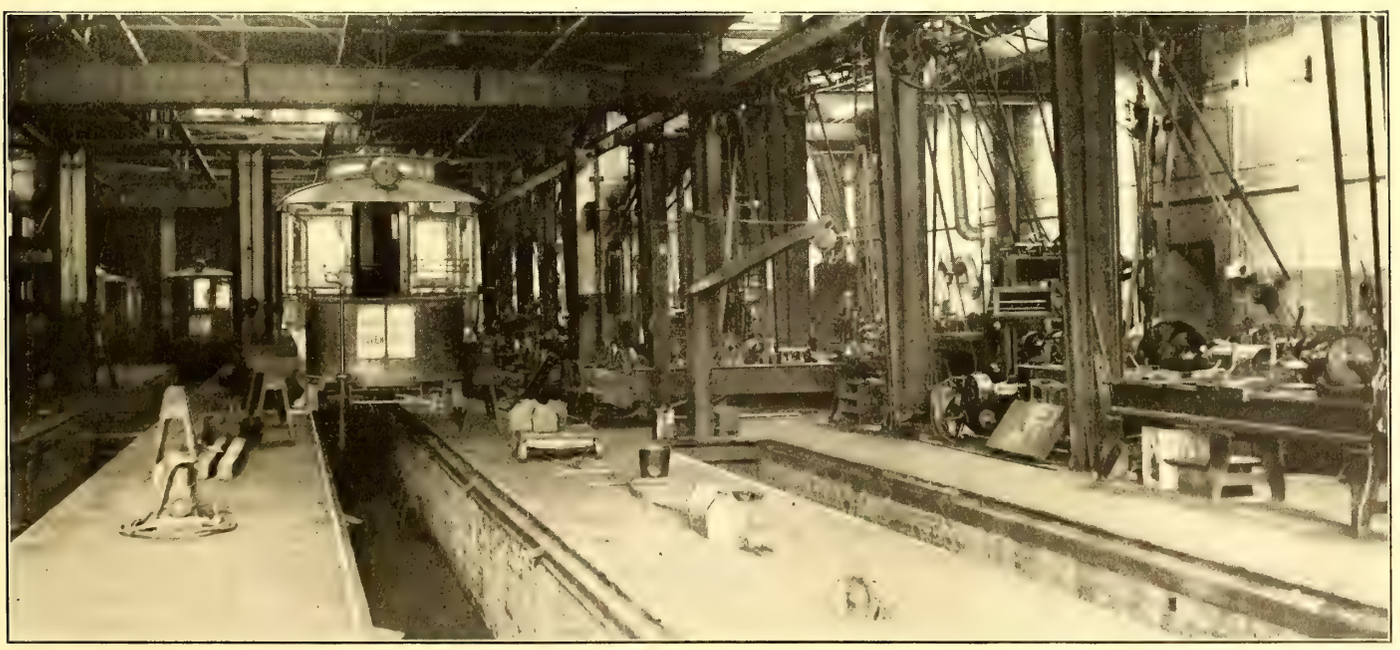
EXTERIOR OF CAR HOUSE AND REPAIR SHOPS AT WOODSIDE



THE WOOD WORKING SHOP

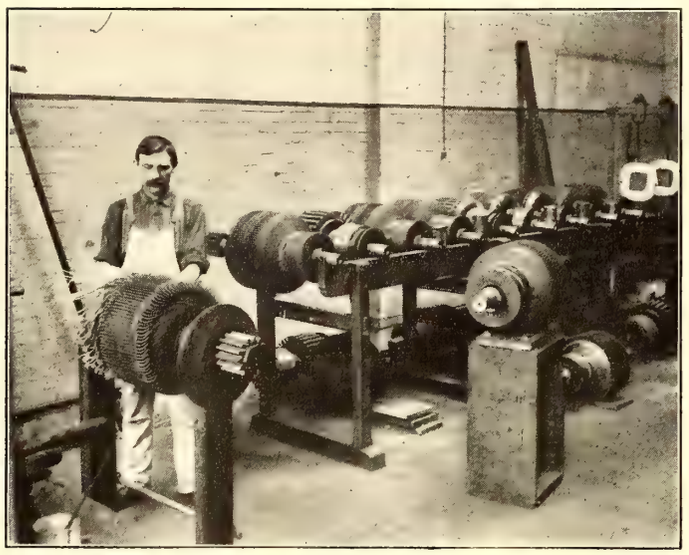


VIEW IN THE MACHINE SHOP

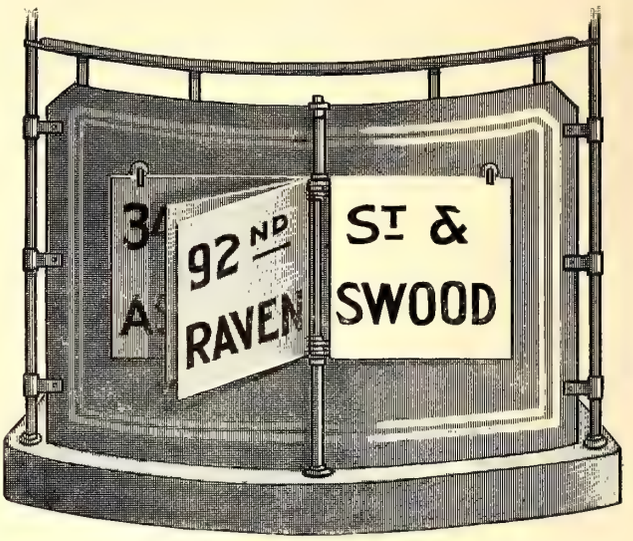


GENERAL VIEW OF THE REPAIR SHOP AT WOODSIDE CAR HOUSE

The foundations for this bridge have already been commenced, and it will have four tracks for trolley cars and two tracks for elevated trains, making an estimated capacity of 700 trolley cars each way per hour and sixty elevated trains. On a basis of fifty passengers per trolley car and 480 passengers per elevated train, the total capacity of the bridge transportation will be 63,800 passengers per hour in each direction. This bridge will connect directly with the elevated system in New York, so that it will bring the vast region at this eastern terminus considerably nearer in point of time than the present Borough of the Bronx.



ARMATURE WINDING DEPARTMENT



CHANGEABLE DESTINATION SIGN

While it is impossible that a passenger movement of the capacity indicated by the figures above should develop within probably several decades after the completion of this means of transportation, the figures published above show the opportunities possessed by the Borough of Queens and the importance which the street railway transportation system of that borough will assume within the next ten years.



CARS WAITING AT TERMINUS OF THIRTY-FOURTH STREET FERRY FROM MANHATTAN

Practically all the street railway lines in this district are now owned and operated by the New York & Queens County Railway Company, an organization which is entirely separate from either of its big neighbors, the Brooklyn Rapid Transit Company or the Metropolitan Street Railway Company. The company was chartered in 1896 as a consolidation of the Steinway Railway Company, the Long Island City Railway Company, the Newtown Railway Company, the Riker Avenue Railway Company, the Long Island City & Newtown Railway Company and the Flushing & College Point Railway Company. It was owned largely in Philadelphia, until the change in ownership mentioned above. It is under the management of F. L. Fuller, formerly general manager of the United Power & Transportation Company, of Philadelphia who was appointed about six months ago. The company owns 75.47 miles of track and operates 203 motor cars. The system owned by the company is shown on page 250.

As will be seen, there are at present two main termini, one at the Astoria ferry, which connects with Ninety-Second Street, New York, and the other at the foot of Borden Avenue, where there are ferry connections to Thirty-Fourth Street and Jay Street. As there is no elevated or surface railway connection on the New York side at Ninety-Second Street, the greater part of the traffic to New York is carried to the Borden Avenue terminal. The line also runs to two or three very popular shore resorts, one at North Beach and another at College Point; serves four large cemeteries and supplies the only electric railway transportation between the New York ferries and

Long Island City, Flushing and other population centers.

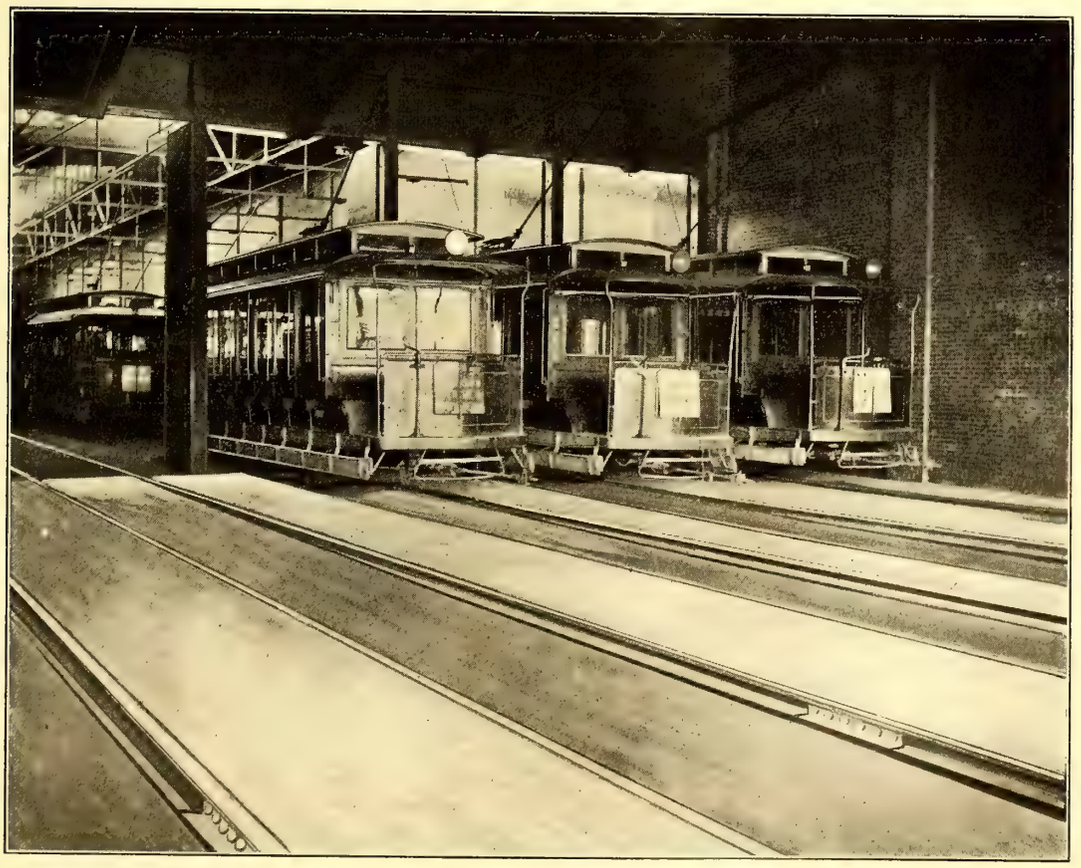
The traffic development of the New York & Queens County Railway Company is a question largely of the future, so that the purpose of this article is not to discuss this branch of the subject, which remains yet largely to be worked out, but to outline the situation in this borough and also to take up some of the interesting points from a mechanical standpoint which exist on the system.

CAR HOUSE REPAIR SHOP

Of these perhaps the most interesting, from a street railway standpoint, are the repair shops and car house at Woodside, of which a plan view is given on pages 254 and 255. The latter diagram gives the arrangement of the repair shop portion on a larger scale. Although somewhat restricted in area the repair shop has been carefully laid out to utilize all of the space available.

The building is a very handsome brick structure, about 260 ft. x 348 ft., and was erected several years ago from designs drawn up by J. H. Bickford, consulting engineer of Salem, Mass., and is in charge of C. F. Banghart, superintendent of motive power. The car house has a capacity of 200 cars, and is divided into one large storage room with ten tracks, one smaller storage room with five tracks, a wash room, the repair shop with four tracks, offices, store rooms, waiting room, etc. A spur track from the Long Island Railroad also extends along the side of the building, in which are the store rooms of the company, so that all supplies can easily be unloaded into the proper rooms provided for the purpose.

As the repair shop is not only well equipped with machine tools for the repair of cars, but as the tools are very conveniently located for the repair of cars, extending as they do along the repair tracks, a list is given below of the tools employed:



WASH ROOM AT ENTRANCE TO CAR HOUSE

LIST OF TOOLS

Carpenter Shop

1 rip and crosscut circular saw.
1 pony planer.
1 large planer.
1 16-in. drill press.
1 mortiser and borer, 5-in. stroke.
1 vertical borer, 10-in. stroke.



FRONT ELEVATION OF ENTRANCE TO CAR HOUSE

1 double spindle shaper, (spindles are 24 ins. apart).
1 hand feed jointer.
1 wood turning lathe.
1 36-in. band saw.
1 grindstone.

Machine Shop

1 20-in. lathe.
1 11-in. lathe.
1 14-in. lathe.
1 planer, width of table 30 ins., length of table 8 ft.
1 24-in. drill press.
1 12-in. drill press.
1 18-in. emery wheel.
1 power nut and bolt cutter.
1 33-in. wheel grinder.
1 100-ton hydraulic wheel press.
1 36-in. wheel boring mill.
1 hydraulic axle straightener.
1 power shear and punch.
1 pinion press.
1 grindstone.
1 babbitting apparatus and furnace.
2 10-ton hand traveling cranes in Pit Department.

Blacksmith Shop

1 forge.
1 75-lb. power hammer.
1 18-in. drill press.
1 12-in. emery grinder.

Commencing at the end of the shop nearest the entrance (page 255) the "Electrical Room" is the room in which the winding and baking of coils is performed. It contains a baking oven with work benches and racks for the finished and partly finished coils, and is separated from the rest of the building by a brick wall 12 ins. thick and with a fireproof door. Adjoining the electrical department is the machine shop, the tools of which are driven by belt and shafting from

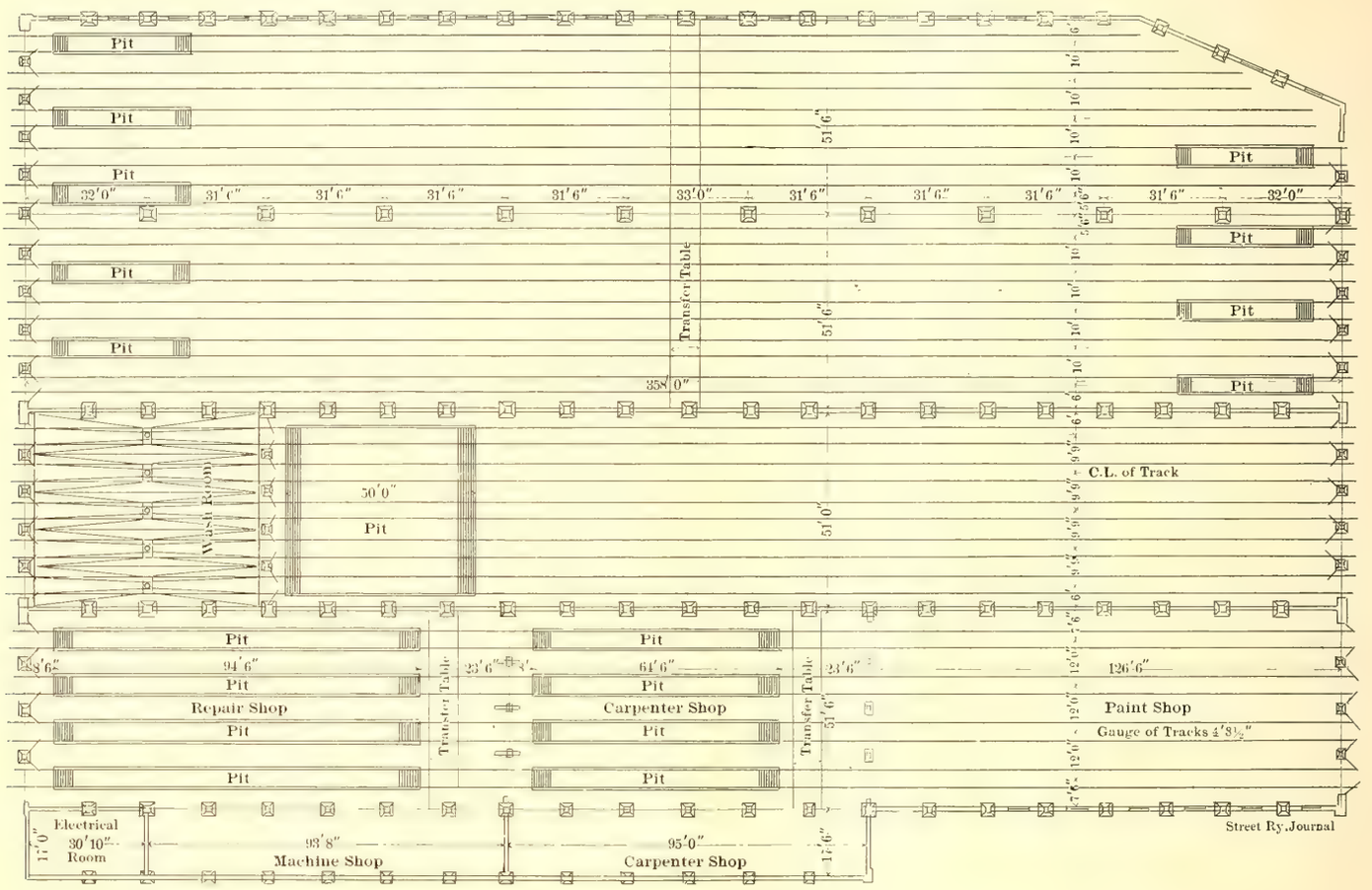
a 50-hp motor. The armatures are lifted from the cars by two traveling cranes, which command the tracks in the repair shop, or by a jib crane with an arm of 15 ft., and are then swung directly to any of the machine tools by which the work is required to be done.

Directly back of the machine shop is the carpenter shop, which contains such a complete equipment that the company has recently built in its own shops one of the most attractive parlor cars in the neighborhood of New York. The machinery in this room is driven by a separate motor of 15 hp. The carpenter shop, which also contains four tracks with pits, is separated by fireproof doors from the machine repair shop. At the end of the tracks in the carpenter shop, as well as in the repair shop, is a flush transfer table.

changed from one route to another. It is shown on page 252, and consists of several pieces of sheet iron hinged on a rod carried on the dash. As there are four or five routes in regular service this number of leaves is required for each sign. The leaves are held in position by two small gravity clips. Each line has a different characteristic color; thus, one sign (or double leaf) will be painted with red letters on a brown background, another black letters on a white background, another brown letters on a light blue background, etc.

CAR CLEANING AND INSPECTION

The cars are cleaned and inspected every night and are washed once a week. When a car is found to have run 4500 miles, notice is given to the superintendent, who regreases the journals, and after the car has run 9000 miles it is thoroughly



PLAN OF CAR HOUSE

The paint shop is located at the rear of the carpenter shop adjoining the paint, storage and oil rooms.

The car houses are heated throughout by a system of hot-air pipes, supplied from a boiler by a blower.

The rear end of the car house is equipped with a complete set of doors and entrance curves similar to those at the front end of the car house, with the entrance tracks on a grade, so that in case of fire and interruption of current the cars could be pushed by hand to the doors and then would pass out of the car house by gravity. There is also a driven-well with a motor pump for use in filling the sprinklers.

The standard equipment of the company consists of ten-bench open cars and 28-ft. closed cars with 5-ft. platforms. All the open cars are mounted on Peckham single trucks, and the closed cars on Peckham and St. Louis maximum traction trucks. The company has forty-five double-truck closed cars and thirty-eight single-truck cars, 138 open cars, five sweepers, five Taunton plows, two rotaries and three sprinklers, also a number of flat cars.

CHANGEABLE SIGN.

As the cars run on different routes an ingenious form of changeable sign has been adopted so that a car can easily be

overhauled. The force required in the inspection, repair and cleaning departments on the entire road are as follows:

34th STREET CAR DEPOT

2 day men—1 repairer, 1 cleaner.
2 night men—1 repairer, 1 cleaner.

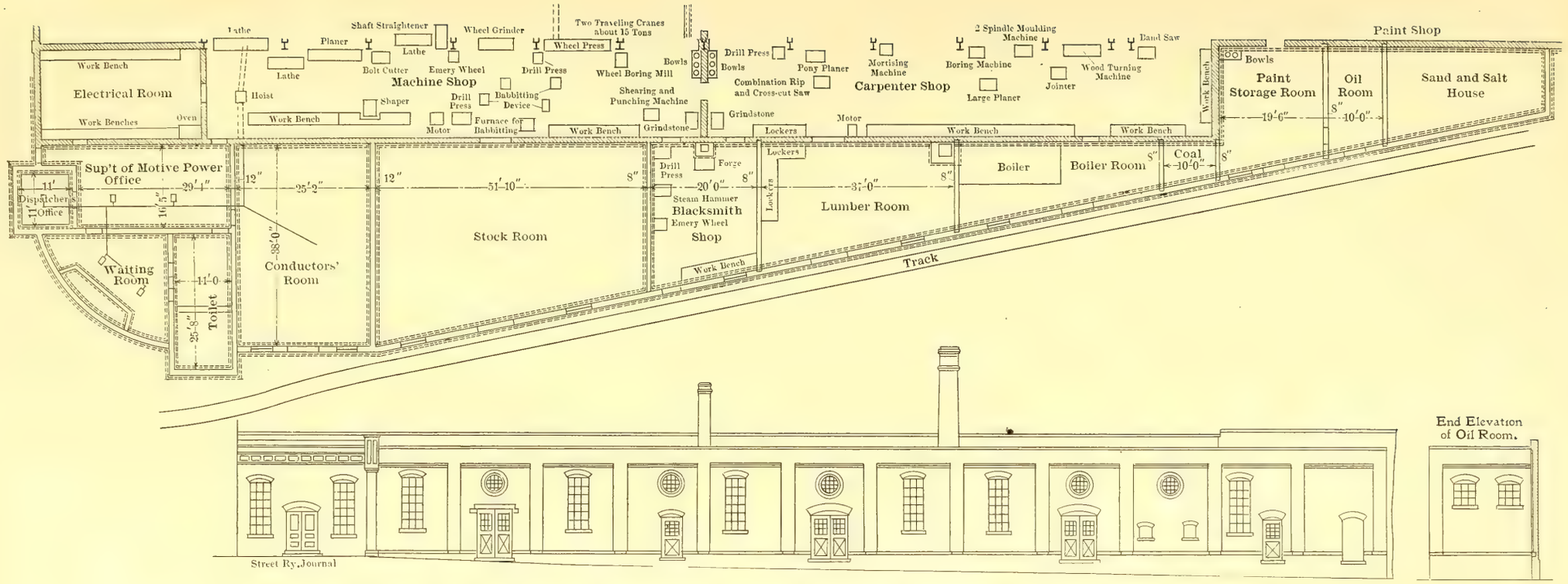
STEINWAY CAR BARN.

4 line men.
2 line men helpers.
1 day stableman.
1 night stableman.

WOODSIDE CAR HOUSE

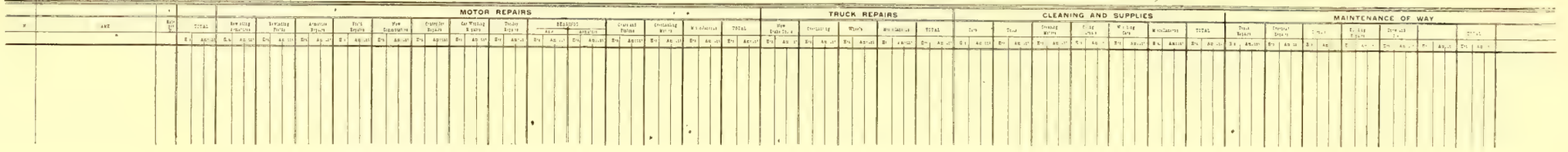
Day Force

1 general foreman.
1 machinist.
1 armature winder.
1 armature repair man.
1 blacksmith.
1 blacksmith helper.
3 pit men.
3 pit men helpers.
1 boy to look after tail lights and controllers.
1 boy to pour boxes, etc.
4 car cleaners.
1 janitor.
1 storekeeper.

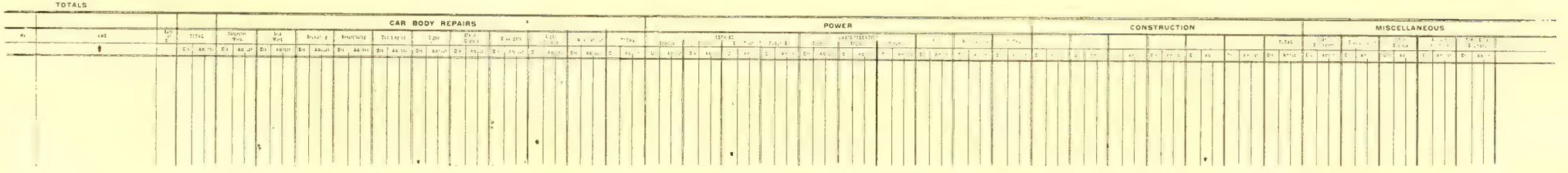


SIDE ELEVATION AND PLAN OF REPAIR SHOP END OF CAR HOUSE, SHOWING LOCATION OF MACHINERY

NEW YORK & QUEENS CO RAILWAY COMPANY.—Distribution of Labor. 190



TOP OF LEFT-HAND PAGE, SHOWING HEADINGS USED IN DISTRIBUTION OF LABOR IN REPAIR AND POWER STATION SERVICE



TOP OF RIGHT-HAND PAGE, SHOWING HEADINGS USED IN DISTRIBUTION OF LABOR IN REPAIR AND POWER STATION SERVICE

1 storekeeper boy.
3 painters.
4 carpenters.

Night Force

1 fireman.
1 motor greaser.
1 brake inspector.
1 trolley wheel and pole inspector.
2 car cleaners.

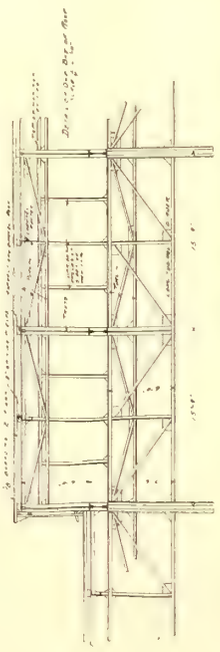
The company operates from forty cars to fifty cars on week days, and on summer Sundays its full equipment of 130 cars.

B. O. SIGNS

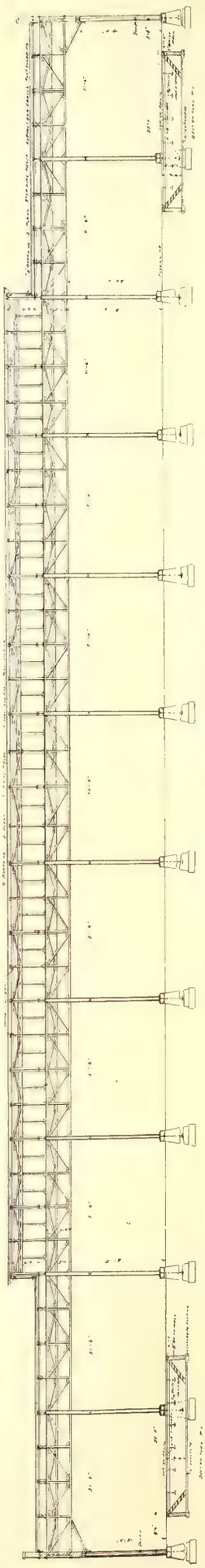
When the crew leaves a car the motorman is obliged to fill out a card similar to that shown on page 258, and popularly known as a B. O. car. On this he checks off any part of the equipment which is in bad order, and hangs the card on a hook in the car. If the equipment is "o. k." the card is so marked. When a bad order card is found in a car the inspector immediately makes an examination, and if the apparatus is defective has it repaired. He then signs the card and hands it in at the office of the superintendent of motive power. Under no circumstances is a crew allowed to take out a car with a "B. O." sign. The advantages of the practice are numerous. It locates the responsible person in case of defective apparatus and prevents a motorman from claiming that a car was in bad order when it left the car house, a common excuse in cases of accident.

REPORTS

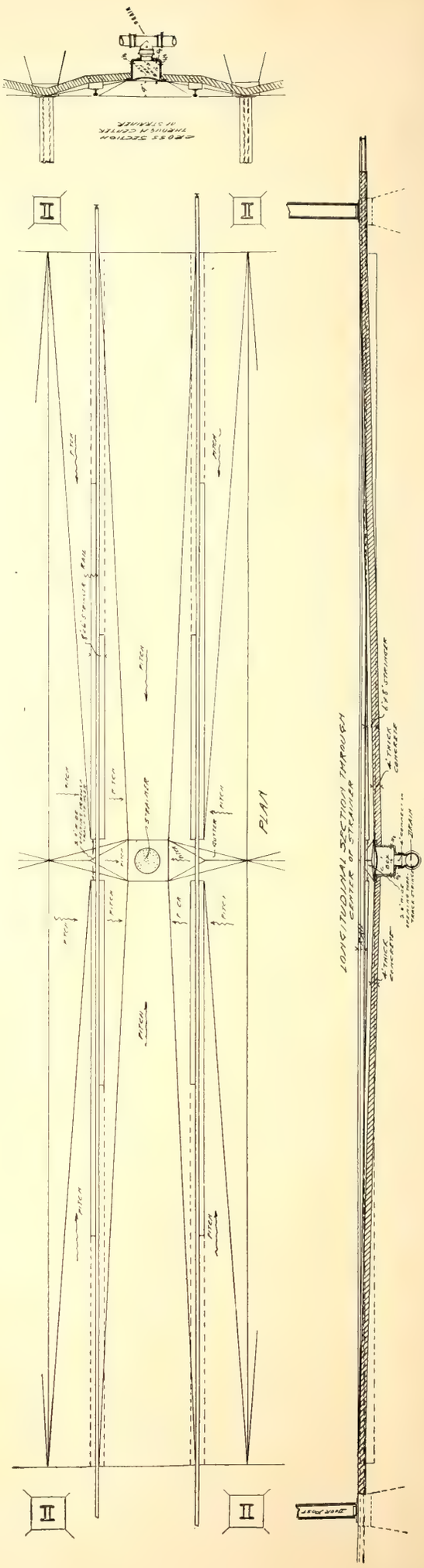
The system of repair shop records of the New York & Queens County Railway Company is very complete, and gives the manager at a glance full information as to the amount spent on repairs of cars and all of the different parts as well as the service given by the different car apparatus. From the records thus kept statistics as to the life of different parts of the car equipment are obtained, and as can readily be appreciated they are of the greatest value in determining future orders, as the record of the apparatus furnished by each manufacturer is kept separately.



The first set of records required in these compilations is a set of books kept by the master mechanic, giving the life of each important part of the apparatus subject to wear. For instance, one set of books is devoted to wheels, and a reproduction of the heading of a page of the book devoted to wheels is given on page 257. As will be seen, a line is given to each wheel. The heading given on the sixth column, which in the blank is indicated as "division," has been changed to mileage, the



LONGITUDINAL SECTION OF CAR HOUSE



PLAN AND SECTIONS OF WASH ROOM IN CAR HOUSE

Form 140-500-6-23.—1901

New York & Queens County Railway Co.

CAR DEPARTMENT.

TO GENERAL MANAGER: DAILY REPORT, _____ 190

Day Men—Woodside, ...
Night Men—Woodside, ...
Day Men—34th Street, ...
Night Men—34th Street, ...
Day Men—Jamaica, ...
Night Men—Jamaica, ...
Total Men, ...

REPAIRS TO CARS.

Armatures
Bearings
Brake Shoes (New)
Brakes taken up
Brush Yokes
Cars Finished
Controllers
Dash Repaired
Field Coils
Fuse Boxes
Gates
General Overhauling
Glass Replaced
Hood Switches
Lighting Arresters
Light Circuits Repaired
Resistance
Steps Repaired
Trolley Poles
Trolleys Repaired
Wheels (New)

REMARKS

Supt. Motive Power.

DAILY REPORT OF REPAIRS TO CARS

figure being taken from the car mileage record book. Similar books are kept for armature, brake-shoes and trolley wheels, and a somewhat similar book for fuses. The fuse book, however, is indexed according to the names of the motormen, and its principal use is to determine whether the men are careless with their fuses. When a car starts out in the morning it is supposed to be in good condition, and this fact, as explained in the section devoted to repair shops, is certified to by the inspector. The motormen are then given six fuses, and the blowing out of an undue number of fuses shows either that the car is in bad condition or else that the motorman is careless.

Returning now to the subject of report blanks the system will perhaps be more easily understood by taking up the uses of each blank in order. Only a few of these blanks will be reproduced owing to the space available in this issue, and those will be selected which are particularly interesting. Each repair shop workman has, of course, a time card which he fills out daily and turns in to the shop foreman. This is printed with a number of lines as follows: ..... Hrs. on..... and shows the work upon which the man has been engaged. These time cards are classified at the repair shop and are summarized in the blank, at the top of this page, sent by the superintendent of motive power to the general manager daily, and showing the repairs made to the cars, also the number of men, day and night, employed in each of the car houses of the company.

TABLE SHOWING LIFE AND OTHER STATISTICS OF WHEELS USED BY THE N. Y. & QUEENS COUNTY RAILWAY AND DIVIDED ACCORDING TO MANUFACTURER OF WHEELS

	Manufacturer A	Manufacturer B	Manufacturer C	Manufacturer D	Manufacturer E	Manufacturer F
Total wheels	235	75	34	26	9	1
Less than 10,000 miles	9	----	1	----	----	----
Between 10,000 and 20,000 miles	33	6	----	6	----	1
Between 20,000 and 30,000 miles	62	24	3	16	3	----
Between 30,000 and 40,000 miles	68	30	15	3	3	----
Between 40,000 and 50,000 miles	48	14	13	1	3	----
Over 50,000 miles	15	1	2	----	----	----
Average mileage	31,748	32,302	38,108	24,578	34,032	12,621
Worn out	210	65	32	24	6	1
Broken flange	7	7	----	2	2	----
Broken spoke or hub	9	----	1	----	----	----
Other defects	9	3	1	----	1	----

Much the same system is followed in the maintenance of way department, where a blank, as shown below, is employed, and in the motive or power station department where the chief engineer renders a report giving the following items:

Total engine hours.
Total boiler hours.
Total output, watt-hours.
Average output, watt-hours.
Maximum output, watt-hours.
Average output per pound of coal.
Coal consumed, pounds.
Water used, cubic feet.

SHOP REPORT ON CAR WHEELS.

New York & Queens County Railway Co.

Repair Shop. _____ *Date.* _____ *189.* _____ *Foreman.*

DATE. IN	DATE. OUT	Shop No.	Maker's No.	Car No.	DIVISION.	CAUSE OF CHANGE.	MAKER.

SHOP REPORT ON WHEELS

Form 127-300-3-6-1903 ORIGINAL.

New York & Queens County Railway Co.

Order No. _____
Req. No. _____
To _____ *Dr.*
Consigned to _____ *Address* _____
Date of Shipment, _____

NOTICE.—All Bills against the **New York & Queens County Railway Co.,** for supplies ordered, must be made out upon this Form and in accordance with the following directions:
1. Make one set of **original** and **duplicate** bills for each order, **showing order number.** Duplicate being an exact copy of the original.
2. After the supplies have been shipped, **send both original and duplicate bills, with Bill Lading, to Gen'l Manager**

I certify that the above supplies have been received in good order, and quantity and quality are correct.	Audited and found correct	I certify that the above account is correct, that the items were contracted for on favorable terms, and were necessary for the use of the Company	Approved for Voucher Chargeable to
Storekeeper	Auditor.	Purchasing Agt.	General Manager

FORM OF BILL

NEW YORK & QUEENS COUNTY RAILWAY CO.

MAINTENANCE OF WAY DEPARTMENT.

DAILY REPORT. *For 24 hours ending* _____ *189*

REPAIR WORK.

Track
Paving
Bonding
Miscellaneous

Total Men _____

CONSTRUCTION WORK.

Track
Paving
Bonding
Miscellaneous

Total Men _____

DAILY REPORT OF MAINTENANCE OF WAY DEPARTMENT

From these reports the distribution of labor and material are made in the office of the treasurer upon three large sheets, two devoted to distribution of labor and one to distribution of material, labor requiring two sheets, as both hours and men paid are kept. The size of these sheets makes it impossible to reproduce them, but a good idea of the completeness with which these reports are kept can be obtained from page 255, which gives a reproduction of the headings of the blanks used in the distribution of material and distribution of labor items.

New York & Queens County Railway Co.

CAR REPORT.

LINE .....

CAR NO. ..... DATE 190

TOOK CAR OUT OF DEPOT IN GOOD CONDITION AT.....M.

TOOK CAR ON STREET IN GOOD CONDITION AT .....M.

PUT CAR IN DEPOT AT ....M.

LEFT CAR ON STREET IN GOOD CONDITION AT.....M.

FOR INSPECTION OF

TRUCK	.....MOTOR NO. .....
BRAKES	.....ARRESTER .....
GONGS	.....LAMPS .....
GATES	...HEADLIGHT NO. .....
LIFE GUARDS	.....WINDOW .....
TROLLEY	.....REGISTER .....
HOOD SWITCH NO.	.....RESISTANCE .....
CONTROLLER NO.	.....SAFETY CHAIN .....
JOURNAL BEARING NO.	.....FUSE. BLOWN .....
ARMATO REBEARING NO.	.....PLACE .....
MOTOR AXLE BEARING NO.	....POINT BLOWN ON .....
GEAR NO.	.....CAUSE .....
GEAR CASE NO.	.....MOTORMAN'S BADGE NO. .....
PINION NO.	.....CONDUCTOR'S BADGE NO. .....
BRUSH HOLDER YOKE NO.	

NOTE.—If you put car in depot in good condition, mark O. K. in large letters on the face of the card. If in bad order mark B. O. opposite that part of the apparatus that is in bad order, and hang this card in car for the Inspector.

No.....Motorman.

No. .....Conductor.

INSPECTOR'S REPORT.

Date.....190

I have inspected, and certify that this car is in good running order.

.....*Inspector.*

"B. O." CARD FILLED OUT BY CAR CREW TO SHOW CAR PARTS IN BAD ORDER

STOREKEEPING RECORDS

The storekeeper is allowed to issue material on requisition only, and the practice employed is as follows:

If the material is in stock, the repair man is obliged to fill out a requisition for the goods required, and the job for which it is needed, and this requisition is signed by the foreman and sent to the storekeeper. If the material is not kept in stock a separate form of requisition is used. The storekeeper is not the purchasing agent, but the purchases are made by the general manager upon requisition by the storekeeper, who specifies not only the apparatus desired, but the quantity desired, its destination and the price last paid. When the goods are ordered a requisition similar to that on page 257 is sent to the manufacturer, upon which the bill must be rendered in duplicate, and after the supplies have been shipped, both original and duplicate bills, with bill of lading, are sent to the general manager. As will be seen, spaces are left at the foot of the bill for o. k's. by the storekeeper, auditor, purchasing agent and general manager, before the bill is paid. If the goods are not sent directly to the storekeeper, but are delivered to one of the other departments of the company, as is often the case, the storekeeper withholds his signature to the bill until he has been notified by the foreman of the department to which the goods have been sent that the material has been received.

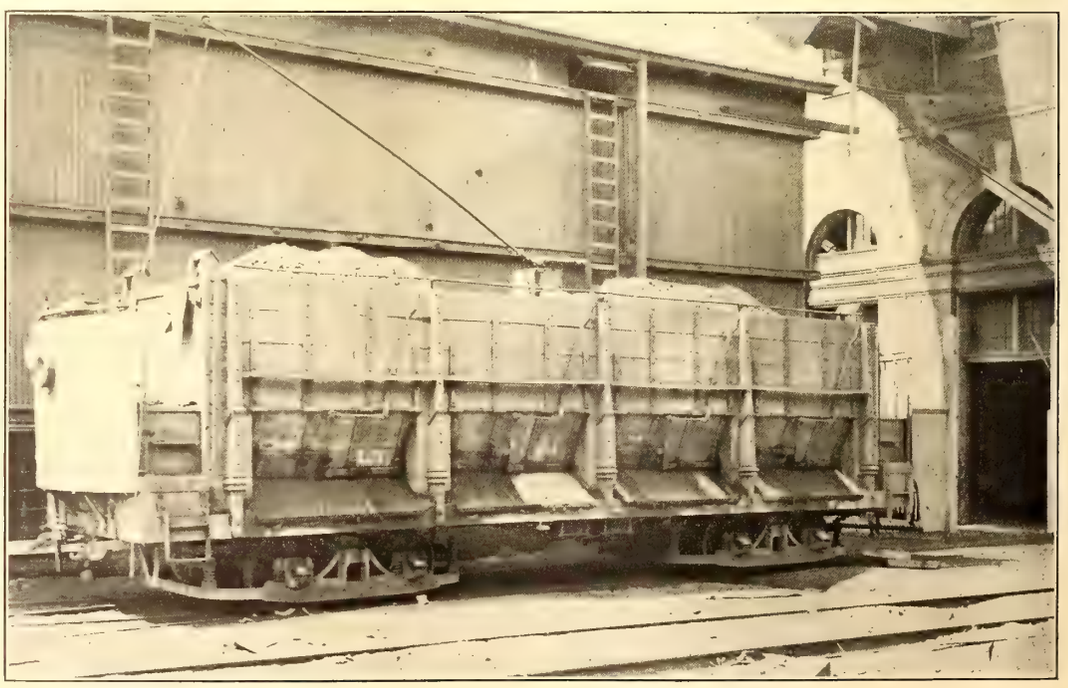
POWER STATION

All of the power for the New York & Queens County Railway Company is generated at its direct-current station at Astoria, directly opposite the foot of East Ninety-Second Street, in New York. This station, which was described in the Street Railway Journal for May, 1895, has had no increase in its equipment since that date, and is, consequently, somewhat antiquated. The equipment consists of one direct-connected 500-kw generator, one belted 500-kw generator, and two 300-kw generators.

It is an interesting fact that on busy days the 500-kw machine has frequently been called upon to deliver 1900 amps., and only fails to carry more because the commutator leads become unsoldered at that output. The company, under the new organization, will undoubtedly add largely to its power equipment and rolling stock, but the detail plans for the extensions have not been completed.

CINDER CAR AT ST. LOUIS

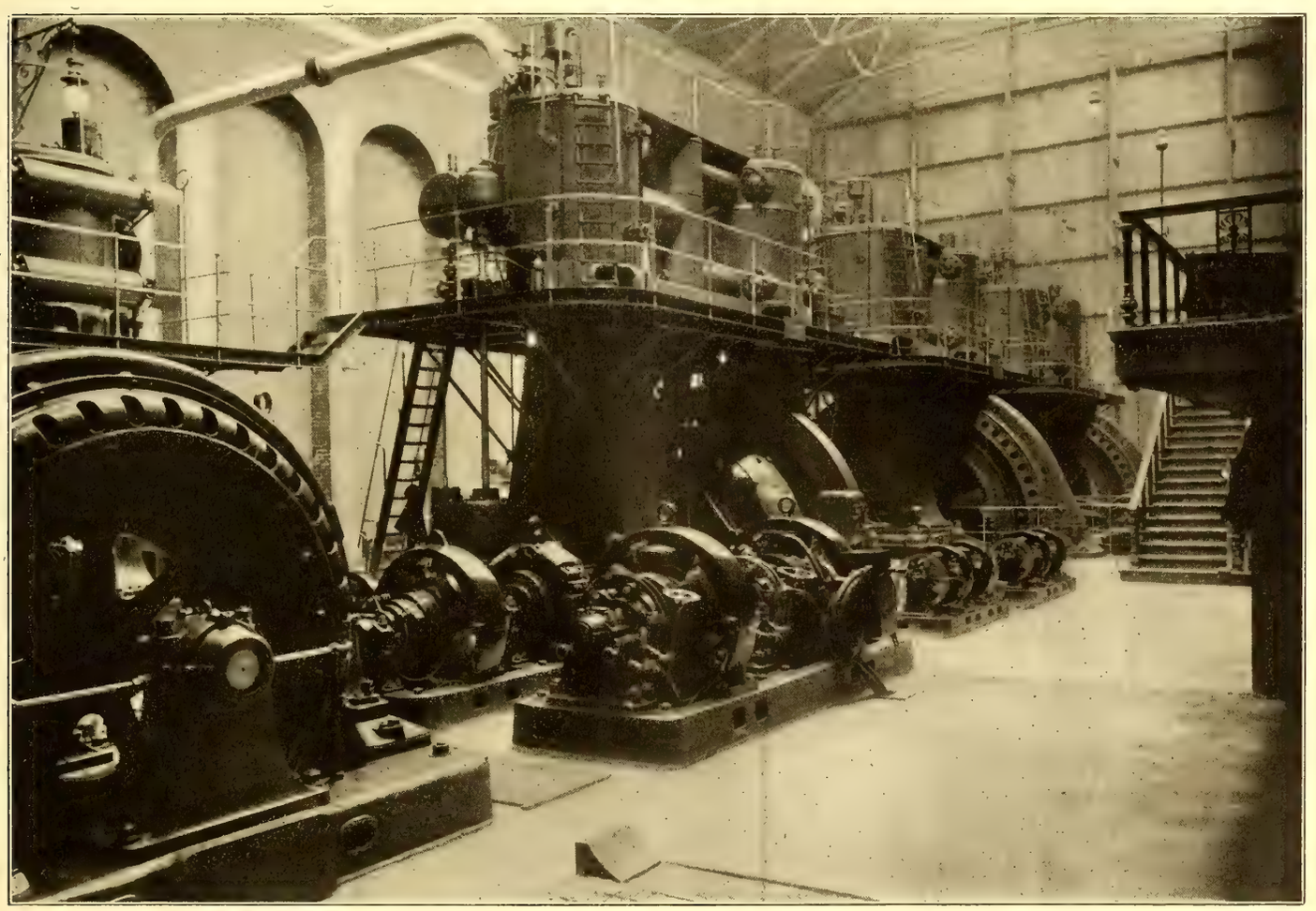
The St. Louis Transit Company has a number of cars of the type illustrated herewith for hauling ashes from the power house, or, if necessary, for hauling coal to the power house over steam roads. This car, when even full, holds 40 cu. yds., and can be heaped to hold 46 cu. yds. It is 40 ft. long over all, and is equipped with four Westinghouse No. 56 motors. As can be seen from the engraving, it is a side-dump car, there being four swinging doors on either side for dumping. The company now sells all of its ashes not required in its own construction at a price which more than pays for the handling, instead of having their handling a dead loss, as formerly. Much is used in making concrete for various purposes,



CINDER CAR OF ST. LOUIS TRANSIT COMPANY

THE INTERURBAN SYSTEM OF THE SOUTH LANCASHIRE TRAMWAYS

Although city electric railway construction has progressed so rapidly in Great Britain during the past ten years that practically every large city has its tramway system, the development of interurban railroads in that country has been greatly retarded from a number of causes ever since the general introduction of electric power for transportation service in that country. The principal factors which have held back interurban electric railway construction in Great Britain have been fully set forth in the two articles which have appeared in the last two issues of this paper, written by Hon. Robert P. Porter. Mr. Porter, however, refers to one important interurban electric railway undertaking which has been put in operation during the past year in South Lancashire, and the readers of this paper have also become acquainted with some details of this project from the article by "A British Engineer" on page 8 of the STREET RAILWAY JOURNAL for July 4. It is thought, therefore, that some particulars of the equipment of this line will prove of interest.



POWER HOUSE AT ATHERTON

This important undertaking, which is said to be the most extensive system of tramways for which statutory powers have ever been granted by Parliament, is designed to connect the cities of Manchester and Liverpool, and at the same time serve all the important towns, villages and manufacturing and mining districts lying around and between those great commercial centers.

When the construction of the South Lancashire Tramways Company's system is completed (which in itself will traverse 113 route miles) no less than 535 miles of tramways, the greater part of which are at present isolated, will be linked up. The towns and districts thus brought into direct communication with one another will include the following: Liverpool, Manchester, Bolton, Wigan, St. Helens, Atherton, Tyldesley, Leigh, Lowton, Newton, Ealestown, Prescot, Rainhill, Knotty Ash, Warrington, Astley, Boothstown, Worsley, Eccles, Patricroft, Swinton, Salford, Walkden, Hulton, Hindley, Westhoughton, Abram, Golborne, Ashton-in-Makerfield, Haydock, Rochdale, etc. The population thus served is estimated at 5,000,000.

The first section of the South Lancashire Company's lines, 10 miles in length, was put in operation Oct. 20, 1902, and additional sections have been opened, until on March 30 of this year an inaugural trip was made between Liverpool and Bolton, which is distant from Liverpool about 26 miles and from Manchester about 10 miles.

In addition to its extent the system is especially interesting for two other reasons. In the first place, the system has been designed with a view to the institution of a freight and express service; and in the second place it exemplifies in a very marked fashion the relationship which can exist between a private company operating an interurban system and the managements of large and comparatively small municipalities which operate their own systems of tramways in their own cities. This relationship includes the right to run through cars over the municipal railway tracks, and the importance of this feature, as affecting the status of electric transportation in Great Britain, cannot be too strongly emphasized. If arrangements of this kind had not been made the South Lancashire system would have had to have a terminus at Knotty Ash, on the outskirts of Liverpool, instead of being able, as is now the case, to run cars right through the city of Liverpool down to the pier head on the banks of the River Mersey and at the very center of the city of Liverpool. These negotiations were not completed without a certain amount of trouble. That they have been completed is mainly due to Mr. Atherton, the president of the South

Lancashire Tramways Company, and to C. R. Bellamy, the popular general manager of the Liverpool Corporation Tramways, whose agreement provides not only that the South Lancashire cars will run over the Liverpool system but also that the Liverpool Corporation cars are to be allowed to continue their journey over the entire system of the South Lancashire system. This is, perhaps, not the first arrangement of the kind in Great Britain, but at the present moment, when other private companies are hammering loudly at the doors of corporations with a demand to be let into the city, it is particularly interesting and can heartily be recommended. The plan adopted is not complicated, and is similar to that usually followed in America under similar conditions. When a South Lancashire car comes to the boundary the motorman and conductor of the South Lancashire car step off and those of the Liverpool Corporation take charge, collecting their own fares. Similarly when a Liverpool Corporation car comes onto the South Lancashire system at Knotty Ash the South Lancashire Company crew takes charge and collects the fares. In that way it is only necessary to make a car mileage arrangement, which can readily be done when two reasonable business men get together. It is understood that arrangements have also been made with the city of Bolton by which the South Lancashire cars are allowed to enter that city's territory, and that later on Salford and Manchester will also probably adopt a similar plan.



ONE OF THE FIRST CARS ENTERING BOLTON

Coming now to the actual equipment of the line the system is operated from a large power station at Howe Bridge, near Atherton, in close proximity to a number of coal mines. The engine room is 60 ft. x 125 ft., and contains at present two 625-kw alternators, one 500-kw and one 350-kw direct-current generator. The alternators are two-phase and generate current at 7000 volts and 50 cycles per second at 100 r. p. m., and were supplied by Witting, Eborall & Company. They are direct-connected to vertical cross-compound engines, built by Witting, Eborall & Company. They are direct-connected by vertical cross-compound engines built by the Nuremberg Machine Works, and with cylinder dimensions, 25.5-in. and 33.5-in. x 33.5-in. stroke. The engines are designed for operating at a pressure of 155 lbs. per square inch, with a vacuum of 25 ins., and under these conditions are guaranteed to work at 23.4 lbs. per kilowatt-hour at full load. The high-pressure cylinders are arranged with four-seated lift valves, while the low-pressure cylinders are provided with Corliss valves. The governing is effected on the high-pressure cylinders only. The exciters for the alternators are rope-driven from the engine shaft, as shown on page 259.

The direct-current generators were also supplied by Witting, Eborall & Company, and the 500-kw machine is driven by an engine similar to those which supply power to the alternators, except that a separate fly-wheel of 15 tons is used. The 250-kw generator is driven by vertical cross-compound engines, with cylinder dimensions 19 ins. and 30.3 ins. x 25.6 ins. This engine has piston valves on the high-pressure cylinder and Corliss



STREET IN WIGAN WHERE SOUTH LANCASHIRE TRAMWAYS ARE COMPELLED TO AVOID THE CITY, SHOWING ALSO OLD STEAM CAR OF WIGAN CORPORATION

valves on the low-pressure cylinder, and carries a 5-ton flywheel. Its guaranteed steam consumption is 25.5 lbs. of dry steam per hour with a steam pressure of 155 lbs. and a vacuum of 25 ins.

In addition the station contains a 250-kw motor generator, operating at 300 r. p. m. The motor is a two-phase synchronous machine, which is worked directly at 7000 volts, while the direct-current generator to which it is connected can be run either as a shunt or a compound-wound machine. There is also a positive booster of 56 kw, two negative boosters of 8 kw, a milking booster of 240 amps. and a 40-kw reversible booster for the storage battery. All of these machines are driven by shunt-wound motors operating at 500 volts, and with the equipment of the sub-stations were supplied by the same manufacturers as in the case of the large generators. The switchboards in both the power station and sub-station were supplied by Ferranti & Company, and rotary synchronizers of Everett, Edgcumbe & Company's make are used throughout. The power station is served by an overhead traveling crane of 35 tons capacity, which is operated by electricity.

The boiler room contains four Lancashire boilers supplied by Yates & Thom, each being 8 ft. 6 ins. in diameter by 33 ft. long, and fitted with automatic stokers. Economizers are used and the stack, which is fitted with forced draft, is 150 ft. high.

The sub-contractors for the condensing plant were Cole, Marchent & Morley. The plant consists of two complete sets of air and circulating pumps, each set being capable of dealing with 19,000 lbs. of steam per hour. The air pumps are of the Edwards type and a Klein cooling tower is used.

At present only one sub-station is in use. It contains three 150-kw synchronous motor generators, one 20-kw positive feeder booster, one 8-kw negative feeder booster, one 14-kw battery-charging reversible booster, and one 80-amp. milking booster. The motor generators work at 7000 volts, and run at 428 r. p. m.; they are generally similar to the motor generator in the power station described above.

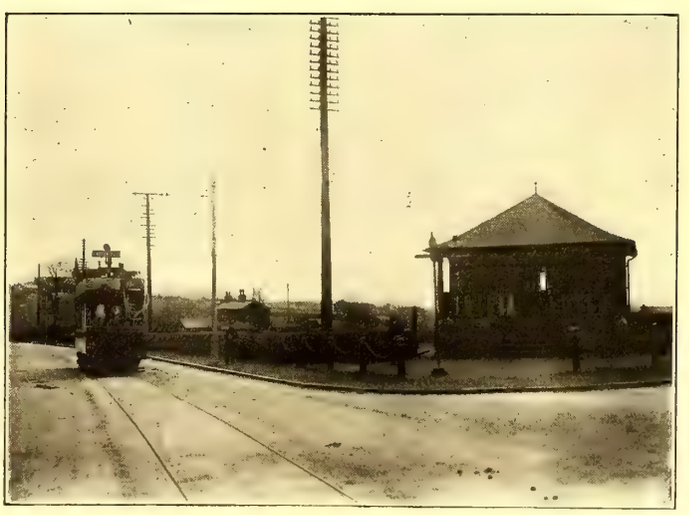
The cars are from the works of G. F. Milnes & Company, and are of the single-truck, double-deck type, with seating accommodations for fifty-five passengers, thirty-three outside and twenty-two inside. The motors are of the Witting, Eborall & Company's 30-hp-type, and fifty car equipments are at present in use.

The overhead line is particularly attractive and was built by R. W. Blackwell & Company, Ltd. The pole brackets are constructed with wrought-iron ornamental scroll work, and are fitted with Ætna insulation with flexible suspension. Two incandescent lamps are carried on alternate poles except in certain of the city districts, where lamps are carried on every pole.



EXTERIOR OF POWER HOUSE AND CAR DEPOT AT ATHERTON

The track is laid with 90-lb. 6-in. rail with standard gage. Tie-bars are used every 7½ ft. The track is laid on a 6-in. concrete foundation extending entirely across the track. Cross-ties are also used on a section of the track. The special work is of crucible cast-steel and was built by Askham Brothers & Wilson.



WAITING ROOM, SOUTH LANCASHIRE SYSTEM, BETWEEN LIVERPOOL AND ST. HELENS

The feeders are in general underground, and are paper-insulated and lead-covered. The high-tension feeders are carried in earthenware pipes and the low-tension feeders in wooden troughs. They were supplied by the British Insulated & Helsby Cable Company.

The engineers of the line were Messrs. Kincaid, Waller, Manville & Dawson. Sir John A. Willox is chairman of the South Lancashire Tramways and J. R. Salter is the company's chief engineer.

Before closing the description reference will be made to the freight business which the company is planning to install. As a preliminary to it, and until the service is entirely ready for operation, an express service has been instituted. The parcels are received at any point on the route by the conductors, who are furnished with a pair of scales to ascertain the weight and correct charge for the parcel given them. On receiving a package the conductor gives the shipper a numbered receipt. These receipts are printed in convenient form in triplicate. One, as stated, is handed to the shipper, a second, which is adhesive, is affixed to the parcel, and the third is returned to the company's office for checking purposes. Books of prepaid tickets are also issued to firms who have occasion to send parcels in considerable numbers. This, of course, saves considerable time in shipment.

The following rates are charged for parcels:

4 lbs	3d
14 lbs	4d
28 lbs	5d

The parcels when received are at once taken to the central office for sorting, and are then despatched by rail, carts or otherwise to their respective destinations.

The company is planning, however, to introduce a much more complete system for the transportation of merchandise, and as the system is located in one of the busiest, if not the busiest, section of country in Great Britain, or in the world, it is thought that a large business of this kind can be built up. Thousands of tons of raw cotton, manufactured goods, timber, minerals, provisions, chemicals, glass, earthenware goods, etc., are daily collected and carried at present by railroads between the cities through which the system runs, but many of the mills and factories are not now conveniently located for railroad connection, so that the cost of transshipment by wagons in many cases is excessive, to say nothing of the damage and delay. The result is that many of the manufacturing firms have found it more convenient, up to the present, to haul the goods by road, and have even instituted a system of steam motor wagons for road transportation, but this has not proved a great success.

It is proposed in the near future to connect the tramway system by means of sidings with the yards and wharves of the mills and factories, and also to establish freight depots at the most convenient places along the route where freight which has been collected may be received and despatched at convenient hours of the day, or by night, to its destination. By these arrangements very little interference will take place with the ordinary day passenger traffic. For the conveyance of general merchandise it is proposed to use two kinds of cars, viz., flat-deck cars and box cars. The former will be fitted with detachable crates on rollers. It is proposed to construct these fittings in three sections, so that one or more could be lifted off the cars, thus giving greater convenience in handling, and thus obviating the necessity of removing the whole of the upper loading capacity if not at once required. Provision for this form of traffic is somewhat different from that of coal, in which case ordinary coal cars will probably be used and run direct onto the tipping cradles at the docks. Arrangements have already been made by the company with several of the principal mill and factory owners, who have agreed to construct sidings in their works to connect with the tramways.

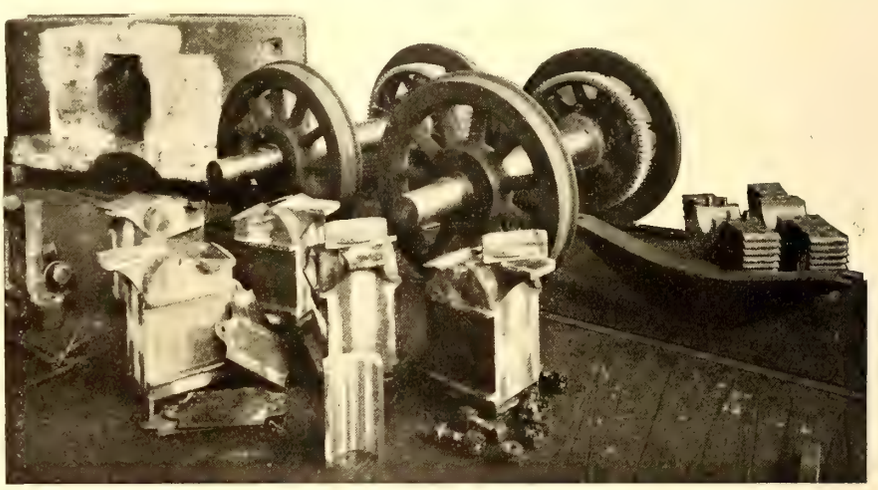
NEW ELECTRIC LOCOMOTIVES FOR THE B. & O.

A flattering recognition of the success of heavy electric traction in tunnel work is shown by the Baltimore & Ohio Railroad in increasing the equipment for the Baltimore tunnel by the purchase of two additional electric locomotives. These locomotives are now in process of construction, and will weigh 150 tons each.

They differ very radically from the first locomotives furnished this company, being much simpler in design and more accessible in construction, and equipped with the latest improvements in controlling apparatus. The whole design affords the greatest flexibility of operation.

Each locomotive is made up of two 75-ton units. The two units forming a 150-ton locomotive will be coupled together and operated with type-M control. The control is so arranged that each section may be operated independently, or any number of sections coupled together and operated from any one section.

The service required is to handle a 1600-ton train, exclusive of electric locomotive, on the Baltimore & Ohio trunk line through the tunnel over an 0.8 of 1 per cent grade at a speed of 10 miles per hour, and over a 1½ per cent grade at a speed of 9 miles per hour on 625 volts. Under practical operating conditions the motors have sufficient capacity to maintain this service hourly, running loaded up the grade and returning light. In starting they have sufficient capacity to slip the wheels, or, at not too frequent intervals, the motors are large enough to handle as heavy a train as the weight of the drivers will permit.



WHEELS, GEARS AND JOURNALS OF BALTIMORE & OHIO LOCOMOTIVE

The motor equipment of each unit consists of four General Electric 65 motors of about 225 hp each, with special slow speed winding, making a total for the eight motors of about 1800 hp.

In design the locomotive is exceedingly simple and accessible with a minimum number of wearing parts. It is believed that with this construction the maintenance account of the locomotive will be very low.

Special attention was given to securing ease of inspection for the motors, and the few number of parts entering into the truck construction. All wearing surfaces are made large for the purpose of insuring a long life. Special provision has been made for the easy replacement of wearing parts whenever it becomes necessary to renew the same. There is a large space under the cab floor in which a man can stand and inspect the motors or truck gear.

The main body of the truck consists of a rectangular frame work of cast steel built up of four pieces, two side frames and two end frames, made heavy and strong. The parts are machined at the ends and securely fitted and bolted together, thus forming a very strong and rigid structure, capable of withstanding the most severe shocks without injury. The end

pieces form the buffer beams, and to these a suitable standard draft gear of approved design is attached. The side frames have machined jaws protected by wearing shoes between which the journal boxes slide.

The truck frames are supported at four points on equalizers. Each equalizer rests on a pair of half elliptic springs, the ends of which are supported on top of the journal boxes through suitable wearing plates. This construction forms a simple and effective arrangement of parts.

The journal boxes are made quite similar to standard car journal boxes; the parts, however, are made larger and stronger. The brasses can be easily removed, and by dropping down the wearing shoes it is possible to remove a journal box



NEW ELECTRIC LOCOMOTIVES OF THE BALTIMORE & OHIO RAILROAD.

complete without removing the wheels and axles or other parts of the truck. In order that the locomotive may round curves easily, the axles are given considerable lateral movement in the journal boxes, it being practicable to do this with this design of electric locomotive, and thus reduce the effective rigid wheel base. Wheels, axles or motors can be easily removed from the trucks by dropping into a suitably constructed pit or by raising the truck frame.

Each section of the locomotive has eight steel-tired spoked wheels. The tires are 2⅞ ins. thick, with M. C. B. standard tread and flange, and are securely held in place by approved fastenings. The axles are made of forged steel, turned throughout, 6 ins. x 12 ins. in the truck journal bearings, 8 ins. in the wheel fit and motor bearings.

The cab is large and roomy. The floor rests on the truck frame. The lining floor is made of 1¾-in. hard pine, tongued and grooved; the upper floor is made of hard pine, ⅞ in. thick, tongued and grooved and laid in the opposite direction from the lining floor. Suitable traps are provided in the floor to permit of the easy passage of a man for inspection of the motors, etc.

The sides of the roof of the cab are made of sheet steel. On each side there is an entrance door, and at each end there is an additional door, which permits of ready communication between sections when coupled together. Large windows afford a practically unobstructed view in all directions.

The controlling apparatus, consisting of a Sprague-General Electric multiple-unit control system, so arranged as to be able to operate each section independently, or two or more sections coupled together. The master controller, engineer's valves, etc., are in duplicate, a complete set being located in diagonally opposite corners of each cab, so that the engineer, when it suits his convenience, can stand in the front end of the locomotive when running in either direction.

Each section of the locomotive is equipped with one bell, one whistle, two locomotive headlights, approved air-brake mechanism, including two engineer's valves and air gages, necessary brake cylinders, foundation brake, air reservoirs, couplers and draw heads, also a Leach pneumatic track sander.

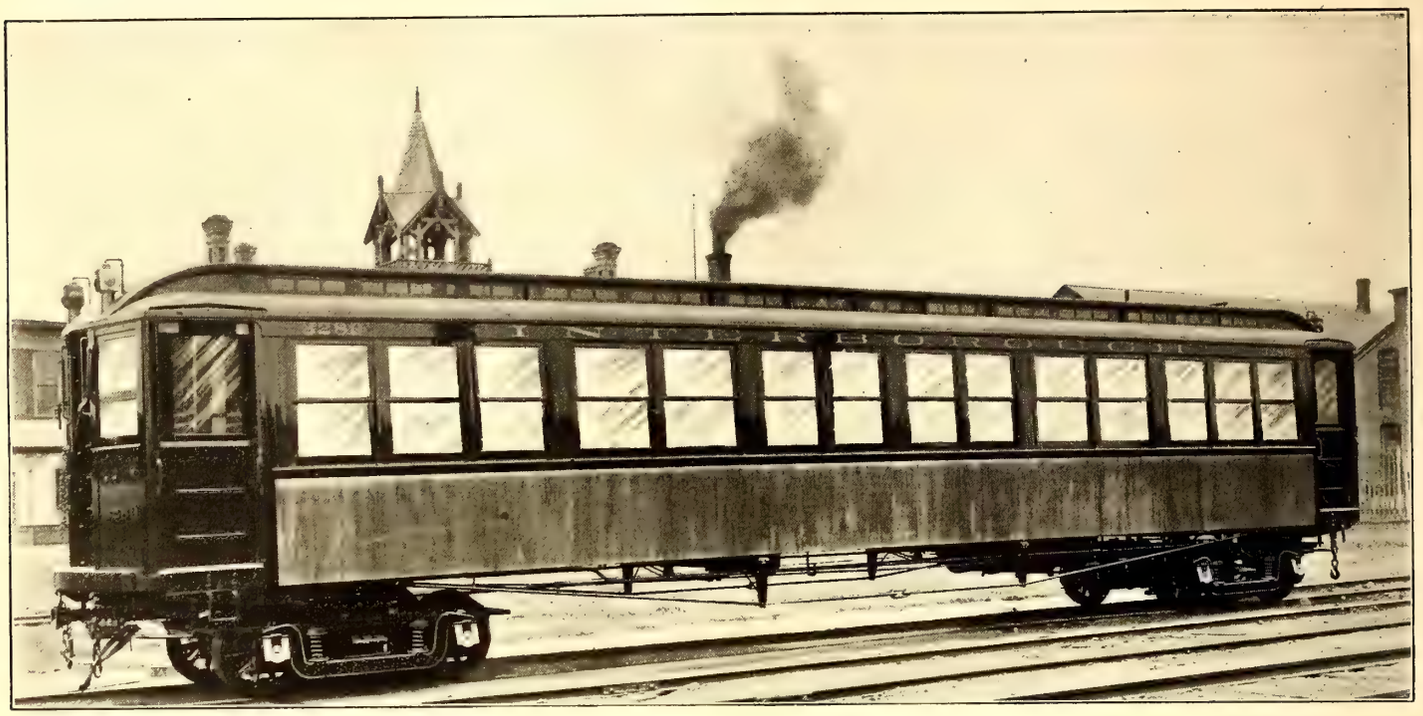
The locomotives have just been finished at the works of the General Electric Company, and will be put in service in Baltimore at once.

A well-known traffic manager of steam lines entering Indianapolis, in commenting on the encroachments that the electric railways are making on the passenger business of the steam roads, particularly the inroads made on Sundays and holidays, says that the steam roads must prepare to meet the competition. To illustrate this he said that there is not a steam line running out of Indianapolis that could not, at small expense, increase the width of its roadbed to admit of putting a third or fourth track to permit the use of electric cars on the right of way owned by the steam lines. The authority quoted thinks this would solve the question as to local traffic, but he regrets that the steam lines did not take up the question of electric competition before their territory was so thoroughly cut into by the electrics.

CARS FOR THE NEW YORK SUBWAY

The first shipment of five cars built for the new subway have just been received in New York by the Interborough Rapid Transit Company, and are now at the Ninety-Eighth Street shops. In general they resemble closely the sample cars which were described in the STREET RAILWAY JOURNAL Sept. 20, 1902, the dimensions being the same and the principal features in design, construction and equipment having been adopted. The decorations and interior fittings differ materially, however, from the sample cars, which, it will be remembered, were equipped with a variety of furnishings to enable the officers and engineers of the company to make a selection after instituting a comparison between the several styles exhibited.

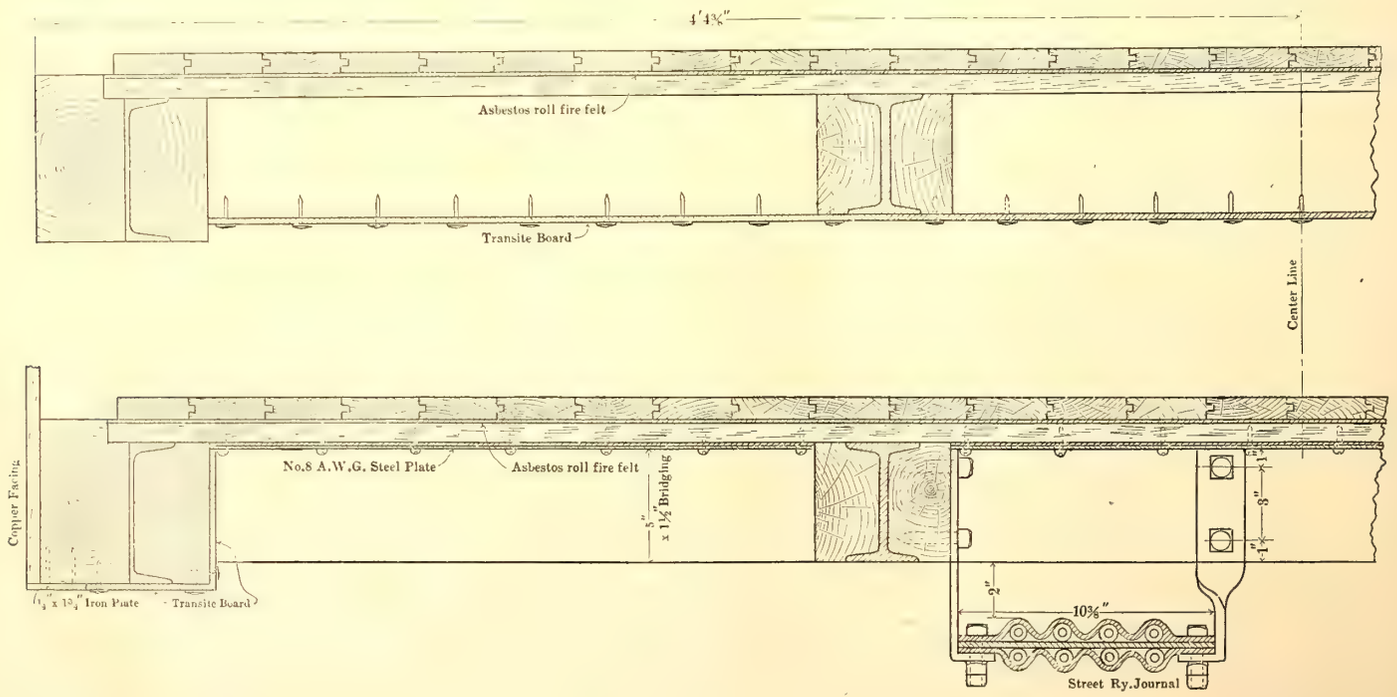
The subway cars are longer than the elevated coaches, wider at the window stools, but narrower at the deck line, owing to the tapering form adopted to conform to the tunnel, and the roof is considerably lower for the same reasons. The dimensions of the subway cars and those of the elevated are given herewith, and a comparison will show that they differ materially in many respects:



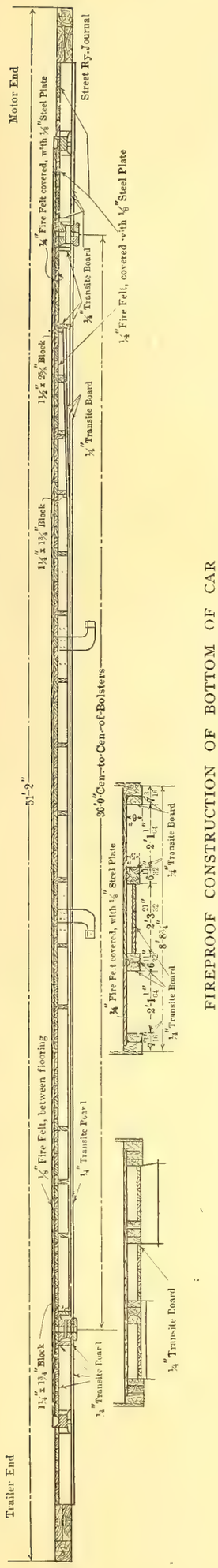
ONE OF THE FIRST SUBWAY CARS

	Subway.		Elevated.	
	Ft.	In.	Ft.	In.
Length over platforms	50	1	47	1
Length over car body	42	7	39	10
Length center of bolsters	36	0	33	2
Width over window stools	8	11⅝	8	9
Width over sheathing	8	9¾	8	7
Width over deck eaves' moulding	8	5	8	9½
Height, top of rail to center draw-bar	2	5	2	5
Height, top of rail to under sills	3	1⅛	3	3¼
Height, top of rail over platform	3	8	3	9
Height, top of rail over roof	12	0	12	10½

The exterior of the subway car differs in appearance very markedly from that of the elevated, as the former is vestibuled at both ends and has a copper-faced sheathing below the belt



BOTTOM LINING AND SUSPENSION OF MOTOR LEADS



FIREPROOF CONSTRUCTION OF BOTTOM OF CAR

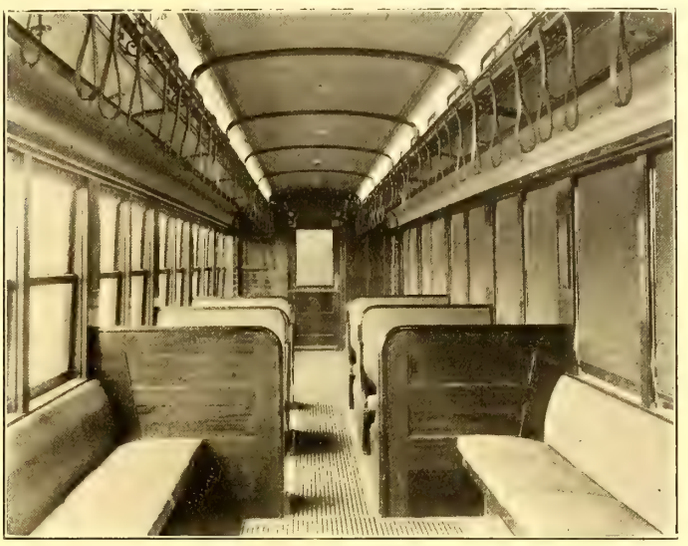
rail. The woodwork on the car body and the vestibules is painted a tuscan red, the Pennsylvania Railroad standard having been adopted. In the interior the difference is equally noticeable, as the car has been given a very light finish, and the space between the longitudinal seats is greater than in the present elevated coaches. Exterior and interior views of one of the new cars accompany this article, from which an excellent idea of their general appearance may be gained.

In construction the general features are the same as those of the sample cars, the only changes made having been adopted with the view of adding to the strength of the structure by substituting slightly heavier timbers than those originally suggested. The framework is particularly heavy. The longitudinal sills are of compound construction, with center cross-trussing between the steel needle-beams, and the platform end sills are of steel, fitted with heavy steel anti-telescoping plates. The side framing of the car bodies is of white ash, doubly braced and very heavily trussed. The platform posts are of compound construction, with anti-telescoping posts of steel bar sandwiched between heavy white ash posts at corners and centers of the vestibule platform. These posts are securely bolted to steel longitudinal sills, the steel anti-telescoping plate below the floor and to the hood bow, which serves to reinforce it, and is of heavy steel angle in one piece, reaching from plate to plate and extending back into the car body 6 ft. on each side.

By this construction, it is believed, the structure is made practically indestructible. In case of accident, where one platform rides over the other, 8 sq. ins. of metal would have to be sheared off in the posts before the main body of the cars would be reached. This would afford effective means of protection.

The floors are double with asbestos roll felt sandwiched between, and the floor sheathing is of white pine completely covered on the under side with ¼-in. asbestos transite board. All parts of the car framing, flooring and sheathing are covered with fireproofing compound.

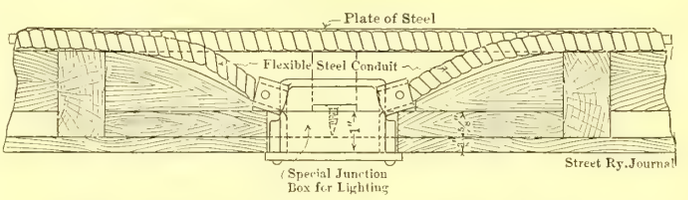
These precautions to secure safety from fire extend to the arrangement and installation of the electrical apparatus and the electrical wiring. For the lighting circuits a flexible steel conduit is used, and a special junction box has been designed. This feature is illustrated herewith. On the side and upper roofs, over these conduits for the lighting circuits, a strip of sheet iron is securely nailed to the roof boards before the canvas is applied; the entire under portion of the car flooring is covered with electrobestos, and the wires are carried in ducts moulded into suitable forms



INTERIOR NEW INTERBOROUGH CAR

made from the same material. The pump box under the car is lined with steel. Special precautions have been taken with the insulation of the wires, the specifications calling for, first, a layer of paper, next, a layer of rubber, then a layer of cotton saturated with a weatherproof compound, and outside of this a layer of asbestos. The hangers supporting the rheostats under the car body are insulated with wooden blocks, which are subjected to a special process, being dried out in an oven and then soaked in an insulating compound, and covered with ¼-in. transite board. The rheostat boxes themselves are also insulated from the angle-iron supporting them. Where the wires pass through the flooring they are hermetically sealed to prevent the admission of dust and dirt.

An idea of the construction of the flooring can be gained



SPECIAL JUNCTION BOX FOR LIGHTING CIRCUITS

from the accompanying diagrams, showing the bottom lining and suspension of motor leads and the fire-proofing of the bottom of the cars. The floor ceiling is of ¼-in. transite board, securely nailed to all bridges and carefully fitted to the side sills, and all joints are cemented with asbestos cement. In all spaces above the motor truck in the floor framing, between sills and bridging, are plates of No. 8 steel and ¼-in. roll fire felt, securely fastened with screws and cleats. These extend from the platform end sill to the third line of bridging back of the bolster in sections for fire protection. The construction adopted provides that in case of the entire weight of the car being suddenly dropped upon the trucks, the motors and leads would not be injured.

At the forward end, or what is known as the No. 1 end of the car, all the wires are carried to a slate switchboard in the motorman's cab. This board is 44 ins. x 27 ins., and is mounted directly back of the motorman. The window space occupied by this board is ceiled up with mahogany panels, the space back of the panels is boxed in and provided with a door

of steel plate, forming a box, the cover, top, bottom and sides of which are lined with electrobestos ½ in. thick. All of the switches and fuses, except the main trolley fuse and bus-line fuse, which are encased and placed under the car, are carried on this switchboard. Where the wires are carried through the floor or any partition a steel chute, lined with electrobestos, is used to protect the wires against mechanical injury. This also makes the wiring fireproof.

An innovation in the general design of these cars is the arrangement of the platform. The cars are vestibuled, and when made up into trains each car can be closed so as to be entirely distinct or a passageway may be opened throughout the train. The platforms are of the Gibbs patent type, with side doors arranged to slide into pockets in the side framing, thereby giving up the entire platform to the passengers. The sliding door in the motorman's cab may be partly opened and secured in this position by a bar, which will serve as an arm-rest for the motorman. The platform swinging door is arranged to close the passageway in one position, and to inclose the master control and brake valve in the other position. The side plates of the car extend to the front of the vestibule. Each vestibule is fitted with two windows, and each window is fitted with upper and lower sashes of straight grained mahogany; the upper sash being arranged to drop and provided with rubber stops.

Pitt safety gates for coupling between cars are provided. They are fastened to the vestibule corner posts by means of malleable castings. These gates are placed on left-hand corner of the vestibule, looking at the end of the car from the outside. They are constructed so as to adjust themselves to suit the various positions of two adjoining cars while passing in, around and out of curves of 90-ft. radius. A substantial malleable iron bracket is fastened to the face of the vestibule sheathing, to which the gates are to be attached when not in use.

On the door leading from the vestibule to the body of the car is a curtain that can be automatically raised or lowered as the door is opened or closed to shut the light away from the motorman. Another attachment is the peculiar handle on the sliding door. This door is made to latch so that it cannot slide open with the swaying of the car, but the handle is so constructed that when pressure is applied upon it to open the door the same movement will unlatch it.

Entering the car the visitor is at once impressed by the amount of room available for passengers. The seating arrangements are similar to the elevated cars, but as the subway coaches are longer there are two additional seats on each end. The total seating capacity of each car is fifty-two. The seats are all finished in rattan, and are designed for rapid loading and unloading, and their outlines are rounded to the slightest curves. Stationary cross-wise seats, after the Manhattan pattern, have been adopted. The longitudinal seats are 17¾ ins. deep, with the exception of those nearest the door, which are only 15½ ins., as the pocket for the sliding doors cuts off a portion of this space. The space between the longitudinal seats is 4 ft. 5 ins., giving a much greater clearance than the Manhattan type.

The windows have two sashes, the lower one being stationary, while the upper is a drop sash. This arrangement reverses the ordinary practice, and is due to the desire of the management to keep the passengers from thrusting their arms and heads out of the windows and thus incurring danger of striking some obstruction. The side windows in the body of the car, also end windows and end doors, are provided with "Pantasote" curtains with pinch-handle fixtures.

The floors are covered with hard maple and securely fastened with oval-head brass screws.

Six single incandescent lamps are placed on the upper deck ceiling and a row of ten on each side deck ceiling is provided. There are two lamps placed in a white porcelain dome over each platform, and the pressure gage is also provided with a miniature lamp. Head linings are of composite board. The interior finish is of mahogany of light color.

A straight grained polished mahogany hand rail, 1½ ins. in diameter, extends the full length of the clere story on each side of the car, supported in brass sockets at the ends and by thirteen heavy brass brackets on each side. These brackets have smooth round holes for the bell cord. The hand rail on each side of the car carries thirty-eight plain leather straps, forming loops 14 ins. long, 1¼ ins. wide and ⅛ in. thick, lapped together at the ends and secured by two copper rivets. Hand straps are to be distributed on hand rails, two opposite each of the four middle side windows and three opposite each of the other side windows.

Each sash is secured on the inside to a brass operating arm, manipulated by means of iron rods running along each side of clere story, and each rod is operated by means of a brass lever, having a brass fulcrum secured to the inside of the clere story.

All hardware is of bronze, including all locks, pulls, handles, sash fittings, window guards, railing brackets and sockets, bell cord thimbles, chafing strips, hinges and all other trimmings.

The upright panels between the windows and in the corner of the car are of plain mahogany, as are also the single-post pilasters, all of which are decorated with marqueterie inlaid. The end finish is of mahogany, forming a casing for the end door.

The general features of the motors and trail cars are the same, and they will all be wired so that they can be used as motor cars on demand. The entire car equipment for the subway will be uniform, and they will all be built after the specifications of the Interborough Company, the type here illustrated and described having been adopted as the standard for the road. The initial equipment will comprise 500 cars, orders aggregating that number having been placed with the John Stephenson, St. Louis, Jewett and Wason companies. These cars were designed by George Gibbs, consulting engineer, and by W. T. Thompson, master mechanic of the Interborough Rapid Transit Company.

THE INDIANAPOLIS & CINCINNATI TRACTION COMPANY

An interurban railway undertaking which is of somewhat different character from the usual interurban electric road as constructed so extensively in the Central States, is that of the Indianapolis & Cincinnati Traction Company. Construction is now in progress between Indianapolis and Rushville. Charles L. Henry, who will be remembered as the promoter and organizer of the Union Traction Company, of Indiana, and formerly its president, is president and general manager of the new undertaking. According to Mr. Henry's plans, the road will cater mainly to the through traffic between Cincinnati and Indianapolis, rather than to the local traffic that is the chief source of income on the majority of interurban roads at the present time. It will thus come into direct competition with the two steam roads between those points for the patronage of passengers to whom time is an object. The line is to be graded for double track. In locating the road care has been taken to maintain an alignment that will permit of high speed, even at the expense of grades, as it was reasoned that grades could be overcome by power or by momentum and would not prohibit high speeds, while on the other hand there is no possible way of making a crooked line safe for high speeds. The overhead trolley will be used, as it is considered more desirable than the third rail, everything considered. Between the Indianapolis city limits and Rushville there is no curve which will not permit cars to speed up to 70 miles an hour. From Rushville the road is surveyed to Connorsville, and from there it will run to Oxford, Ohio, and Hamilton.

COMPLETION OF THE ELECTRIC RAILWAY BETWEEN COLUMBUS, OHIO, AND INDIANAPOLIS, IND

The completion of the Indianapolis & Eastern Railway, from Indianapolis to Dublin, and of the Dayton & Western Railway, from Dayton to Richmond, completing the gaps in a chain of electric railways extending through Indiana and Ohio, and connecting Columbus and Indianapolis, was formally celebrated at Richmond, Ind., on Wednesday evening, Aug. 12. The city was elaborately decorated in the national colors, and thousands of citizens from the two States gathered to join in rejoicing with the officials of the roads, the State, county and municipal officers and other invited guests. It was a matter of regret that neither Governor Durbin, of Indiana, nor Governor Nash, of Ohio, could be present.



INTERURBAN LINE BETWEEN INDIANAPOLIS, IND., AND COLUMBUS, OHIO, WITH CONNECTING LINES

The cars from Indianapolis from the west, and those from Dayton from the east, and the cars of Richmond Street & Interurban Railway Company from Milton arrived in front of the Westcott Hotel about the same time. The visitors, numbering in all over two hundred, took dinner at the Westcott, having been met by reception committees. At 7:30 the procession to Glen Miller Park began. The Richmond band, in an open car, led the way, followed by the interurban cars. The trip to the park was one of continuous ovation. Red light illuminated the scene all the way.

The exercises at the park were of an informal nature. Hon. Wilfred Jessup acted as chairman, and introduced the speakers in a felicitous manner. Mayor Zimmerman was first introduced. He made a brief but fervent address of welcome. W. A. Hough, of Greenfield, attorney for the Indianapolis & Eastern, spoke in behalf of that line. He reviewed the history of the pioneer line, and paid a deserved tribute to the energy and progressive spirit of the men connected with the road from its inception to the present time. J. S. McMahan spoke in behalf of the Dayton & Western Company. He boasted jokingly of Dayton as an interurban center, and said that Dayton had annexed Columbus, Cincinnati, Eaton, and other Ohio cities, and was now about to invade Indiana and annex Richmond.

Mayor Bookwalter, of Indianapolis; Judge Gilmore, of Eaton, and Senator Sheppard, of West Alexandria, spoke in behalf of their cities, each making appropriate remarks. Judge Gilmore said that the interurban lines had not only enlarged the social realm, but they had enhanced the value of property from 20 per cent to 50 per cent. Mayor Bookwalter compared the joining of the two States by electric railway to a marriage ceremony, with Indiana and Ohio as the contracting parties. An elaborate display of fireworks on the banks of the lake terminated the celebration.

FROM INDIANAPOLIS TO COLUMBUS

The special car from Indianapolis left at 2:30 p. m. and arrived at Richmond at 6:00. No attempt was made for a record of fast time, stops being made at a number of points to take those invited to accompany the party. The trip was made in one of the new cars built by the Kuhlman Company, which is a palace of comfort and convenience. The Indianapolis party was made up of Frank M. Fauvre, president; J. W. Chipman, secretary and general manager; D. H. Robinson, superintendent; Mayor Bookwalter, Harold McGrew, Charles McGuire, Conrad Keller, members of the board of public works; E. D. Logsdon, member of the board of public safety;

John McGregor, John McGaughey and Thomas Spafford, county commissioners; Harry B. Smith, county auditor; W. A. Rhodes, vice-president of the City Council; R. O. Johnson, Fred Sheppard, E. F. Warfel, H. D. Michael, R. D. Fisher and others.

At Greenfield the Hancock County delegation was taken on board. The delegation was made up of Col. E. P. Thayer, County Auditor E. C. Richmond, Judge Felt, J. Ward Walker, Commissioners Barnard and Webb, Councilmen Wood Walker, F. G. Banker and Will A. Hough, attorney for the road. The Knightstown party was composed of Councilmen J. D. Snow, James Hudson, T. G. Cammack and W. C. Gurley; E. N. Sherbern, city engineer, and Frank Dovey.

A small party was taken on at Lewisville, including Albert Porter and L. F. Symons, cashier of the First National Bank, and G. W. Russell, commissioner of Henry County.

At Dublin, Albert Davis, Edward Myers and other prominent citizens joined the party. The official photographers of the road joined the party at this point, but before starting the car was run on the Y and the car and whole party were photographed. Small parties were taken on at Cambridge City and Centerville. The car was delayed at one point twenty minutes, as it was necessary to remove the trolley stand in order to pass under a low bridge.

When the Indiana car left Indianapolis it was the purpose of General Manager Chipman that his car and a few invited guests should go on an extensive trip through Ohio, touching Dayton, Springfield, Columbus, Newark and Cincinnati. The car left Richmond at 8:30 on Thursday morning, over the Dayton & Western line, and at nine minutes to 9 o'clock the first Indiana car passed into Ohio, marking, as it is believed, the beginning of a great interstate trolley traffic.

The party was made up of President Fauvre, General Manager Chipman, George L. McNutt, Ward S. Arnold, manager railway department of the Bullock Electric Company, of Cincinnati; Charles B. White, agent for the Harrison Safety Boiler Works, of Philadelphia; G. C. Kuhlman, of the Kuhlman Car Company, of Cleveland; R. D. Fisher, representing the Street Railway Journal, and Monroe George, official photographer. The car arrived in Dayton at 10:45, making the 40-mile run in less than three hours, despite the fact that a portion of the route was over new and unballasted track.

The Indiana car was at last denied further progress. Because of its great length and width, and the peculiar curve in the tracks at the entrance to the Fifth Street bridge, and, to the great disappointment of Manager Chipman, the trip to Columbus and Newark was necessarily abandoned. President Winters, of the Dayton & Western Company, did everything possible to overcome the obstacle, but the iron bridge could not be made wider, nor the approaches changed in a day. The incident, however, has aroused the city of Dayton to the necessity of constructing a number of modern bridges over the Miami River. The return trip from Dayton to Indianapolis was made Thursday evening, without incident. The trip was very enjoyable, and all concerned agree that much of the pleasure of the trip was due to Manager Chipman's care and kindness.

THE ROUTE AND THE CONNECTIONS

The accompanying map shows the chain of interurban lines now connecting the two cities. As has previously been stated, the last link to be built was that between Eaton, Ohio, and Richmond, Ind., belonging to the Dayton & Western Railway Company, which had previously built the line between Dayton and Eaton. Beginning at Indianapolis and going eastward the first road in the chain is the Indianapolis & Eastern Railway, which carries passengers as far as Dublin, Ind., where connection is made with the Richmond Street & Interurban Railway Company's line, operating between Dublin and Richmond. Between Richmond and Dayton is the Dayton & Western Railway; between Dayton and Springfield, the Dayton, Springfield & Urbana Electric Railway, and between Springfield and Columbus, the Columbus, London & Springfield Railway. The two latter roads are controlled by the Appleyard syndicate. The distance between the two State capitols is 188 miles. From Columbus it is possible to go 38 miles east to Newark, Ohio, on the Columbus, Buckeye Lake & Newark Traction Company's lines. A line is soon to be completed from Newark to Zanesville, which will complete the chain from Indianapolis to Wheeling, W. Va. The map is not intended to be complete, and does not show electric lines in either State other than those actually in operation or nearing completion, which form part of the networks centering in Indianapolis, Columbus and Dayton. There are many lines radiating from Cincinnati not shown, and the northern part of the State between Toledo and Cleveland has even more extensive interurban service than the southern part of the State.

ANALYSIS OF THE OPERATING REPORT OF THE INTERNATIONAL TRACTION COMPANY

BY H. D. EMERSON

The International Traction Company, through its ownership of the stock of the International Railway Company, owns and controls practically all of the street railroads in Buffalo, and a large number of the outlying interurban roads. According to the latest authentic reports the system includes 352 miles of track.

The income account for the fiscal year ended June 30, 1903, compared with the two years preceding, is as follows:

	1903	1902	1901
Gross earnings	$3,728,173	$4,566,502	$3,092,016
Operating expenses	2,013,624	2,254,084	1,587,407
Net earnings	$1,714,549	$2,312,418	$1,504,609
Charges	1,538,484	1,548,960	1,030,436
Surplus	$176,065	$763,458	$474,164

The decrease in earnings for 1903 from 1902 is explained by the large but temporary Pan-American traffic, and, consequently it is much fairer to compare the earnings for the year just past with the earnings for 1901. This comparison, with the changes, is as follows:

	1903	1901	Changes
Gross earnings	$3,728,173	$3,092,016	Inc. $636,157
Operating expenses	2,013,624	1,587,407	Inc. 426,217
Net earnings	$1,714,549	$1,504,609	Inc. $209,940
Charges	1,538,484	1,030,436	Inc. 508,048
Surplus	$176,065	$474,164	Dec. $298,099

The increase in gross earnings of 21 per cent is normal and to be expected in a city developing as rapidly as Buffalo, but part of the increased earnings is undoubtedly due to the increased mileage. We have not the statistics at hand showing the comparative mileage for the year just ended and 1901, but material additions have been made to the lines operated, although not sufficient to account for more than part of the increased gross. The operating expenses, that is the percentage of operating expenses to gross earnings, has materially increased, and the probabilities are that the present ratio of 54.01 per cent is more nearly the ratio which future operations will develop than the preceding ratio of 51.26 per cent. The International Traction Company, having long time franchises, has no particular object in reducing temporarily its cost of operations. On the other hand it has the same inducement as have steam railroads to fully maintain its property, and to charge the cost of such complete maintenance into annual expense rather than as against

capital account. The charges have materially increased, as the result of additions to the plant, both for the Pan-American traffic and for extensions and branches, but from now on we should begin to see a reduction in this account. An examination of the prior lien bonds outstanding develops the fact that $950,000 drawing interest at 7 per cent and 10 per cent, maturing on or before 1904, and that $150,000 at 5 per cent, also maturing in the same year. These bonds can be refunded and replaced with the collateral trust 4 per cents, which will reduce the fixed charges. In the same way a majority of the remaining outstanding prior liens mature in the next decade, and the substitution of the 4 per cents will again diminish fixed charges.

The net earnings for the present year are under the required $200,000 for the cumulative dividends of the $5,000,000 outstanding preferred stock, but it would seem that the operating expenses and the fixed charges other than interest, might be reduced, and consequently a surplus shown for the common stock. The full annual report of the corporation is waited with much interest, as it will give the various items which go to make up the fixed charges and the operating expenses, and we can then determine what proportions are permanent and what were temporary increases for the year just ended.

The International Traction Company, viewed strictly from a financial standpoint, is one of the best traction companies which have sprung into existence in the past few years. It has practically perpetual franchises, running, as they do, for over 900 years, which is very materially greater in length of time and beyond the maturity of any of its outstanding obligations. In this respect its financial doings can be considered in the same manner, and the same rules applied, as are applicable to steam railroads.

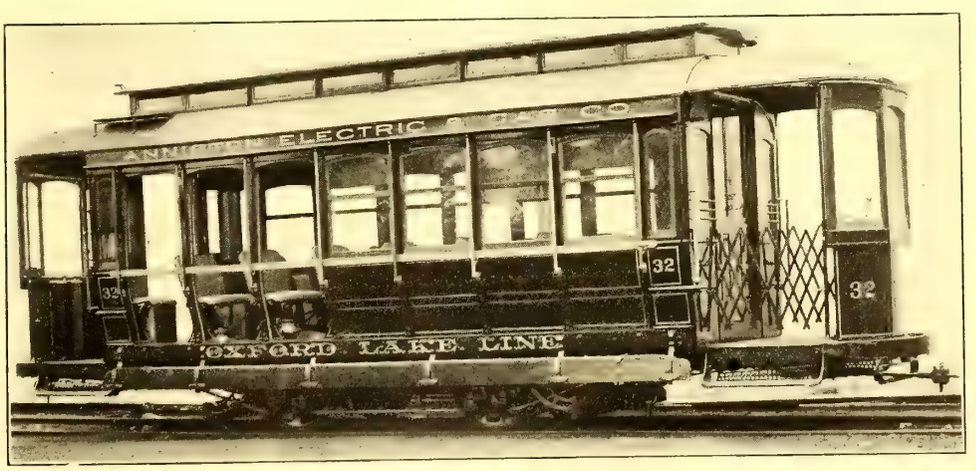
In considering the earnings of steam railroads a decrease in net earnings is not considered as detrimental to the property or to the value of securities as a decrease in gross earnings, because a decrease in net may indicate simply changes strictly under the control of the management. In the past few years we have found when considering steam railroads that decrease in net earnings oftentimes meant the best management, because when figures were finally analyzed and the doings of the property summarized, it became evident that the management was spending more money in maintenance than was absolutely necessary to keep the property in safe working condition. This added expenditure for maintenance, or, as it is frequently called, over-maintenance, is in effect a reserve fund invested in the property, for if the expenditures are carefully and intelligently made the property is put in such condition that expenses can safely be reduced when gross earnings fall off. In considering the maintenance accounts of most electric railway and traction companies, it has been demonstrated in many cases that the figures submitted cover simply daily operations and the expenditures necessary simply to keep the traffic moving.

In the case of a new trolley road the absolute necessary cash expenditures are much less for the first few years than for the second five. New rails, new equipment and new motors should not, and naturally do not, require the same expenditures for upkeep that will be laid out after the plant has become worn. Of course a decrease in net earnings, resulting from an increase in operating expenses, is temporarily disadvantageous to stockholders, but the experience of steam railroads has been that it is much better to defer dividends on stock and have an ample reserve by putting the property in first-class condition, than it is to pay dividends to the limit. The report of the International Traction Company, on the face of it, tends to demonstrate that its management at least is making all proper expenditures, and is charging the same to the operating expense. This policy is to be commended, and its adoption by other traction companies will tend materially to strengthen the public confidence in traction securities.

CONVERTIBLE CARS FOR ANNISTON, ALABAMA

The J. G. Brill Company recently completed three cars of its patented convertible type for the Anniston Electric & Gas Company, of Anniston, Ala., the order for which was placed by the General Electric Company, of Schenectady, N. Y. Anniston is a town of 14,000 population, situated in the northeastern part of Alabama, at the junction of several trunk railroads, and is the commercial center of a large district. Large steam car building shops are located there, and the town furnishes an excellent field for electric railway operation. Oxford Lake Park, about 4 miles south of Anniston, is a pleasure resort owned by the railroad company, containing about 70 acres, and is very popular. There are bathing houses at the lake, a half-mile race track and a large dancing pavilion. Each year a fair is held at the park. Cars of the type herein described are intended for use on the line running to the park.

The accompanying cut shows the car partly opened, the running board is folded up and the guard rail down. The vestibules at either end are the builders' removable type, and are well suited to this style of car, especially in the South, where in winter it is only necessary to furnish protection from rain. The cars are 20 ft. 7 ins. long over the end panels; 29 ft. 7 ins. over crown pieces; from end panels over crown pieces, 4 ft. 6 ins.; width over sills and sill plates, 6 ft. 11¼ ins.; width over posts at plate, 7 ft. 9 ins. From center to center of posts, 2 ft. 7 ins.; sweep of post, 5 ins.; thickness of corner posts, 3¾ ins.; thickness of side posts, 3⅜ ins. The interiors are finished in natural cherry with ceilings of decorated birch. The seats are of the Brill patented revolving type, 34 ins. in length, with spring cane seat and back, and furnish seating for twenty-eight passengers. The cars are mounted on No. 21-E trucks, having a 7-ft. wheel base, 33-in. wheels, and 4-in. axles. The trucks are equipped with General Electric No. 67-motors; weight of a car and truck without motors about 18,000 lbs.



CONVERTIBLE CAR FOR ANNISTON, ALA.

The new touring car on the Cleveland Electric Railway has proved such a popular innovation that a second car will be added. The routes of the present car have been rearranged so that it now makes an extra trip.

ECONOMY JOURNAL LUBRICATOR

A journal lubricator, which is said to be meeting with quick success among electric railways, as well as steam roads, in the vicinity of Chicago, is now on the market under the name of the Economy journal lubricator, and is made by the Railway Journal-Lubricating Company, of Milwaukee, and of Chicago.

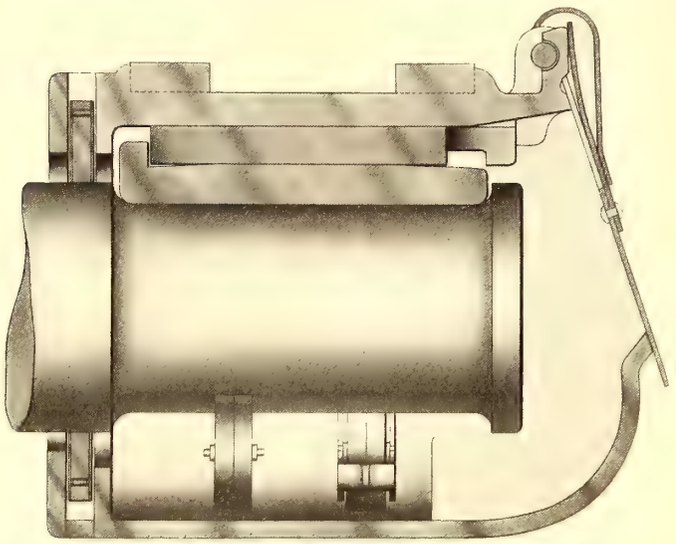


FIG. 1.—M. C. B. 5-IN. X 9-IN. JOURNAL, SECTIONAL SIDE VIEW

This journal lubricator depends for its operation on the distribution of oil on the journal by two small ball-bearing lubricating wheels, the lower portions of which run in the oil. Fig. 1 is a sectional side view of an M. C. B. 5-in. x 9-in. journal box equipped with the new lubricator. Fig. 2 is a sectional end view of the same box, and Fig. 3 is a sectional view from the top, looking down on the lubricators in position in the journal box. From Fig. 1 and Fig. 2 it is seen that these little ball-bearing lubricating wheels run in oil in the lower part of the journal box. The oil is carried by capillary attraction on the rims of the lubricating wheels to the car journal. The wheels are held against the journal by a spring pressure. The whole apparatus is easily taken apart without the removal of any bolts or screws.

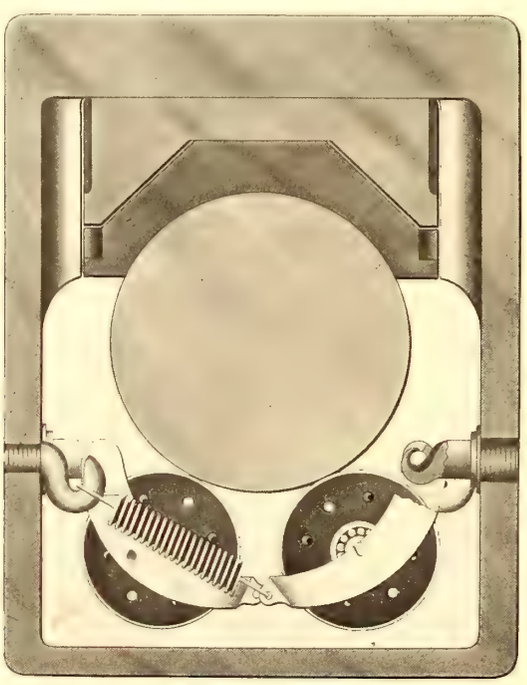


FIG. 2.—SECTIONAL END VIEW

In connection with this lubricator it was necessary to devise a dust guard which would effectually close the space around the journal where it passes out of the box. The dust guard is shown in Fig. 4, and has two hard-fibre guards held by springs against the journal, the springs being arranged to provide for both vertical and horizontal movement. The bottom of the journal box is filled with oil, which is practically all returned after being used on the bearing. The dust guard and shape of the box near the dust guard are such that whatever oil creeps toward the dust guard is returned to the bottom of the box instead of running down the outside.

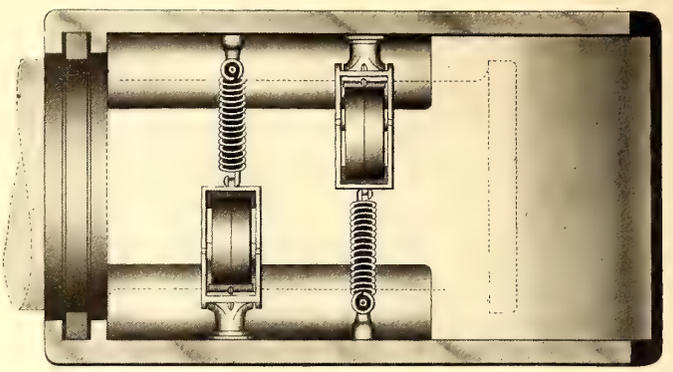


FIG. 3.—LOOKING DOWN ON LUBRICATORS IN POSITION IN JOURNAL BOX

The most notable use of this lubricator is on the Aurora, Elgin & Chicago Railway, which is a very high-speed line, cars weighing 74,000 lbs. making over 60 miles per hour. The importance of first-class journal lubrication was early apparent in the operation of this road, and all the cars are now being equipped with this lubricator. It is also in use on the Halsted Street and Wentworth Avenue lines of the Chicago City Railway, the cars on this line weighing 48,000 lbs. without load, and requiring unusually good lubrication of the journals.

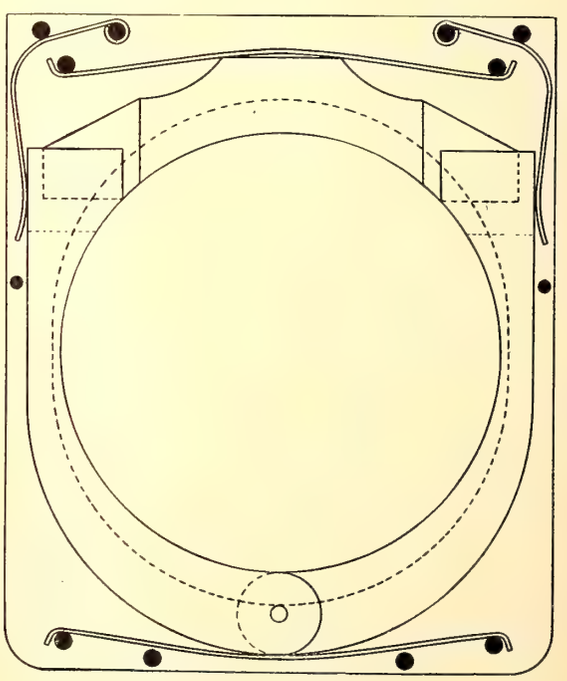


FIG. 4.—DUST-GUARD

This is a radical change from lubrication by means of waste, involving principles similar to the self-oiling bearings used on stationary machinery. With an effectual dust guard, such as is placed on journal boxes equipped with this lubricator, the manufacturer believes that there is no reason why it should not be as successful as the ring oiling bearings on stationary machinery.

FINANCIAL INTELLIGENCE

WALL STREET, Aug. 19, 1903.

The Money Market

Decided ease in call loans and equally pronounced firmness in the longer time maturities, continue to be the feature of the money market. The ease in call money, which is quoted at 1½ to 2 per cent, reflects the large balance of surplus capital released by the recent liquidation in securities and also the absence of public speculative borrowing. Large advances are reported as having been made to important financial interests to finance recent purchases of stocks, and it is this which in part explains the failure of the loan account to decrease in proportion to what might be expected as the result of the upheaval in the stock market. Loans of this character, however, have for the most part been time loans, and consequently have influenced the rates for time money rather than those for call money. Time accommodations are quoted at 4 per cent for sixty days, 5 per cent for three months and 5½ to 6 per cent for five to six months. Apart from the large borrowing operations referred to on the Stock Exchange, the main factor tending to sustain the loan account has been the huge outtakings of capital by the various railroads in connection with the schemes for improving property and equipment. No more of these transactions have been announced during the past week, but the market evidently has not ceased to feel the effect of the operations previously made public. In Saturday's bank statement the $4,350,100 loan contraction fell far short of the more sanguine expectations, although the showing in this respect was a marked improvement as compared with previous weeks. The Street was unpleasantly surprised, moreover, by a loss of $2,257,000 in cash when the estimates of Sub-Treasury and interior currency movements had indicated a fair sized increase. For this discrepancy no adequate explanation appears, but it was suggested that recent bank mergers might have had some effect in distorting real conditions.

The money situation as a whole seems to be shaping itself in conformity with opinions long ago expressed in this column. The stock market decline has anticipated, and has thereby modified the natural tendency of the season toward a money stringency. Higher rates for time money have already brought down foreign exchange rates to within a short distance of the gold import point, the heavy purchases of securities by Europe being a contributory influence in the same direction. There can no longer be doubt that when our money rates harden still further, as they assuredly will in the course of another month, we shall be able to draw gold freely from abroad. Gold imports will make good in large measure the drafts upon bank reserves occasioned by the crop-moving demands. There will be, of course, no room for any expansion of credits in a fresh Stock Exchange speculation, but in view of the favorable position in the foreign exchanges, and in view also of the fact that the surplus reserve stands $14,000,000 above last year's total, there is reasonable assurance that no further mulcting of existing stock market loans will be necessary. The whole banking condition is extremely healthy, and whatever rise in money rates and lowering of bank reserves may be brought about by the usual autumn requirements, can be looked forward to with complacency.

The Stock Market

This week's very sharp recovery in prices is chiefly significant, because it denotes a greater degree of confidence than has yet existed that the stock market has at length turned the corner. Prices have moved in the manner they usually do when weak speculative holdings have been thoroughly weeded out, leaving securities in strong hands. The usual sign of the culmination of a protracted decline is just such a violent rebound as has been witnessed during the past ten days. According to all accounts, the heads of the financial community came to the decision a week ago that liquidation had gone far enough; that the temper of the rank and file of security holders had become so thoroughly demoralized that a serious panic was likely to ensue unless prompt measures were taken to avert it, and that it was time for them to apply the remedies. Purchases from these high quarters went on in enormous quantity at the opening of last week, and it was their influence which served to turn the tide. The market from the low level of Monday week up to yesterday's close had advanced ten points or more among the active stocks, with much larger gains in numerous specialties. This much, it is agreed, was consistent with the limits of a normal recovery. The question now arises whether attempts will be made to induce a revival of speculation and carry the upward movement further, or whether the market, having recovered its equilibrium, will be allowed to shift for itself. In the latter case some substantial setback should occur, inasmuch as the real demand is not sufficient to support such a rapid upturn in prices. There is no doubt that the idea of another speculation at this season is repugnant to conservative opinion. Such a movement would weaken bank reserves at a time when they are most in need of sustenance, and it would also check Europe's buying, which has been an influential factor of support. Not only this, but the danger would be that recent European purchasers, seeing the opportunity for a quick profit, would unload their holdings, an operation that would not only be unsettling to the stock market, but would tend to destroy the present favorable situation in the foreign exchanges. As pointed out in the foregoing article, the money market must count upon gold imports to make good its losses in the autumn crop movement. With Europe's investment buying of securities to offset our reduced trade balance, we can count with some assurance on drawing the necessary gold from abroad, but should Europe cease to buy and turn seller it would certainly lessen the chance of the home money market obtaining the aid required from foreign capital. These are some of the main considerations why it is advisable for the stock market to go slow. It remains to be seen whether the Wall street leaders will abide by this conservative view.

The local traction stocks have enjoyed their full proportion of the general improvement. The only important specific development in this group was last week's quarterly earning statement of the Manhattan Elevated, which in some respects is the most important that the company has yet published. It shows that along with the increased volume of traffic the ratio of operating expenses under the electrical equipment has been reduced to a much greater extent than expert opinion had predicted. The saving under the new system appears to be nearly a half of a cent on every passenger carried—a truly astonishing exhibit

It is no wonder, under these circumstances, that the rise in the stock has been a violent one. In the case of Metropolitan and Brooklyn Rapid Transit, the technical condition created by a scanty market supply on the one hand and a fair-sized short interest on the other, has been conducive to a particularly sharp recovery.

Philadelphia

The general improvement in speculative circles has made itself felt very decidedly among the Philadelphia traction specialties. In most instances the recovery from the recent low level has carried prices back to where they were two months ago. American Railways has enjoyed the sharpest advance, moving up under active trading from 43 to 47. Buying of these shares has been stimulated by the near prospect of the dividend declaration, at which time it is also expected that a highly favorable statement of the company's operations will be given out. Philadelphia Company common was bid up during the week from 38 to 41 without bringing out much stock. The preferred changed hands at 43¾ and 44. Philadelphia Traction, after selling at 93⅞, advanced to 95½, and Union Traction rose sharply from 42½ to 44. Rapid Transit advanced from 12 to 13½ and fell back to 13. In speculative circles the movement was regarded with suspicion as indicating a desire to distribute stock. The only other noteworthy sales of the week among the traction stocks were Pittsburg Traction preferred at 47½, Consolidated Traction of New Jersey at 62, and Chicago Union Traction at 5⅞ to 6¾.

Chicago

This has been one of the dullest weeks recorded for some time in the market for traction shares at Chicago. There is gratifying evidence, however, that liquidation has run its course here the same as elsewhere. The only incident of importance was the application for a receiver for the North Chicago and West Chicago properties, made in behalf of the bondholders who are not satisfied at the disposition provided under the Union Traction reorganization plan. So far as any effect on the market was concerned, this action seemed to be pretty well discounted. North Chicago sold at

100 and West Chicago at 55, but only for a few insignificant lots. City Railway shares recovered 5 points from 165 to 170, and Union Traction common gained 2½ points from 4½ to 7. Among the Elevated shares the most noteworthy improvement occurred in Metropolitan issues, the common rising from 20 to 24, and the preferred from 57 to 65 on fairly active trading. Other sales for the week included Northwestern common at 20, the preferred at 60, South Side at 97 to 97¼, and Lake Street receipts at 5¾ to 6.

Other Traction Securities

Massachusetts Electric common was the feature of the week in the Boston dealings, gaining 3 points from 21½ to 24½. A large part of the buying in this issue represented covering of short contracts. Massachusetts preferred rose from 80 to 81 and later sold at 80½. West End common went up from 89 to 89¾, but subsequently lost the whole of its gain. Only one transaction was reported in the preferred at 110. Boston Elevated selling ex-dividend sold as low as 136 and as high as 138. Among the Baltimore specialties little change occurred. United Railways common rose a fraction from 10½ to 10⅞, the income bonds went up from 62 to 64¼, while the general mortgage 4 per cents were steady at 92½. The other sales reported comprised Knoxville Traction 5s at 101, Newport News and Old Point Comfort 5s at 100, and City Passenger 4½s at 103¼ and 102¼. On the New York curb the feature of the week was an active inquiry for Brooklyn City Railroad stock, in the course of which the price was bid up from 223 to 240. Following the excellent report of the company, Interborough shares were strong at an advance from 96 to 99. Other sales included American Light and Traction common at 56, Washington Electric common at 9¼, the preferred at 37 to 37½, New Orleans 4½s at 82, New Orleans common at 11 to 11½, and Nassau Electric preferred at 79.

Detroit United was again the active issue in Cincinnati, about six hundred shares changing hands at a range of from 65¾ at the opening to 70 at the close of the week, the gain being steady throughout the week. About 500 shares of Toledo Railways & Light sold at between 21½ and 24. The disinclination of the Toledo Council to grant a new franchise is affecting this issue somewhat. Cincinnati Street Railway was weaker, the range being from 130⅞ to 132, the former the closing figure. A small lot of Miami & Erie Canal brought 7, and a small lot of Elgin, Aurora & Southern 48½. Columbus, Delaware & Marion 5s were the only active bonds, selling at the old price of 101.

Northern Texas Traction was the most active issue in Cleveland, which is not saying much, since less than 200 shares changed hands. These brought 30, which was slightly higher than previous sales. Lake Shore Electric preferred sold at 45, Cleveland & Southwestern preferred 64, and Aurora, Elgin & Chicago preferred 60. Cleveland Electric sold at 72 for a small lot, and Northern Ohio Traction made a new low mark of 17½ for several small lots and then advanced to 13. Stark Electric Railway, a new Cleveland road, brought 28 for a small lot, the first ever sold. The property is a most promising one.

Security Quotations

The following table shows the present bid quotations for the leading traction stock, and the active bonds, as compared with last week:

	Closing Bid	
	Aug. 11	Aug. 18
American Railways	43	46½
Aurora, Elgin & Chicago	b17½	b17½
Boston Elevated	135½	137
Brooklyn Rapid Transit	41	47¾
Chicago City	165	160
Chicago Union Traction (common)	3½	5
Chicago Union Traction (preferred)	30	25
Cleveland Electric	72	b72
Columbus (preferred)	102	—
Consolidated Traction of New Jersey	64	61
Consolidated Traction of New Jersey 5s	103½	103
Detroit United	65½	69¾
Elgin, Aurora & Southern	b52	b52
Lake Shore Electric	b10½	b10½
Lake Street Elevated	4¾	5¾
Manhattan Railway	130⅞	135
Massachusetts Electric Cos. (common)	21	24
Massachusetts Electric Cos. (preferred)	80	80
Metropolitan Elevated, Chicago (common)	18	22
Metropolitan Elevated, Chicago (preferred)	55	60
Metropolitan Street	111	116
New Orleans (common)	9	11⅛
New Orleans Railways (preferred)	30	35
North American	71¾	79⅜
Northern Ohio Traction & Light	18	18
Philadelphia Rapid Transit	11¾	12¾
Philadelphia Traction	94	95½
St. Louis Transit (common)	17	19
South Side Elevated (Chicago)	97	96
Syracuse Rapid Transit	25	25
Syracusce Rapid Transit (preferred)	72	73
Third Avenue	111½	114
Toledo Railway & Light	21	22
Twin City, Minneapolis (common)	91	95
Union Traction (Philadelphia)	42⅜	43⅝
United Railways, St. Louis (preferred)	64½	68⅝

a Asked. b Last sale. * Ex-dividend. † $10 paid.

Iron and Steel

The market for pig iron continues somewhat unsettled, although to a less degree than in some time past. A better demand is reportd ed all over the country. In the West sales of 150,000 tons at the prevailing prices are reported, and fair-sized orders have been placed also in the Pittsburg district. Notwithstanding this better buying, however, prices are still being shaded. A cut of 1.50 a ton all around was reported as late as yesterday. Significant of the general uncertainty as to the future, the United States Steel Corporation has postponed placing its tonnage for the final quarter of the year, and it is not clear on what terms this all important business will be arranged. In the products of the higher rank, such as steel billets, tin and sheet bars, the demand is comparatively light, although to offset this it may be noted that steel production is being curtailed. Quotations are as follows: Bessemer pig iron, $18.75 to $19; Bessemer steel, $27 to $27.50; steel rails, $28.

Metals

Quotations for the leading metals are as follows: Copper, 13½ to 13¾ cents; tin, 27¾ cents; lead, 4¼ cents; spelter, 5½ cents.

ARGUMENT ON METROPOLITAN SUIT

Argument on the application of John F. Doyle, a stockholder of the Metropolitan Street Railway Company, of New York, for an order for the investigation of the books of the company, was heard Wednesday, August 12, by Justice McCall, sitting in Part 1 of the Supreme Court. Mr. Doyle alleges that there have been irregularities in the management of the company. Former District Attorney Philbin, on behalf of Mr. Doyle, said that there was no connection between the present action and the Amory fiasco.

De Lancey Nicoll and Paul A. Cravath, of Guthrie, Cravath & Henderson, who appeared in opposition to the motion, through Mr. Nicoll, raised a preliminary objection to the hearing on the ground that as every allegation of Mr. Doyle's had been denied his only application could be for an alternative writ. Justice McCall said he would deal with the case on its merits and hear the argument.

Mr. Philbin, in opening the argument, said his client held 520 shares of stock in the company, and, after an absence from home, his attention was called by his son to the fact that the newspapers had been commenting upon the affairs of the Metropolitan Street Railway Company. Mr. Doyle's 520 shares of stock represented a value of about $60,000, and he had been a stockholder of the corporation since its organization. In 1902 he attended a meeting of the stockholders at which he proposed a motion which was only defeated because the chairman held so many proxies.

Mr. Philbin said he had been retained by William N. Amory and others in proceedings pending at the time, and Mr. Doyle, who had known him for many years, also retained him.

"On my advice," said Mr. Philbin, "he wrote to the Metropolitan Street Railway asking for an explanation with regard to certain financial matters, but received no reply. About ten days afterward, however, a report was sent to every stockholder, including Mr. Doyle, based on the examination of expert accountants, and which was in the nature of a reply to the twelve items in which Mr. Doyle desired information. An examination of this report was carefully made, with the hope that the matters complained of would be satisfactorily explained. It appeared, however, that the investigation, which was made by Mr. Teale, did not cover Mr. Doyle's requests, and it then became necessary for him to apply to the company for leave to inspect its books, which was denied, the president giving as the reason for his refusal that Mr. Doyle had joined in the attack made by Amory

and Braker on the company. As a matter of fact, Mr. Doyle's application was made in good faith.

"This application cannot be considered an attack on the Metropolitan Street Railway Company, and that is shown by the fact that Mr. Doyle owns stock worth now $55,000, his stock a few years ago having been wo~th $120,000.

"The reason for our application is that several months have elapsed since these charges of mismanagement were made and published, and the directors of the company have never done anything to dispel the uneasiness that exists in the community as to the value of the stock and assets of this company."

Mr. Nicoll in opposing the granting of mandatory writ said there are 2500 stockholders and Mr. Doyle was the only one to apply for a writ. No company, he asserted, has been so thoroughly investigated, and the District Attorney and his experts found nothing wrong after a winter spent on them. Mr. Moore, the company's auditor, denied emphatically all the allegations against the company made by Mr. Amory.

"We deny all charges of mismanagement," continued Mr. Nicoll. "We deny all charges of misapplication, we deny all charges of waste of assets, and we support our denials by the statements of the accountants. The least that can be said of those making these charges are that they are mistaken.

"The experts never examined the books," interrupted Mr. Philbin. "There is nothing to show they did."

"They did," replied Mr. Nicoll. "They spent two weeks examining the books, and then we offered the testimony heard by Justice Scott in the action to break the Interurban lease as proof that the books had been examined."

Mr. Philbin made a short rejoinder to Mr. Nicholl, saying: "Our application is not based on any expert accountant's reports, but on the discrepancies contained in the company's report to the Railroad Commissioners."

Justice McCall then reserved decision.

CONSOLIDATION OF SUBURBAN COMPANIES AT WORCESTER, MASS.

The directors of the Worcester & Southbridge Street Railway Company, the Worcester, Rochdale & Charlton Depot Street Railway Company, the Southbridge & Sturbridge Street Railway Company and the Worcester & Southbridge Development Company, at a meeting Aug. 15, voted to consolidate the companies into the Worcester & Southbridge Street Railway Company, capitalizing the new corporation at $2,000,000. Meetings of the stockholders of the four corporations have been called to act on the matter, but as 4000 of the 5000 shares in them all were represented at the meeting of the directors, there is no doubt of the action being ratified. In order to have more time for his other duties, Wilford A. Bailey resigned as treasurer of the Worcester & Southbridge Street Railway Company, and John A. Hall, treasurer of the Southbridge Savings Bank, was elected to succeed him. Mr. Bailey was selected by the directors as general manager of the consolidated companies. He has had the direction of the building up of all the properties owned by these companies and has been in general charge of their operation.

The directors voted to develop the common carrier business on the line and connection is to be made with the tracks of the New York, New Haven & Hartford Railroad at Southbridge. The rights to engage in this business have been granted by the State and municipal authorities. It was voted, also, to extend the Southbridge & Sturbridge line to Palmer.

All these properties are practically new, the oldest being the Southbridge & Sturbridge Street Railway, which was built six years ago and practically rebuilt last year. The Worcester, Rochdale & Charlton Depot Street Railway Company owns no rolling stock, but cars are operated over its tracks under a traffic agreement with the Worcester & Southbridge Street Railway, which was completed last year. The Worcester & Southbridge Development Company owns Pinehurst Park, which is being developed into one of the finest amusement parks in New England, and Hotel Overlook, in Charlton, a country hotel, which, with the grounds, will cost, it is said, $200,000. The consolidation will centralize the various companies which were being operated harmoniously. The stock will remain practically where it is now, shares in the new company being given for shares in the old in proportion to their value.

San Blas, a seaport town of some 2000 population, in the State of Jalisco, Mexico, is to have up-to-date American electric lighting and traction systems. H. B. Masset, representing California capitalists, is now in Mexico on the matter.

REPORT OF INTERBOROUGH COMPANY FOR QUARTER AND THE YEAR

The Interborough Rapid Transit Company, which operates under lease the Manhattan Elevated Railway Company, of New York, has made public statements of its earnings for the quarter ending June 30, 1903, and for the year ending June 30, 1903. By comparison with the figures of the company for the same periods of the previous year, the increases shown are very heavy. Taking the statement for the quarter, the increase in gross receipts for 1903 was $414,537, with a decrease in operating expenses of $99,017. This makes the total increase in net earnings $513,554. The item of other income, however, shows a decrease for 1903 of $21,100, leaving the increase in total income of $492,454. There is an increase in taxes of $28,714, but the increase in surplus shows the magnificent sum of $463,740. The percentage of operating expenses was further decreased from 49.03 per cent to 39.80 per cent. Turning to the statement for the year, the gross receipts for 1903 increased over 1902 $1,542,188. There was a decrease in operating expenses of $57,791, leaving an increase for 1903 in net earnings of $1,600,217. The item "other income" shows a decrease for 1903 of $278,941. The increase in total income for 1903 was $1,321,276. Interest and taxes for 1903 increased $121,188, leaving an increase in surplus for 1903 over 1902 of $1,200,089. The percentage of operating expenses to gross receipts decreased from 51.74 to 44.73. There was an increase in passengers carried of 31,327,677. The statements follow:

Quarter Ending June 30.	1903	1902
Gross receipts	$3,271,787	$2,857,250
Operating expenses	1,302,089	1,401,106
Net earnings	$1,969,698	$1,456,144
Other income	90,187	111,287
Total income	$2,059,885	$1,567,431
Interest and taxes	684,563	655,849
Surplus	$1,375,322	$911,582
Op. per cent	39.80	49.03
Passengers carried	66,105,436	57,699,248
For the Year Ending June 30.	1903	1902
Gross receipts	$12,208,337	$10,665,911
Operating expenses	5,460,794	5,518,585
Net earnings	$6,747,543	$5,147,326
Other income	346,859	625,800
Total income	$7,094,402	$5,773,126
Interest and taxes	2,820,859	2,699,671
Surplus	$4,273,544	$3,073,455
Operating, per cent	44.73	51.74
Passengers carried	246,587,022	215,259,345

The general balance sheet as of June 30, 1903, follows:

ASSETS

Cost of lease and equipment of subway	5,378,357
Stocks and bonds of other companies	13,527,266
Other permanent investments, real estate	1,738,341
Supplies on hand	550,291
Due by agents of this company, on account of traffic	164
Due by others than agents, on account of traffic	11,311
Due by companies and individuals, on open accounts	68,315
Cash on hand	10,886,248
Loaned on collateral	1,015,000
Manhattan guarantee fund	4,018,811
Prepaid insurance	6,748
Total	$37,180,852

LIABILITIES

Capital stock	$35,000,000
Interest on funded debt of N. Y. Met. and Man. Ry Cos., due and accrued	288,497
Sundries	7,636
Manhattan Ry. Co. lease account	430,920
Due for wages	94,703
Due for supplies, taxes, etc.	267,614
Due companies and individuals	10,085
Interest and premium on capital stock	371,073
Taxes in litigation	163,000
Profit and loss (surplus)	547,324
Total	$37,180,852

President Belmont, of the Interborough Company, is quoted as making the following statement regarding the earnings of the Manhattan system: "It is gratifying to the management of the Interborough Company that the Manhattan lease is proving such a success. The surplus over and above liberal expenditures in operation and the 7 per cent guaranteed in the lease for the current year will enable the Interborough Company to carry out the intended improvements in stations, care of structure and equipment and adopt every device within reach of its technical department to insure the safety of the traveling public."

AFFAIRS IN CHICAGO

Almost every day last week there was some more or less startling announcement concerning the affairs of the Union Traction Company. On Wednesday, Aug. 12, two bills were filed in the Superior Court asking the appointment of receivers for the North Chicago Street Railway Company and the West Chicago Street Railway Company. These actions were begun by bondholders in the two companies who declare that the action in the United States Court against the Union Traction Company and the two subsidiary companies will not afford proper protection to the creditors of the two lesser companies.

On Friday, Aug. 14, unofficial announcement was made that more than two-thirds of the stock of the companies was in the hands of Fred H. Rawson, vice-president of the Union Trust Company, and Harry H. Blair, both of whom are members of the protective committee of the underlying companies.

This announcement was followed on Saturday by action on the part of the majority faction in the companies that it was thought practically guaranteed the ratification of the reorganization plan to be acted upon Tuesday, Aug. 18. This action consisted of securing from the Federal Court a restraining order to prevent any interference with a vote upon the propositions of reorganization. This court order, naming as defendants the stockholders opposed to the new lease and their attorneys, representatives and employees, bade them appear in court on Monday to show cause why the order should not be made permanent.

When the attorneys for the minority stockholders appeared in court on Monday, a sensation was sprung. Judge Grosscup said knowledge had come to him that an offer had been made of $100,000 to settle the difficulty. The judge further said that he would call for all the evidence concerning this phase of the matter, and would sift it to the bottom. He made plain the statement that the affairs of the Union Traction Company are in the hands of the United States Court, and that the receivers in charge are there to protect all the stockholders. The injunction order restraining the minority stockholders from interfering in any way with the reorganization meeting of the traction companies called for Tuesday was made permanent.

At the meeting on Wednesday, at which 70 per cent of the stockholders of the underlying companies was present, it was unanimously agreed to accept the terms as suggested by the traction people. This contemplates a reorganization and a tripartite agreement.

FIFTY-MILLION-DOLLAR HOLDING COMPANY FOR SOUTHERN CALIFORNIA LINES ABANDONED

The holding company with a capital of $50,000,000 for the Hellman and Huntington electric railways in Southern California has been abandoned. Senator W. A. Clark of Montana and E. H. Harriman were to have held a minority of stock in the proposed company, Hellman and Huntington keeping the control. The interested parties, for some reason not made public, have, however, decided not to disturb the existing four companies which represent the Hellman and Huntington lines. They comprise the Pacific Electric Railway Company and Interurban Electric Railway Company, with $10,000,000 each of stock and bonds; Los Angeles Street Railway, with $5,000,000 each stock and bonds, and the Los Angeles Traction Company, recently bought by the Pacific Electric Railway Company for about $2,000,000.

The Los Angeles Traction Company was to have been used by Clark and Harriman as the nucleus of a rival electric system in the south. They, however, finally agreed to let Huntington and Hellman buy it. They also arranged to enter the Huntington and Hellman roads as investors in one big holding company for the four roads. Now that the latter has been abandoned it is understood Clark and Harriman will take as an investment a certain amount of stock and bonds in the Pacific Electric and the Interurban Electric Companies.

EXHIBIT BOOTHS AT SARATOGA

A number of manufacturing companies which are planning to make exhibitions at the coming convention at Saratoga Springs have already made arrangements with the Allen-Bates Company, which makes a business of constructing booths of this kind. The convenience of having a professional firm undertake the work, as well as the better results usually secured, makes the fact that this firm is engaged in this work of interest. Its headquarters are at 10 North Market Street, Boston.

ELECTRIC RAILWAY TAXATION IN INDIANA

The State Tax Board of Indiana has completed its assessment of electric lines and the report shows an increase of $2,374,450 over the appraisement of last year, making a total valuation placed on such roads of $12,013,762, distributed as follows: Main track, $10,313,795; second main track, $68,890; side track, $75,657; rolling stock, $347,109; improvements on right-of-way, $378,285. There are 754.17 miles of main track and 26 miles of side track in the State.

The appraisement of the Indianapolis Street Railway Company remains at $32,000 per mile and the Indianapolis Terminal & Traction Company is assessed on 29 miles of track at $3,500 a mile. The Union Traction Company is assessed at $15,000 per mile, and the Indianapolis Northern at $5,000 per mile. The board reduced the assessment of the Indianapolis & Eastern Company from $11,000 to $4,000 a mile. The company has built 13 miles since last year. The Indianapolis, Columbus & Southern (the Greenwood line) was increased from $9000 to $11,000 per mile. The three new lines that have come into Indianapolis since last year were assessed as follows: The Indianapolis & Martinsville line, $7,000 per mile on 13 miles and $3,000 on 14 miles; the Plainfield line, $9,000 a mile on 12 miles, and the Shelbyville line, $8,000 a mile on 26 miles of road.

WORK BEGUN ON TUNNEL EXTENSION ON BROADWAY, NEW YORK

Work was begun last week by the Degnon-McLean Construction Company, sub-contractors, on what probably is the most important and difficult section of the subway—the extension from the City Hall, Manhattan, down Broadway to Bowling Green to connect with the extension under the East River to Brooklyn. Lower Broadway, lined with sky-scrapers, and on which traffic is terribly congested, presents a problem not encountered anywhere else along the route of the entire line. But even beset with these difficulties the contractors plan to carry on the work so as not to interfere with ordinary traffic from 8 A. M. to 6 P. M. Nearly all of the work will be done at night. The contract with the city requires that two gangs of men, each working eight hours, must be used.

The contractors intend to use the "slice" system, which was employed in Boston. They will work from two shafts sunk in the sidewalk—one at Trinity church and one at St. Paul's The framework for the shaft structure has been erected in front of St. Paul's Chapel. When completed this structure will cover Broadway like a shed. The supports on either side of Broadway are heavy 30-ft. beams. There will be twenty-six feet of head room over the trolley tracks. A 6-ft. passageway will be left in front of St. Paul's and a somewhat larger one in front of the Park National Bank, on the other side of the street.

When the shed is up the roof will be used as a dump for the buckets which will bring the excavated material up from the shaft. The dirt will be put into carts by a chute from this platform. Two openings in the sidewalk will be made at this place, each 6x20 ft. They will be boarded in. It is thought that a third shaft will be needed between Trinity and St. Paul's, in which case it will be put down in the neighborhood of Liberty street. The material used in the construction of this tunnel will also be taken in through these shafts. The street will be torn up at night where the contractor wants to work, but will be boarded over and restored for traffic by 8 o'clock in the morning.

The officers and enlisted men of the Twenty-Third Regiment, N. G. S. N. Y., with headquarters at Brooklyn, were the guests of the management at Manhattan Beach a few days ago. The question of transporting the regiment fell to the management of the Brooklyn Rapid Transit Company, and was solved by Superintendent Edwards, of the elevated division of the company, who made up a train of ten motor cars, probably the longest electric train ever operated.

THE COLORADO ELECTRIC LIGHT, POWER & RAILWAY ASSOCIATION

As a result of a very enthusiastic meeting of electric lighting, power and street railway men in Denver, Col., on Aug. 12, the Colorado Electric Light, Power & Railway Association was organized. The meeting had been called by George B. Tripp, of Colorado Springs, and representatives were present from nineteen companies operating in Denver, Colorado Springs, Pueblo, Greeley and other points in the State. Through the courtesy of Henry L. Doherty, the meeting was held in the rooms of the Denver Gas & Electric Company. J. F. Vail was made temporary chairman, and a constitution and by-laws were adopted, subject to future correction. The following permanent officers were chosen to serve until the first annual meeting: J. F. Vail, general manager Pueblo & Suburban Traction & Lighting Company, of Pueblo, president; William Mayher, manager Greeley Power & Light Company, of Greeley, vice-president; George B. Tripp, general manager Colorado Springs Electric Company, of Colorado Springs, secretary and treasurer. The headquarters of the association will be in Colorado Springs, and annual meetings will be held on the last Wednesday in October. This will bring the next annual meeting on October 28, and it will be a two-days' session. The convention will be held in Denver, and papers on topics of interest to the members will be presented, while the social feature will not be neglected.

The association begins its existence with very promising prospects and the officers are confident that nearly all of the fifty-five companies in the State will become members. Dues will vary from $10 to $25 a year, according to the population of the city in which the company operates. The object of the association is "to foster and promote the common interests of its members and to advance scientific and practical knowledge in all matters relating to electric light, power and railway companies; also to establish cordial and beneficial relations with kindred associations and between the manufacturers of apparatus and the purchaser."

WATER POWER DEVELOPMENT AT COLUMBUS, GA.

The industrial development of Columbus, Ga., promises to receive a substantial impetus before long by the utilization of another water-power of considerable magnitude on the Chattahoochie River. A large tract of land about 3 miles from the centre of the city on both sides of the river has been acquired by Messrs. Stone & Webster, of Boston, who are operating the street railway system of the city, and the plan is to donate manufacturing sites free of charge and furnish power from the water-power plant at $15 per horse-power. Street car facilities are to be established connecting with the lines of the city, and shipping can be done on the several steam railroads converging at Columbus and on the Chattahoochie River, the city lying at the head of navigation. The plant is to be developed for 10,000 horse-power under a head of 49 ft., and if the flow of water should at any time prove insufficient, additional power is to be developed or storage dams built on the river above the city, rights having also been secured for this purpose for perhaps 12 miles or more toward West Point. From that city to Columbus, a distance of 34 miles, there is a fall in the river of 362 ft., and 120 ft. of this occurs in the last 4 miles above navigable water. The power within the city limits has long been utilized and a few years ago the Columbus Power Company built a plant just above the city. The proposed development will require a long dam, but its height will probably not be much over 12 feet, being located at the head of a long fall which will give the remaining 37 ft. of head.

NEWARK & HACKENSACK TRACTION COMPANY TO BE SOLD

The Newark & Hackensack Traction Company's railway, franchise and property are to be sold at the Sheriff's office, Hackensack, N. J., on Sept. 1 at 3 p. m. The sale is brought about by the Guaranty Trust Company, of New York, and will be conducted by Senator Edmund W. Wakelee as special master in chancery.

This traction company succeeded the Union Traction Company, which built the greater part of the line several years ago. After its reorganization it passed into the hands of capitalists represented by William C. Giles. The road now extends from Hackensack to Arlington, a distance of 12 miles, and passes through Hasbrouck Heights, Wood Ridge, Carlstadt, East Rutherford, Rutherford, Lyndhurst, Kingsland and North Arlington, connecting in the last named place with the Newark lines of the Public Service Corporation.

A few months ago the New Jersey & Hudson River Railway & Ferry Company secured a controlling interest in the road through purchase of its bonds and stock, and an extension was built connecting the Hackensack line with the Newark line at Hasbrouck Heights. It is said that the residents along the line desire the New Jersey & Hudson River Railway & Ferry Company to acquire full title to the property, as they believe that this will result in improved service.

OFFICERS OF RAILWAYS & LIGHT COMPANY'S PROPERTIES MEET IN ANNUAL SESSION

The first annual meeting of the general managers, superintendents and accountants of the Railways & Light Company of America was held at Norfolk, Va., early in August. Some fifty or sixty persons were in attendance at this meeting. C. H. Harvey, general manager of the Knoxville Traction Company, was selected as presiding officer during the business sessions. The election of the permanent officers resulted as follows: E. L. Bemiss, of Richmond, Va., president; C. H. Harvey, of Knoxville, vice-president; Miss Crump, of Richmond, secretary. The business session ended with a banquet. Among the papers presented were: "Transfers, Their Use and Abuse," by C. H. Harvey, general superintendent of the Knoxville Traction Company; "Are Trailers Satisfactory During Rush Hours?" by J. T. Nyhan, superintendent of the Macon Railway & Light Company, of Macon, Ga.; "Relative Merits of Sliding Scale and Absolute Scale in Payment of Wages of Motormen and Conductors," by H. H. Carr, general superintendent of the Hampton & Newport News branch of the Norfolk, Portsmouth & Newport News Company; "Personal Injuries and Damages and Settling the Same," by E. C. Hathaway, general manager of the Norfolk, Portsmouth & Newport News Company, of Norfolk, Va.; "Bureau of Publicity," by D. P. Campbell, press agent, Norfolk, Portsmouth & Newport News Company, Norfolk.

PROJECTED RAILWAYS IN CALIFORNIA, MISSOURI AND MEXICO

The Western Electrical Supply Company, of St. Louis, Mo., is furnishing a complete equipment, including everything from cars to spikes, for the San Jose & Los Gatos Railway Company, to be operated from San Jose to Saratoga, to Pacific and from Congress Springs to Los Gatos, Cal. The road will be 18 miles long, 12 miles of which have already been completed. The contracting company is supplying Westinghouse apparatus, including rotary converter, with a Gould storage battery of 225 cells and a 22 kw regulating booster. The cars are to be of the steam road type for a speed of 35 miles an hour. This railway expects to do a heavy freight business, and will be ready for operation about Oct. 15. This railway will be run through the Santa Clara Valley, known as the best fruit district in California. The company expects to be able to build about 30 miles more of road in the near future.

At Auguascalientes, Mexico, the same contractor is to supply all material and rolling stock for the local railway with the exception of the engines. This road will be about 8 miles in length. Westinghouse apparatus is to be furnished. The cars will be of the open summer type, Brill full convertible and California type with closed centers. This road expects to do a heavy freight business, and will be in operation about the first of December.

The Cape Girardeau & Jackson Interurban Railway Company, Jackson, Mo., is to be completely equipped by this firm, using Westinghouse generators with rotary converter stations. The railway company will also furnish light and power for both cities. The cars will be of the steam road type for speeds of 35 to 40 miles an hour, and will do general express, freight and passenger business. The road is to be about 15 miles long.

H. S. Doyle, manager of the Western Electrical Supply Company's Street Railway & Mining Department, is consulting engineer for all these railways.

The steam railroads in the Indiana gas belt have begun to discard printed card way station tickets. The Big Four is taking the initiative in this, and hereafter blank forms will only be used between gas-belt way stations. The card tickets have stood, almost undisturbed, in the racks for a year or two, and it is found advisable to get them out of the way. The Pennsylvania is doing a very meagre local passenger business between Anderson and Elwood, and the Lake Erie & Western has lost most of its local business between points where it is paralleled by the electric lines. —Indianapolis News.

BROOKLYN BRIDGE TERMINAL AND MUNICIPAL OFFICE BUILDING

Commissioner of Bridges Lindenthal, of New York, has had plans prepared for the proposed Brooklyn Bridge Terminal and city offices on Manhattan Island. A 42-story building is contemplated, with trolley loops and other tracks in the lower stories or levels. This enormous terminal station will extend up as far as Duane Street, and provides for five stories of city offices. It would involve an expenditure of $50,000,000 ultimately, and $9,000,000 now. The building will be carried out on the same architectural design as the new Hall of Records, and the plan provides for the construction of the campanile up to that level. The campanile proper, with its thirty-seven additional stories, is to be used for office purposes, and to house city departments. The full height of the campanile, as projected, will be 650 ft., giving in all 400,000 sq. ft. of office room. The cost of $9,025,825 for this terminal station does not include the campanile above the roof of the base, or a height equal to that of the Hall of Records. The cost of completing the tower would be $1,468,800 more.

STREET RAILWAY PATENTS

STREET RAILWAY PATENTS ISSUED AUG. 11, 1903

735,743. Side Bearing for Railway Car Trucks; H. W. Fowler, Chicago, Ill. App. filed Jne 15, 1903. The roller between the upper and lower members has a corrugated surface which engages with similar corrugations on the two members. This affords larger bearing surface and prevents flattening.

735,826. Switch Operating Mechanism; T. Rundorff, Burlington, Iowa. App. filed Feb. 9, 1903. A swinging segment having a lug, is attached to the platform and can be thrown downward by the foot to bring the lug into position to strike a lever in the road bed, and thus move the switch.

736,006. Traveling Connector for Third Rail Electric Systems; J. W. Perkins, San Jose, Cal. App. filed Sept. 23, 1902. The third rail is in a depression of the roadway between the two traction rails.

736,050. Electrical Signaling System; J. L. Wreen, Washington, D. C. App. filed May 11, 1903. Details of a block signaling systems for trolley roads.

736,055. Electromagnetic Railway Switch; R. A. Baldwin, South Norwalk, Conn. App. filed Dec. 18, 1902. An improvement on the "Baldwin" switch, wherein the switch point is locked in both positions and automatically released when the reversal of the switch takes place.

736,063. Electrical Switch; R. L. Border, Pittsburg, Pa. App. filed March 24, 1902. Details of circuit closer attached to the trolley wire.

736,120. Electric Brake; G. A. Le Fevre, New York, N. Y. App. filed June 21, 1902. Independent motors for setting the brake mechanism are applied to each car, the motors being all in one circuit and provided with means for automatically cutting out any motor independently of the others, as a predetermined pressure of its brakes is reached.

736,190. Cast Steel Wheel; T. B. Zell, Reading, Pa. App. filed May 25, 1901. A high-grade steel rim is cast around a low-grade steel hub and web.

736,318. Four Wheel Swing Fulcrum Truck; B. R. Van Kirk, Philadelphia, Pa. App. filed March 21, 1903. The two axles on a single truck are mounted to assume a radial position in rounding curves.

PERSONAL MENTION

MR. JILSON J. COLEMAN, consulting engineer, has moved his office at 57 Broadway, New York.

MR. E. F. GOULD, formerly of the General Electric Company, has been appointed electrical engineer of the Aurora, Elgin & Chicago Railway Company.

MR. SYLVESTER POTTER, of the Aurora, Elgin & Chicago Railway, has succeeded Mr. Thomas Farmer as master mechanic of the Detroit United Railway Company. Mr. Potter held a similar position with the Toronto Railway before going to the Aurora, Elgin & Chicago Company, and is known as a man of thorough methods and a master of his craft.

MR. JOSEPH O'HARA, for a number of years superintendent of the Cleveland & Eastern division of the Eastern Ohio Traction system, has resigned to accept a similar position with the Aurora, Elgin & Chicago Railway. On Aug. 6 a number of the employees of the Eastern Ohio Company met at the operating offices of the company and presented Mr. O'Hara with a handsome gold watch.

MR. JOSEPH T. McNARY, president of the Logansport, Rochester & Northern Traction Company, Logansport, Ind., assumed the position of general manager of the Logansport & Wabash Valley Traction Company, having control of the electric line between Wabash and Logansport, and also the local lines in Logansport. He succeeds Mr. L. T. Lew, who returns to his home in Connecticut. Mr. E. C. Folsom, who has been the manager of the Logansport line, goes to Ft. Wayne as manager of the local railway.

MR. T. FIERZ, who has recently been appointed chief electrician to the Brush Electric Engineering Company, Limited, of London, brings with him from the Continent a high reputation for technical ability. A Swiss by birth, Mr. Fierz received his early training at the Polytechnic High School of Zurich, where he took his diploma with honors as mechanical and electrical engineer. His first engagement was with Messrs Brown, Boveri & Company, of Baden, Switzerland, with whom he was chiefly occupied with the design of polyphase alternators. Mr. Fierz afterward spent some time with a French firm, which he left on being offered the position of designer for continuous-current machinery at the Charleroi works of the Société Electricité et Hydraulique. Subsequently, and in succession to Mr. Heyland, one of the most eminent Continental designers, the supervision of the alternating-current department was added to his duties, and a considerable number of single and polyphase generators, synchronous and asynchronous motors, etc., were developed during his stay. The result of Mr. Fierz's work at Loughborough will, no doubt, soon be practically appreciated in the British market for the latest types of generators, motors and other electrical apparatus.



T. FIERZ

MR. A. J. J. PFEIFFER, who for some time has been connected with Messrs. Dick, Kerr & Company, in London, Eng., is about to visit the United States before proceeding to Calcutta, India, where he will assume the position of assistant manager of the Calcutta Tramway Company, whose extensive lines have recently been electrified. Mr. Pfeiffer, after graduating from Yale in the class of 1894, entered the employ of the General Electric Company at Schenectady, N. Y., and remained with that company until 1898, when he went to Europe as electrical engineer for the Compagnia Thomson Houston della Mediterranie, an affiliated company of the General Electric Company, whose headquarters are in Paris. Shortly afterward he was called to Milan in the interests of this company to work up and carry out the electric transformation of the important steam railway, the Milan-Gallarate-Varese-Porto Ceresio, which is one of the first and longest third-rail high speed electric railway installations in Europe. Mr. Pfeiffer will return from the United States to London in time to leave on Oct. 1 for Calcutta.

MR. GEORGE FLETT, who has for many years been the managing director of Messrs. Dick, Kerr & Co., Ltd., of London, now allied with the English Electric Manufacturing Company, has been recently establishing a reputation for himself as a yachtsman. Mr. Flett has been an enthusiastic yachtsman for a great many years, and this season is the fortunate owner of the yacht "Evelyn," a schooner of 246 tons, which has been specially built for him. Recently Mr. Flett raced Mr. C. T. Caley, the chairman of Dick, Kerr & Company, in his schooner yacht, "Adela," of 245 tons register, across the German Ocean, and afterwards in a number of races in the Baltic, under the auspices of German clubs and in German waters. Mr. Flett was fortunate enough to win a cup from the Kaiserliche Club, and both he and Mr. Caley and the owners of other British yachts who were taking part in the races had the honor of dining with the Kaiser on board the royal yacht "Hohenzollern." Yachting is a sport in which kings and merchants alike take pleasure, and Mr. Flett has stated, with a great deal of satisfaction, that the Kaiser during the whole of the races was most cordial in his relations with owners of other yachts and entertained them right royally on his own yacht, placed himself on a pleasant footing with them, and, in fact, was a right good fellow while the festivities lasted.

NEWS OF THE WEEK

CONSTRUCTION NOTES

JONESBORO, ARK.—The Mobile Rapid Transit Company has been incorporated, with a capital stock of $10,000. W. W. Cate, president; Rudy Copeland, secretary; J. H. Little, treasurer.

ALAMEDA, CAL.—Another application to operate an electric line over the north and south side lines now operated by the Southern Pacific has been filed with the executive committee of fifty chosen by the City Trustees to assist them in settling the matter of local franchises. P. N. Beringer, as agent of Eastern parties, submitted the application. It is stated that the Eastern people are the firms of Mechem, Mitchell & Company and Kay, DeWolf & Company, both of New York.

EUREKA, CAL.—Articles of incorporation of the Humboldt Transit Company have been filed. The purpose of the company is to build 20 miles of electric railway in Eureka and an additional 54 miles to other towns in Humboldt County. The capital stock is $300,000, of which $75,000 has been subscribed. The directors for the first year are: J. C. Bull, Jr., of Eureka; George Henderson, of Oakland; R. W. Bull and John C. Bull, of Arcata, and Charles P. Cutten, of Eureka.

LOS ANGELES, CAL.—C. S. Campbell-Johnston says that his electric road from Pasadena to Garvanza, by way of California Street, will be ready for traffic by Jan. 1. Since the purchase of the Los Angeles Traction Company it had been generally thought that this road would not be completed, as Mr. Huntington is the man behind the enterprise, and it is thought that the Campbell-Johnston franchise was procured merely to keep the Traction out of Pasadena.

LOS ANGELES, CAL.—Col. J. W. Eddy has been granted a right of way through Griffith Park for his electric railway to connect with the inclined railway he is to build there.

LOS ANGELES, CAL.—Sub-stations are being built by the Pacific Electric Railway Company at Arcadia, Long Beach, Dominguez, Watt, Eastlake Park and Laguna. The company will also build $2,500 station buildings in the Mission style of architecture at the junction of the Pasadena and Monrovia and the Long Beach and Whittier lines.

MONTEREY, CAL.—R. C. Smith has been awarded the contract to construct and operate a single or double-track electric street railway on the following streets: Commencing at the intersection of Franklin and Taylor Streets, thence along Franklin Street to Calhoun Street; thence along Calhoun Street to the United States military reservation.

REDWOOD CITY, CAL.—Reports state that Charles Clark & Henry Dowie, of San Mateo, have applied to the Board of Supervisors for a franchise to construct an electric railway from San Mateo over the mountains to Half Moon Bay. The Board will receive bids for said franchise Sept. 7.

SAN JOSE, CAL.—The track of the San Jose-Los Gatos Interurban Company has been laid as far as Saratoga, and the construction train is now running to that point. Ballasting is now being rushed, and a trial trip will be made over the line shortly. Work on the line between Saratoga and Los Gatos will now be taken up. A power house near Saratoga and car houses in this city will be built at oice.

VALLEJO, CAL.—An ordinance has been passed granting a franchise to the new electric railway in Vallejo, and work on the new line of the Vallejo, Benicia & Napa Railway will begin in sixty days and be completed in one year.

GREELEY, COL.—Application has been made to the City Council by George J. Spear to secure a twenty-year franchise for an electric railway to pass through the city. The different lines projected are: One from Greeley to La Falle, a distance of 7 miles; another from Greeley to Seeley's Lake, a pleasure resort 5 miles from town, and one connecting the city with Ault, 8 miles distant.

PUEBLO, COL.—The surveying corps of the Rapid Transit Company in charge of R. L. Kelly, has about completed preliminary surveys for the electric railway projected to connect Pueblo with the Beulah Valley, 30 miles southwest. The line will be located at once. The subscriptions of the citizens of Pueblo to the stock of the company are progressing favorably under the auspices of the Pueblo Business Men's Association, and it is expected that work will be commenced on the line by Oct. 1. The actual road will be about 30 miles in length, and will be built on a one-per-cent grade the entire distance. There will be about 10 miles of additional track in Pueblo and for sidings. The Beulah Valley is rich in agriculture, live stock, mining, marble and lime rock, and is noted as a summer resort. The railway expects to do a large freight business, and already has assurances of a business of 1000 tons a day. The road will start at the post office in Pueblo, and the company's franchises will allow it to build to the western limits of the city, should it desire to extend its line to Florence and Canon City. The source of power for the operation of the road has not been determined upon yet, but it is possible that a station will be located at the coal mines in the vicinity of Florence and high-tension power lines built to sub-stations on the road. The following-named gentlemen are officers of the Rapid Transit Company: George Peck, of Cincinnati, Ohio, president; John J. Burns, of Pueblo, vice-president and secretary; James N. Carlisle, of Pueblo, treasurer. The constructing company is known as the Pueblo & Beulah Realty & Construction Company, and W. A. Beatty, room 17, Opera House Block, Pueblo, is the president and general manager.

ODESSA, DEL.—The electric railway between Odessa and Middletown, in New Castle County, is about completed and will probably be opened between the two towns in a few days. The track laying has been finished in the rural districts, the men being now employed in grading the streets of the two towns. The feed-wire has been put in along the entire route. It is thought that the line will be extended through Kent and Sussex Counties.

WILMINGTON, DEL.—The new line of the West Chester, Kennett Square & Wilmington Railway Company has been put in operation, and the cars are running as far as Toughkenamon, Pa. They will be run to West Chester as soon as the upper part of the road can be completed.

ST. AUGUSTINE, FLA.—It is reported that Jacksonville capitalists will soon make application to the City Council for the passage of an ordinance granting franchises for the construction of an electric railway here.

ATLANTA, GA.—The County Commissioners have granted the Piedmont Electric Company a franchise to construct an electric railway between Atlanta and Roswell.

ATLANTA, GA.—The City Council has passed an ordinance granting the Central Passenger Railway Company the privilege of building an electric railway on Virginia, Adriatic and South Carolina Avenues. The company is headed by William McLaughlin.

CHICAGO, ILL.—Reductions in assessments aggregating $2,940,500 were granted the Chicago Union Traction Company and the Chicago Consolidated Railway Company by the Board of Review Aug. 17. The assessment against the former was cut from $10,125,000 to $9,125,000, nearly all the reduction accruing to the West Side lines connected with the company. To the Chicago Consolidated Company a reduction from $3,940,500 to $2,000,000 was granted, cuts being made in each town traversed by the roads of the company.

GALESBURG, ILL.—Articles of incorporation have been filed in the office of Clerk Gamble, of the Galesburg, Monmouth & Rock Island Railway, which contemplates constructing an electric railway beginning at Galesburg and extending through Monmouth and terminating in Davenport, Ia. The capital stock of the concern is placed at $100,000, which is divided into 1000 shares of $100 e ach. George F. Duncan and Edward Woodman, of Portland, Maine; W. B. McKinley, J. E. Johnston and Charles Zilly, of Champaign, Ill., are the incorporators and the first board of directors.

OTTAWA, ILL.—The Northern Illinois Light & Traction Company, Ottawa, capitalized at $250,000, has been incorporated to operate a system of street railways and furnish light. The incorporators are: Louis W. Hess, Jacob I. Warner, Charles E. Woodward.

DECATUR, ILL.—The Decatur, Tuscola & Champaign Interurban Railway has been incorporated, with headquarters at Decatur, Ill. It will construct an electric railway to connect with the McKinley line, now building through Springfield to St. Louis.

LINCOLN, ILL.—The Lincoln Street Car & Heating Company has been incorporated in New Jersey, with $110,000 of authorized capital stock. The general belief is that the company will succeed to the property of the Lincoln Street Car Company. The incorporators are: Louis B. Dailey, Warren U. Akers and H. O. Coughlan.

TAYLORVILLE, ILL.—J. N. C. Shumway and Benjamin Sharpe are pushing a scheme to build an interurban electric railway from Taylorville southeast through Assumption, Shelbyville and beyond.

DECATUR, ILL.—A number of men at Champaign, Tuscola and Decatur are interested in a project to construct an interurban electric railway from Champaign south to Tuscola and thence to Mattoon and Charleston. A line will also be constructed from Tuscola to Decatur. Among the promoters are the Messrs. Campbell, wealthy land owners of Champaign County; Attorney Ray, of Champaign; Messrs. Wallace, Tuscola bankers, and Attorney Charles Eckert.

QUINCY, ILL.—At the annual meeting of the Quincy & Western Illinois Railway Company, which has franchises for building interurban lines in Quincy, the franchises voted the company by the city of Quincy were accepted and Gen. A. B. Nettleton, S. H. Bracey, F. E. Lonas, James Potter, W. A. Howard, L. J. Highland and John Tiease were elected directors. The meeting voted to increase the capital stock from $500,000 to $3,500,000, and to authorize a bond issue for $3,500,000.

STERLING, ILL.—The Columbia Construction Company is pushing the work of building the Sterling, Dixon & Eastern Electric Railway from Sterling to Dixon. Over a mile of track has already been laid east from the city limits, and the prospects are now good for the completion of the entire work before winter. Nearly all of the material is here, and the balance is on the way. The poles are being set rapidly and the wire has arrived.

VIRDEN, ILL.—The city of Virden has granted a franchise to the Decatur, Springfield & St. Louis Electric Railway to run its lines on the streets of Virden on the east side of the square. The City Council of Carlinville is discussing an ordinance whereby the same company may have the use of certain streets in that place. It now appears that the interurban railway is a sure thing.

ANDERSON, IND.—W. B. Campbell and others are projecting an electric railway from Anderson through Noblesville to Lebanon. Mr. Campbell is procuring right of way and franchises, and says the financing of the road has been arranged for. The line would complete a great cross State line north of Indianapolis and connect with nearly a dozen lines running north, east and west.

ANDERSON, IND.—Ground has been broken for the new interurban line from this city to Elwood by the Indiana Union Traction Company. The line will add 20 miles to the company's system. F. N. Stillwell has the contract to construct the grade and track work. The line is to be completed in 90 days.

ELKHART, IND.—The St. Joseph Valley Traction Company, of which H. E. Bucklen, of Elkhart, is the principal backer, and which is endeavoring to break into South Bend, has filed a petition for a franchise to cross La-Grane County in the direction of Angola.

GREENSBURG, IND.—It is said that all the capital required has been subscribed for building the Madison, Greensburg & Indianapolis Traction Company's line. The line will connect Madison, Rexville, Versailles, Osgood, Napoleon, Greensburg and other towns. The length of the line is 49 miles.

HAMMOND, IND.—Russell B. Harrison is asking a franchise of the City Council for an interurban line from Michigan City to Hammond. The South Chicago Electric Street Railway Company is opposing the grant.

INDIANAPOLIS, IND.—The Commissioners of Marion County have granted to the Indianapolis & Southwestern Traction Company a franchise to construct a single or double track from the city limits along the Bluff Road to the south line of Marion County. The company will build a line to Martinsville via Waverly. It is the purpose to extend the line to Vincennes and Evansville.

INDIANAPOLIS, IND.—The Indianapolis & Plainfield Electric Railroad has not, so the officers say, abandoned its plan to build a spur off its Greencastle and Brazil extension from Cartersburg to Danville. It is announced that the work of pushing the line on west from Plainfield has been taken up again and that it will be carried through to Greencastle and put in operation thus far early next year. It will be completed into Brazil for Terre Haute connections next summer.

KOKOMO, IND.—The City Council has passed an ordinance granting the Kokomo, Marion & Western Traction Company the privilege to lay a double track on Main Street, from the south suburbs to the north side of the Court House Square.

KOKOMO, IND.—"Electric trains will be running between this place and Greentown by Sept. 1, and on to Marion within six months," says President Mariott. "I am satisfied," says he, "that we hold the record for fast work on an electric line. In four months we made the survey, bought the right of way, graded 14 miles and laid 5 miles of track, and in less than thirty days will have trains running."

LA GRANGE, IND.—The Council has granted a franchise to the St. Joseph Valley Traction Company.

LOGANSPORT, IND.—The Frankfort-Logansport Traction Company, composed of Frankfort and Logansport capitalists, which proposes to build an electric railway between the two cities, has been granted an extension of six months, in which to begin construction work. This will give the company until Jan. 11, 1904, to start the work of building.

MUNCIE, IND.—The trouble over the location of the Indiana Union Traction Company's double-track entrance in this city is growing more complicated. The general sentiment is that the city wants all the traction lines it can get, but nobody wants the tracks on his street. The company has decided to abandon the building of its big terminal station in Muncie until the matter is settled. The ordinance passed is not acceptable to the company.

RICHMOND, IND.—The Council has granted a franchise to the Richmond & Northwestern Traction Company. The provisions are not what the company wanted, but are in the main the same as granted to other companies. The two points on which the franchise was held up so long were the crossing of the Doran bridge and the clause which permitted the company's lines to traverse streets occupied by the local company. The franchise provides that no cars shall be run over the bridge heavier than the estimated capacity of the bridge as fixed by the civil engineer and an expert employed for that purpose. The franchise grants the use of certain streets on which the local company operates, but in order to use them the company will have to make traffic arangements with the Richmond Company. The term of the franchise is thirty-five years.

SHELBYVILLE, IND.—The County Commissioners have granted the Indianapolis & Cincinnati Traction Company a franchise permitting it to construct a line through the northern part of Shelby County.

VINCENNES, IND.—S. N. Chambers, president of the Vincennes, Petersburg & Jasper Traction Company, announces that he heads a syndicate of Cincinnati, Cleveland and Indianapolis capitalists that will purchase and combine the Vincennes Street Railway Company with the Southern Indiana Traction Company.

WABASH, IND.—Jilson J. Coleman, of New York, and John C. Calhoun have recently put through the deal to finance the Indiana & Northern Railway. J. G. White & Company, of New York, have the contract to build the road. It will be open for operation early in the spring of 1904. The terminals of the road are Marion and Wabash, Ind., separated by a distance of 20 miles. This road forms the connecting link between Indianapolis and a large center of population in the northern part of Indiana, connecting with the Union Traction Company lines at Marion and with the Wabash & Logansport Railway at Wabash.

MUSKOGEE, I. T.—The City Council has granted a street railway franchise to C. N. Haskell and W. R. Eaton. The plans anticipate the building of about 6 miles of street railway. The Muskogee Traction Company will be organized to carry out the project.

DUBUQUE, IA.—The Dubuque Northern Railway Company is surveying a route for an interurban electric railway from Dubuque to Greeley, in Delaware County, about 30 miles north and west of Dubuque. The surveyors have met with considerable difficulty at some places owing to the roughness of the country. From Greeley the proposed route is westward a few miles and then northward to Fayette, a distance of about 32 miles. Fayette is a point on the Milwaukee line near the center of Fayette County. The Dubuque Northern Company also proposes to construct several other interurban lines out from Dubuque, both in a northerly and southerly direction.

KALONA, IA.—Articles of incorporation have been drawn by the Iowa City, Kalona & Washington Railway Construction Company. The plan of the company is to build to connect Iowa City, Kalona and Washington.

MOUNT PLEASANT, IA.—J. O. Ball, Joseph Green and Henry Traut have been voted a franchise for an electric railway here.

TABOR, IA.—President Robert McClellan, of the Tabor & Northern Railway Company, a road extending from Tabor, Fremont County, to Malvern Mills County, Iowa, a distance of 8 miles or 9 miles, has been inspecting the road, with a view to installing electricity as the motive power in place of steam. He has been considering the matter for some time, and has now decided that the time has arrived to make the change. It is also a part of the programme to run a train each way every hour, instead of two a day as at present.

OELWEIN, IA.—The officials of the Oelwein & Northeastern Interurban Railway Company are preparing to commence surveys just as soon as the Board of Supervisors of Fayette County grants permission for the construction of the line over the highways of Fayette County. This permission has already been granted by the Supervisors of Clayton County. The proposed line of this road is from Oelwein to Fayette, and from Oelwein to Arlington and Strawberry Point. The latter place is a point on the Milwaukee Road, in Clayton County.

WINFIELD, KAN.—Plans are being discussed for building an electric railway to connect Winfield, Wellington and Arkansas City. It is said that a proposition has been made by a St. Louis company to build the road if franchises are granted by the towns along the line. J. Mack Love, of Arkansas City, is interested.

MADISONVILLE, KY.—Articles of incorporation have been filed by the Madisonville Traction Company, with headquarters in Louisville, Ky. It is given out that the company plans soon to begin the construction of an electric railway from Madisonville to Nortonville, Ky. The proposed road is to be about 20 miles in length, beginning at Madisonville and passing through Earlington, Barnsley, Morton's Gap, White Plains and Nortonville, all important mining towns of Hopkins County.

FRANKFORT, KY.—The Louisa Railway Company, of Lawrence County, has filed articles of incorporation, capital stock $80,000. The company is incorporated to construct a railroad from Levisa Fork of the Big Sandy River to connect with the Ohio & Big Sandy Railroad. The road is to be built to Stratton Branch and will be 4 miles in length. F. S. McConnell, Mount Vernon, Ohio; M. G. Watson, R. D. Casterline, C. Y. Hays, W. L. Watson, F. J. Dixon and Al Carter, Louisa, and Ashland people, incorporators.

LOUISVILLE, KY.—Plans for a company now being organized in Bowling Green, in which Louisville capital is interested, to build a trolley railway from that city to Louisville, are in an advanced state and the road is a certainty, says the Courier-Journal. Construction work will begin in the fall and the work pushed rapidly to completion. This line will be absorbed by the Kentucky Traction Company, and will form one of the links in the chain from this city to Nashville, Tenn. While the work on the Bowling Green end is being constructed the Kentucky Traction Company will be working at this end of the line, and the two ends will meet to complete the line.

LOUISVILLE, KY.—The Louisville & Southern Indiana Traction Company, organized as successor of the Southern Interurban Railway Company by the United Gas & Electric Company, has elected officers as follows: Samuel Insull, of Chicago, president; R. W. Waite, of New Albany, vice-president and treasurer; J. O. English, of New Albany, secretary. Unofficially it is said that the company will build an electric railway from New Albany to Paoli, French Lick and West Baden Springs, traversing the counties of Floyd, Washington, Harrison and Orange, next year, and within twelve months it is believed that the line to Corydon, Wyandotte Cave and Leavenworth, with its branches, will be in operation.

LOUISVILLE, KY.—The Louisville Railway Company will soon begin the erection of a power house at Meadow Brook Station, on the Third Avenue Jacob Park car line. It will be a brick structure, two stories in height, and will cost about $26,000.

ALGIERS, LA.—Martin Behrman, of Algiers, has presented a petition to the Police Jury of Jefferson Parish asking for rights of way for an electric railway through certain streets in McDonoughville and Gretna.

CAMBRIDGE, MD.—The Eastern Shore Transportation Company contemplates building an electric railway from Cambridge, Md., to Wye Station, on the Queen Anne Railroad. A ferry boat will be run from Cambridge to Cambridge Ferry connecting with the electric railway. The road, which will be 24 miles long, will pass through a thickly settled and prosperous agricultural section of Talbot County. It will connect the towns of Cambridge, Easton, Trappe, Longwood, Skipton and Wye Mills, by way of the Queen Anne Railroad, with the Baltimore & Philadelphia, and enable the farmers to ship their produce to the city markets at a much less expense and in a shorter time than at present.

BOSTON, MASS.—The Blue Hill Street Railway has opened its new line from Mattapan to Blue Hill. Arrangements have been made with the Boston Elevated Railway Company and the Old Colony Street Railway Company whereby the cars of the Blue Hill Company run direct from the elevated station at Dudley Street to the foot of Blue Hill, where connections may be made for Canton and Stoughton. The running time over the new route will be about forty minutes.

FALL RIVER, MASS.—At the annual meeting of the stockholders of the Newport & Fall River Street Railway Company the following directors were elected for the ensuing year: T. F. Sullivan, of Lowell; Angus McLeod, of Newport; Dr. C. A. Brackett, of Newport; George C. Chase, of Middletown; George R. Fearing, Jr., of Boston; Robert S. Goff, of Fall River; H. H. Read, of Fall River. Mr. Read was elected in place of the late Gardiner B. Reynolds, of Newport. It is expected that at the next meeting of the directors matters will be arranged between the road and the city of Newport, and that something will transpire in regard to the road taking over the franchise of the Newport & Providence Street Railway Company. Work on the latter road has been resumed in Middletown and Portsmouth, and it will be pushed toward completion now that the construction men have finished work for the farmers on the island.

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Saratoga as a Convention City

The American Street Railway Association is making a change this year in the policy which it has followed for the last twenty-one years, or since its establishment, by meeting in a small city. Whether this policy will be followed in subsequent years is for the association to determine. We are not sure that a fixed policy to meet in Saratoga or some corresponding small city would be the wisest thing to do, but the association has made no mistake in deciding to try the plan this year. Saratoga has many advantages as a convention city. It is celebrated for its excellent hotel accommodations, is very central for the Eastern States, which furnish the bulk of the membership of the association, and a visit to it makes an attractive trip for all at any time of the year, but particularly during the first two weeks of September. The principal argument in favor of meeting in a large city is that the delegates have an opportunity during the time in which the association is not in session of inspecting local street railway operation, and thus gaining an idea of how others solve the problems in which they themselves are engaged for twelve months in the year. Saratoga itself cannot in one sense supply this opportunity. Nevertheless, although there is no local street railway system in Saratoga, there is much of electric railway interest to be seen in the immediate neighborhood. The city is on a spur of the Hudson Valley Railway Company, one of the longest interurban electric railways in the country, and within easy riding distance are the large water-power plants of Spier Falls and Mechanicsville, the works of the General Electric Company, at Schenectady, and the important chain of city and interurban railways connecting the Hudson River on the south and east with the extensive valley of the Mohawk River.

The Papers and Programme of the American Street Railway Association

The list of papers to be presented at the twenty-second annual meeting of the American Street Railway Association is a most interesting one, and the standing of the gentlemen who are to read the papers is sufficient guarantee that they will be up to the high standard which has been established in previous conventions of the association. All the important branches of electric railway operation are comprised in the programme which has been arranged by President Hutchins and Secretary Penington. They include a treatment of two legal topics, one paper on a subject connected with track construction, one on rolling stock, two papers relating to power station practice, and two which can be considered as of interest particularly to interurban railways. In addition, a report can also be expected from the standing committee on rules and one from the committee on standards. There is no one of these topics, except possibly on interurban railway work, which is not of very great interest to all street railway managers, and the growing number of interurban roads, as well as the especial value which papers on train orders and signalling and the transportation of freight and express possess, make a treatment of these topics of great interest. The meetings of the association are essentially experience meetings, and we sincerely trust that every delegate who attends the convention will do so with the express intention of contributing some results of his experience to the association on at least one of the topics which are to be discussed. If this plan is followed the success of the convention from a technical standpoint is assured.

Through the courtesy of the Hon. A. B. Colvin, president of the Hudson Valley Railway Company, and through that of the General Electric Company, three attractive excursions have been arranged during the three days of the convention. The excursions in the neighborhood of Saratoga are among the most enjoyable of any of the country, as the Saratoga region is not only very picturesque, but possess great historical interest. Within a few miles of Saratoga Springs have occurred many of the most deadly contested battles conducted during the French and Indian War and later during the War of the Revolution, while the pen of Cooper and other writers of fiction has lent a touch of romance to many of the scenes which lightens the more grisly aspect of actual warfare. With Lake George on the north, Saratoga Lake on the east, Schenectady on the south, and the manifold charms of Saratoga Springs themselves, the visitor to Saratoga will find much to occupy him whether he is in search of picturesque or historical scenes, the more practical achievements in electrical science of a later day, or desires to spend a few leisure hours in the many pleasures afforded in a typical American summer resort.

The Accountants' Convention

The programme of the Street Railway Accountants' Association meeting is, like those of past years, a very practical one. This has been one of the strong features of this association, and also one of the causes of its success, in that it has aimed at practical assistance toward solving live problems within its line of work.

The paper entitled "Freight and Express Accounts," by Irwin Fullerton, general auditor Detroit United Railway, is upon a subject that is holding the attention of all interurban companies, and many urban companies at this present time. Mr. Fullerton is located in a part of the country where this branch of electric railroading is at a high mark, and his paper will be of thorough interest. Added to this is the discussion which will follow from the accountants of other sections, so that the result should be for the betterment of this accounting. "Car Maintenance Records," by S. C. Stivers, who has just left the Jersey City, Hoboken & Paterson Street Railway, is of interest because a wide diversity exists in the treatment of the details of car maintenance, and this will probably result in more uniformity.

No title has been given to the "paper or address by a representative of the United States Census Bureau," but as the Census Bureau used the standard classification of the association, it no doubt will be along the lines of its experience with it. Anything its representative will say will be of value as throwing a side light upon the classification which has been so cordially received by electric railway interests.

The "Report of the Committee on a Standard Form of Report for Electric Railways" is of great importance, because of the discussion which preceded its experimental approval last year. Since then it has been adopted by the National Association of Railroad Commissioners at their convention in Portland, Maine, in July of this year. The arguments against it at the Accountants' convention last year seem not to have developed strength, but it will probably be taken up in a thorough manner again.

Individual opinion is wide apart on the method of conductors' remittances, and, like so many of the subjects interesting to the operator, it has never been thoroughly discussed, therefore the paper by Frank R. Henry, auditor St. Louis Transit Company, entitled "The Advantages and Disadvantages of the Bag System as Compared with the Receiver System of Handling Conductors' Remittances," will open up a discussion that will, it is hoped, benefit this much vexed problem.

C. N. Duffy, secretary Chicago City Railway, and chairman of the committee which formulated the standard classification, is always interesting, therefore his comparison of the American standard with the proposed British municipal standard, should be interesting to our British friends as to us. While, of course, America is not called upon to discuss the proposed British standard, it can do no harm, and it may point out the desirability of international uniformity along the American line, as this paper showed in its editorial columns Aug. 1.

A new idea is to be tried in "Replies to Questions," which is to throw open a portion of each session to the asking and replying to any questions not provided for in the programme. This should be a popular feature, and we understand it is not necessary for the questioner to be present, but by writing the question the answers will be given in the verbatim report, which is always published immediately after the convention.

Taken as a whole, this programme is full of promise, and in the light of past performances by this association, it will be turned to account before the convention is over.

The Meeting of the American Railway Mechanical & Electrical Association

The Saratoga Convention will be noteworthy from the fact that at it will be held the first regular meeting of the American Railway Mechanical & Electrical Association, which convenes one day earlier than either of the two other associations, that is, the first meeting will be held at 10:30 a. m. on Tuesday, September 1. The papers to be read at the meeting have already been printed and distributed to the members, and present an array of interesting topics which should elicit an extended discussion. The association has a wide sphere of usefulness and can, by concerted effort, effect as important improvements in the mechanical side of street railway operation as has already been accomplished in accounting by the older Accountants' Association. When we consider the topics to be treated at the Saratoga meeting, which include two papers on repair shop practice, two on controlling mechanism, one on motors, and one on rolling stock, it will be seen that the four days selected by the association for its meeting this year are none too long to cover the field mapped out in the programme. We believe that the Saratoga meeting of this association will be the first one only of a most honorable and useful career, and one which will reflect great credit on the foresight of those who organized the association and those who have joined its membership.

The Electric Railways in the Hudson and Mohawk Valleys

Electric railways in the vicinity of Saratoga present many interesting features for the consideration of practical railway managers and engineers, for while the convention city itself has no distinctive street railway facilities whatever, and may be said to be almost entirely without a local service, it is connected with some of the most important properties of this class in the Empire State, all of which are easily accessible to it. The principal features of these enterprises are outlined and discussed in the series of articles on "Electric Railway Attractions of Saratoga and Vicinity," which form an important part of this issue. By reference to the map of the district, which accompanies these articles, it will be seen that there has been a remarkable growth of electric lines in the Hudson and Mohawk Valleys, centering at Albany and extending as far north as Warrensburg and south to Hudson.

The territory served by these electric lines had already enjoyed steam railroad service that was far superior to that of almost any other part of the country, but the abundant water-power available favored the cheap production of electric current, and ways and means were quickly devised for utilizing it. At the present time the water-power development is one of the largest and most important in the country, and just now its value is greatly enhanced because of the increasing cost of fuel. The magnitude of the transmission system, too, and the refinements that have been introduced add to the interest of this feature of the work. But while the water-power development has done much for this region, and is confidently expected to do still more, it has been found impracticable to discard steam power, and, as a matter of fact, one of the most important recent additions is a steam-driven interurban power plant, designed in accordance with the latest practice. This equipment furnishes power for the operation of the Fonda, Johnstown & Gloversville system, and is described in detail elsewhere. On the other hand the United Traction Company, the Hudson Valley Company and the Schenectady Railway Company are depending more and more on water-power, and the first-named company is even now preparing to dismantle its remaining steam plants. A comprehensive system of feeding the transmission lines upon which these railways depend has been

worked out, and ultimately it is expected that provision will be made against every contingency that would necessitate a shut down or seriously cripple the service.

In other features of construction and equipment the properties of this section, although pioneers, rank high in comparison with similar enterprises. Bold engineering marked the laying out of many routes, and while this gave them an advantage as scenic railways it necessitated a high standard of track and line construction and the use of cars equipped with approved safety appliances. In spite of the fact that most of the present properties are made up of smaller roads, which were absorbed and welded together, they have been improved or rebuilt, so that they now form a very creditable system. High speed is maintained on all the interurban lines, and the suburban service has here reached a point that for cities of the size served is in a class distinctly its own.

From an operating point of view a better locality could not be found for holding a street railway convention, as every class of service—city, suburban and interurban, excursion and tourist traffic, freight and express business—are all to be found here. The natural center of this development is Albany, the capital city and most important electric railway point in that part of the State, and the predominating influence is the United Traction Company, which controls the transportation facilities of Albany, Troy, Cohoes, Watervliet and Rensselaer, and thus holds the key to the situation. This company has confined its operations to the local and suburban service of the cities it controls, and its policy is a guarantee of non-interference with the companies developing the interurban business. This has enabled the projectors of this class of road to develop new fields with confidence, and has, at the same time, assured them admittance to the "five cities," an important consideration in that section, especially for companies handling freight and express. This branch of the service has already been developed to a point where it is apparent that electric railways can handle it with profit. At the present time the steam and electric roads are working much more harmoniously than formerly, and in several cases they exchange traffic. This condition has not always prevailed, however, but the New York courts last year decided that electric railways could compel steam roads to permit the establishment of a physical connection between the systems and accept business involving transfers between their roads; in other words, the electric railway was recognized as a common carrier, and the steam road prevented from discriminating against it. The express companies find it to their advantage to recognize the electric lines and cater to them. Altogether, it will be seen, therefore, that street railway men visiting Saratoga will find much in the properties of that section to command their earnest attention.

Our Convention Issue

Following the series of articles in this issue on the electric railway system in the Hudson and Mohawk Valleys, we have attempted to outline briefly the standard practice of the largest cities in this country in track construction, overhead construction, power stations and rolling stock. In these chapters the methods followed in New York and Brooklyn have been omitted, as the practice in these cities was so fully discussed in our New York convention number published in October, 1901. We realize that outside of the fourteen or fifteen cities selected for this discussion on city practice, there is much that is of value and worthy of adoption. The space at our disposal, however, permitted us only to take up the practice of a certain limited number of cities, and the data from these have been grouped in a way which, so far as we know, has never been followed before. In other words, a comparison has been made at one time of the practice of the various companies considered, so that the differences between them can be readily understood. We cannot attempt here to discuss editorially all the topics treated in the several chapters, as in each subdivision of the subject a series of general conclusions has been appended in which a comparison is drawn of the plans followed. We believe, however, that the general trend of practice of the different companies whose methods are discussed in this series of articles will be found of practical value by constructing and operating engineers in all parts of the world.

Mr. Dawson's Article

We present in Mr. Dawson's able paper a very judicious *resume* of current international practice in power station operation. It is not strange that common necessities and requirements should have produced a certain unity of method, yet the divergencies from a common standard are conspicuous and instructive. In the general matter of power station design we feel that the influences now at work are likely to effect considerable changes in the next few years. Looking at the subject in its broad aspects, it is apparent that in the century now begun the fuel question is likely to take on a far more serious aspect than in the past, and that the engineer will find the necessity of economy in fuel ever more and more imperative. Up to the present the aim of, perhaps, the majority of improvements, has been the reduction of labor costs, with highly successful results, but at the present time there is every indication that the price of fuel is rising more rapidly than the price of labor, and that future efforts should be directed mainly at fuel economies. Moreover, nothing is more certain than that interest charges have entered in this country upon a downward gradient, so that capital investment is already far less of a burden than it was a decade since. The normal and proper tendency in station design would, therefore, appear to be the diminution of operating expense, both of fuel and labor, even at the cost of considerable increased investment. This is the more important since the depreciation charges on modern machinery are materially less than they were a few years ago, so that on the whole the fixed charges are diminishing while the fuel charge is increasing, and the labor charge is barely holding its own, and, perhaps, even has a downward tendency.

These conditions, while general all over the world, have affected the world gradually, and our own country only recently. In England the capital charges are low, and the labor charge, while less than here, is still materially greater than on the Continent. This condition has materially affected the design not only of power stations, but of the machinery installed in them. Some of the peculiarities of German practice, as instanced by Mr. Dawson, speak plainly on this point. High superheating of the steam has generally been regarded here, and in fact in England, as "too troublesome" or "too theoretical," or too something or other else, but in Germany they have neither spared the trouble nor the theory, and have reached in virtue of their labor some truly remarkable results. If the triple expansion engine was the thing that saved steam the triple expansion engine was the thing they wanted, and in it went, never mind if it was a trifle more complicated and required a little more care. And we are strongly of the opinion that the need of economy, together with the competition of the steam turbine, will compel the use of the triple expansion engine here. In stations large enough to insure a good load factor there is no valid objection to its use. In the same way the

Germans and Continental engineers generally like to connect all the auxiliaries possible to the main prime mover. This, to our eyes, seems clumsy and inconvenient, but it undeniably saves power over either steam or electric auxiliaries, and that is what counts in the long run under Continental conditions. Mr. Dawson very justly remarks that English and American engineers aim at simplicity in design, which is in itself a good thing; but there is a kind of simplicity which contents itself with being "just about as good," and there is still another kind which accomplishes, by means of a single intricate piece, what could be done as well by two simple pieces. Neither sort is especially commendable. We do not say these things in reproach, but as a reminder that our Teutonic friends are not so far behind us as we sometimes love to think.

We think that Mr. Dawson does not overestimate the importance of the steam turbine. This truly remarkable machine is forcing its way very rapidly. Its strongest points are its high rotative speed as applied to driving alternators, and its very uniform economy under widely varying loads. Both these advantages are somewhat reduced by the difficulty of designing direct-current dynamos for turbine speeds, and its consequent inapplicability to small and moderate-sized railway plants in which its uniform efficiency would be particularly available. Its best hold in large stations is its economy of space, which again is reduced in value by its special suitability to alternators which can readily be placed where saving in space counts for little. Of course, the adoption of alternating motors or a great improvement in the reduction of alternating to direct current would remove these disabilities and very greatly increase the use of the turbine. The gas engine as a prime mover is one of the most interesting of possibilities. It certainly is capable of greater economy than any steam engine has yet shown, but it is, nevertheless, not in a satisfactory state. That it will be greatly improved is certain, but whether it will soon compete with the steam engine is quite another matter. The same economic forces that tend to compel modifications of practice in the direction of fuel economy act as a direct stimulus to improvements in the gas engine, and the result may well be sensational. If the steam engine is to be our main reliance in the future, as in the past, we are inclined to think that improvement in furnaces is likely to lead to greater economies than improvements in any other single direction. One has only to look at a series of boiler tests to be impressed with the fact that proper burning of the fuel is the exception rather than the rule. The evaporative efficiency of a single type of boiler varies more than any other factor in power production, and this is a matter mainly depending on the design and operation of the furnace. One must watch the fuel from coal pocket to stack in order to insure proper economy in its use.

The Design of City Power Stations

The general theory of power house design applies to city stations as well as others, but in large urban systems certain conditions arise which greatly modify the factors which control location and design. These in chief are the cost of real estate, cost of water supply, and the great mass and density of the traffic. In the case of interurban roads or those in and about the smaller cities the cost of real estate is not a serious matter. It is a small fraction of the total investment and within the area near enough to the center of load to be considered it is fairly uniform. Likewise the water supply, especially for condensation, can generally be obtained quite easily from wells or streams anywhere within the area concerned. As to the traffic, it is usually such in amount and kind that it is hard to get a good load factor, and the output is likely to be greatly affected by temporary local conditions. In large urban stations real estate and water supply are serious matters. It is a tremendously costly matter, even if it would be permitted, to build the power station or stations at the point which economy of distribution would dictate, and even if it were feasible water supply might involve great expense for even a very inadequate supply. As a city gets bigger and bigger the number of sites available on the score of cost, water supply, and, for that matter, fuel supply, rapidly diminishes. As regards load conditions an urban system generally has a far better load factor than usual, and much greater uniformity of load factor with much less likelihood of relatively great and sudden disturbances. As an offset to this advantage the center of load on a large urban system fluctuates with almost tidal regularity, moving in and out from the geometrical center or back and forth with the diurnal movement of passengers. This fluctuation should be taken account of in the distribution system and implies increased feeder capacity.

When the small systems of a decade ago grew to formidable dimensions they rapidly outgrew their power stations, and in the press and hurry of increasing demands all sorts of makeshifts were indulged in to tide over the present emergency. These proved expensive, and have gradually been supplanted by stations laid out with reference to the demands of the system as a whole. As our data here presented show, there are two fairly distinct plans for supplying a great urban load. One is the system of distributed power stations, so thoroughly worked out in the practice of the Boston Elevated Railway Company, the other the central station idea, well exemplified in Baltimore and in several metropolitan instances. The former establishes several stations in the load district and feeding the railway system directly. The other establishes one immense station at some particularly favorable spot and transmits over a separate feeder system high-tension polyphase current to sub-stations with rotaries located at favorable points on the general network. The theoretical questions involved between the two plans are those touching, on the one hand, the cost of generating power in stations of different capacities and load factors, and on the other the cost of distributing and retransforming current in case a single generating plant is chosen. The costs here considered must be based not only on operating expenses, but on the total cost of the energy, including fixed charges, upkeep and depreciation. Most of the misunderstandings in the premises have come from the omission of these latter factors. Not only the relative but the absolute magnitudes of the various stations compared obviously enter the question, together with the magnitude and variations of the load factors. In due time experience will settle the question, but up to our present writing sufficiently complete data from the large central power stations are not at hand. Nothing final is yet known of their economy, and still less of the practical cost of taking their current, transmitting it to the sub-stations and reconverting it into direct current.

One thing, however, appears to us reasonably certain, that when a station gets so big that it should be subdivided and run in practically independent sections to insure safety against a general breakdown, a point has been reached at which there is very little hope of reaching an economy in generation much in excess of that which would be attempted by the sections run independently at separate points. Any material gain must be made in such case by the lessened cost of real estate and water and fuel haulage, and a possible gain in the steadiness of the load factor. As a matter of fact the load factor reached in the

separate stations of the Boston system is so high as scarcely to warrant hope of much further gain, so that the question of economy simmers down to an equation between real estate and feeder copper. The greatest gain possible on the one-station plan is in increasing the number of feeding sub-stations, and the economies of this step have not yet been thoroughly discussed. A converting apparatus which does not require attention is greatly to be desired and would change the whole situation most radically. The advent of the steam turbine, on the other hand, lessens the space required for a station and makes it easier to establish separate feeding plants, although the unsuitability of the turbine for direct-current generation is a serious drawback. In a turbine-driven station the boiler space is the most considerable factor, and to keep this within limits a steeple construction of the boilers would seem logically to be the next step. Further economy in generation depends very much on increase in pressures, high superheating and the use of improved turbines and triple expansion engines. In large stations, with high and relatively steady load factors, triple expansion is worth while, and the higher the pressures go the more important is its advantage. Triple expansion is the logical step if the reciprocating engine is to hold its own against the increasing competition of the steam turbine.

The Functions of the Repair Shop

Mr. McCulloch's description of the equipment, operation and methods of the repair shop of the Chicago City Railway is one of the most valuable contributions to the literature of practical railroading that we have seen for some time. It is particularly useful to the railway fraternity on account of the details regarding costs, which throw much light on the vexed questions of maintenance and its cost. The Chicago City road is an excellent one from which to derive data, as it is large enough to justify the establishment of completely equipped repair shops without being so large as to lose its value as an example. It also includes both cable and electric equipments, so that not only does the report give some comparative data, but the shop itself was compelled to do a larger variety of work than would be usual. The first thing to be noted in the equipment of the plant is that no mistakes were made in half-doing it to save initial cost. It was constructed on the theory that such a shop must be able to compete in economy of operation with first-class establisments of far greater size. It must make castings as cheaply as a large foundry, and wind armatures at as low a price as the big electrical manufacturers. Therefore, it was fitted up with the latest forms of machine tools, electrically driven throughout, and was organized as carefully as if it were going into sharp competitive business quite on its own account. The result not only has justified this thoroughness of equipment. but is a lesson on the economy with which a small establishment can do work when well administered. There is no greater mistake than to think that all the advantages in cost lie with the large shop. On the contrary, in the very big establishments there is likely to be a vast amount of "lost motion" between ordering a thing and getting it done, all of which costs good money.

Very few persons outside of the executive departments of street railways have any adequate notion of the work that is cut out for the repair shop of any large street railway system. The Chicago City Railway operated in 1902, for which year the data are given, 527 motor equipments and 172 grip cars, making a total, including trailers, of about 900 to 1000 cars. It has a little over a hundred miles of double track, of which about 40 per cent is cable road and the rest electric. Yet on this system the repair shops required the services of from 300 to 350 men, including the repair force in the car houses, and the repair force including the car house crews, ran up a yearly pay roll of more than $350,000, to say nothing of materials used. This fact is respectfully commended to the non-technical reader who labors under the delusion that incidental expenses are moderate. To be sure, the repair shops in this case do no small amount of work which most repair shops do not attempt, but on the other hand the equipment is such as to tend toward reduction of labor costs. It is not so much, however, the total pay roll that is striking as the itemized report showing the distribution of repair costs. For instance, the average man does not realize at all the cost of maintaining a car equipment. Unless he is in the railway business he looks upon it rather lightly, and even if he knows something about it he is apt to be misled by glib recitals of percentages of depreciation and the small cost of repairs superinduced by "our latest type R. S. V. P. 4-11-44 equipment." The weary souls who stand over the system 24 hours per day to foot up the leering lines of the monthly expense list know better, but generally hold their peace. But here are some of the figures. The repairs and renewals on motors and the purely electrical equipment of the cars averaged $134.21 per motor car. This does not look much like the current estimates of depreciation, does it, long-suffering friend? And then there is to be added another cheerful item of $28 per equipment for inspection and ordinary supplies, bringing the total maintenance charge to $162.21 per car.

This result, it should be borne in mind, is from a good-sized road, well operated and successful, in which the very repair shop equipment we are considering has brought down the costs of work to a point very considerably below those which would commonly be charged for the same items. We would much like to see an equally rigid analysis of the maintenance charges on a road of only average size and under only ordinarily good management. The results would not be cheerful reading, but they would be a good lesson to the gibbering idiots who are chortling about 3-cent fares and figuring salesman's depreciations and repairs. The thorough organization and equipment of the repair shops under consideration have encouraged the undertaking of repairs and minor manufactures of a kind not usually attempted except in emergencies. Many roads do more or less at rewinding armatures and fields, but few go so far as to strip, retape and rewind the wire of burnt-out fields or to reforge old axles into guard irons and switch tongues, let alone manufacturing special track work for crossings. The costs given by Mr. McCulloch for armature and field winding on the various types of motors in common use are very instructive, and while a good many roads may find it difficult to duplicate them, others, which have the advantage of relatively low-priced labor, will find it quite possible to do so. It is always a nice question how far it pays to go into heavy repair work and minor manufacturing, and each road must settle the question for itself. The danger from an economic standpoint lies in the tendency of repairs to make repairs. Does, for example, a field rewound from scrap copper retaped stand up as well as a new field, and will a switch tongue forged from axle steel last like one made from special steel for the purpose? These are questions that must be answered by experience, and while the results in Chicago have apparently been good we should greatly dislike to guarantee similar satisfaction in the average repair shop. Nevertheless, the Chicago City Railway has set a pace that is stimulating.



W. CARYL ELY



P. S. ARKWRIGHT



W. KESLEY SCHOEPF



J. C. HUTCHINS



H. H. VREELAND



R. T. LAFFIN

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OFFICERS AND EXECUTIVE COMMITTEE AMERICAN RAILWAY MECHANICAL AND ELECTRICAL ASSOCIATION



H. H. ADAMS



T. J. MULLEN



D. F. CARVER

THE COMING CONVENTIONS

AMERICAN STREET RAILWAY ASSOCIATION

The meetings of the American Street Railway Association will be held in the ball room of the Grand Union Hotel, Saratoga Springs, on the afternoon of Wednesday, Sept. 2, and on the mornings of Thursday, Sept. 3 and 4. The programme of the Association is as follows:

Wednesday, Sept. 2, a. m. Registration.
2:00 p. m. First session.
Address of welcome, by Mayor Knapp.
President's address.
Report of the executive committee.
Report of the secretary-treasurer.
Presentation of papers.
8:00 p. m. Excursion to Saratoga Casino upon invitation of the Hudson Valley Railroad Company.

Thursday, Sept. 3.
10:00 a. m. Session.
Presentation and discussion of papers.
1:00 p. m. Excursion to the works of the General Electric Company at Schenectady, upon invitation of the General Electric Company.

Friday, Sept. 4.
10:00 a. m. Session.
Election of officers and any unfinished business.
1:00 p. m. Excursion to Lake George on train drawn by electric locomotive, upon invitation of the Hudson Valley Railroad Company.
8:00 p. m. Banquet in the ball room of the Grand Union Hotel.

The titles of the papers to be presented are announced as follows:

"The Right of Way," by Herbert H. Vreeland, of New York.

"Comparative Merits of Single and Double Truck Cars for City Service," by John I. Beggs, of Milwaukee.

"The Manufacture and Distribution of Alternating Currents for City Systems," by Richard McCulloch, of Chicago.

"Freight and Express on Electric Railways," by J. B. McClary," of Birmingham.

"Train Orders and Train Signals on Interurban Roads," by T. E. Mitten, of Buffalo.

"The Evils of Maintenance and Champerty in Personal Injury Cases," by Michael Brennan, of Detroit.

"Electrically Welded Joints," by William Pestell, formerly of Worcester, and now of J. G. White & Co.

"Steam Turbines," by W. L. R. Emmett, of the General Electric Company, Schenectady.

THE STREET RAILWAY ACCOUNTANTS OF AMERICA

The meetings of this association will be held in one of the club rooms at the end of the court piazza of the Grand Union Hotel. The entrance will be found very near the headquarters of the STREET RAILWAY JOURNAL. The following programme has been adopted for the Saratoga meeting:

Wednesday, Sept. 2, 1903.—In Convention Hall, Grand Union Hotel. 10 a. m., sharp.
Annual address of the president.
Annual report of the executive committee.
Annual report of the secretary-treasurer.
Paper: "Freight and Express Accounts," by Irwin Fullerton, general auditor, Detroit United Railway, Detroit, Mich.
Appointment of convention committee on nominations.
Appointment of convention committee on resolutions.
Replies to questions.

Thursday, Sept. 3, 1903.—10 a. m., sharp.
Paper: "Car Maintenance Records," by S. C. Stivers, New Jersey & Hudson River Railway, Edgewater, N. J.
Paper or address by a representative of the United States Census Bureau.
Report of the committee on a standard form of report for electric railways. Chariman, William F. Ham, comptroller Washington Railway & Electric Company, Washington, D. C.
Replies to questions.

Friday, Sept. 4, 1903.—10 a. m., sharp.
Paper: "Advantages and Disadvantages of Bag or Envelope Receiver System of Conductors' Deposits," by F. R. Henry, auditor St. Louis Transit Company, St. Louis, Mo.
"Comparison of the Municipal Tramways Association of Great Britain, Proposed Standard Classification and Form of Report with the American Standard," by C. N. Duffy, secretary Chicago City Railway, Chicago, Ill., chairman committee on standard classification.
Report of committee on resolutions.
Report of committee on nominations.
Election and installations of officers.
Adjournment.

THE AMERICAN RAILWAY MECHANICAL AND ELECTRICAL ASSOCIATION

The convention of this Association commences one day earlier than that of the American Street Railway Association, or of the Accountants' Association. The meetings of the Association will be held in one of the club rooms of the Grand Union Hotel, very near the meeting halls of the other two associations, and the first meeting will be held on Tuesday, Sept. 1, 10:30 a. m. An address of welcome will be extended by Hon. Edgar T. Brackett, State Senator of New York State.

The meetings on Sept. 2, 3 and 4 will be called to order at 10:00 a. m. The papers to be read are as follows:

"Shop Kinks," by H. H. Adams, of Baltimore.

"Type-M Control," by W. O. Mundy, of St. Louis.

"Improvements in Street Car Motors," by E. W. Olds, of Milwaukee.

"Care and Maintenance of Car Bodies," by C. F. Baker, of Boston.

"Shop Practice," by Alfred Green, of Rochester.

"The Use and Abuse of Controlling Mechanism," by D. F. Carver, of Jersey City.

ELECTRIC RAILWAY ATTRACTIONS AT SARATOGA AND VICINITY

ELECTRIC railway operators who go to the Saratoga Convention carrying with them the impression that there is little of interest to be seen or heard aside from the exhibits of manufacturers and the sessions of the conventions, will be agreeably disappointed. Within a radius of 50 miles of Saratoga at points accessible by electric travel, are no less than seven systems, each of which affords interesting features in operation and construction. In fact, it would be difficult to find in the entire country a district offering so great a variety of methods as the roads of this section.

Most of the systems in this territory depend upon water-power for operating their plants. This method of generating current, which, by reason of the gradual advancing cost of coal, is bound to receive increasing attention in the future, has reached a high stage of development in this valley, and because of the great variety of these water plants, as well as the magnitude of some of them, the live railway operator will find plenty of opportunity of making a study of this feature under the most favorable circumstances.

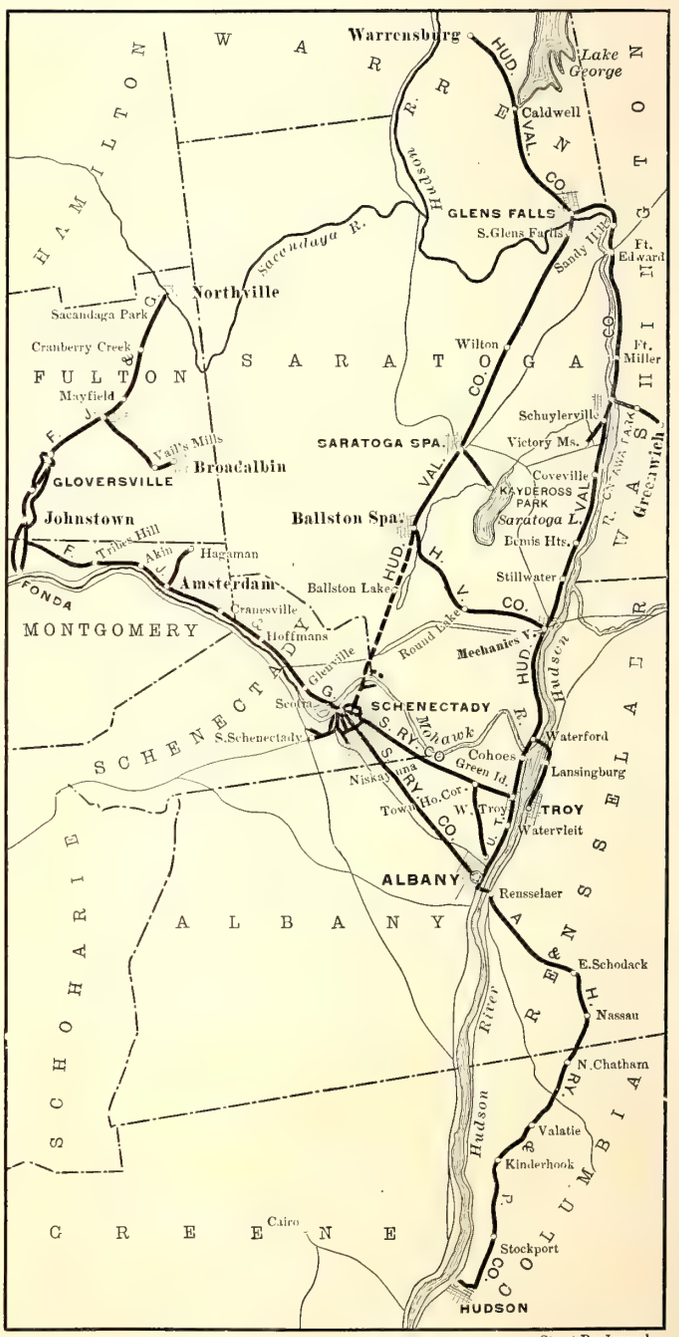
Methods of transmitting and handling current after it has been generated have also received careful attention. In fact, some of the most interesting transmission lines in the country are located in this portion of the Hudson Valley, and not only are these lines remarkable for their length, but for the methods of utilizing and distributing the power. The number of water-power plants, and the great demand for current at widely separated points, have encouraged engineers to work out novel and interesting methods of sectionalizing and grouping the circuits, so that current may be taken from different plants and delivered at various points, thus insuring the consumers protection against breakdown at generating stations and on transmission lines, and at the same time permitting of greater flexibility in the amount of current that may be utilized at any given time or point.

The development of these water-powers and transmission lines has also resulted in the designing of a number of unusually large sub-stations for utilizing and handling the power. Some of these sub-stations supply current for manufacturing purposes, for arc lighting, and for incandescent lighting, as well as for electric railway operation, and in several instances the four varieties of equipment are installed under one roof, forming a complex and interesting layout.

One of the electric railway systems in this district has adopted the method of generating direct current by means of water-wheels and then transforming and transmitting the current at high potential through the use of inverted rotaries. The reasons for utilizing this seemingly roundabout method and the advantages claimed for it are detailed in the succeeding pages.

While water-powers form the principal source of supply in this district, there are also several large and well-equipped steam-power stations, and one of these in particular, which is described in detail, may be commended to the attention of visitors as one of the largest up-to-date interurban power plants in the country.

From the standpoint of roadbed construction the electric roads of Eastern New York show many features of superiority over the general run of lines in other portions of the country. Several of these lines lay in the route of that growing system of electric roads which enthusiasts hope will some day afford unbroken electric travel from New York to Chicago. At any rate, it is evident that the builders have had in mind the possibility that some day they may be called upon



MAP SHOWING ELECTRIC RAILWAY DEVELOPMENT IN THE HUDSON VALLEY

to take care of through high-speed traffic, for while the topography of the country has made it difficult at present, the grades have been brought down to a very low standard. There are numerous extensive cuts and fills, many of the former being through solid rock, and double-track lines are the rule rather than the exception. There are a number of note-



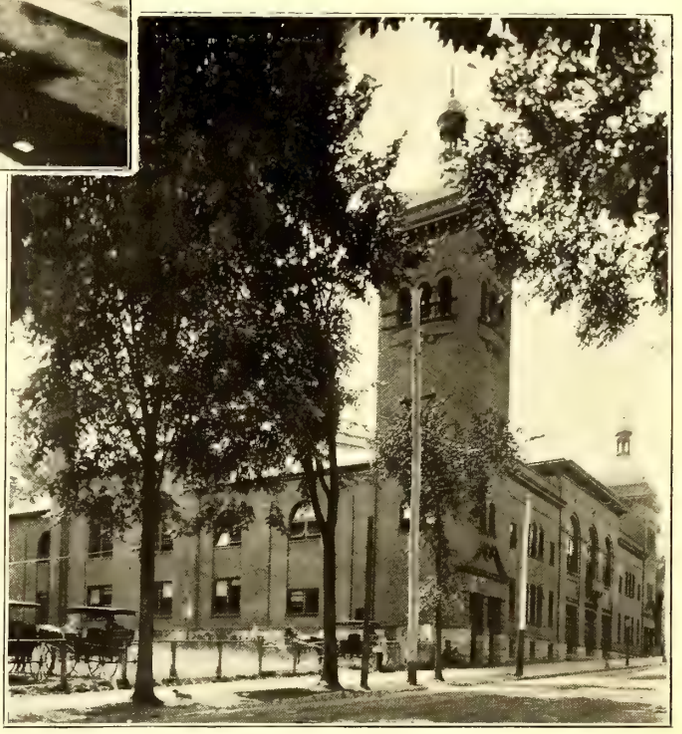
TYPICAL SCENE ON BROADWAY, SARATOGA

worthy steel bridges, and the construction of concrete bridges and crossings has been brought to a high stage of perfection.

The cities and towns are larger and closer together in this district, than they are in the newer western portions of the country, and the headway of the interurban roads is more frequent than on the majority of the best-known lines of the Central West. Half-hourly headway is the usual rule, while some of the roads give fifteen-minute headway over portions of their lines. High-speed is the rule on nearly all the lines in this district. In the matter of rolling stock, as a rule, they compare favorably with modern interurbans elsewhere, and, in some instances, they present the latest and highest examples of the car-builder's art.

The city, as well as the interurban lines of the district, are developing the package express business, but as a rule they are handling freight only as a secondary consideration. The rates for express matter are considerably higher than those received by the majority of the roads that are developing this business in the Middle West. Some of the lines carry on a very profitable exchange of freight and express with the Hudson River steamboat lines, an example which could be followed to advantage in other portions of the country.

In the development of summer traffic the Eastern New York roads can furnish many valuable suggestions. The remarkable scenic beauties of the Mohawk and Hudson valleys give a natural impetus to summer traffic, and this has been stimulated by the establishment of summer parks, and the practice adopted by three of the roads in the erection, at points of natural attraction, of the large summer hotels which are operated by the companies themselves.



CONVENTION HALL



GRAND UNION COURT

THE HUDSON VALLEY RAILWAY

The only electric railway line at present operating into Saratoga is that of the Hudson Valley Railway Company, but it is expected that by the latter part of the year, the Schenectady Railway will gain admission to the city under a traffic arrangement with the Hudson Valley Company from Ballston.



GRAND UNION HOTEL PARK

The Hudson Valley Railway Company was formed in 1901 through the consolidation of the Stillwater & Mechanicsville Street Railway Company, the Greenwich & Schuylerville Electric Railway Company, the Saratoga Traction Company, the Saratoga Northern Railway, the Glens Falls, Sandy Hill & Fort Edward Railway, and the Warren County Railway. These were short lines built by independent interests and merged into the present company by a group of capitalists known as the Powers-Colvin syndicate. Connecting links were built, so that the line now extends from Waterford to Warrensburg, a distance of about 60 miles, with a branch line leaving the main line at Mechanicsville, and running by way of Ballston and Saratoga, and connecting with the main line at South Glens Falls. This system has a spur from Saratoga to Saratoga Lake, and there is also a spur from the main line at Thompson to Greenwich. The section between Saratoga and Glens Falls has only been completed a short time, and it is practically an air line of 18 miles. The total system, including second track and sidings, aggregates 127.73 miles, of which about 88 miles is on private right of way.

Historical Points and Scenic Attractions

The frequent waterfalls in the Hudson River afford cheap power, which has been taken advantage of by numerous manufacturing establishments, and the valley itself supports a large farming population, thus presenting a very good average per mile. But it is from the summer traffic that the system receives its heaviest returns. There are few portions of this country where nature and history have combined in providing so much to please and interest humanity as in the portion of the Hudson Valley traversed by this road. The noble Hudson, famous throughout its entire length for beautiful scenery, is less placid in these parts than in the portion below Albany, and is dotted with numerous islands, and interrupted at frequent intervals by the dams and waterfalls, which turn the wheels of many industries and add to the attractiveness of the scenery. It might be mentioned incidentally that the Hudson Valley Company controls a number of these water-powers, some of which are developed and others retained for future requirements. The main line of the system furnishes an almost uninterrupted view of the Hudson for nearly 50 miles, and twice it crosses the river on expensive bridges.

On either side a range of mountains follows the wide valley, and at intervals on the main line one can catch glimpses of the Green Mountains in Vermont, 30 miles or 40 miles distant, while on the Saratoga division, and approaching the northern terminus, may be seen the forest-covered peaks of the Adirondacks. The Saratoga division passes in close proximity to Mount McGregor, famous as a mountain health resort, and as the spot where President U. S. Grant breathed his last. Lake George, near the northern terminus, has been described by many writers as the most beautiful lake in America. The southern end of the lake was selected by the company as the site for its chief summer resort.



CONGRESS PARK

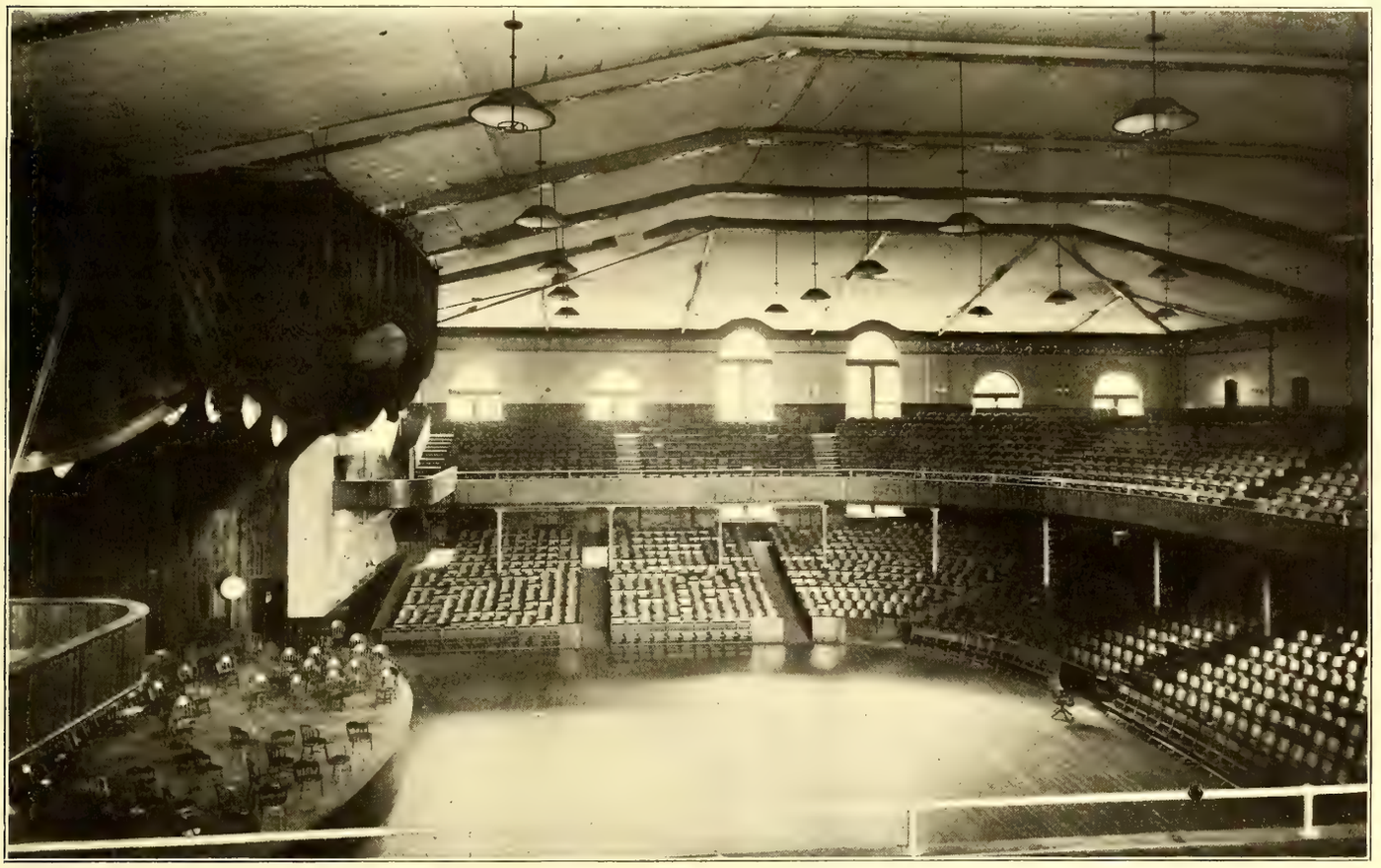
Many and varied are the historic attractions of this portion

of the valley. Every hill and vale in the entire district has been the scene of warfare, first, between the early settlers and the Indians; later, between the French and Indians on one side and the colonials and the English on the other, and still later, between the veterans of George III. and the Revolutionary heroes.

Waterford, at the southern terminus of the company's property, is famous as the center of the knit goods trade. Tradition says that this was the northern point reached by Henry Hudson, when, in 1610, the "Half Moon" crept up the Hudson. A short distance south of Mechanicsville is the power station of the Hudson River Power Transmission Company, which supplies power to a number of electric roads and plants in this district. Here also are grouped a number of important manufacturing industries, which derive their power from the river. Stillwater, a few miles north on the main line, was settled in 1690, and has several manufacturing plants. The town was the base for the American army during its campaign against Burgoyne. Several battles were fought in that section, and all over a wide district are battlefield tablets marking the graves of English or American soldiers.

Schuylerville is rich in its historic interests. It was settled in 1690 by the illustrious Schuyler family, and a short distance from the village is to be seen the old Schuyler mansion, erected by soldiers of the American army shortly after the surrender of Burgoyne. To the west of the village is the famous Saratoga battle monument, marking the scene of the great American victory of Saratoga. Near Moses' Kill the line crosses a fine concrete bridge, and a short distance from this point there is one of the most beautiful views in the entire valley. Fort Edward is the site of several famous fortresses in colonial and revolutionary days. Near the center of the town is a memorial erected to Jane McCrea, the "maiden martyr" of the Revolution, who was murdered there by Burgoyne's Indians. Near Sandy Hill are the car houses, shops and largest steam power stations of the Hudson Valley Company. Here, also are several large factories driven by water-power.

Glens Falls, a live city of 20,000 inhabitants, and the headquarters of the system, is famous for its beautiful waterfalls and the paper manufacturing industry which this water-power has made possible. A few miles north of Glens Falls the road almost loses itself in the forests at the base of French Mountain, historic in French and Indian warfare. Near Caldwell are the ruins of Fort William Henry, and not far distant are those of Fort George. At Warrensburg, the northern terminus of the line, are a number of large mills. The town is almost surrounded by hills and mountains.



INTERIOR OF "CONVENTION HALL," SARATOGA, WHERE THE STATE POLITICAL CONVENTIONS ARE HELD

SARATOGA

The branch line to Saratoga leaves the main line at Mechanicsville, passing Willow, Glen, Round Lake and Ballston. In the early part of the last century, the latter was a famous watering-place, and there are a number of ancient hotels, which in the twenties were the Mecca for gay society. But the mineral springs which made the place famous have failed, and it has now settled down to a quiet manufacturing town.

The fame of Saratoga is too well known to require detailing. The entire district bubbles with mineral springs, the waters of which have acquired a national reputation. As a center for fashionable summer life, Saratoga has long rivaled Newport. The huge hotels which line Broadway accommodate many thousands of guests, and by reason of this fact, Saratoga has of late years acquired a widespread reputation as a convention city. Convention Hall, Saratoga, has been the scene of hundreds of political, fraternal and trade conventions. Saratoga Lake, 3 miles from the city, is the site of Kaydeross Park, one of the several resorts owned by the company.

OPERATION

The Hudson Valley Railway does not pass through Saratoga, as the citizens are unwilling that famous Broadway shall be traversed or even crossed by an electric road. The southern division terminates in the neat terminal station on Broadway opposite Congress Park and within a few steps of the Congress Hall and Grand Union Hotels. The northern portion of the Saratoga division ends on a street parallel to Broadway about four blocks from the terminal station. The company has not given up hopes of operating cars through the city, and expects soon to complete arrangements whereby the two sections of the Saratoga division will be connected.



TROLLEY LINE CROSSING SCHROON RIVER AT WARRENSBURG



FORT WILLIAM HENRY HOTEL AT LAKE GEORGE

At present the system is operated in three divisions. One division extends from Troy; that city is entered over the tracks of the United Traction Company. The line extends to Fort Edward, including the southern portion of the main line and the Greenwich branch. A second division comprises the southern portion of the Saratoga branch, and includes the spur line to Saratoga Lake. The third division includes the northern portion of the Saratoga branch and that portion of the main line extending from Fort Edward to Warrensburg. Cars alternate out of Troy on half-hourly headway, one car going to Saratoga and the next going through on the main line to Fort Edward. The car to Saratoga connects in that place with a car on the northern portion of the Saratoga branch, and this car operates through Glens Falls to Warrensburg. City cars operate between Glens Falls, Sandy Hill and Fort Edward on 7½-minute to 15-minute headway, and these cars transfer the through passengers from the main line to the cars which go to Warrensburg. Cars on the Greenwich branch operate south to Schuylerville on the hourly headway, so that there is half-hourly service through Schuyler to Thomson Junction. Between Saratoga and Ballston, and between Saratoga and Saratoga Lake, there is 15-minute headway.

EXCURSION AND FREIGHT BUSINESS

The company pays particular attention to special excursion business, and for this service furnishes either an open car seating ninety passengers, or a parlor car seating twenty-five passengers, and furnished with refrigerator, tables for serving lunch, etc. An extra charge of $10 is made for the latter car. The charge for a special car from Waterford to Warrensburg is $92, and a charge of $5 and $10, respectively, is made for cars run into Troy and Albany. If desired, special cars are run in trains drawn by an electric locomotive.



TROLLEY LINE NEAR MT. M'GREGOR

The company has a traffic arrangement with the United Traction Company to run its cars through to the center of Albany, but at present this is not done.



FORT WILLIAM HENRY DOCK

Formerly the company operated an express business over the

entire system, but at present this is not in effect. Freight cars from steam roads are handled over portions of the system between Mechanicsville and Glens Falls. These are handled for the factories along the line, and switching charges are made. The only portion of the system over which regular express business is conducted is between Greenwich and Schuylerville. Two cars per day are operated over this portion. The reason for the partial abandonment of this important branch of the business is the loss sustained by the company in the recent strike, when the road was practically tied-up for nearly two months. Before the strike, plans had been made to rebuild and improve the system in many ways, but the loss occasioned by these labor troubles has prevented the execution of many of the projects.

INTERURBAN SERVICE

For interurban service there are sixteen 42-ft. closed cars, thirty-two 42-ft., 15-bench open cars, and five thirteen-bench open cars; also about fifty smaller single-truck cars for use on the city lines. For express service there are eight 40-ft. express cars, while for handling freight and construction trains two electric locomotives of standard type are equipped with four 75-hp motors. Among other rolling stock are six snow plows of the nose type, and one rotary snow plow; 20 hand cars, 10 push cars, one rail-laying car, and one gasoline inspection car. All the cars were made by J. M. Jones' Sons, of West Troy, N. Y. The interurban cars are equipped with four 50-hp Westinghouse motors and have the Westinghouse automatic air equipment.

The interurban cars have Ohmer fair registers. The present system of selling tickets is somewhat complicated, in view of the fact that cars do not run from one terminus to the other. Tickets are sold only from point to point, and the conductor takes up a coupon for each portion of the trip as it is covered. The conductor must turn in a coupon for each division of the line for which a passenger is carried, and each coupon is marked with a value for the accounting department. Mileage books containing $10 worth of coupons are sold for $7.50. Weekly limited tickets for twelve round-trip rides are sold between any two points for one-half of the regular fair. Between Glens Falls, Sandy Hill and Fort Edward tickets are sold at the rate of 33 for $1.00, each ticket being good for a five-cent fare. These books are limited to three months.

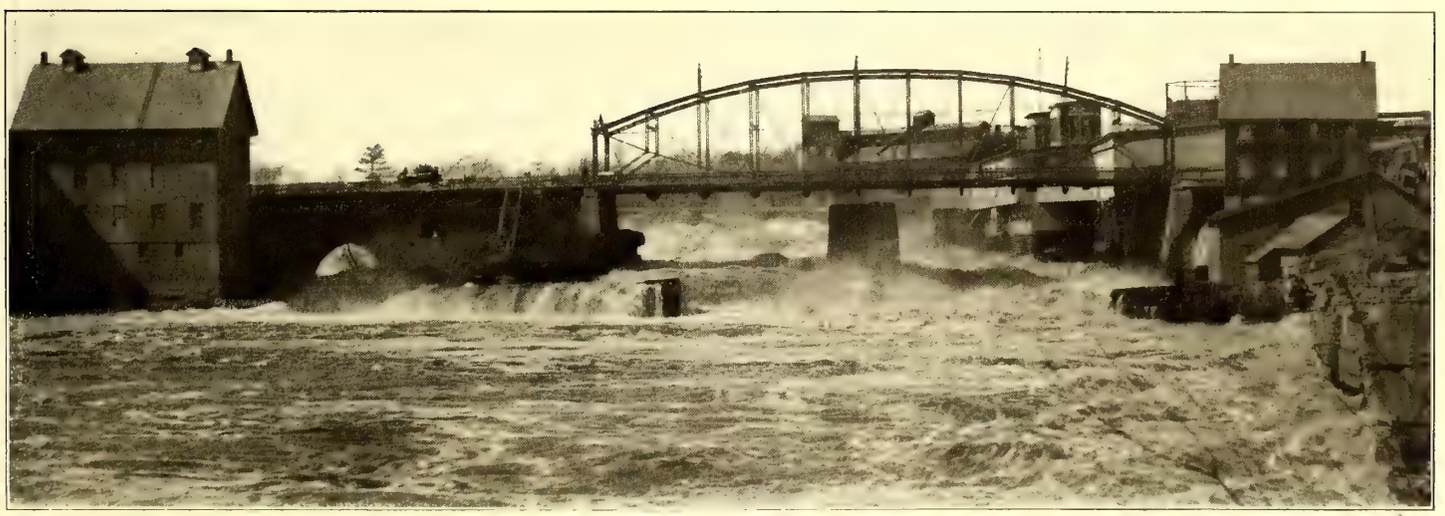
POWER EQUIPMENT

The present power equipment of the Hudson Valley Company is a heterogeneous mixture of old and new, combining, as it does, the equipment of the consolidated roads. At present there are five power stations in operation, four of which are combined water and steam plants. There are also six sub-stations.

Early in the fall of 1902 it was decided to build a large dam on the Hudson River, or purchase power from the Hudson River Water-Power Company. With this in view, and knowing it would be impossible to secure quick deliveries on apparatus suitable for this kind of work, the railway company ordered eight 300-kw 40-cycle Westinghouse rotary converters, but, owing to labor troubles, it was decided to purchase power temporarily from the Hudson River Power Company and not make any effort to establish a water-power plant at that time. Shortly after this, it became apparent that the Hudson River Water-Power Company would not be able to furnish all the power required by the Hudson Valley Company for the present summer, and these negotiations had to be abandoned. This left the Hudson Valley Railway Company with eight complete sub-station outfits, but with no available power to drive them. These conditions resulted in the employment of the rotaries as auxiliaries, and the development of the present system.



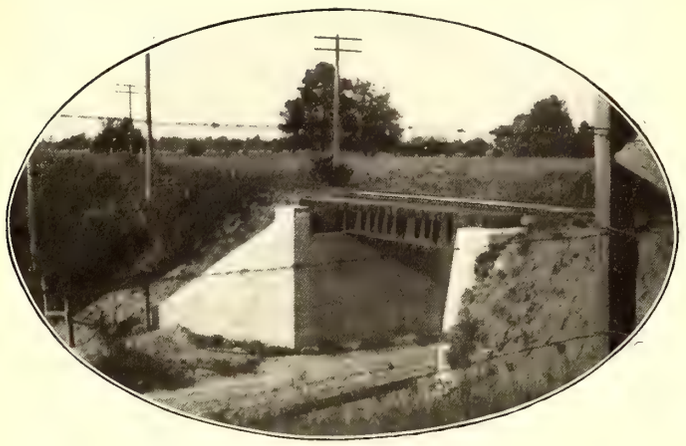
FORT EDWARD CAR HOUSE



TROLLEY CROSSING AT GLENS FALLS

One 300-kw 40-cycle rotary was installed at Warrensburg. It was belted to a 400-hp water-wheel, and separately excited, making a double-current generator, from which direct current was supplied to that end of the line, while alternating-current was furnished through step-up transformers at 22,000 volts to Lake George, a distance of 7½ miles. Lowering transformers and a rotary converter were employed to change it to direct-current at 600 volts, at which it was sent out on the line at that

point, thus taking care of about 16 miles of railway line. The same general plan was followed in utilizing rotaries at the steam plant in the Queensbury power house, supplying alternating current at 22,000 volts to the sub-stations at Wilton, a distance of 11 miles in one direction, and Moses Kill, a distance of 14 miles in the opposite direction.



STEEL AND CONCRETE CROSSING

At the Saratoga plant, one of the 300-kw rotaries was belted to a 500-hp engine, using a separate exciter, the same as at Warrensburg. While it is not claimed that this is the most efficient way of operating a road, it has been found to increase greatly the flexibility of the system and show the advantages of using rotary converters as auxiliaries. In fact there are few water-power plants even of the most modern types that do not shut down for occasional short periods, causing great inconvenience to the public and a considerable loss to the company.

The largest steam station is at Queensburg, near Fort Edward. It has a total output of about 1200 hp. The largest unit is an 800-hp Allis tandem compound engine, direct-connected to a 550-kw multipolar 600-volt direct-current generator. It is this machine that supplies direct current to two inverted Westinghouse rotaries of 300-kw capacity. Current from these is stepped up to 22,000 volts, through banks of single-phase oil-cooled transformers, and it then passes over a three-phase transmission line to the Wilton sub-station. The remaining machines at Queensburg include a 400-hp Bates straight line engine, belted to a 300-kw generator, and a Lake Erie cross-compound 300-hp engine direct-connected to a 200-kw generator. Steam is supplied by four 250-hp and two 200-hp water-tube boilers, all hand fired. The two largest engines operate condensing, and there are Blake condensers of sufficient capacity to take care of them. There is also installed in this station a booster set in connection with a storage battery which operates in multiple with the line, and takes the peak of the load in this vicinity. The battery is of the Chloride make, has 276 cells, and supplies 400 amps. for three hours.



TYPICAL CONCRETE BRIDGE

The switchboard in this station has twelve panels—two alternating current and two direct current panels in connection with the rotaries, four generator panels, one booster panel, and three feeder panels. The instruments are of Westinghouse type, with the exception of a total Weston ammeter and a total Thompson recording wattmeter. The outgoing high-tension lines have long-arm, high-tension circuit breakers, and Westinghouse low-equivalent lightning arresters.

At Saratoga there is an 800-hp steam station. The equipment comprises one 500-hp cross-compound Armington & Sims engine, belted to one 250-kw General Electric generator; also, one 300-hp cross-compound Ball engine, belted to two 100-kw General Electric generators. It is proposed to change this arrangement somewhat and have a 300-kw rotary converter, belted to one of the engines, and operated as an alterating-current direct-connected generator, supplying high-tension alternating current to the rotaries at the Round Lake sub-station.



STEEL BRIDGE CROSSING HUDSON RIVER

At Stillwater, where there is an 8-ft. fall in the river, there are three 200-hp water-wheels, and a 300-hp engine, the water-wheels being connected by a clutch to a shaft through the center of the house. Belted to the shaft are two 200-kw generators. Steam for the engine is supplied by two 200-hp Franklin boilers.

At Warrensburg, where there is a 13-ft. fall in the river, there is another combined steam and water plant. The water-wheels supply 400 hp, which is conveyed by belt from a shaft to a 300-kw Westinghouse converter, at present used to supply direct current, but to be used later as an alternating-current direct-connected generator to supply alternating current to the sub-station at Caldwell.

At Middle Falls, on the Greenwich spur, there is a 300-hp water-wheel belted to a 200-kw Westinghouse generator, and a 250-hp Knowlson & Kelley engine belted to a 200-kw Westinghouse generator. These supply direct current in their district.

TRANSMISSION

At present there are installed 52 miles of wire for the three-phase transmission system, and it is the intention ultimately to string high-tension lines over the entire system, connecting up all power stations and sub-stations. The company proposes to purchase sufficient current from the Mechanicsville water-power station of the Hudson River Power Company to operate the sub-station near the southern terminus of the line, and arrangements will be made so that, should occasion require it, the Mechanicsville plant could supply power for any of the other sub-stations on the system, of which six are now under construction.

The ultimate plan of operation, however, provides for the utilization of an undeveloped water-power located 3 miles beyond Warrensburg, the northern terminus of the road. The company controls this water-power, and it is believed that with proper equipment about 3000 hp may be developed. It is probable that these plans will be carried out during the coming year, when the value of this rather complex system of operation will be tested. At present the load for the system under average service is about 1200 hp, while the maximum load is about double that. The large water-power plant could be depended upon to take care of the average load, while the smaller water plants would be arranged to take care of the peaks. The smaller water plants would serve as a duplicate, while the steam equipment would form a second reserve. With the Mechanicsville plant offering still another source of supply, it will be seen that there will be practically no possibility of any portion of the system being tied up.

LINE AND TRACK

Owing to the fact that much of the system is very old, portions of the track and overhead are not up-to-date, but on the recently constructed section, between Saratoga and Fort Edward, an 80-lb. rail has been used. This is laid on good standard ties, and figure 8 copper bonds under fish-plates are used. The trolley wire is double 000 figure 8, with side-arm bracket pole construction. The greater portion of the line is ballasted with cinders, there are a number of quiet heavy cuts and fills, and the average grade on the entire system is quite low. A number of highways are crossed by concrete culverts, and there are two concrete arch bridges of very fine appearance. Passing over the Hudson near Thompson, the line crosses a 900-ft. railway bridge. The girders are of timber, braced with steel, and the bridge forms a notable piece of engineering, in that the girders for the twenty spans were built on shore, and then dropped into place upon the stone piers, by means of a steam derrick car. This bridge is illustrated herewith.

PARKS AND LAKE RESORTS

The park properties of the company are as follows: Kaydeross Park, on the shores of Saratoga Lake, comprises about 50 acres of land, well laid out, on a high tableland or bluff overlooking the lake, which stretches away for miles in either direction, thus affording beautiful views and excellent boating facilities. The grounds are attractive, and there are, besides a substantial dwelling-house and office, a large casino, a most excellent and unusually attractive summer theater, a number of booths for refreshments, a boat-house and other buildings.

Ondawa Park is located at Big Falls, on the Greenwich branch, and consists of about 27 acres of woodland, well laid out, on the shores of the Battenkill River, which at this point forces its way through a narrow defile in the rocks, which rise perpendicularly on either side to a height of more than 100 ft. The spot is very picturesque. The cliffs on both sides of the stream are covered with trees and ferns, the river rushes down this channel a raging torrent, and all lovers of nature in her wildest aspects are bound to be attracted here.



IN KAYDEROSS PARK, NEAR SARATOGA

At the southerly end of Lake George is located Fort William Henry Hotel and Park. This property comprises 30 acres of land, a large four-story hotel, capable of accommodating 800 guests (its piazza commanding a fine view of the lake, is 825 ft. long, and 24 ft. wide), a large, new casino, with stage, boat-house and steamboat wharf. The grounds around the hotel are beautifully laid out, and include the site of Fort William Henry, of historic fame.

ORGANIZATION

The Hudson Valley Railway Company has an authorized capital stock of $3,000,000, of which $2,272,000 has been issued. The total bond issue is $4,000,000, of which $3,000,000 has been issued. The balance sheet, dated June 30, 1902, showed the cost of road and equipment to be $5,744,057, and other permanent investments of $844,960. This does not include the Saratoga-Glens Falls line, which was recently completed.

The officers of the company are A. B. Colvin, president; John W. Herbert, first vice-president; George Greene, second vice-president; Peter McCarthy, chairman of executive committee; Frank W. Cowles, treasurer; Hermon E. Smith, general passenger agent; J. A. Kellogg, secretary; J. B. Ingersoll, superintendent of power and lines.

UNITED TRACTION SYSTEM OF ALBANY

The hub of all interurban roads in Eastern New York is Albany, the capital of the Empire State, famous as a city of wealth and homes, and for the magnificent State building which crowns the crest of a hill a short distance from the business center. The United Traction Company, which controls the



STATE HOUSE

city systems of Albany, Troy and the surrounding group of cities, has been particularly liberal in its treatment of interurban roads, and has offered them every inducement to enter the capital city under traffic arrangement. It is the fixed policy of the company to develop its present territory, and to make no extensions outside the cities it controls, preferring to leave the interurban business to those who make a specialty of that work. In consequence, the building of interurbans has gone on with the assurance that the city company will not encroach upon newly developed fields. Traffic arrangements are maintained with the Hudson Valley Railway Company for entering Albany, the Albany & Hudson Railroad Company in Albany, the Schenectady Railway Company in Albany and Troy, and the Troy & New England Railway in Troy. The cars of the Fonda, Johnstown & Gloversville Railway will shortly enter Albany under an arrangement with the Schenectady Company. These traffic arrangements are uniform, the city company taking one-half of the city fares collected by the interurbans. These receipts last year amounted to about $100,000. For permitting the express cars of the interurban roads to run over its tracks, the city company receives 25 cents per car-mile.

The United Traction Company was formed Dec. 30, 1899, through the consolidation of the Albany Railway (chartered in 1863), the Watervliet Turnpike & Horse Railway, and the Troy City Railway. It operates under lease the Troy & Lansingburg Railway, the Troy & Cohoes Railway, the Lansingburg & Cohoes Railway, and the Waterford & Cohoes Railway. The towns touched and their population are as follows: Albany, 94,191; Troy, 60,651; Cohoes, 23,910; Watervliet, 14,321; Rensselaer, 7,466, and Waterford, 3,146. The cities are grouped on either side of the Hudson within a radius of 12 miles, and the system is operated in two departments, under division superintendents having headquarters in Albany and Troy respectively.

NO TRANSFERS

From a financial standpoint the position of the company is an enviable one. All of its grants are perpetual, having been obtained before the days when people professed to believe that electric roads could be operated profitably on a basis of twenty-five-year franchises, 3-cent fares and universal transfers. The company sells no tickets and receives a straight 5-cent fare for all city passengers. It is claimed positively that free transportation is given to no one, except to employees in uniform and wearing a badge. In Albany no transfers are issued, but in Troy transfers are given at certain points under the franchise of the old Troy Company. The officials of the United Traction Company have deep-rooted ideas on the subject of transfers. It is claimed that electric roads operating in cities of from 75,000 to 100,000 inhabitants cannot give transfers and make money, and in support of this position, it is claimed that the United is the only railway in a second-class city in New York State that pays dividends. Before the consolidation the company paid as high as 12 per cent dividends, and is now paying 5 per cent.

To obviate the necessity of transfers the lines in Albany are operated on an interchangeable system, by which a passenger can secure a car from one portion of the city to any other portion of the city within fifteen minutes. The leading north and south lines alternate as follows, each on a fifteen-minute headway: North Albany to Pine Hills; North Albany to West Albany; South End to Pine Hills; South End to West Albany. From the railway station in the center of the city cars operate on a seven and one-half-minute headway to Pine Hills, West Albany and Delaware Avenue. Cars operate directly through the business section on a five-minute headway to Troy. This



STATE STREET HILL, 10 PER CENT GRADE APPROACHING CAPITOL

arrangement gives a two and one-half-minute headway for considerable distance on Broadway, on Washington Street, and on South Pearl Street. From Albany to Cohoes there is a ten-minute headway; Rensselaer to Troy, ten-minute headway, and Kenwood to Troy, ten-minute headway. At night there is a twenty-minute headway on all city lines, and half-hourly on the Albany-Troy line. In all, the company operates 83 miles of track, and with regular summer headway has 150 cars in service. Rates of fare are as follows: Albany to Troy, 10 cents; Albany to Watervliet, 8 cents; Albany to Rensselaer, 6 cents; Rensselaer to Troy, 11 cents; Albany to Cohoes, 15 cents.

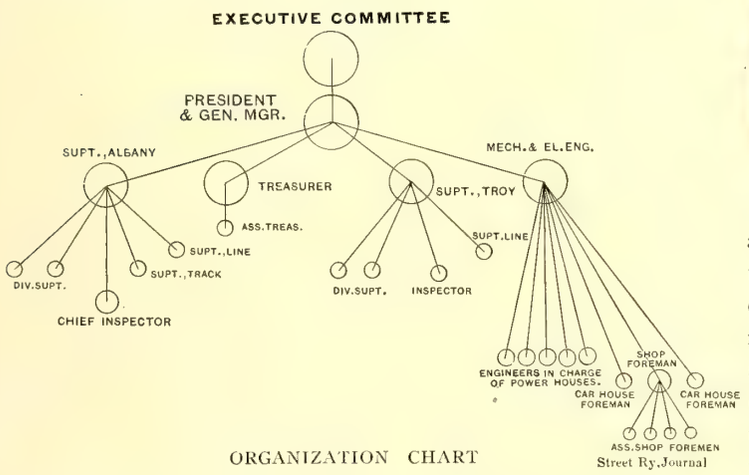
National fare registers are used on all city cars, while on the interurbans the conductors punch different colored slips.

DISCIPLINE

The United Company maintains a very rigid system of inspection. The force of inspectors includes forty-five men, on an average of about one to every five cars operated. They board cars at frequent intervals, inspect fare registers and slips, and report any infraction of rules on the part of motormen and conductors. They go at once to the scene of accidents, and secure all evidence and statements required. The system is covered by private telephones and inspectors have keys to boxes, giving them instant communication with the division superintendent. Inspectors make reports each evening to the chief inspectors, one for each division, who in turn make written extract reports to the division superintendents.

Two years ago the United Company went through an exceedingly hard-fought strike with its motormen and conductors. The matter was finally compromised, and the company reserved the right to employ non-union as well as union men.

At the present time the employees seem well satisfied and



ORGANIZATION CHART

good discipline is maintained. The men are uniformly courteous and careful in operating cars, and accidents have been reduced to a minimum. Carelessness by a conductor or motorman is reprimanded by the division superintendent, and only in extreme cases is a man sent to the general manager. In all hearings before the latter stenographic notes are retained for reference. For missing a car without an excuse the man is assigned to the last extra for a week.

Collision with another car or with a wagon is considered cause for immediate discharge. Runs are apportioned in strict order of seniority. There are four classes of runs: (1) Regular men, who work ten hours, with one and one-half hours relief. (2) Short-run men who work from 8 a. m. to 8 p. m., with one and one-half hours relief. (3) Relief men, who take the relief runs and the night runs. (4) Trippers, who run from 12 p. m. to 2 p. m., 5 p. m. to 7 p. m., and 11 p. m. to 12:30 p. m. The trippers also handle the Sunday traffic. The peculiarity of the "rush hours" in Albany is that at no time in the morning is the traffic especially heavy. It is not a manufacturing city, and the travel to work strikes about an even average from 6 a. m. to 10 a. m. Many people go home at noon, and the theater traffic is also very heavy. At the largest theaters the company maintains sidings, and there are numerous extra cars to all parts of the city, as well as to the surrounding towns. In Troy, which is essentially a manufacturing city, the peak in the morning is very pronounced, and, on the other hand, the theater load is not very heavy.

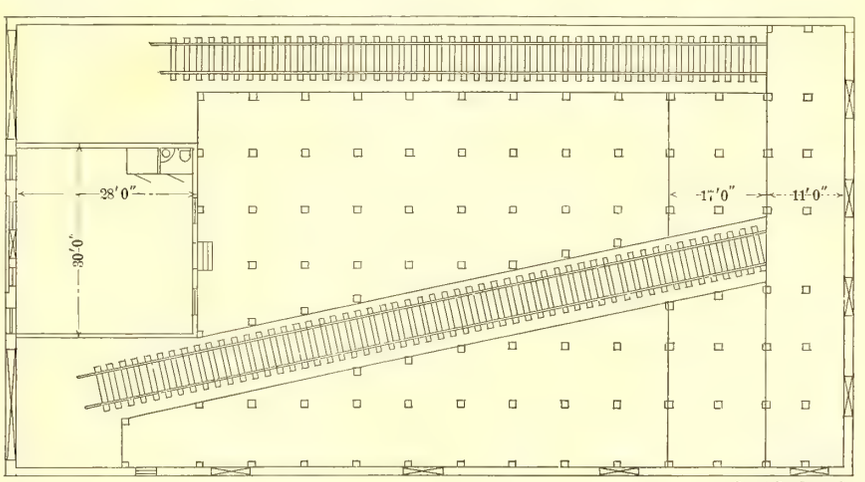
EXPRESS AND FREIGHT

The Albany company was one of the first in the country to appreciate the advantages to be derived from handling express. Its express system was placed in operation in September, 1894, and it has made steady gains until it has become a very important factor in the gross business. This branch is conducted



STOCK ROOM AT NORTH ALBANY SHOP

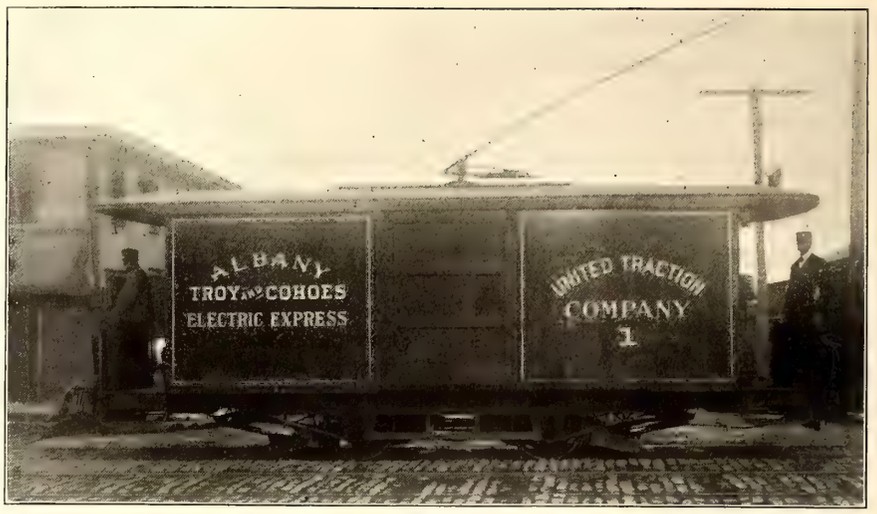
as a separate institution under a manager, who reports directly to the general manager. The operation of cars, of course, comes under the operating department of the road, and it might be mentioned incidentally that the express runs are considered the most desirable by the men. The regular schedule calls for five round trips per day between Albany and Troy, three between Albany, Cohoes and Waterford, and three between Albany and Watervliet. The company maintains stations in all towns and has five delivery wagons in Albany, four in Troy, three in Cohoes, and one in Watervliet. There are three classes of business: Express, which includes delivery and collection; second-class express, which includes wagon service at one end, and freight, which includes no wagon service. There is no guaranteed time of delivery for freight, and the greater



PLAN OF DIVISION STREET FREIGHT HOUSE AT TROY

portion of this class consists of rags from the knitting and collar mills at Troy and Cohoes. A large amount of business is forwarded from the Hudson River boat lines throughout the territory covered by the company. A large amount of business also comes from the Boston & Maine Railway, which touches

Troy, but not Albany. Express cars earn on an average 75 cents per car-mile, and the cost to operate is about 65 cents per car-mile, the long lay-overs being accountable for the high cost of operation. The earnings from passenger cars are 20 cents to 22 cents per car-mile, while the cost of operation is only from 12 cents to 13 cents. The express cars are all of the single-truck type, and have a capacity of about 10 tons each.



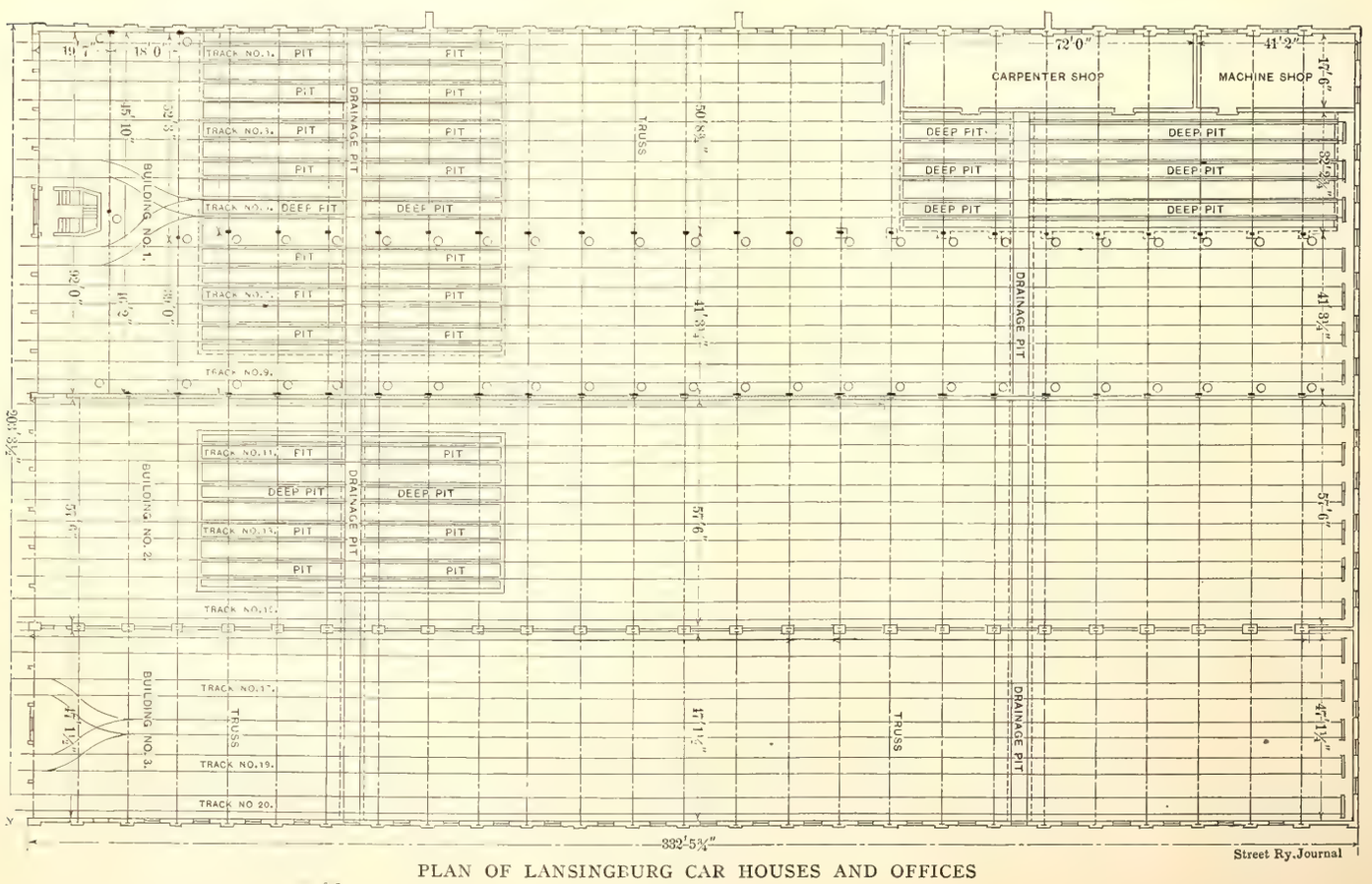
EXPRESS CAR

ROLLING STOCK.

The management of the company is a strong believer in the use of single-truck cars. It is claimed that frequent headway with small cars gives better service than longer cars on less frequent headway, and, furthermore, that during the rush hours the crowds can be handled with greater rapidity with the small cars than with large ones, since passengers can get in and out quicker. It is claimed also that the liability of accidents is considerably less with the small car, since the conductor has less to attend to. It would be difficult to find a company where the rolling stock is more uniform. Most of the cars on the system were built by J. M. Jones' Sons, of West Troy, and Taylor single trucks, Westinghouse 12-A motors with K-10 controllers are standard. There are 193 box cars with 18-ft. to 20-ft. bodies, 158 nine-bench open cars, 6 express cars, 12 snow-plows, 6 sweepers and 12 service cars. Providence fenders are used on both ends, and one of the most stringent rules for motormen is that they shall test the fenders by "tripping" them at the end of each run. For winter service between Albany and Troy the company has purchased eleven 38-ft. double-truck cars, built by the J. G. Brill Company, and ten more of these have been ordered. These were purchased in answer to a demand for smoker facilities, and to compete with the service of steam roads between the two cities. These cars have a peculiar seating arrangement, with four cross-seats at either end of the passenger compartment, and longitudinal



INTERIOR INTERURBAN CAR



PLAN OF LANSINGBURG CAR HOUSES AND OFFICES

seats occupying the remaining space on both sides. At one end of the car, partitioned off as in Pullman sleeping car, is a smoking compartment with seats around the sides. By this arrangement ladies may enter from either end without submitting to the annoyance of tobacco smoke. A cheap and convenient method has been adopted for preventing passengers from getting on or off open cars on the wrong side when on double track. A twine netting is strung over the entire side of the car and is buttoned at each end and to the center post. It can be removed and placed on the opposite side in a very few seconds. It is claimed to be an improvement over the removable guard rail, since it covers the entire side of the car, and if a passenger leans out and forces it beyond its natural tension he does so at his own risk.

Four emergency stations are maintained; two in Albany, which have two tower wagons each, one in Lansingburg and one in Troy, with one wagon each. They have the appearance and equipment of fire department houses. Harnesses are suspended and horses and men are drilled daily. There are fire alarms in the houses, and the wagons respond to alarms from certain boxes. They are equipped with hose bridges and all necessary tools and material. Houses are connected with the private telephone system, which has fifteen boxes in different parts of the railway system.

LINE AND TRACK CONSTRUCTION

For city track the latest adopted standard rail is a 9-in. girder, Pennsylvania Steel No. 200, laid with Continuous or Weber joints, staggered. Double 0000 Crown bonds are used under the joints. For a stretch of 5 miles, between Troy and Albany, a 70-lb. A. S. C. E. T-rail is used. A very large proportion of the system is double track, and cross suspension overhead is used. In the country 35-ft. octagon wood poles are used, while the city poles are about evenly divided between three-leaf tubes and built-up channel iron with lattice work. Trolley wire is all 00.

CAR HOUSES AND REPAIR SHOPS

At North Albany there are two car houses which hold 150 cars; at Quail Street, Albany, a house for 100 cars; Albia, near Troy, 50 cars, and Lansingburg, 250 cars. All of the houses are provided with pits equipped with 2-ton hydraulic pit jacks. Light repairs are done at all the houses, and they have blacksmith shops and light machine tools. All pits are covered by 10-ton cranes, manufactured by Pawling & Harnischfeger Company, of Milwaukee, the company having recently purchased a number of these cranes for repair shops, car houses and substations. All car houses have quarters for the convenience of the men, provided with reading tables, wash rooms, etc.

The main repair shop, with offices of the electrical and mechanical engineer and the master mechanic, are at North Albany, where two old car houses are utilized. The equipment is very complete but is of the usual order. In the rear is a paint shop recently erected. This is 100 ft. wide by 50 ft. deep, and is provided with a transfer table in front so that cars can be placed without the use of special work. The building is conveniently arranged and well lighted. In another building, 60 ft. x 75 ft., lately erected, is the general stock room for supplies of all kinds. The storekeeper and assistants have a well arranged office. In the storeroom proper all small material is arranged in compartments which are properly tagged, and a record of everything is kept by card system. Material is checked off on the card system as it is given out. All requests

C H. 600 4-22-'03 No 2635

UNITED TRACTION CO.

DAILY REPORT OF CARS REPAIRED

CAR HOUSE ... Date ...

Car Open No.	Car Box No.	Account No.	MATERIAL

REPORT FOR LEGAL DEPARTMENT

No. 3M-11-15-01-C.M

LOCATION	TROUBLE	INSPECTED BY	REPAIRED BY	DATE REPAIRED
Car Body				
Windows				
Steps				
Gates				
Grab Handles				
Doors				
Foot Gongs				
Signal Bells				
Fenders				
Heaters				
Lighting Circuit				
Push Button Circuit				
Trolley Circuit				
Diverters				
Motor Switches				
Fuse Box				
Controllers				
Controller Cable				
Hand Brakes				
Air Brakes				
Emergency Brakes				
Motors				
Trucks				
Wheels				
Axles				
Gears				
Pinions				
Scrapers				
Draw Bars				

... Conductor No. ... Driver No. ...

Car No. ... Run No. ... Line ... Time Out ... Time In ... Date ...

Mileage ...

FORM T. 5M-6-15-'01.

United Traction Company ..... Car House

DAILY REPORT OF FOREMAN TO MASTER MECHANIC

..... 190

No. Repair Men on duty—day,

No. Repair Men on duty—night,

Total Cars on hand at 6 P. M., No. Cars O. K. not in service,

CARS IN BAD ORDER AT 6 P M.

CAR NO.	TROUBLE	CAR NO.	TROUBLE

CARS PULLED IN SINCE LAST REPORT

CAR NO.	TROUBLE	CAR NO.	TROUBLE

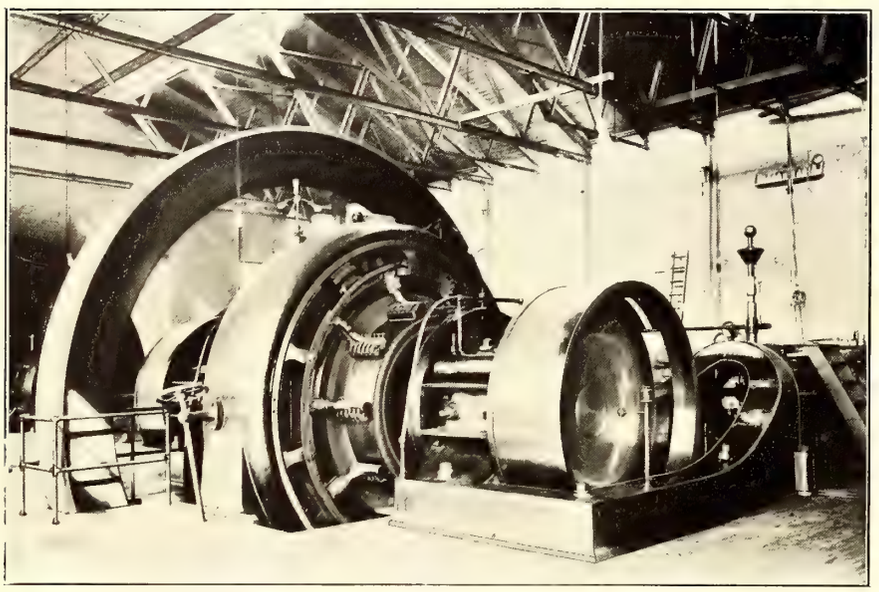
Remarks:

FORMS OF REPORT ON ROLLING STOCK

for material are by requisition from foremen of departments, and charges are made to the several departments on daily charge sheets. Supply sheets are entered in a loose leaf ledger.

RECORDS AND REPORTS

The foreman of each department makes a daily report to the master mechanic of all material used and the details of all work done on a form similar to that reproduced herewith. The mechanical engineer keeps a card system record of each car, the date and character of all repairs and the time in service. The average mileage of cars in service is 200 miles per day. Trolley wheels average about 6000 miles. Rawhide pinions average sixty days.



800-KW GENERATOR IN SOUTH PEARL STREET STATION, ALBANY

The company has a very practical and comprehensive system of reports and records. Some of the forms employed in the car house, repair shops, power stations and legal department are herewith reproduced. They are self-explanatory, and are so simple that no difficulty is experienced by employees of all grades in filling in the desired information.

POWER HOUSE UNITED TRACTION CO.

DAILY REPORT.

Form B. B. 1M 1-5-03
No 3197

24 HOURS ENDING _____ 1903

	Disabled	In and Ready	Max	Min	Mean	REMARKS
Engines						
Boilers						
Steam Pressure						
Vacuum						
Temperature of feed water						
Coal Consumed						
Generators						
Converters						
Voltage						
Amperes						
Total E. H. P.						
Av. E. H. P. converters in service						
Av E. H. P. special feed						

ENG. OIL_____ CYL. OIL_____ LBS. WASTE_____

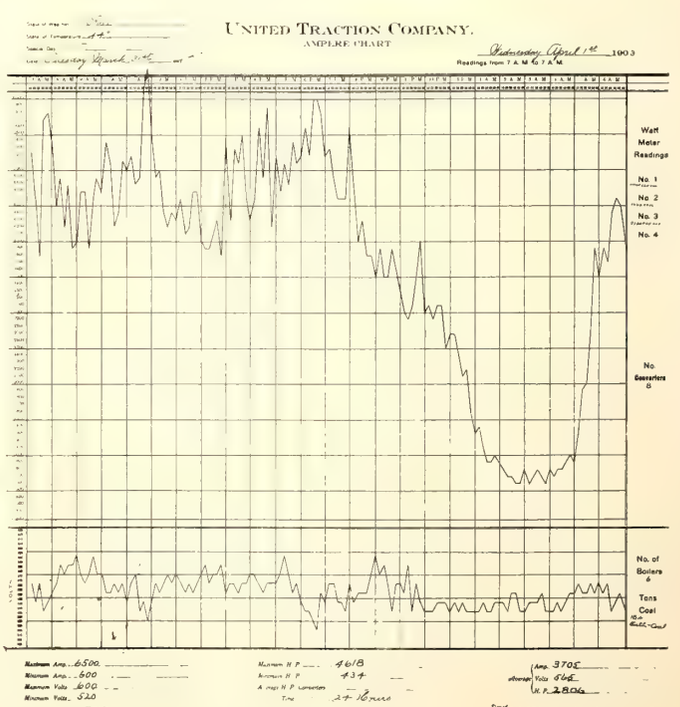
GENERAL.

FORM USED FOR POWER HOUSE REPORT

POWER EQUIPMENT

The company has three steam power stations and two rotary sub-stations. One of the stations is located on South Pearl Street, Albany, the second at Division Street, Troy, and the third at Lansingburg. The larger sub-station is located in Watervliet, and the other at the North Albany shops. During the season when the traffic is heaviest their peak requires a current capacity of about 8000 amps. at 550 volts, or equal to nearly 6000 ehp. The average load is about 5600 amps. At the present time the company has a contract with the Hudson River Power Company, of Glens Falls, to deliver practically 4000 hp at the two sub-stations; hence, during the time when the traffic is lightest, it is not necessary to operate the steam plants. At the same time the steam stations are kept in readiness to take care of a peak and have ample capacity to carry the entire load if necessary.

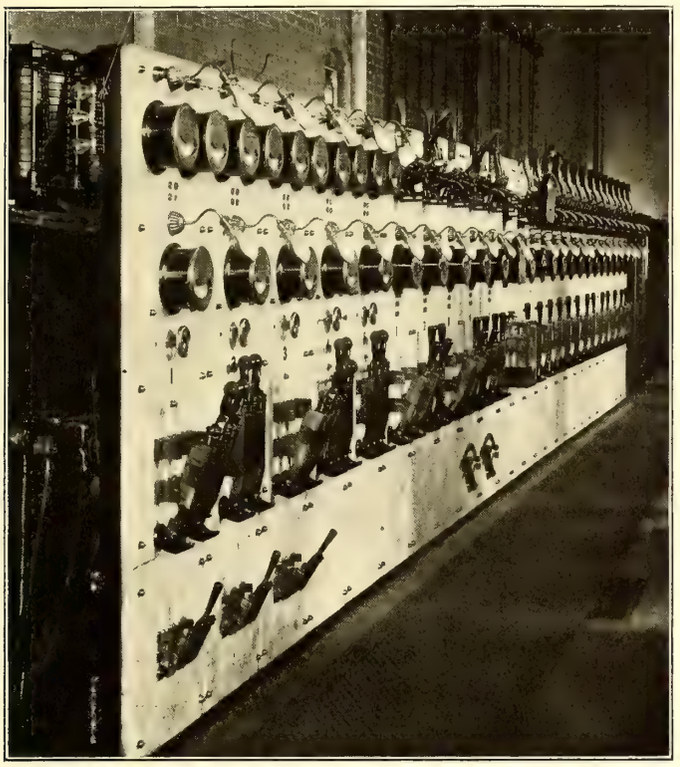
At present the current purchased from the power company comes from the water-power plant at Mechanicsville, but as soon as the Hudson River Power Company completes its large power plant at Speir Falls, the traction company will purchase additional power and will take current from either station; then, it is probable, one or two of the steam plants will be dismantled. From Mechanicsville three-phase alternating-current is furnished at 12,000 volts, 4800 alternations. The current is conveyed over two sets of three-phase transmission wires, a distance of 12 miles, to the Watervliet sub-station, and from there 6 miles to the North Albany sub-station. The pressure on the bus-bars of the sub-stations is approximately 10,800 volts.

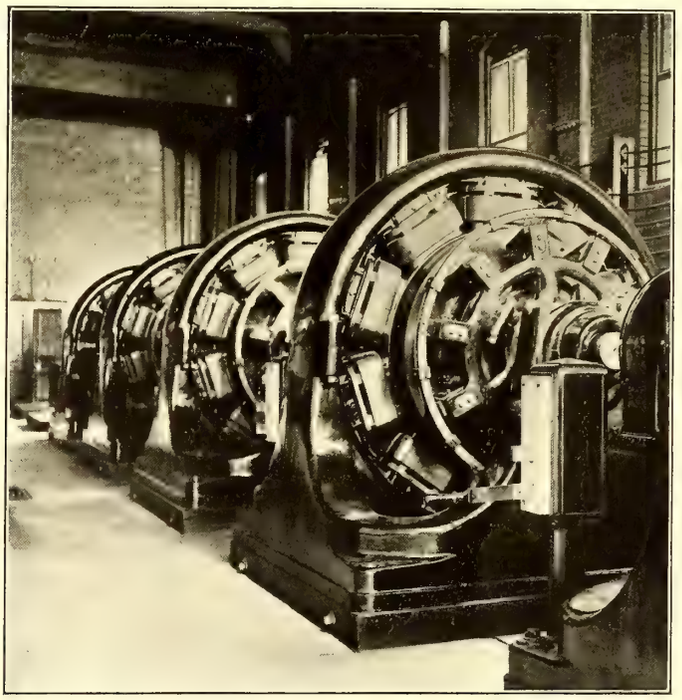


TYPICAL DAILY CHART

The Watervliet sub-station is 85 ft. x 30 ft., and 25 ft. high, and is of the most modern fireproof construction, with heavy

walls built of hard brick. A 10-ton crane covers the house. The main flooring is concrete. The rotaries are five in number, 375 kw each, of the compound-wound Westinghouse three-phase, 40-cycle type. Three of these rotaries have induction starting motors, mounted upon an extension base attached to the main rotary frame at the alternating current end, the motor secondaries being pressed directly upon the extended end of the shaft of the rotary armature. The other two rotaries are without starting motors, being started and brought up to synchronous speed by applying direct current taken from the other rotaries to their direct-current end, running then as direct-motors. The voltage at the direct-current end of these





25-PANEL SWITCHBOARD AND ROTARY CONVERTERS AT WATERVLIET SUB-STATION

rotaries varies from 550 to 600. Each rotary is mounted upon a substantial brick foundation, covered with well-seasoned and treated planking, and securely fastened with holding-down bolts running up through holes in the rotary base frame. There is a cable duct 4 ft. sq. running the entire length of the building under all rotaries and between the side walls of their foundation.

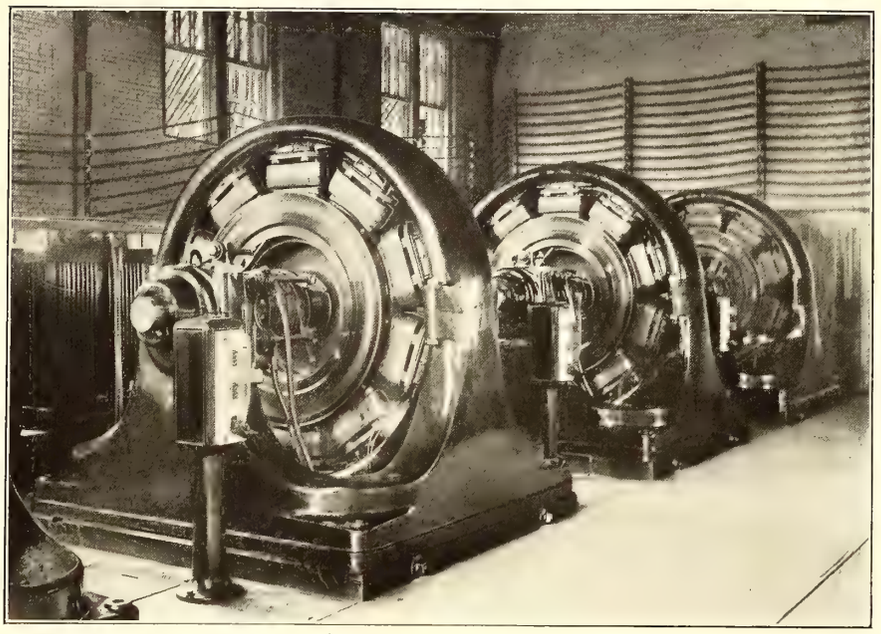
There are fifteen 150-kw Westinghouse oil-cooled transformers installed along the west side of this station. These are divided into five groups, and supply current to rotaries. The transformers lower the voltage from 10,800 volts to 370 volts. They are mounted upon a platform back of and within 2 ft. of the rotaries. Beneath this platform is a 4-ft. duct, the brick walls of which form the foundations for the transformers. Across the top of the foundations forming this platform are laid heavy planks, which are 14 ins. above the floor.

The low-tension switchboard is installed along the east wall of the station. The board is of blue Vermont marble slabs, and the apparatus is finished in bronze and black enamel. There are five alternating-current rotary panels, five direct-current rotary panels, one station instrument panel and fourteen feeder circuit panels. Three of the five rotary panels have one three-pole main knife switch, three 1200 ammeters, one three-pole induction motor starting switch, one synchronizing outfit and receptacle for voltmeter plugs. The two other panels are similar except that they have no motor-starting switches. Two of the five direct-current rotary panels have two single-pole main knife switches, one 1200-amp. direct-current ammeter, one 1500-amp. Westinghouse brush-type circuit breaker, one direct-current rotary starting rheostat, one field rheostat and one set of voltmeter receptacles. The three remaining direct-current rotary panels are the same as the others except that they have no rotary starting rheostats. The station instrument panel has mounted upon it one 700-volt Weston standard voltmeter, one 5000-amp. Weston ammeter, and one 5000-amp. Thomson recording wattmeter. On each of the feeder panels are one single-pole main switch, one 1200-amp. ammeter, and one 1500-amp. Westinghouse-Brush-type circuit breaker. A single-pole equalizing knife switch is mounted upon a pedestal on the main floor and located between each two rotaries.

The high-tension switchboard was built by the General Electric Company, and consists of eight blue Vermont marble panels, and is also located along the east wall of the station. Each of five panels has one 12,000-volt, three-phase oil-break switch of 25-amp. capacity, and three high-tension fuse blocks separated by marble barriers. These panels are used to cut the current in or out of the high-tension side of the transformers; one panel being used for each group of transformers. The fourth panel has a 12,000-volt, three-phase oil-break switch, one 12,000-volt Thomson voltmeter, and one high-tension ammeter. One of the two remaining panels has one 12,000-volt oil switch, one 12,000-volt ammeter, one power factor meter and one Bristol recording ammeter. Two panels are used to control the incoming lines and the current to the five transformer controlling panels. The third remaining panel has mounted on it one 12,000-volt oil switch, which is used to control the lines to the North Albany sub-station.

The high-tension wires are brought into the northeast corner of the station and down to the main switchboard. The high-tension transformer feeders are carried from the switchboard around the north and west walls of the station, being properly spaced and mounted upon suitable insulators, each consecutive three wires running to their respective group of trans-

formers. From the low-tension side of each group of transformers three heavy feeders are carried down outside of transformer tanks and into the cable duct beneath the platform, then running into a cross duct, which leads into a cable duct underneath the low-tension switchboard; they are then carried up



VIEW OF NORTH ALBANY SUB-STATION

to the alternating-current rotary panel used to control that particular rotary which this group of transformers is to serve. Three low-tension leads are then brought down from this panel and carried back through the cross duct into the main rotary cable duct and up to the brush holders on the alternating-current end of the rotary.

From the direct-current end of the rotaries heavy cables are carried down through the cable duct across to the direct-current rotary controlling panels, and from there the current is conveyed over solid copper bus-bars on the back of the board to the various direct-current feeder panels. From the feeder panels the current is conveyed to the trolley feeders over heavy cables.

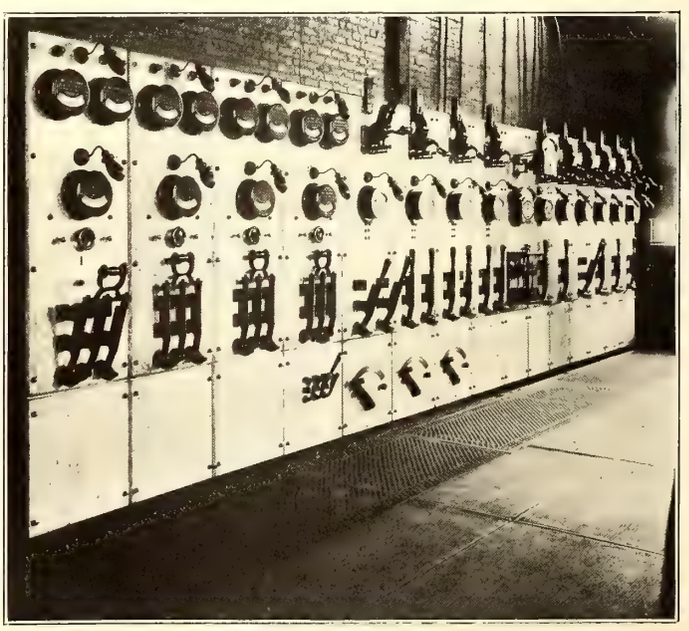
In the roof of this station are installed five 36-in. Globe ventilators. These are not only used to maintain proper circulation of air through the main building, but also force a circulation of air through the cable ducts beneath the floor, thus providing against undue heating of cables. An air compressor outfit is used for cleaning and cooling the electrical equipment.

Plans are being made to install at Watervliet a 500-kw rotary converter with the necessary transformers and switching apparatus. The switchboard will also be arranged to control the new lines which will come from Speir Falls, and arrangements will be made so that it will be possible to carry the full load from either set of transmission lines.

The North Albany sub-station is similar to the Watervliet sub-station except that at the present time it is smaller. At present it contains four 375-kw Westinghouse rotaries and twelve 150-kw Westinghouse transformers. The low-tension switchboard was built by the Westinghouse Company, and has four alternating-current rotary panels, four direct-current rotary panels, one station panel and six feeder panels. The high-tension board was built by the General Electric Company and has two main feeder panels and four transformer controlling panels. The other details are similar to those at Watervliet. Eventually, however, the North Albany station will be the larger, as there will be installed shortly two 500-kw rotaries and the other necessary equipment, also a differential booster set, which will handle current from a Chloride type-G battery outfit of 264 cells, supplying 1360 amps. in ordinary regulation. The low-tension switchboard will be extended to control the booster and battery and a number of new direct-current feeder circuits, while the high-tension board will have installed on it switches for controlling the new incoming lines from Speir Falls.

An interesting feature in connection with these sub-stations is that in event of an accident to the Mechanicsville plant or transmission lines the company would then start its South Pearl Street generators and deliver 550 volts direct-current to the North Albany sub-station, where it would invert the rotaries, supplying the direct current to the direct-current end of the machines, running them as shunt motors (by shunting the series field windings), and deliver alternating current to the rotaries at Watervliet.

The South Pearl Street steam station is of modern construction with heavy walls of firebrick. The dimensions are 171 ft. x 117 ft., and 36 ft. high. It has a corrugated iron roof, constructed upon structural steel work. The following apparatus is installed in this station: One 800-kw Westinghouse 550-volt, direct-current compound-wound multipolar railway generator; 1000-hp steam engine, running at 80 r. p. m.; one direct-connected 800-kw, 550-volt direct-current compound-wound multipolar railway generator, running at 80 r. p. m.; two 550-hp General Electric 550-volt compound-wound



15-PANEL SWITCHBOARD IN NORTH ALBANY SUB-STATION

multipolar direct-current generators, belted to a 500-hp engine. There are one 500-hp, three 250-hp and six 125-hp Babcock & Wilcox boilers, operating at 125 lbs. steam pressure. The switchboard consists of four generator panels and eight feeder panels, all of which are constructed of white marble.

The Division Street station, Troy, is 110 ft. long by 110 ft. wide and 30 ft. high. The equipment consists of one 800-kw

Westinghouse 550-volt direct-current compound-wound, multipolar railway generator, directly connected to a Knowlson & Kelley cross-compound 1000-hp engine, running at 80 r. p. m.; two 175-hp General Electric, 550-volt, direct-connected compound-wound multipolar railway generators, belted to a 350-hp Greene simple engine, and two 200-hp Thomson-Houston 550-volt direct-current compound-wound bipolar railway generators, belted to a 350-hp Greene simple engine. The steam is furnished by two 175-hp Babcock & Wilcox boilers, one 375-hp Stirling boiler, three 200-hp Manning boilers, and two 150-hp tubular boilers. The board is Westinghouse make, constructed of white marble slabs, and consists of five generator panels, seven feeder circuit panels and one station panel.

The Lansingburg steam plant has one 350-hp Greene engine, belted to three 80-kw Edison generators, and two 150-hp Knowlson & Kelley engines, each belted to two 80-kw Edison generators.

In the steam plants the company uses buckwheat hard coal at $2.70 per ton.

MANAGEMENT

The United Traction Company has an authorized capital stock of $5,000,000, of which $4,999,950 has been issued. The funded debt is $5,350,800, of which $4,241,000 has been issued. The financial statement for the year ended June 30, 1903, is as follows:

	1903	Increase
Gross earnings	$429,950	$50,570
Operating expenses	316,081	61,004
Net earnings	$113,869	*10,434
Total income	$115,443	*$10,434
Fixed charges	76,916	3,340
Surplus	$38,527	*$13,774
Net income for year	248,319	45,274

*Decrease.

The growth of the business since the electrical system was installed has been remarkable. In 1889, the last year of horse operation, the number of passengers carried was 4,047,000. In 1896 the figure reached 9,500,000, while for 1900 it was about 16,000,000. During this entire period there was no material growth in the city of Albany and only 2½ miles of additional track was constructed.

It is worthy of record here that this company was one of the pioneer electric railway concerns of the country to engage in the handling of express, and that the thoroughness with which it engaged in this branch had much to do with the ultimate success which rewarded its efforts. It has afforded the interurban lines entering its territory exceptional facilities for developing this branch of their service likewise. It was also one of the first companies, in the pioneer days, to adopt electricity, and the consequent litigation with the telephone interests and the decision in favor of the railway went a long way toward establishing the legal status of the overhead system.

The officers and directors of the United Traction Company at the present time are as follows:

Robert C. Pruyn, chairman board of directors; John W. McNamara, president; Francis N. Mann, Jr., vice-president; Charles G. Cleminshaw, secretary; James McCredie, treasurer. The directors are: A. Bleecker Banks, Anthony N. Brady, Thomas Breslin, Charles Cleminshaw, Albert Hessberg, George P. Ide, William Kemp, Francis N. Mann, Jr., James H. Manning, William McEwan, John W. McNamara, James O'Neil, Robert C. Pruyn, William Shaw, William J. Walker.

SUMMER ROAD FOR TROY

The Troy & New England Railway operates from Albia, 3 miles from Troy, to Averil Park, a distance of 8¾ miles. The towns on the line are Wyantskill, with a population of 300; Snider's Corner, 200; West Sand Lake, 800; Averil Park, 1400. The line is built on private right of way, 40 ft. wide, and extends across the country. The road was designed essentially for summer traffic, but there is a considerable farming population along the road. The line follows the Wyantskill Creek, and crosses it fourteen times on timber trestles. The scenery in the valley is quite beautiful, making it an ideal summer ride. The company owns and operates Averil Park, which is a very popular summer resort, and is provided with a large pavilion and numerous other attractions. These features were described in the STREET RAILWAY JOURNAL of June 1, 1901. The line



TERMINAL STATION, TROY & NEW ENGLAND RAILWAY

affords the only connection to Burdon Lake, East Sand Lake, Glass House Lake and Crooked Lake, which are favorite fishing and hunting resorts for thousands of people.

The company has a traffic arrangement with the United Traction Company by which it is permitted to enter the center of Troy, but at the present time the cars operate only to the terminal station, illustrated herewith, located at Albia. Cars connect with the Albia line of the Troy system. During the summer the cars run on half-hourly headway, and on hourly headway in winter. There is very heavy special excursion traffic during the summer months. The company handles considerable express business for the summer resorts and farms along the route, but this branch of the business is somewhat handicapped because of the fact that cars are unable to operate into the center of Troy, being prevented by the very steep hill; hence, it is necessary to haul the goods by wagon into Troy.

The rolling stock includes 5 open motor cars and 4 open trailers, built by the American Car Company, and 4 closed motor cars, built by the Jackson & Sharp Company, all single truck cars. They are equipped with two 40-hp motors. A portion of these cars are equipped with Diamond trucks, while several others have new equalizing trucks, built by the Powell & Turner Truck Company, of Troy. The trucks are built with an extended frame, by means of which weight is evenly dis-

tributed, doing away with a large amount of rocking. The track is laid with 60-lb. T-rail, and a concealed bond is used under angle plates. The nuts on the plates are locked with a patent nut lock, consisting of a flat strap hooked at either end of the plate and fastened in the center with cotter pins. Originally the track was bonded with outside bonds, but one day last winter it was discovered that the power was insufficient, and an investigation showed that a band of industrious copper thieves had cut out practically every bond on the line, and had also carried off 2 miles of trolley wire; hence, the company's belief in the concealed bond.

The power house for the line is located at Wyantskill Creek, at the center of the road. The building is 40 ft. x 60 ft., divided in the center. In the boiler room are three 175-hp Manning tubular boilers, a Deane jet condenser, two Deane boiler-feed pumps and a Metropolitan injector. In the engine room two 250-hp Westinghouse compound engines are belted to 225-kw compound-wound generators, operating at 290 r. p. m. The engines operate condensing, and the condensation is returned to the boilers by a loop system and Stratton separators. Connected to the engines are Spencer automatic damper regulators. At the side of the engine room is a five-panel Westinghouse board. There are two line panels, a station panel and two generator panels. The station panel has a volt motor and a total ammeter. The entire equipment was installed in 1895 by Westinghouse, Church, Kerr & Company.

The experience of this company in the handling of freight and express is different from that of the other roads in this neighborhood, due largely to special conditions. It is the only one of the lines in this locality which has not found its freight service profitable. The express business is continued, however, more as an accommodation to the patrons of the line than through any direct profit accruing from this branch of the service. One freight car is run daily between Albia and Averill Park, in each direction. This car is of the same general type as the smaller of the Hudson Valley express cars, and measures 27 ft. inside. The Troy & New England Company was one of the earliest in the field, having maintained its express service for nearly seven years, but usually with trailer cars. Its rates were 10 cents a hundred for light freight, and $1.50 per ton for heavy. The teamsters who collect and deliver were paid by the 100 lbs., and the management, owing to the natural disadvantages with which the line is confronted, says that there is no money in freight, under the present conditions. The Troy & New England Railroad Company has a capital stock of $350,000, and a funded debt of $183,800. During 1902 the road carried 264,255 passengers with a total car mileage of 159,348, and receipts per car-mile were $0.166, while operating expenses per car-mile were $0.103. The following figures of operation are for the year ending June 30:

	1899.	1900.	1901.	1902.
Receipts from passengers	$ 2,079	$26,368	$27,382	$26,236
" " other sources.	1,987	400	400	220
" total	34,666	26,768	27,782	26,456
Operating expenses	20,107	14,488	15,740	16 458
Earnings from operation	14,559	12,280	12,042	9,998
Deductions from earnings.				
Interest	9,663	9,584	9,584	9,548
Taxes	659	723	631	617
Net income	4,237	1,973	1,826	*166
Total surplus account	5,232	7,205	9,031	8,865

——* Deficit.

The officers of the company are Edward F. Murray, president; Rice C. Bull, secretary and treasurer; A. W. Bentley, superintendent.

FONDA, JOHNSTOWN AND GLOVERSVILLE SYSTEM

The Fonda, Johnstown & Gloversville Railway is unique in that it combines both steam and electric operation, but each is entirely distinct, and over a short stretch of country the electric railway is in competition with the steam line. The foundation of this system dates back to January, 1867, when the Fonda & Gloversville Railway, a steam road, was placed in operation. This line was designed to connect the prosperous city of Gloversville with the main line of the New York Central & Hudson River Valley at Fonda, a distance of 10 miles. In 1881 the company purchased at a receiver's sale, the Gloversville & Northern Railway, which extended from Gloversville north to Northville, a distance of 16 miles. These two sections, with the steam branch line recently built, have since been operated as a steam road. In 1893 the Cayadutta Electric Railway was completed between Fonda, Johnstown and Gloversville, paralleling the lower portion of the electric road. About the same time the Johnstown, Gloversville & Kingsboro Horse Railway Company, connecting Gloversville and Johnstown, was equipped with electricity. In 1894 the steam road acquired, under 999-year leases, the property of both companies, and, in 1900, purchased the capital stock of the Amsterdam Street Railway Company, which included four city lines in Amsterdam, together with the city lighting plant, which was operated under a separate name. The Amsterdam line was at once extended, a distance of 13 miles, to connect with the line at Johnstown, and work was started on an extension to Schenectady, a distance of 16 miles. This line has just been completed. The company also completed a spur line from Amsterdam north to Hagaman, and a steam spur line to Broadalbin. On Jan. 1, 1903, all the lines mentioned were merged into the Fonda, Johnstown & Gloversville Railroad Company. The charter of the steam company gives it the right to use a variety of power, but the charters of the old electric roads do not permit steam trains to run over their tracks. In consequence it is possible for electric cars to operate over steam tracks, and this fact has been taken advantage of, and between Johnstown and Gloversville, at the present time, the north-bound through interurban cars operate over tracks on the steam right of way.

The total mileage of steam road, including sidings, is 37.4. From Gloversville to Schenectady is 32.7 miles, all double track. Branch lines from the main line aggregate 8 miles, the local lines from Gloversville to Johnstown, 4 miles, and the city lines operate 7.2 miles. The total system is 124.1 miles of single track on 94.4 miles of road. Of this 71.7 miles are on private right of way, and the balance on streets and highways.

The Fonda, Johnstown & Gloversville Railroad Company has a capital stock of $2,500,000. The authorized bond issue is $7,000,000, of which $5,000,000 has been issued. The company owns the capital stock of the Edison Electric Light & Power Company, of Amsterdam, which operates the lighting and power system in Amsterdam, and the Coal Company of Fulton County, which conducts an extensive wholesale and retail coal business. The company has coal yards in Fonda, Johnstown, Summersville, Fultonville and other towns. At Gloversville, the company has a storage house, having a capacity of 30,000 tons. This connection is a very good one for the railway company, since by purchasing in large quantities it is enabled to secure cheap fuel for locomotives and its power plant.

EQUIPMENT

The steam road has twelve locomotives, twenty-four passenger coaches, six baggage and combination coaches, and ten flat cars. A portion of the equipment has been purchased recently,

which tends to refute the general supposition that the steam road is to be changed over to electricity. The road has exclusive freight connection with Johnstown and Gloversville. Gloversville has a population of 20,000, and is famous for its glove industry. During the winter months a large amount of lumber is shipped from the northern end of the road. The company operates five passenger trains per day from Fonda to Gloversville, and three of these go through to the northern terminus. A very large proportion of the passenger business of the road is summer excursion traffic. The company maintains a fine park near the northern terminus. At Northville the road connects with stage lines to Lake Pleasant, and to points in the Adirondack Mountains. The traffic to these points is very heavy, and the only reason that the roadway is not extended is the fact that the laws of New York have reserved this district as a forest preserve, and railroads are not permitted to extend through it. Numerous excursions are operated from Troy, Albany, Utica and other points on the New York Central, the coaches being taken through by the locomotives of the Fonda, Johnstown & Gloversville on a pro-rata basis. The company gives a 15-minute electric service between Gloversville and Johnstown, while from Gloversville to Fonda there are cars which connect with all New York Central trains. These cars go over the old horse line route, and do not interfere with the speed of the interurban cars. In Gloversville the company operates a city belt line on 10-minute headway, while in Amsterdam there are 8 miles of city lines operated under a 10-minute headway.



TRIBE'S HILL VIADUCT



STEAM AND ELECTRIC LINES ENTERING GLOVERSVILLE ON SAME RIGHT OF WAY

The through interurban cars from Gloversville to Schenectady operate at present at hourly headway, but half-hourly service will soon be instituted. The company is expecting the delivery of a number of high-speed cars, and these will be operated through to the center of Albany under the traffic arrangement with the Schenectady Railway Company. The cars leaving Gloversville on the even hour will stop only at certain points, and it is expected they will make the run into Albany, 49½ miles, in two hours and forty-five minutes. While on the Schenectady line they will run as second sections to the Schenectady limited cars, and will make no stops between Schenectady and Albany. The half-hourly cars from Gloversville to Schenectady will be arranged to carry baggage. Between Johnstown and Gloversville the company operates its through cars in but one direction over the single-track sections in these cities. The north-bound cars operate over a track on the steam right of way, while the south-bound cars go over the old Cayadutta line through the main streets of the cities and over a private right of way between them. The two routes are only a short distance apart.



LINE VIEW NEAR JOHNSTOWN, SHOWING TRACK AND OVERHEAD CONSTRUCTION

TRACK AND LINE CONSTRUCTION

By this arrangement the entire interurban system is practically all double-track, the portion between Johnstown and Schenectady being entirely so. The maximum grade between

Amsterdam and Johnstown is 1½ per cent, and between Amsterdam and Schenectady 1 per cent, while the maximum curvature is 8 degs. To accomplish this, it was necessary to do a large amount of cutting and filling. There is one fill of 33,000 yards, and one cut of 97,000 yards. A considerable portion of the road is built on a bluff high above the four tracks



PROTECTING WIRES AT RAILROAD CROSSING

of the New York Central Railroad, which it closely parallels, and a large amount of rock cutting was necessary. In one place there was a cut of 19,000 yards, through solid rock. The right of way is from 66 ft. to 150 ft. wide, and the roadbed is



ROCK CUT AT HOFFMANS

graded 30 ft. wide, on a level, and 26 ft. wide on fills. The track is laid with 80-lb. A. S. C. E. section. Weber 4-bolt, 22-in. joints are used, under which are placed 0000 Crown bonds, furnished by the American Steel & Wire Company.

On city streets, cross-suspension overhead is used, but the interurban portion is all single and double bracket construction. Poles are 35 ft. tall, with butts 7 ft. below surface. A filling of charcoal is placed below the pole, and at the base of the pole is a copper plate 24 ins. x 24 ins. x 1½ ins., to which are soldered the cross-bonds from the rails of either track. The trolley lines are 13 ft. between centers and 000 trolley wire is used. There are two cross-arms, the lower one carrying the telephone, signal and direct-current feeders, and the upper carrying high-tension lines. The engineer adopted the plan of using four high-tension lines over the entire system, the fourth line being for emergency. High-tension lines are 0000 bare copper, and the installators are Locke No. 1000, chocolate color, 7 ins. wide. Grade crossings were eliminated wherever possible by building concrete crossings. There are a number of these along the line, all showing first-class construction. The composition used in preparing concrete is: One part Portland cement, three of sand and five of broken stone.

The system is ballasted throughout with very coarse gravel, which is obtained from three almost inexhaustible gravel banks on the company's line. The gravel is handled in dump bottom cars, and hauled by small steam locomotives, six of which were purchased for this purpose from the Manhattan Elevated Company, of New York.

At Tribe's Hill, a short distance from the power house, the company was obliged to erect a large steel viaduct. This is 617 ft. long and 76 ft. above the stream. It consists of a series of deck plate girders, the main girders being 30 ft. long, and 6 ft. wide. The tracks are laid on 13-ft. centers, and the bridge was designed to carry two Consolidated locomotives, followed by a moving load of 4000 lbs. per lineal foot. The structure cost about $50,000.

ROLLING STOCK

The rolling stock of the road is of several types and makes, as is usual with consolidated properties, but the latest cars are of modern design. Four 35-ft. cars have side seats, Westinghouse air brakes, No. 56 Westinghouse motors, K-10 controllers, and Taylor double trucks. Six 29-ft. closed cars were built by



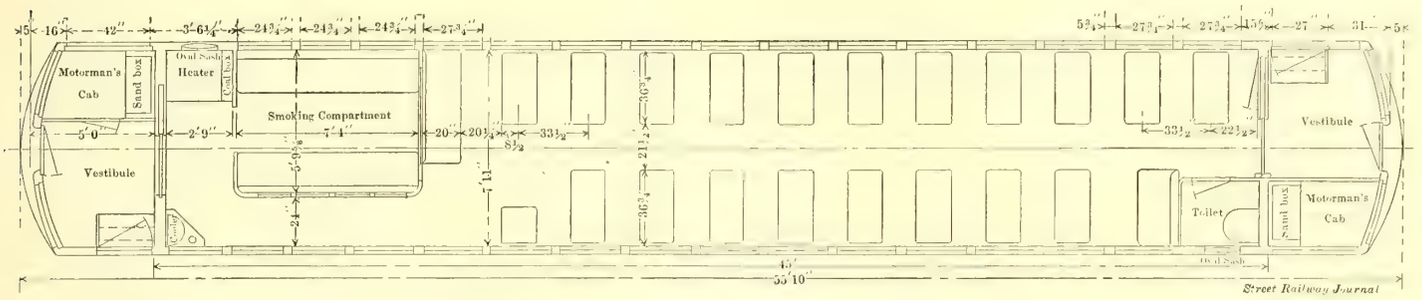
VIEW ON ROAD TO HOFFMANS

the J. G. Brill Company. They are mounted on McGuire single trucks, two General Electric No. 1200 motors, and Westinghouse K-10 controllers. Four 44-ft. fifteen-bench open cars, built by J. M. Jones' Sons, have Taylor double trucks, Standard traction air brakes, four General Electric 67-motors, and K-14 controllers. Five 30-ft. cars, built by Jackson & Sharp, have side seats, Taylor single trucks, Westinghouse magnetic brakes and hand wheels, and Westinghouse electric

heaters. Eight 47-ft. interurban cars, built by the St. Louis Car Company, have St. Louis walkover seats, Peter Smith water heaters, and St. Louis arc headlights, St. Louis B-49 double trucks, Christensen air brakes, four General Electric 57 motors, K-14 General Electric controllers. Four of these cars have baggage and smoking compartments. These cars are 9 ft. wide, and will be used for the local through service. Other rolling stock includes five 32-ft. ten-bench open trailers, built by the Ellis Car Company; three eight-bench open motor cars, built by Lewis & Fowler; twelve ten-bench open cars, built by J. M. Jones' Sons; two McGuire double-truck sweepers, one Pollard snow-plow; one Stephenson snow-plow, and two Wason double-truck snow-plows.

For the high-speed limited service between Gloversville and Albany the company is expecting an early delivery of six very fine cars, built by the St. Louis Car Company. The total length over the bumper is 54 ft. 5 ins., length of body 45 ft., height from underside of sill 9 ft. 6½ inches, width 8 ft. 7½ ins. The special feature of the cars is the fact that the floor frame is entirely of steel. The main sills consist of 10-in. channels, built together with malleable separators, 3 ft. apart, and at the end of all transverse beams. The separators are inserted so that the riveting of the work will be entirely independent of the steel bottom. An important point about this construction is that all steel connections are on steel, making the framework absolutely independent.

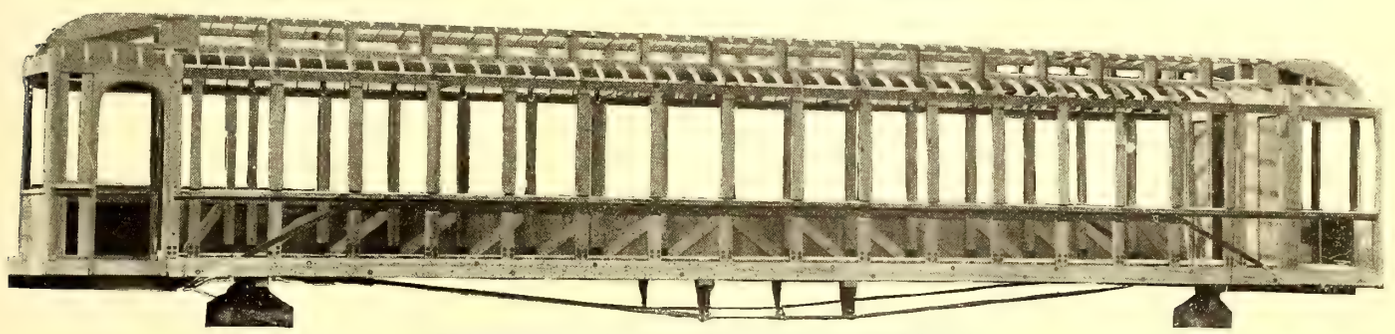
These cars have a smoking compartment in the rear, which is separated from the passenger compartment, the arrangement being similar to that of a smoker in a Pullman car. High-back, reversible seats, finished in plush, with roll head rests and foot rests, have been adopted. Car bodies are mounted on extra M. C. B. trucks furnished by the Taylor Electric Truck Company, of Troy, N. Y. They have a wheel base of 6 ft. and are arranged to receive two General Electric No. 73-C motors on each truck, four to the car, arranged with the M. C. B. swing bolster mounted on triple elliptical springs. The jaws and journal boxes are of the M. C. B. standard type. The trucks are equipped with steel-tired wheels and Mansell retaining rings, 33 ins. in diameter with 3-in. tread and ¾-in. flange, and the axles are of 5 ins. diameter. The General Electric type-M control system is used. One of these cars will be exhibited at Saratoga by the St. Louis Company, and arrangements will be made to take a party from Saratoga through to Gloversville.



STEEL BOTTOM FRAME FOR 45-FT. MOTOR CAR FOR INTERURBAN SERVICE

CAR HOUSE AND SHOPS

At Amsterdam the company has a car house, 200 ft. x 50 ft., having five tracks. This is to be doubled in capacity very soon.



FRAMEWORK FOR NEW STANDARD INTERURBAN

woodwork, and that no loosening of joints will occur by the shrinkage of any timber put on the car. The outside channels are rounded at the corners, forming the end of the sills. The transverse beams consist of 10-in. I-beams, secured to the main sills with angles and plates, while the main platform is framed with 6-in. channels, constructed in the same manner as the main sill. The bolsters are built up from 8-in. 24½-lb. channels, and are reinforced with 1-in. x 7½-in. plates. The cars have steel bumpers, arranged with spring resistances, capable of withstanding a blow of 150,000 lbs. Couplers are M. C. B. The features of the body construction are: Each post is fastened to steel sills by steel angles, and a ⅞-in. rod passes through it; this rod extends to top of cant rail and passes through the foot of steel carlins; carlins are also fastened or bolted to the cant rail, which is reinforced by a steel plate extending around entire car, thus making a steel skeleton framing, as well as a

It has 280 ft. of pit, and inspecting and light repairs for the eastern division of the electric line are done here. The headquarters of the eastern division are located in an adjoining building, which is also arranged for stock and supply house for this division. At Gloversville the company has a car house, 200 ft. x 75 ft., with six tracks. The company is well equipped to take care of repair work of all kinds, since it has quite a complete locomotive repair shop at Gloversville. This includes a machine shop, 60 ft. x 180 ft., equipped with all necessary tools for repairing locomotives, a blacksmith shop, 50 ft. x 75 ft., and a car shop, paint shop and woodworking shop, 50 ft. x 150 ft. The latter house is equipped with woodworking tools, suitable for repairing and rebuilding cars. The company is now rebuilding several of its interurban cars, placing smoking and baggage compartments in them. This shop is equipped for armature winding. The company has a foundry which answers

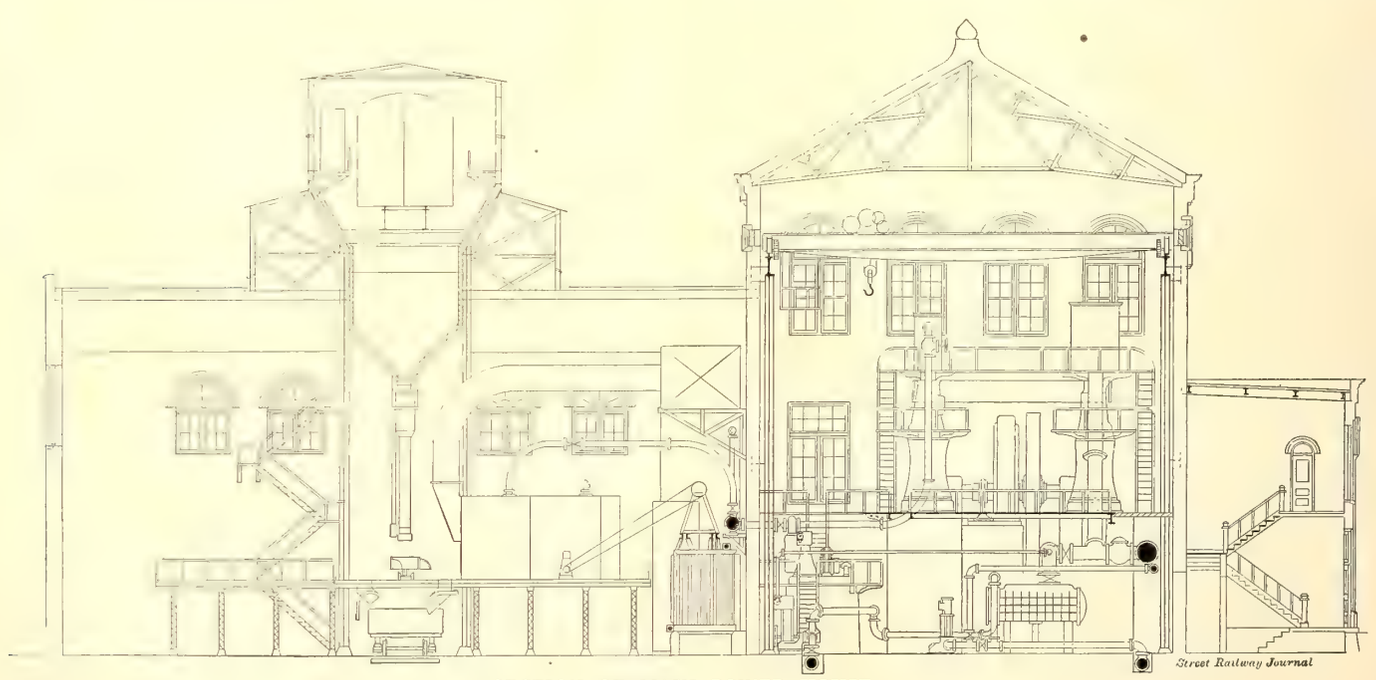
all its requirements for brass and iron castings. Despite the completeness of this layout the company is planning to erect at Gloversville a special repair shop, which will be equipped and used exclusively for the electrical division of the system.



MAIN POWER HOUSE AT TRIBE'S HILL

MAIN POWER HOUSE

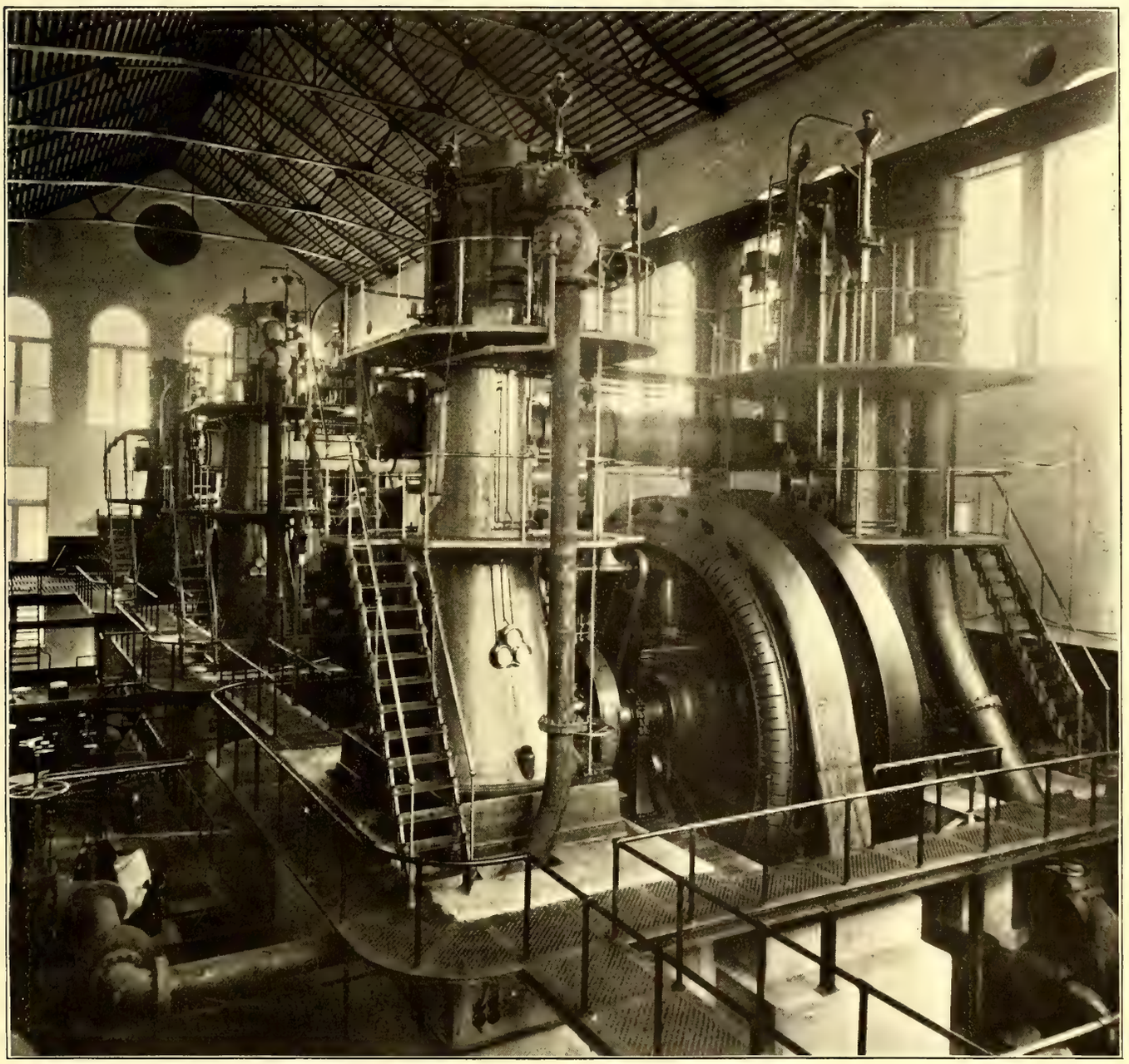
The power station of the Fonda, Johnstown & Gloversville Railway is unquestionably one of the largest and most up-to-date interurban stations in the country. The site selected is at Tribe's Hill, on the Mohawk River, a few miles from Amsterdam, at a point where the interurban road leaves the river, which it has paralleled all the way from Schenectady. The building is on a level with the tracks of the New York Central & Hudson River Railroad, which it faces, and is about 40 ft. below the elevation of the electric line. The building has an outside measurement of 164 ft. 4 ins. x 191 ft. 2 ins. It is of pressed brick exterior with limestone and terra cotta trimmings, and is divided into three sections. The boiler room at the north side measures 85 ft. x 162 ft.; the engine room, 52 ft. x 153 ft. 3 ins. and 74 ft. from the basement floor to the peak of the roof, and a wing 21 ft. 4 ins. x 143 ft. 4 ins. at the front side of the building. The roof of the engine room section is supported on steel trusses and perlins.



SECTION OF MAIN POWER HOUSE

The coal bunkers are located on the boiler room roof, which is approximately on a level with the interurban track, and they are reached by a steel viaduct, cars being run in from the main line and coal dumped into the bunkers, five in number, having

a total capacity of 1200 tons. Coal is conveyed from each bunker to the boiler room below by the Hunt Conveyor system. There are valves at the base of the bunkers and at the bottom of the chutes, and the bunkers are suspended in connection with automatic scales. Coal is dumped into 1-ton cars, which operate through the center of the boiler room on a track of 22-in. gage. There are sidings in the center of the boiler room permitting cars to pass, and at the end of the room there is a turn-table by which cars may be shifted to sidings in the house.



ENGINE ROOM OF MAIN POWER HOUSE AT TRIBE'S HILL

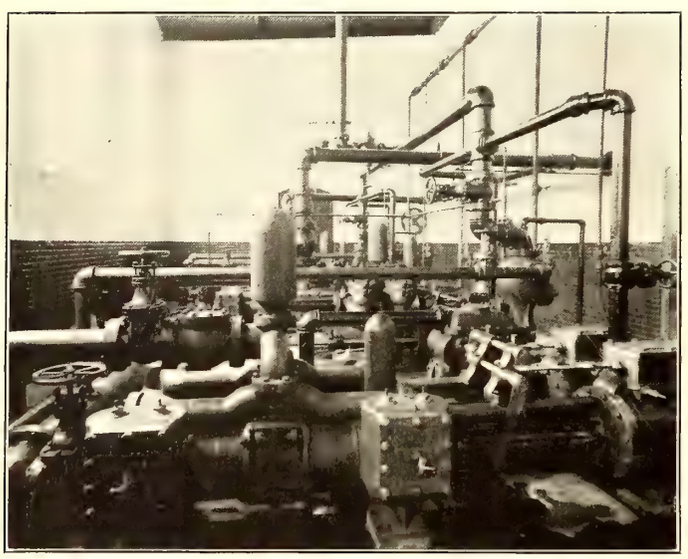
STEAM PLANT

The boiler equipment consists of ten 500-hp Scotch marine type boilers furnished by the Springfield Boiler & Manufacturing Company, Springfield, Ill. These occupy the east half of the boiler room, there being space on the other side for a duplicate layout. The boilers have two furnaces, each measuring 8 ft. x 4 ft., of the Morrison corrugated type, and Springfield rocking grates. There are 135 tubes, 16 ft. long and 3½ ins. in diameter. The boiler shells are 10 ft. 6 ins. in diameter, and the shells are 1 3-32 ins. thick. Boiler shells are covered with 3 ins. of asbestos, and the smoke flue and box have 1½ ins. of asbestos covering. The boilers are hand-fired and the ashes are dumped through chutes into the basement where standard coal cars receive them. These cars are then hauled to the main line by electric locomotive. The boiler room floor and boilers rest on steel columns, which also support the overhead coal bunkers. There are four columns to each bunker and they are tied together. The main smoke-box, which measures 8 ft. x 10 ft., is suspended under the roof of the boiler room to the rear of the boilers. Connecting it with each boiler is a 42-in. smoke flue. After entering the smoke-box the smoke is drawn down to a similar smoke-box containing a Burpee's patent American fuel economizer outfit. The blower for the economizer outfit has a 12-in. fan operated by a small marine engine. The economizer tubes are kept free from soot by means of a system of scrapers operated by a small marine engine through a set of gears. The smoke-box is arranged with sets of dampers so that the economizer outfit may be cut out and direct draft used. The stack is at the east side of the boiler house. It is 172 ft. high, and has a flue which is 13 ft. in diameter at the base and 10 ft. at the top. The stack is constructed of radial brick. The main steam header is 18 ins. in diameter and 175 ft. long;

flanges are 1¼ ins. thick, of riveted pipe. There is an 18-in. Crane gate-valve in the center of the main line, dividing the two sections, and ten 8-in. Lunkenheimer check valves, one for each boiler. At the top of each boiler is a Pearson type automatic valve. The main header has two 18-in. x 30-in. expansion joints, furnished by the Taunton Locomotive Manufacturing Company. Above the main header is an auxiliary header, 7 ins. in diameter, which is provided with a number of valves so that in case of accident to the main header any combination of boilers may be used. All steam piping has long bends instead of angles, and all pipes are covered with 3 ins. of asbestos.

ENGINE ROOM

The engines, three in number, are of the Allis-Chalmers vertical cross-compound condensing type, with cylinders of 28-in. x 60-in. x 48-in. stroke. The cylinders have water relief valves in each end and are provided with the Reynolds-Corliss



PUMP ROOM

automatic valve gear. The steam exhaust valves are operated by separate eccentrics providing for automatic cut off. The main journals are 22 ins. in diameter and 38 ins. long, and the shaft is 26 ins. in diameter in the center and weighs 45,000 lbs. The bearings and cross-head slides have water jacketed frames of the Reynolds circular type. The fly-wheel is 20 ft. in diameter, has a 20½-in. face, and weighs 100,000 lbs. The engine has an auxiliary governor which shuts off the steam when the speed runs above 95 r. p. m., the normal speed being 94 r. p. m. There is also an electrical speed controller in connection with the governor, which is used in synchronizing. The apparatus consists of a motor mounted on a screw on the regulator column, and is so adjusted that its movement may be controlled from the switchboard. By the operation of this switch the motor may be made to move backward or forward along the screw, thus increasing or decreasing the weight on the governor balls, and changing the speed of the engine to suit the required conditions. In this way several engines driving alternating-current machines may be made to run in unison.

At 94 r. p. m., with 160 lbs. steam pressure and condensing at 26-in. vacuum, the engines are guaranteed to develop 1700 hp, with a steam consumption not to exceed 13½ lbs. per indicated horse-power per hour, and when developing 2250 hp not more than 18 lbs. per indicated horse-power per hour. The normal load of each engine is 1700 hp, and they are guaranteed to develop 2250 ihp without excessive heating. The total weight of each engine is 380,000 lbs.

AUXILIARY EQUIPMENT

At the base of each engine is a Wheeler surface condenser having 2625 sq. ft. of cooling surface. There are two Wheeler double-inlet circulating pumps, each driven by a 12-in. x 12-in. marine-type vertical engine. They operate at 320 r. p. m., and are capable of delivering 4000 gals. per minute against a friction head of 5 ft. The engines and condensers are connected to the main exhaust pipe so that either engine or condenser may be operated in any combination desired; there is a gate valve for each condenser and each engine. Each engine also has a Davis automatic relief valve so that the engine can exhaust into the atmosphere if necessary. The main pump room is located in the basement of the boiler house. The equipment includes two Chandler duplex compound-condensing tower pumps, two boiler feed pumps of the duplex pot-form type, with two cylinders 12 ins. in diameter, and four 16-in. single-acting water plungers having 18-in. stroke, provided with Fisher governors and relief valves; two independent air pumps and condensers, which take care of the exhaust steam from the boiler feed and tower pumps. Below the basement floor is a hot-well, 14 ft. x 7 ft. x 7 ft. This receives not only the condensation from the condensers, but all condensation from the main steam line, headers and separators, so that there is practically no loss of water in the entire house. Water in the hot-well is replenished by a float valve in the tower line. Water in the tower is maintained at a certain level, and a bell rings in the engine room when it falls below this level.

Water for the circulating system is pumped from the river through a 20-in. steel main laid in a tunnel passing under the tracks of the New York Central Railroad. The feed-water pumps are arranged so that they may take water by suction direct from the hot-well, from the tower or from the river.

As auxiliaries in case of trouble with the economizers there are two National feed-water heaters, installed by the National Pipe Bending Company, of New Haven, Conn. The heaters are located between the economizers and the pumps, and are heated by means of the exhaust from the auxiliaries.

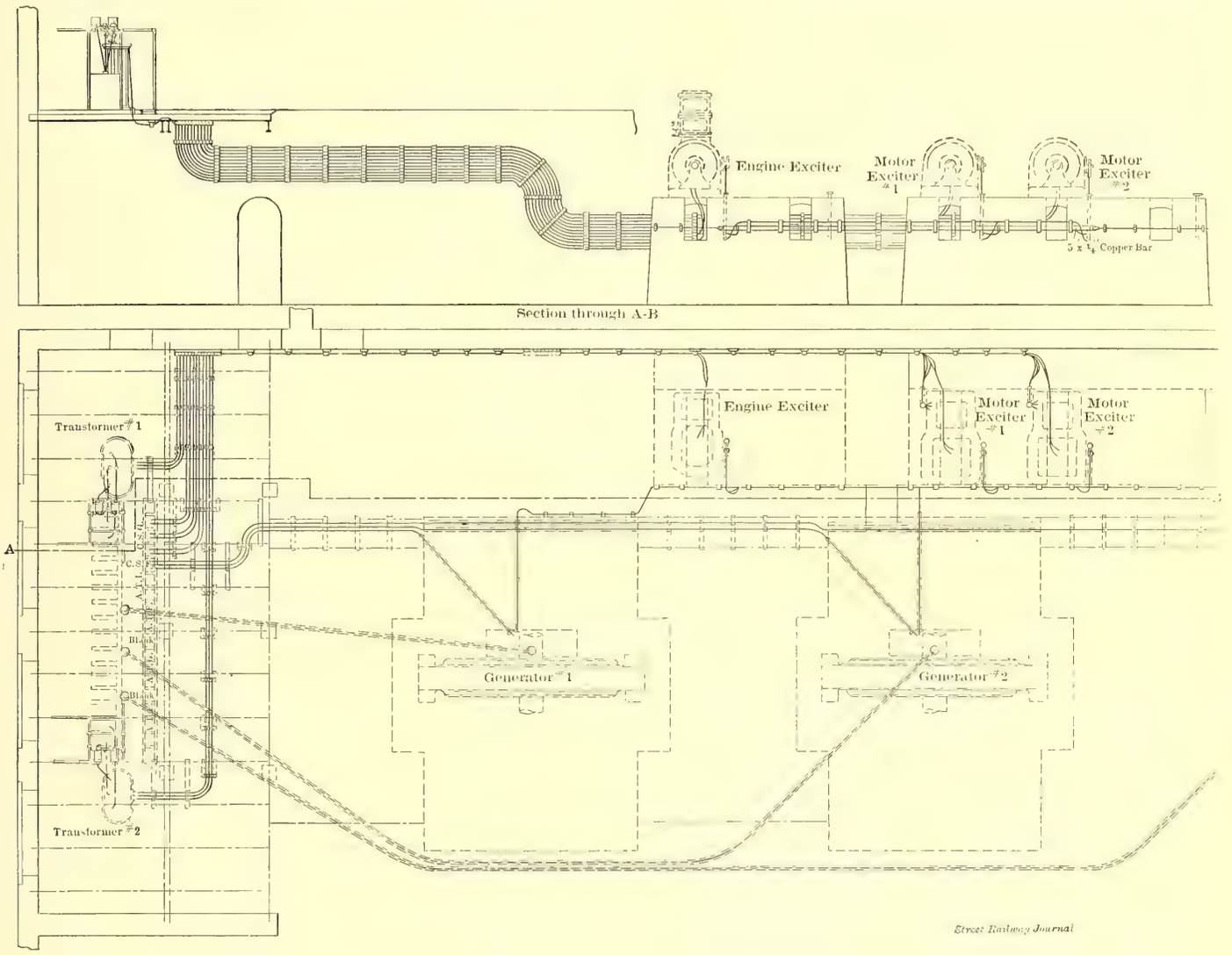
The oiling system in the house is very complete. There are large elevated tanks in the upper part of the engine room with supply pipes to all engine oil cups. Oil from the engines flows by gravity to two No. 10 Turner oil filters and then to supply tanks located in the basement. There are two sets of oil pumps which are cross connected, so that either may be used to pump cylinder oil or engine oil. There are also separate air compressors which are used to pump oil out of barrels and deliver it to the supply tanks. The compressors also supply air for blowing the dust from the generators and from the back of the switchboard.

ELECTRICAL EQUIPMENT OF THE MAIN AND SUB-STATIONS

For the supply of direct current to the line between Schenectady and Gloversville, three direct-current feeding points or sub-stations were considered necessary, these being located about 10 miles apart. One of these was located in the existing generating station in Johnstown, where space left for a future 300-kw engine and belted generator proved to be ample for three 300-kw converters, their transformers and switchboard, with a space for a fourth. It is of interest to note that these converters have a much greater overload capacity than the old-fashioned generator, thus showing a space economy of some 5 or 6 to 1 in units of the same capacity. Another sub-station was located near Amsterdam, and with it is combined apparatus

for lighting the city. The third sub-station (purely railway) was located between Amsterdam and Schenectady (in the town of Glenville), at a point somewhat more than halfway from the Amsterdam sub-station to the section breaker between the direct-current trolley system of this road and that of the Schenectady Railway Company. The location more than halfway to the end of the feed was chosen in order to keep up the best trolley voltage at all points with a given amount of direct-current feeder copper, considering the fact that the feeders are carried through without break from sub-station to sub-station, lines supplied from the Amsterdam sub-station, and the Fonda division supplied from the Johnstown sub-station, three converters were ordered for each of these stations, one for light loads and two for regular service, with one spare.

The converters are the standard machines manufactured by the General Electric Company, six-pole, running 500 r. p. m., with ventilated fields, open type collector rings, series shunt and equalizer switches mounted on machine frames, and other improvements up to the date of their manufacture. Each converter is fitted with field break-up switch for use when starting



WIRING PLANS OF MAIN STATION

thus giving all cars between sub-stations a feed from both ends.

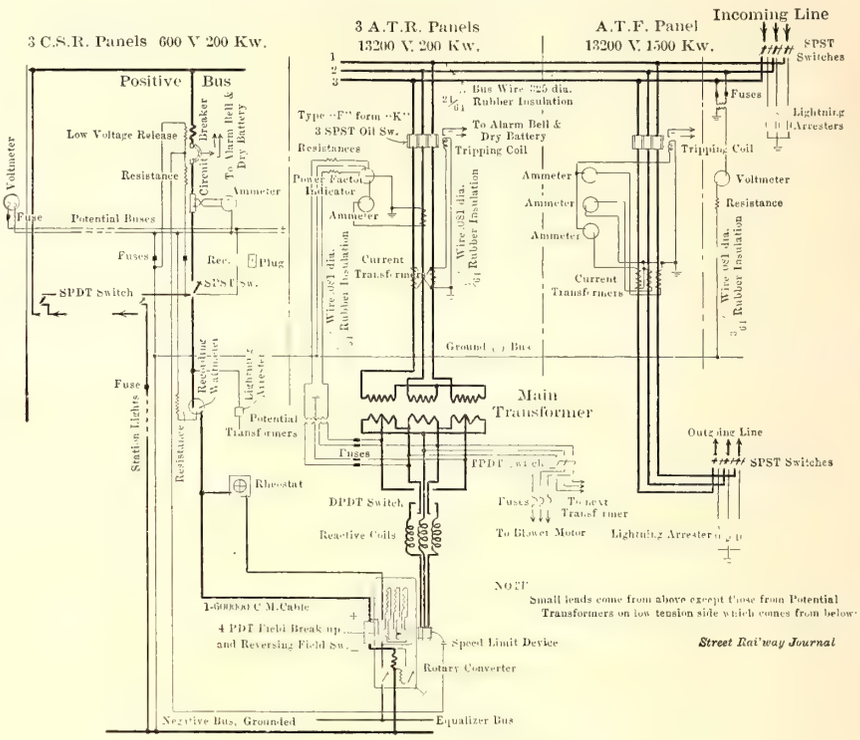
The Glenville sub-station feeds a section of the track carrying interurban cars only, with no local or city traffic.

The equipment of these cars, four 75-hp motors, will take in multiple position, when accelerated rapidly, 800 amps. per car. In order to take care of this swing of load, together with 100 or 200 amps. which may be demanded by other loads at the same time, without running more than one converter, the 300-kw size was chosen, the maximum carrying capacity of this size being 1000 amps. momentarily at 600 volts, on the basis of 100 per cent overload. Two of these converters were ordered for the Glenville sub-station, thus making one spare, as this sub-station will, in all regular service, supply only one car each way, and the equipment is figured for one of these cars accelerating and one running or drifting. Converters of the same size were used in both of the other sub-stations in order to make the apparatus interchangeable. On account of the local urban from the alternating current side, and this break-up switch is made double throw, the lower throw reversing the normal connections between armature and field so that the shunt field winding opposes the magnetism set up in the machine by the alternating currents. By this means the polarity of the machine is readily reversed when, in starting from the alternating-current side, the machine comes up with wrong polarity, that is negative to trolley and positive to ground. This is a recent improvement over previous practice in which reversing was accomplished only by pulling the machine out and throwing it in again on the hit or miss principle.

The converters being all of the same size and there being a spare converter in each sub-station, the usual arguments for single-phase transformers did not exist in this case, and three-phase transformers were adopted on account of lower cost, less floor space, etc. One 330-kw three-phase transformer is installed with each converter. These transformers are of the air-blast type, of shell construction, with three sets of coils similar

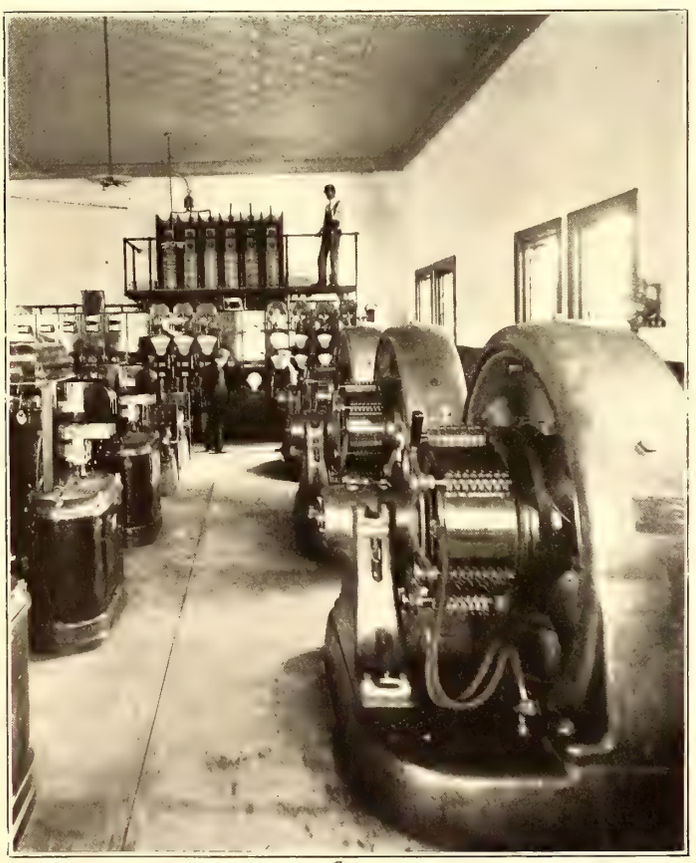
to those of three single-phase transformers, but combined in one shell which serves as a common magnetic circuit. Primary windings are connected in Y with the secondaries in delta, the primaries being provided with taps for changing the ratio of the transformer in 2.5 per cent steps up to 10 per cent, the secondaries being provided with one-half voltage taps in two phases for the purpose of "starting in the corner." In explanation of this term, it should be said that the converters are started by applying to them one-half their normal voltage obtained from one-half of the turns of the secondaries of the transformers. One corner of the delta is connected through to one collector ring of the converter in either the starting or running position of the switch. In the starting position the other two rings of the converter are connected to one-half taps in the two sides of the delta adjacent to this corner; in the running position these two rings are connected to the other two corners.

There is also provided between each transformer and the corresponding converter one three-phase reactive coil. This is designed to give a boost of about 30 volts alternating current with full load current of the converter leading and a depression of about the same amount with full load lagging. This boost or depression in each phase amounts to about 70 volts boost or depression of the direct-current voltage. These reactive coils stand over the air-blast chamber provided for the transformers and are cooled by a small amount of air taken from them.



WIRING PLAN FOR SWITCHBOARD

The high-tension line voltage chosen was the highest standard for which the General Electric Company builds generators without step-up transformers. This pressure, 13,200 volts, is ample for distribution from the generating station at Tribe's Hill to the present sub-stations, and for all extensions up to a maximum distance of about 25 or even 30 miles from the generating station, which is as far as there is any immediate prospect of an extension of this system. To take care of the high-tension power at this voltage in the sub-stations, three single-pole form K oil switches of the hand-operated type connected through mechanism to one handle on the switchboard panel are provided for the supply of each step-down transformer unit. These switches are rendered automatic by the use of current transformers, relays and tripping coils, no high-tension fuses being used. Similar switches are also provided for cutting in or out either or both of two transmission lines to each sub-station, these switches being provided for each end of each of these lines. These, however, have not been utilized, as it has been considered preferable to put some of the cost of the second



SUB-STATION EQUIPMENT AT JOHNSTOWN



CABLEWAY IN SUB-STATION AT JOHNSTOWN

transmission line into the first, thus rendering the one transmission line more nearly infallible. The line between the generating station and the Amsterdam sub-station is in operation twenty-four hours per day—all day for the railway and all night for lighting service. On this account a rather novel expedient was here tried; that is, the use of four transmission wires for a three-phase circuit, one of the four being a spare, and connected to knife switches at each end so that any one of the other three line wires may be cut out at both ends and replaced by the spare wire. It is anticipated that by this means one wire may be killed in case of a punctured insulator, a cross or a break, and service may be continued by means of the spare wire. As this part of the line follows the track and may be reached from a tower wagon, it will be possible to replace an insulator or make other repairs on the dead wire while the other three are in use.



ROTARIES, TRANSFORMERS AND SWITCHBOARD IN AMSTERDAM SUB-STATION

The generating station contains three main units, one of which was intended for light loads and two for ordinary service, with one reserve. These units are rated at 1000 kw each on a very moderate temperature rise, allowing for a 50 per cent overload for two hours and 100 per cent momentarily, the engines being made of corresponding power. It was anticipated that the all-night lighting load would, after a short time, become sufficient to give a fairly economical load to one of these units, and for this reason the complication of a smaller unit was not considered advisable. These units run at 94 r. p. m., requiring, therefore, thirty-two poles to give twenty-five cycles. They are of the usual General Electric type, with revolving fields wound with copper ribbon on edge and with stationary armatures wound with heavily mummified coils of the double chain type in two slots per pole per phase. As noted, these units generate 13,200 volts directly in their windings.

For the excitation of these units three exciters are provided, one being engine driven and intended, as a rule, only for use in starting the plant, but made of sufficient size to excite all three generators, thus serving as a reserve. This exciting unit consists of a marine set. The other two exciters are driven by induction motors supplied from the high-tension bus, through three-phase oil-cooled core type step-down transformers, one for each exciter. The switchboard equipment is somewhat similar to that of the sub-stations, three single-pole, form K, hand-operated oil switches being provided in the circuits of each generator, and in the supply circuit of each step-down transformer for the exciters. The outgoing high-tension lines to the sub-stations are equipped with motor-operated, form H oil switches. These have a very great kilowatt-breaking capacity, and this is considered necessary on account of the fact that they are automatic, and one of them must break the whole power of the station in case of a short circuit on the corresponding line. The generator switches are not automatic, the idea being to keep the generators in parallel on the bus when an overload or short pulls out one of the lines.

High-tension lightning arresters with disconnecting switches are provided at each end of each transmission line. Each line is also equipped at its ends with a simple form of indicator to show whether the line is alive or dead. This consists of a light wheel with tangential points and balanced on a step bearing. The repulsion of the air particles from the points causes the wheel to rotate at high speed when the line is alive, unless the wire is grounded.

The lighting equipment of Amsterdam sub-station comprises three motor generator sets designed to receive 25-cycle power and deliver 60-cycle power. A 25-cycle system with motor generator sets for lighting purposes, although somewhat more expensive than a 60-cycle system with 60-cycle converters, was considered preferable to the latter on account of

the superiority of the low-frequency converters, and also on account of the opportunities given by the motor generators for lighting voltage regulation, either hand or automatic, to take care of all speed or load fluctuations. Two of these motor generator sets are of 500-kw capacity each, the third being a smaller one, rated at 200 kw and intended for carrying the all-day load. One of the large sets is of sufficient size to carry the full evening load for some time to come, leaving the other as a reserve, and space is provided at the end of the station for a third large set when the load becomes so great as to require the two large ones, leaving no reserve with the present equipment.

It is of interest to note that this sub-station is designed for extension with the greatest ease. For example, although one of the railway converters at present installed is a spare, space is provided for a future converter at the other end of the station for a future motor generator set. In addition to these reserves



AMSTERDAM SUB-STATION, SHOWING HIGH-TENSION LINE SUPPORTS

and spaces for future reserves the station is built about midway of the lot so that either end of the building can be extended for even further additions, one end for lighting and the other end for railway. The switchboard, 60 ft. in length, is continuous, with railway panels at one end in front of the railway machines and lighting panels at the other end in front of the lighting machines. Blank panels have been provided in the board for future converter and lighting motor-generator sets for which space is provided in station.

Of the two large motor-generator sets the motors are wound for 13,200 volts, thus doing away with step-down transformers. The smaller set is provided with a three-phase step-down transformer giving 370 volts, the same as the transformers for the converters, so that in case this transformer is crippled the small synchronous motor-generator set could be supplied from one of the railway transformers. Each motor-generator set is provided with its own direct-connected exciter. The small motor-generator set is started just as are the converters, by means of alternating currents introduced directly into the motor windings, these currents being of lower voltage than normal, and this lower voltage being obtained by means of a starting switch, which cuts in only part of the transformer windings in the starting position. In the case of the large motor-generator sets this method was, of course, not available, as there are no transformers supplying these sets. To take care of the starting of these sets without the expense of duplicate compensators with their switches, etc., use has been made of the primary windings of the railway step-down transformers. Taps are provided in these Y-connected primary windings and taken to an oil switch mechanically interlocked with the motor switch, so that the large synchronous motor can be connected first to 6600 volts until it comes up to synchronism, after which it can be thrown over to 13,200 volts without danger of cross-connecting these two sources of supply. The high-tension bus of this sub-station is divided in two sections by means of knife switches, with part of the converters and part of the motor generator sets on each section, so that at times of light load one section can be shut down to clean up or to extend or repair the bus or any of its branches to and including the oil switches supplied from it. The incoming line is cut into either or both sections of the bus.

Careful provision has been made for obtaining proper phase relation of the 60-cycle generators. After the motor generator sets have been brought up to speed and locked in step with the supply circuits, it is obvious that the generators may have any one of several phase relations, owing to the fact that the generators have more poles than the motors. Provision has been made for slipping the motors back one pole at a time by means of field reversing switches until the generators are in phase with each other. The generators supply three-phase currents at 2300 volts to one set of bus-bars, from which power is taken to five fifty-light constant-current transformers for arc circuits, and to twelve outgoing incandescent lighting feeder circuits, eight of which are provided with C. R. regulators and compensated voltmeters.

Provision is made for obtaining energy records on the system by means of an induction recording wattmeter on each of the main generators of the power station, and a recording wattmeter on the output of each converter and each motor-generator set. The first set of wattmeters gives the total output of the steam power plant, while the second gives the sub-station output, the difference being the power lost in transmission lines, transformers, converters and motor generator sets.

MACHINE SHOP

The layout in the wing is an unusual one for an interurban power house. A space, 50 ft. x 25 ft., is utilized as a machine shop, and it is equipped with lathe, drill press, planer, shaper and other tools that might be required in caring for a plant of this kind. There is a large store room fitted up for the systematic handling of duplicate parts and supplies of all kinds. A third is arranged for a drafting room, and it is fitted with tables and necessary apparatus, and files for the convenient handling of drawings and blue prints. Adjoining this room the chief engineer has a private office and connected to it is a private bath room. Adjoining the boiler room is a large toilet room equipped with tubs, shower bath and individual metal lockers for the use of the men.

The entire plans for the buildings, electrical apparatus, engines and all features of the installation were designed under



PASSENGER STATION AND HEADQUARTERS BUILDING AT GLOVERSVILLE

the supervision of Charles H. Ledlie, consulting engineer, St. Louis, and were carried out by H. O. Rockwell, resident engineer, and W. W. Guest, chief draughtsman. All electrical equipment was installed by the General Electric Company, while the engines, feed-water pumps, tower pumps and piping were installed by the Allis-Chalmers Company.

ORGANIZATION AND OPERATION

The company's headquarters is at Gloversville in a handsome brick structure, which is also the station for both the electric and steam divisions. The entire system is covered by a private telephone line with the exchange in the headquarters building, and the telephone system is connected with that of the Glens Telephone Company, of Gloversville. Waiting rooms and ticket offices are maintained in all towns. Baggage is checked on the electric division, but on this portion of the system there is no freight or express business, the reason for this being obvious when one considers the close relationship existing between the company and the New York Central Railway.

Through tickets are also sold from Schenectady to the park at the end of the steam line at the rate of $1.45 per round trip, good any time; and on Sundays, holidays and for picnics the rate of $1.00 is made. Between Amsterdam and Schenectady the company sells a book for thirty days, which gives fifty-four rides for $9.00. The book is not transferable.

The company pays its men 17½, 18, 19 and 20 cents, according to the amount of service. Promotion is by order of seniority, men starting extra on city lines, then going to the Fonda-Gloversville, and finally the interurban lines. The electric system is operated in two divisions, the entire system being in charge of H. O. Rockwell, who has the title of assistant general superintendent.

PARKS AND AMUSEMENTS

The company owns and operates Sacandaga Park, a beautiful natural park located on the river of the same name, and almost surrounded by mountains, the foot-hills of the Adirondacks. The company property embraces 250 acres, which have been laid out and improved by professional landscape artists. The river was dammed in two places, making a shallow pond which affords excellent bathing and boating. The company has a number of steel row-boats, and there is a toboggan slide into the river, use of which is free to bathers who pay 25 cents for bathing suits. The toboggans are drawn up by endless chains. The park is thoroughly sewered and is laid out with water pipes delivering spring water, which comes from the mountains, 3 miles away. A large portion of the park is laid out with streets, and building sites and summer cottages are leased to desirable applicants. There are 150 cottages and several small hotels, in addition to Adirondack Inn, operated by the company. This is equipped with every convenience to be found in the most up-to-date hotels. The building is illuminated throughout with electricity, and each room has a bath room adjoining. Accommodations are provided for 200 guests. There is a large ball room adjoining, and frequent "hops" are given to guests and favored visitors.



ADIRONDACK INN, SACANDAGA PARK

The park also has a dance pavilion which is let out to private parties. There is a summer theater, beautifully situated at a



SUMMER THEATER, SACANDAGA PARK

side of a wooded ravine having a stage backed by the river. A high-class vaudeville programme is given each evening during the season, attractions being furnished by the J. W. Gorman Amusement Company, which has a circuit of a number of parks in New York State.

Other attractions include a railway baseball park, with scheduled league games, laughing gallery, installed by the Ingersoll Construction Company, of Pittsburg, and a steam-operated merry-go-round of very elaborate design, manufactured by G. A. Dentzel, of Philadelphia. The attractions mentioned are operated by the company, in addition to which there is a photograph gallery, restaurant and a number of fancy goods stands, for which privileges are let out. During the season there are three daily concerts by Prouty's Orchestra, of Boston. The popularity of this resort will be appreciated when it is stated that on July 4 the attendance was over 20,000.

The entire system affords a delightful route for pleasure seekers, particularly the electric division, which, for a number of miles, affords a view of the picturesque Mohawk Valley, backed by a range of mountains. The Mohawk River, through which the aborigines were wont to ply the canoe, the old Albany turnpike, the Erie Canal, through which packet boats were operated in the early days of the last century, the New York Central, with its great steam railroad of four tracks, and the double-track electric line, all parallel, give striking evidence of the remarkable advances in the way of transportation facilities afforded in the valley of the Mohawk for the last 100 years.

THE ALBANY & HUDSON THIRD-RAIL SYSTEM

The fertile territory to the south of Albany is being developed by the Albany & Hudson Railroad Company, whose line from Albany to Hudson, through the counties of Columbia and Rensselaer, and touching a number of small towns, was placed in operation in November, 1900. Over a portion of the distance the line follows the New York Central & Hudson River Railroad, but over the remaining portion it is back in the country at some distance from the river.

The line in question is the only third-rail electric road in Eastern New York, and at the time of its construction it was looked upon as one of the highest examples of third-rail practice in the country. The enterprise was fully described in the Street Railway Journal of Feb. 2, 1901, and as few changes have been made since that time, a brief review only is necessary.

Current for the operation of the road is supplied from the water-power plant situated in Kinderhook Creek, 10 miles north of Hudson. Four varieties of generating apparatus are installed at this house, making it a very novel combination. These include railway circuits, operating at 25 cycles, lighting circuits operating at 60 cycles, direct-current generators for the section of the line adjoining the house, and an auxiliary steam plant. The main building is 82 ft. x 142 ft., containing the water-wheels, dynamos and engines, while the boiler house is 52 ft. x 80 ft. Water is brought from the dam in two 7½ ft. penstocks. These penstocks are tapped by pipes leading to the turbines which are placed along the side of the house adjoining the river. The turbines are in the lower of a series of three floors into which the bay on that side of the building is divided. They are ten in number, of various capacities for running the different generators, exciters, etc. They are of the Victor type, supplied by the Stilwell-Bierce & Smith-Vaile Company, of Dayton. The generators extend into the main building, and beyond these are the engines so situated that they may be readily coupled to the shafts of the generators. The engines are three in number, two 1000-hp Ball & Wood marine type, and one 750-hp Buckeye cross-compound condensing horizontal type. The first two of the engines are arranged to drive 750-kw generators, while the other engine has two shafts in line with two 250-kw single-phase generators. There are three Bulkley injector type condensers, one for each engine, and the condensers have a duplicate system of piping, by which they receive water from the penstocks.

Two feed-water pumps are arranged to take water from the penstocks or from the hot well. Steam is furnished by three 500-hp Aultman & Taylor water-tube boilers. Natural draft is used, the chimney being 125 ft. tall x 6½ ft. flue.

As the power station is close to the main line, a considerable portion of the power generated is direct current. Two 200-kw direct-current generators are connected to water-wheels. For the high-tension transmission there are three 750-kw, 25-cycle, three-phase generators, delivering 12,000 volts directly from their windings. Exciting current for the field is generated by two 60-volt exciters, driven by independent water-wheels.

Switches are located in two galleries above the water-wheels. The switchboards are located in the first gallery, and include panels for the exciter, the three-phase generators, single 60-cycle generators for lighting, and the 600-volt railway generators; each set being separated by passage-ways. The several switch and transformer cells are in the upper gallery, and include oil switches, separated by soapstone barriers, oil potential, and current transformers electrically connected to instruments on the switchboard panel, being of the usual type now employed by the General Electric Company, but which were advanced departures at the time this station was installed. The instruments on the switchboards are supplied by instrument transformers, and no high-tension lines are brought to the board. The outgoing feeder lines are protected by high-tension fuse blocks of the explosion type. The high-tension lines are mounted on 35-ft. poles, spaced 100 ft. apart. At the top of the pole is a cross-arm carrying lighting lines, and below this are cross-arms carrying duplicate three-phase 25-cycle lines. Lines are mounted on 5-in. triple petticoat porcelain insulators. The wires are No. 1 and No. 4 copper. There are three sub-stations located at Hudson, North Chatham and East Greenbush. The stations at Hudson and East Greenbush are in buildings designed exclusively for the purpose, while the North Chatham station is a part of the railway station containing express room, waiting room and ticket office. The equipment of each station includes one 200-kw and one 400-kw rotary converters, supplied with air-blast transformers, oil switches, switchboards, and other standard General Electric equipment.

The third-rail is sectioned at the sub-stations, there being two feeder panels in each sub-station, one feeding north, and the other feeding south. The third rail is of 80-lb. T, the same as the track rail, but it is made in lower carbon, thereby reducing its electrical resistance. The ties for the track are spaced on 2-ft. centers, and every fifth tie is extended to form a support for the third-rail insulators. Insulators are made of wooden blocks, topped with malleable cast-iron caps. At all points where the road crosses highways or farm lanes, the third rail is interrupted, but the circuit is maintained by cable connection placed underground. For collecting the current there are four contact shoes, two for each side. As the road is single-track, and there is only one third rail, only two shoes are in use at any given time. There is a switch on the platform of the

car, which enables the motorman to place the controller upon either pair of shoes, or the trolley wheel.

The car equipment of the road is of very high class, and includes thirty-six cars. The regular passenger coaches are 53 ft. 6 ins. over all, and are in two types. Cars designed for summer use have low drop windows, and are finished in white ash and light colored bird's-eye maple, while the winter cars have mahogany finish, elaborately inlaid. The summer cars have slat seats, while the winter cars have Heywood Brothers & Wakefield-Wheeler patent seats, upholstered in carpet. A portion of these cars have smoking compartments, while others are designed for handling baggage and express. The summer cars have four General Electric 57 motors, while the winter cars have General Electric 51 motors. The type-M control is used, and cars are coupled in trains of two and sometimes three. The company is obliged to run the cars singly in the cities of Albany and Hudson, where they run over the streets. The company has four 43-ft. express cars, and does quite an extensive express business. Of course, in the city streets, the trolley is used. The road is run on steam railroad principles, and the line is covered by both telephone and telegraph, the former being used for despatching cars. The company is installing a semaphore block signal system, which is to be operated by station agents, and which will cover three stations.

Motormen and conductors are obliged to pass a very rigid examination as to their knowledge of operating and equipment, and each man is examined three times a year. The company states that not one man in ten who applies for a position is able to pass the examination, which is evidence as to the care used in making safe operation the all-important item.

The company operates Electric Park, located on a beautiful sheet of water, known as Kinderhook Lake. It is equipped with all desirable accessories for a park of this kind, including a large summer theater, where vaudeville performances are given every afternoon and evening. The park is run strictly on temperance principles, and is well patronized by the best class of people from Albany and Hudson. While the park is not self-sustaining, it is a great inducement to travel, and adds greatly to the receipts of the road. On July 4, of this year, the company handled over 12,000 people, without a single accident, and the only delays were caused by the drawbridge at Albany. These delays made it very difficult to operate on schedule, but by issuing eighty-one special orders the system was kept moving in very satisfactory shape, and without a single breakdown in cars or equipment.

At the present time, the company is lengthening out all sidings, laying about 4 miles of track in this manner, with the view of ultimately double-tracking the entire road. The operation of the road is at present in the hands of J. S. Gillespie, who was formerly assistant division superintendent of the Baltimore & Ohio Railroad.

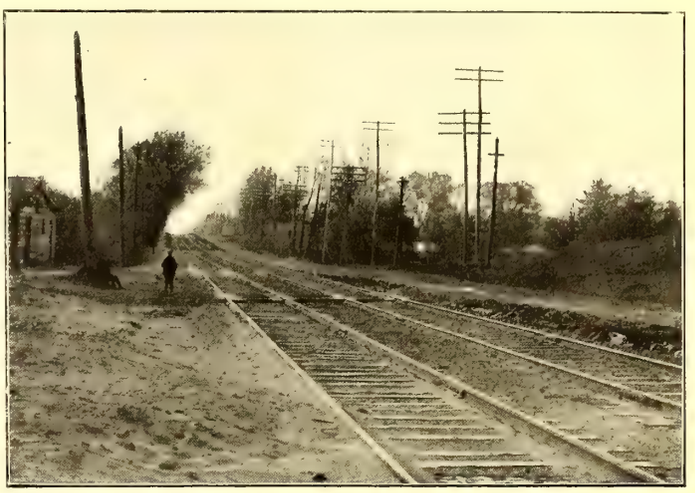
The officers of the company are: C. L. Rossiter, president; A. M. Young, first vice-president; George G. Blakeslee, second vice-president and general manager; L. B. Grant, secretary; H. G. Runkle, treasurer; R. P. Leavitt, electrical engineer; J. Bersel, mechanical engineer, and J. S. Gillespie, superintendent.

For five months last year the company was in the hands of a receiver, Mr. Blakeslee, the present general manager. It was reorganized on March 1, 1903, with the officials here named. During the five months of the receivership, which were the poorest of the year, the road paid all operating expenses and earned money enough to pay all fixed charges, including bond interest.

SCHENECTADY'S CITY, SUBURBAN, AND INTERURBAN ELECTRIC RAILWAY FACILITIES

It would be hard to find a better example of the rapid advancement of the electric railway industry than that afforded by the growth of the Schenectady Railway Company. Only a few years ago, in 1894, this system consisted of 2 miles of single track with an equipment of four closed cars. The management at that time seriously considered the advisability of cutting down the service to three cars on account of the lack of patronage, but to-day it is operating over 75 miles of track and has in course of construction about thirty-six additional miles, while its equipment has increased to over 100 cars, handling during the year closed, July 30, 1903, over 7,000,000 passengers.

Schenectady is now the hub of an electric railway system extending like the spokes of a wheel in all directions. To the



SCHENECTADY-ALBANY LINE OVER OLD STONE TURNPIKE

north, a double-track road to Ballston Spa and Saratoga, a distance of 22 miles, is about completed. To the east, a double-track road to Troy, a distance of 16 miles, was completed in March of the present year. To the southeast, a double-track road to Albany, a distance of 15½ miles, has been in operation for over two years. To the south, a road is contemplated to South Schenectady and Altamont, a distance of 11 miles; while to the west a connection has been made with the Fonda, Johnstown & Gloversville Railroad, making it possible to ride from Albany to Gloversville, a distance of 50 miles, without change of cars.

The extraordinary growth of this system may be attributed to the rapid increase in the population of the city of Schenectady, due to the development of the two large industries—the General Electric Company and the American Locomotive Company. The increase in the population of the city is shown by the following table:

1880	13,655
1890	19,902
1892	22,730
1899	28,791
1900	31,683
1902	53,000

The average number of employees of the General Electric Company and American Locomotive Company is as follows: 1891, 4457; 1901, 10,827; 1903, first quarter, 15,408; with a total annual pay roll of nearly $2,000,000.

The development during the last year has been similar to that of some of the Western boom cities. Entire new districts have

been laid out and 1475 houses erected and occupied. Schenectady is also the home of Union College, one of the oldest institutions of learning in the country.

OPERATION

In the city of Schenectady six lines are operated under the following headway: State Street-Scotia, 10 minutes; Bellevue-Aqueduct, 7½ minutes; Union Avenue, 7½ minutes; "A" Belt, 5 minutes; "B" Belt, 5 minutes; State Street Stub, 15 minutes. These lines cover 22.66 miles within the city limits.

One of the most difficult problems the company had to contend with was the handling of the large number of employees of the General Electric Company in the short space of time allowed before and after shop hours. The company has successfully solved the problem by the building of a loop at the entrance to the works with the necessary storage tracks from which extra cars can be fed into the main line without interrupting the regular traffic. In this manner about 3000 people are loaded and unloaded from the cars in less than half an hour without any apparent discomfort. In order to accommodate the large number of employees of the General Electric and American Locomotive Companies who live in neighboring towns, special cars are run directly from the works over all interurban lines both morning and night.

INTERURBAN LINES

Both the Troy and Albany divisions are operated on a 15-minute headway from 9 a. m. to 8 p. m., and on a 30-minute headway at other hours of the day. On the hour a special service has been established between Schenectady and Albany, called the "Schenectady-Albany Limited." The trip is made in 45 minutes, without stops outside the city limits, no extra fare being charged. A similar service will soon be put into effect on the Troy division. Round trip tickets to Troy and Albany are sold at 40 cents, and are interchangeable; single fare, 25 cents. Commutation books, containing fifty-two tickets and limited to one month are furnished for $7.50. Although all the lines controlled by this company abound in most picturesque scenery, that afforded to passengers on the Troy division is especially notable. At points on this line views of the beautiful Mohawk Valley, the Adirondack, Catskill and Green Mountain ranges may be obtained, providing a panorama of river and mountain scenery which can hardly be excelled in any other part of the country.

With the completion of the Ballston-Saratoga division passengers will be taken from Albany and Troy by means of a cut-off around the city of Schenectady directly to Saratoga in about an hour's time. In order to make this possible the company is erecting, near the Aqueduct, and just outside of the northerly city limits of Schenectady, a double-track steel bridge, having a total length of 1,769.53 ft. This is being built by the American Bridge Company, and is of the riveted lattice truss type, resting on ten concrete and masonry piers. This bridge will be 45 ft. above low water.



LINE CONSTRUCTION FOR DOUBLE-TRACK, WITH POLE AT ONE SIDE—BRIDGE CROSSING MOHAWK RIVER

TERMINAL STATION

The company has made the necessary plans for a large terminal station in the center of the city of Schenectady. In this station will be located the executive offices of the company and the offices of the various departments. The building will also contain suites of offices which will be rented. This terminal station will have a commodious waiting room. The interurban cars, as well as some of the city local cars, will loop around this office building, thus enabling the Albany, Troy, Saratoga, Amsterdam, Johnstown and Gloversville passengers to be conveniently transferred to the cars desired. This terminal station will be the first of its kind erected in any of the Eastern cities.

ROLLING STOCK

The rolling stock of the company is of the most modern type, equipped throughout with electrical apparatus manufactured by

the General Electric Company. A brief description follows:

CITY CARS

29 single-truck closed cars equipped with two G. E.-67 motors.
8 single-truck closed cars equipped with two G. E.-57 motors.
4 double-truck closed duplex cars equipped with G. E.-52 motors.
6 eight-bench and twelve nine-bench single-truck open cars, equipped with G. E-67 motors.
12 thirteen-bench double-truck open cars, equipped with G. E.-67 motors.

INTERURBAN CARS

12 40-ft. double-truck closed cars, equipped with G. E.-57 motors.
10 47-ft. double-truck closed cars, with smoking compartment, equipped with G. E.-57 and G. E.-73 motors.
6 51-ft. double-truck semi-convertible cars, equipped with G. E.-73 motors

MISCELLANEOUS EQUIPMENT

6 motor flats.
25 dump cars.
6 express cars.
3 rotary snow plows.
3 small snow plows.
1 sprinkling car.
1 sand car.

The cars owned by the company were furnished by the St. Louis, Brill, Stephenson, Laconia and Jones car companies.



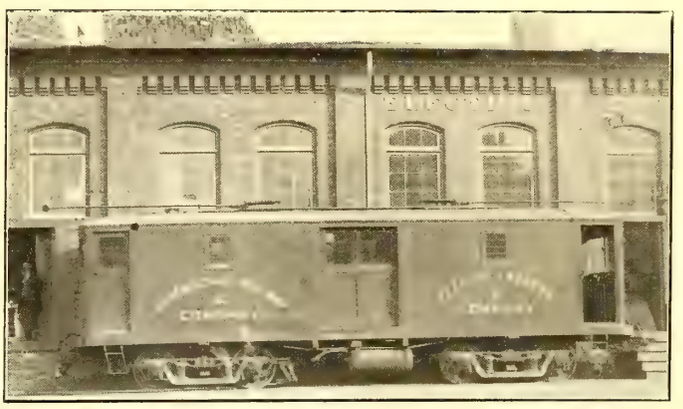
SINGLE-TRUCK CITY CAR



DUPLEX CONVERTIBLE CAR



CAR FOR LOCAL SERVICE ON INTERURBAN DIVISION



SPECIAL CAR FOR EXPRESS

The latest equipments are the six 51-ft. Brill semi-convertible cars. The interior of these cars is divided into two compartments, separated by hard-wood partitions, having single sliding doors. The smoking compartment is 11 ft. 10 ins. long, and the passenger compartment, 27 ft. 10 ins. long. Both compartments are furnished in dull mahogany, handsomely carved, and with a ceiling of bird's-eye maple with gold stripings. Seats are upholstered in leather. The platforms have enclosed round-end vestibules sheathed with steel. The trucks are equipped with four General Electric 73 motors, and the General Electric type-M system of train control is used.

All of the company's interurban cars are equipped with the Magann system of air brakes. The storage tank, capable of holding air at 250 lbs. pressure, is suspended below the car. At all car houses and sub-stations compressor outfits are arranged to supply a full charge of air in less than 1 minute. The Albany cars are fitted with the Flood emergency track shoe-brake, as it is considered necessary to take extra precaution on account of the 10 per cent grade in Albany. The shoe is pick shaped, and the wheel runs up on it and becomes locked, the track bearing onto the lower side of the pick. The brake is operated by a hand lever. A view of a truck equipped with this brake is shown.

All cars on the Troy division carry mail boxes on the front end, and if they desire to do so people along the route may stop cars to mail letters.

TRACK AND LINE CONSTRUCTION

All interurban tracks are laid with 75-lb. T-rails, thoroughly ballasted with either gravel or broken stone 1 ft. under the ties, and filled up even with the base of rail. Tracks are well trenched, and careful attention has been paid to drainage, several miles of 6-in. tile having been laid alongside and between tracks.

On the city lines 7-in. to 9-in. girder rails, Lorain Steel Company's section, are used. Section houses provided with hand cars and all necessary track tools are maintained at several points on the interurban lines, and the tracks are carefully inspected daily. Warning signals are provided at all danger points and clusters of lights mark these spots at night.

All stations or stops along the lines are given numbers in consecutive order, which are announced by the conductor, thus making it impossible for passengers to become confused as to their whereabouts either by day or night.

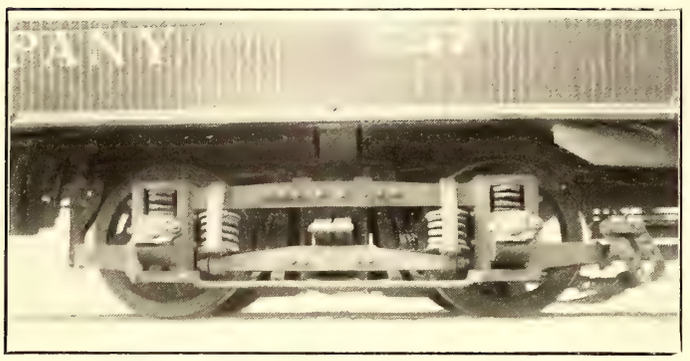
The overhead work on the present system is all span construction, with 35-ft. and 40-ft. chestnut poles set 100 ft. apart. Center pole, double-bracket construction has been installed on the Ballston division, 35-ft. octagonal yellow pine poles embedded in concrete being used. The tracks on the latter division are on 13-ft. centers and the roadbed is graded 29 ft.

The trolley wire on interurban lines is 0000 grooved, and on city lines 000 grooved.

There are several bridges on the system. At the Scotia crossing of the Mohawk River the company extended the piers of the county wagon bridge and erected a superstructure of its own. The bridge consists of eight spans of pony truss type. The total length of the bridge is 773 ft., of which 396 ft. is laid with single track and 372 ft. double track, there being a siding on the bridge. On the Troy division there is a steel trestle 203 ft. long, with an average height of 16½ ft., and on the Aqueduct line there is a pony lattice bridge 103 ft. long with an average height of 26½ ft.

CAR HOUSES AND REPAIR SHOPS

The company has car houses on Fuller Street and on McClellan Street, Schenectady, the latter having been recently erected. The building is 300 ft. long by 116 ft. wide. It is of brick, with timber roof, and has eight tracks, each entrance being provided with Kinnear rolling doors. In the center four of the tracks have pits 75 ft. long, and at one side there are two tracks having pits 75 ft. long. The first mentioned pit has a brick wall through the center. One section of the building is partitioned off for a blacksmith and machine shop, 17 ft. wide by 42 ft. long.



INTERURBAN TRUCK EQUIPPED WITH EMERGENCY BRAKE

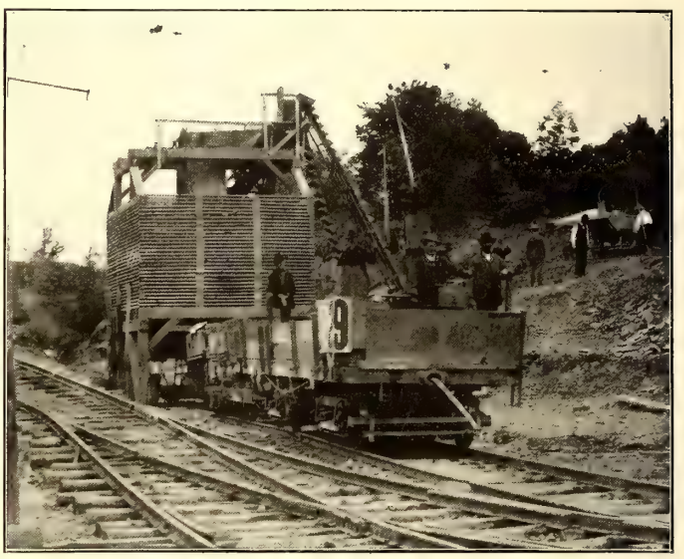


ROTARY SNOW PLOWS

One of the tracks extends through this shop. Included in the equipment of this shop is a 21-in. Barnes drill press, a Buffalo forge, a No. 3 Challenge tool grinder and a 4-ton Harrington hoist, together with all other necessary equipment for handling light repairs. The building has a wing 66 ft. long by 25 ft. wide. The front portion is used for the receiver's room. The center room is for employees, and is provided with individual lockers extending entirely around the sides of the room. Opening from this is a large toilet room. In the rear is a stock room and office for the storekeeper, with a separate room for the shop employees.

The Fuller Street lay-out includes several buildings, being the original car houses and shops of the company. One entire side is utilized for freight and express business. It is equipped with double doors and has a track at the side of the house. The other side of the house is utilized for the main repair shop. The equipment includes a 100-ton 40-in. x 9-in. Niles wheel press, a 36-in. x 16-in. Fitchburg wheel lathe, a 36-in. Niles boring mill, an 18-in. x 8-in. Reed lathe, a 21-in. Barnes drill press, a Yankee drill grinder, a 4-ft. x 4-ft. Buffalo forge, a No. 4 Challenge tool grinder, two Patten motor lifts and a 5-ton 17-ft. span Morris crane.

Plans have been completed and work will shortly start on a very complete repair shop, and when this is completed the Fuller Street shop will be used exclusively for a car house. The new building will be in three sections, the outside measurements being 201 ft. x 210 ft. 4 ins. The first section will include an armature room, machine and blacksmith shops. Adjoining it will be an erecting room which will have 300 ft. of pits. The center section will have two floors. The front is to be utilized for offices and the balance of the section will be utilized for storerooms. The first floor has a steam road track running through it. In front there is a team entrance provided with a platform scale. In the rear will be a large storeyard for rails, ties, special work and other large material. The third portion of the building will have three tracks and will be divided in the center, the front being for the paint shop and the rear for carpenter shop. In addition to the machinery already owned, which will be centralized here, the company will purchase two 15-ton hand-operated cranes, a power rail bender, a motor flat car equipped with an electrically-driven crane of 5 tons capacity, shapers, planers, boring mills and other machine shop equipment. The pits will be open, provided with concrete piers, and will have tracks provided with hydraulic jacks.



HAULING MATERIAL FOR ROAD CONSTRUCTION

In Schenectady the company has a well-equipped emergency house, with tower wagons provided also with hose crossings, tools and wire. The house is arranged similar to a fire engine house and is connected with the fire department alarm system. The wagons respond to calls in all districts covered by the lighting and railway system. Four men are in constant attendance.

FREIGHT AND EXPRESS

The freight and express business of the company is very extensive. It is practically all through business between Albany and Schenectady. It is expected that arrangements will soon be made for a similar service on the Troy and other divisions. The freight and express business is conducted by the Electric Express Company, which maintains a distinct organization. Freight stations have been established in both Schenectady and Albany, the latter being in connection with

the station of the United Traction Company. The business is divided into three classes. Class A, provides wagon service at both ends, handled at 30 cents per cwt.; Class B, goods which are not handled at either end, 10 cents per cwt.; Class C, goods which require wagón service at only one end, 15 cents per cwt.



SCENE IN THE FREIGHT STATION

The company maintains three double and three single teams in Schenectady, and one double team and two singles in Albany. The cars make four round trips per day, and have a running time between cities of an hour and fifteen minutes. The cars are equipped so that they may be run two or more together in multiple unit. The electric road handles no free baggage. The express company calls for trunks in either city and delivers them in the other at 40 cents each. There was formerly a large amount of trucking between the two cities, but the electric line has wholly done away with this practice. About four-fifths of the business is made up of incoming goods purchased by Schenectady merchants. Recent figures on freight business are shown herewith:

May, 1,272,173 lbs., incoming; 366,587 lbs., outgoing. June, 1,431,444 lbs., incoming; 315,901 lbs., outgoing.

ADVERTISING

The company handles is own advertising, the patronage being largely local, and a charge of $7.50 per car per month is made.

DISCIPLINE

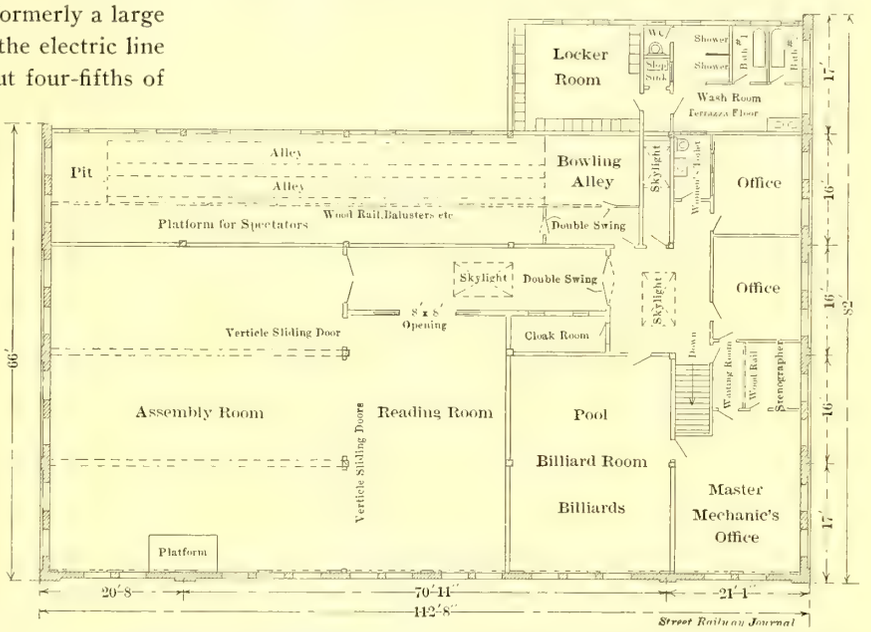
The company is extremely liberal in its treatment of its employees. Promotion is by order of seniority. The men start extra on the city cars and are moved up to regular cars, extra on local interurban cars, and finally to regular on a limited interurban car. The schedule of wages paid is as follows: City lines, 18 cents for the first three months and 20 cents thereafter; interurban lines, 22½ cents for the first year; 23 cents for the second year; 23½ cents for the third year; 24 cents for the fourth year, and 25 cents for the fifth year. All men are allowed ten days vacation with full pay after one year's service. The superintendent keeps a card index system, and a record of each man is kept in a filing case, together with application, medical examination and reports relative to his work. There are three ways of action in case of infraction of rules. First, by inspector; second, by letter; third, by a call before the superintendent. The latter action is seldom taken. The first failure to report on time calls for a suspension of two days. If repeated again within six months a suspension of five days; the third time within six months the offender is called before the superintendent for trial.

BENEFIT ASSOCIATION

A second story has been recently added to the Fuller Street car house and fitted up with an unusually complete club room for the employees. The four front rooms are utilized for the office of the master mechanic, the company's physician, the express manager and office of the benefit association. The club rooms include a billiard and pool room, a locker room, wash room with bath tubs and shower baths, two bowling alleys with platform for spectators, a reading room and an assembly room with platform and stage. The partitions between the assembly room and reading room are vertical sliding doors, so that the rooms can be thrown together for large assemblies. The dues of the association are 50 cents a month, which is deducted from the pay of the men each month. The constitution provides that if the fund is not sufficient to meet the obligations the board of trustees shall have the right to assess each member not to exceed an additional 50 cents a month. Disability by reason of accident or sickness insures the member an income of $1.00 per day for a period not to exceed ninety days. The death of a member provides an insurance of $150. The management of the association is vested in a chairman and six members. The chairman is always an officer of the Schenectady Railway Company, who appoints three members of the board of trustees, the other three being elected by a majority vote of the men.

PLEASURE TRAFFIC

The company has purchased a large tract of land at the east end of Ballston Lake on the new branch, and is planning a very elaborate summer park. There will be a large casino, dance hall, pavilion, toboggan slide, merry-go-round, baseball park, trotting track and numerous other up-to-date features.



OFFICES AND ASSOCIATION ROOMS, FISHER STREET CAR HOUSES

The company now operates Brandywine Park, Schenectady, which is let out to picnics. It contains a pavilion, refreshment stands and other buildings.

A very remunerative departure is the outing feature, advertised as "Twilight Trolley Tours." Special cars leave the city station each evening and run for 12 miles and return over one of the interurban divisions. The cars are decorated with colered incandescent lights, and have a shield, star or crescent on the front dash. These ornaments are wired with a single

terminal, and the cars are used in regular service during the day. A charge of 25 cents is made for the ride, and the load is limited to the seating capacity of the thirteen-bench open cars.

LIGHTING DEPARTMENT

In addition to the express company the Schenectady Railway Company also operates the lighting and gas companies. The installed load of the lighting company amounts to an equivalent

The distributing system in the center of the city will be mainly underground, ducts being laid for this purpose and the cable now being in process of installation.

The system consists of 60-cycle, single-phase, 2300-volt primaries, with manholes and subway transformers and a system of three-wire secondary mains. The outlying portions of the city will be fed by means of underground cables through the business part, then changing to overhead feeders. The

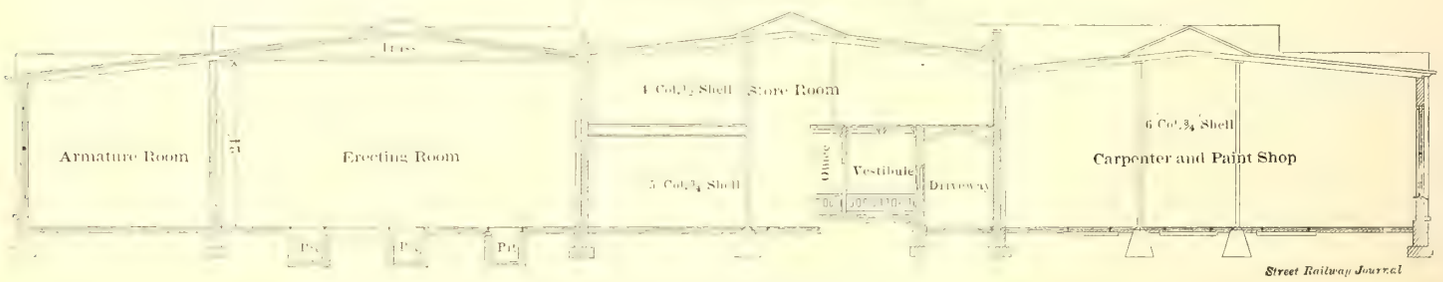


MAIN CAR HOUSE

of about 84,000 16-cp lamps, while the meters for measuring this current number 4556. While a great deal of the lighting is used for stores and signs, yet over 50 per cent of the light is used for domestic purposes. This fact and the great number of meters installed in proportion to the population is one of the features of the lighting system. The lighting company also furnishes the power for lighting the street lamps of the city, the series alternating-tub transformer system, with inclosed arc lamps being used. Current is obtained from Spier's Falls,

system of three-wire secondaries and banded transformers is used wherever convenient, individual transformers only being used in isolated cases.

A contract has just been obtained from the city of Schenectady for furnishing apparatus (pumps, motors, etc.) and power for pumping water used for public purposes. This plant will consist of vertical high-head turbine centrifugal pumps of a capacity of 12,000,000 gals. daily, direct-connected to 800-hp, 40-cycle induction motors. This will be one of the first installa-



CROSS-SECTION OF MACHINE SHOP

Mechanicville, and the General Electric Company in a similar manner to the railway current, and is supplied to the Dock Street sub-station, Schenectady. The apparatus consists at present of motor-generator sets and of static transformers. Owing to lack of capacity three of the feeders are run on 40 cycles, but the intention is ultimately, when the new Dock Street station is completed, to furnish 60 cycles throughout. The new Dock Street station will contain three 500-kw and three 250-kw motor-generator sets, and will be a model in every respect, using the most up-to-date switching and other apparatus.

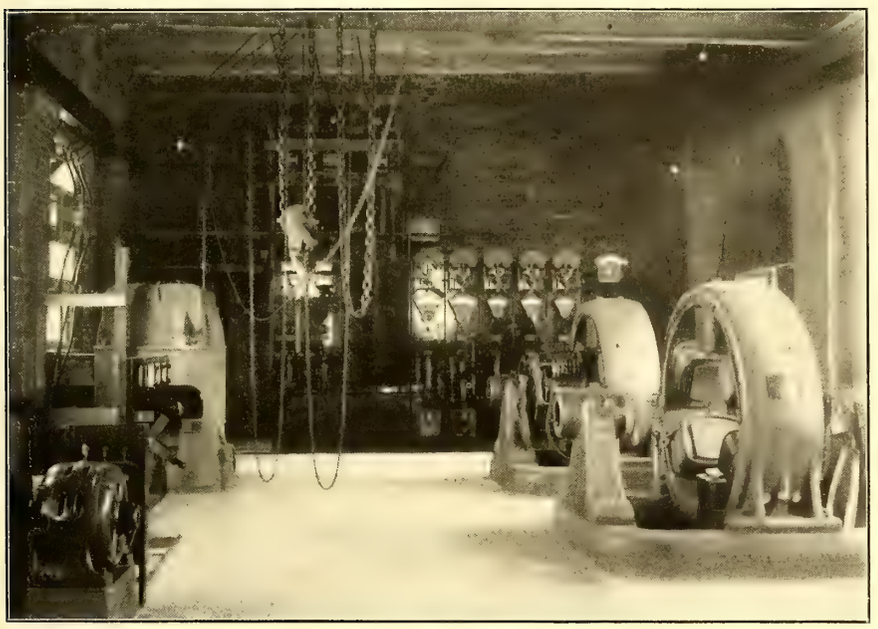
tions of its kind in the world, and will be unique in type, and it is proposed to make it a model.

GAS LIGHTING

The recent purchase of the Mohawk Gas Company has added another link to the company's properties. Extensive plans have been made to rebuild and add to the local plant, some of the work having been already completed. The maximum capacity of the generating plant will be 1,750,000 cu. ft. The company is now serving 3500 customers, 60 per cent of them using prepayment meters. Both coal and water gas is manufactured.

POWER SUPPLY

The power used for operating the Schenectady Railway is furnished mainly by the Hudson River Water-Power Company from the large water-power plant at Mechanicsville, augmented at times by the steam plant of the General Electric Company. The power is transmitted from Mechanicsville at a voltage of 10,000 and a frequency of 40 cycles over two entirely different routes. One of these transmission lines crosses the country about in a straight line from Mechanicsville to the General Electric Works at Schenectady, touching Alplaus and crossing the Mohawk River at the Scioto Bridge. This is the



TROY SUB-STATION

main line, and consists of three No. 3 O. B. & S. bare copper wires mounted on double petticoat porcelain insulators. The power transmitted over this line is used to supply the wants of both the General Electric Company and the Schenectady Railway Company. The power used by the railway company in the Dock Street sub-station is delivered by two No. 1 B. & S. three-conductor cables, one being used exclusively for the railway load and the other for lighting the city, the current being transformed to 2300 volts for this purpose.

The second transmission line starting from Mechanicsville passes along the canal through Watervliet, where it turns, and following the line of the Schenectady Railway Company's Troy division tracks, enters the Troy sub-station of the company located at Lathams Corners. From here three No. 2 B. & S. wires follow across country to the Albany sub-station of the Schenectady Railway Company, located at Karner, on the line of the company's Albany division. Duplicate lines then follow the tracks located on the Albany-Schenectady turnpike into Schenectady, to the General Electric Works, thus making almost a circle from Mechanicsville around through the sub-stations and the General Electric Works back to Mechanicsville. When the new Dock Street sub-station is completed these transmission lines will be changed somewhat. The lines from the Albany sub-station will be rebuilt to consist of duplicate aerial lines of No. 1 B. & S. bare copper from Albany sub-station to the city limits. The current will then pass underground through duplicate paper-insulated cables, each consisting of three No. 1 B. & S. stranded wires, made into a cable, to the new Dock Street station, instead of going direct to the General Electric Works. The connection between the new Dock Street station and the General Electric power house will be by three 3-conductor 3-O B. & S. cables, placed in duct in the street. The line from the General Electric Works to Mechanicsville will remain unchanged.

The Hudson River Water-Power Company will furnish power from another source, i. e., Spier Falls, situated approximately 40 miles from Schenectady, over a transmission line direct to the power house of the General Electric Company. The voltage of this line will eventually be 30,000.

Another steam source for supplying power to the railway company, besides the present power house of the General Electric Company, will be the large steam turbine station now being built by the General Electric Company, which will contain at present three 1500-kw Curtis steam turbine sets, and will use Stirling boilers and electric auxiliaries. The station is designed, however, for a much larger capacity.

DOCK STREET POWER HOUSE

The old power house on Dock Street is a one-story building, having a frontage on Dock Street of 74 ft., and extending 119 ft. toward the tracks of the New York Central Railroad

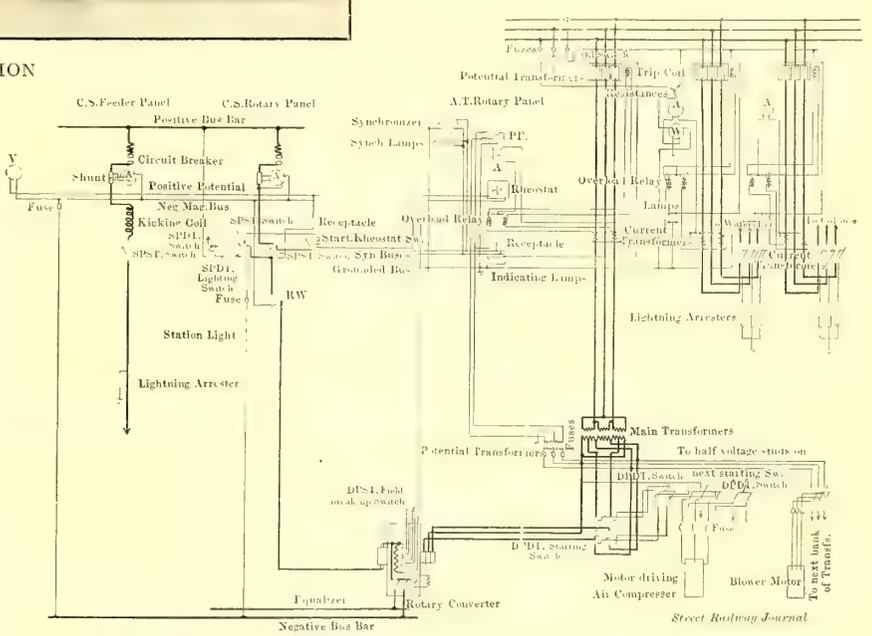


DIAGRAM OF WIRING CONNECTIONS OF TROY SUB-STATION

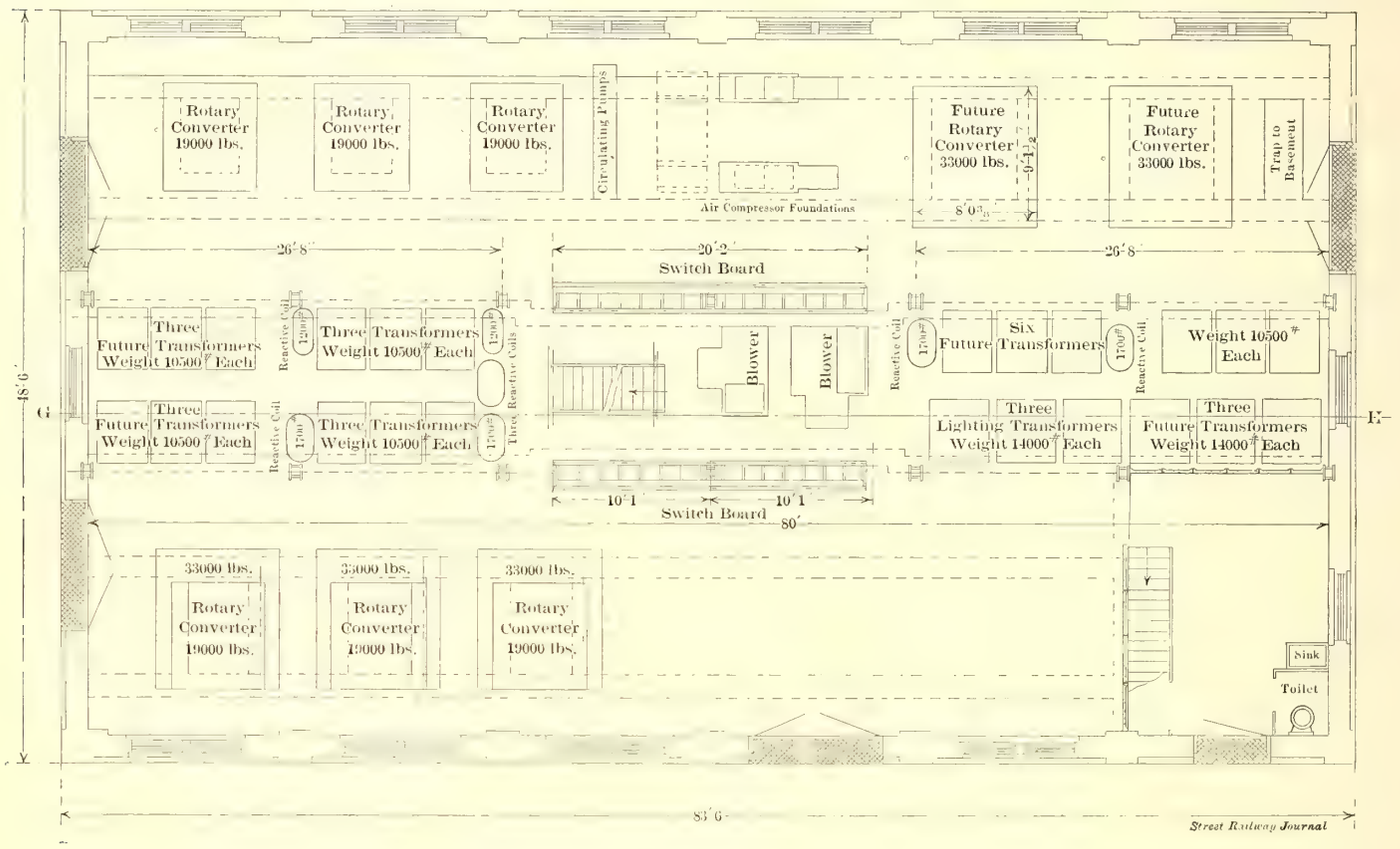
Company. The station is divided longitudinally by a party wall into a boiler room on the south side and an engine and dynamo room on the north side. The use of steam has been discontinued, although the machinery has not been dismantled. The boiler room contains one Stirling and three Babcock & Wilcox boilers, aggregating about 1030 hp, while the engine equipment consists of one Erie simple and two vertical Westinghouse compound; one Ball & Wood having been sold recently. The railway machinery at present operating in the station consists of three rotary converters, made by the General Electric Company, each of 300-kw capacity and 760 r. p. m. There is also one 200-kw, 800 r. p. m. compound-wound General Electric rotary converter. The 10,000-volt, 40-cycle, three-

phase current from Mechanicsville is fed into the three 300-kw rotary converters through nine static transformers of the air blast type, each of 110-kw capacity, and which transforms the voltage from 10,000 to 372.

The 200-kw rotary converter is fed through a 225-kw three-phase air blast transformer. All of these transformers are provided with additional leads connected to the middle points of the secondary windings in order that the rotary converters may be started from the alternating-current side at half voltage, thus cutting down the starting current.

The railway switchboards are of the standard General Electric type for such installations, and are of black enamelled slate, provided with the usual circuit breakers, ammeters, knife-blade switches, etc. One of the panels is provided with a total tension panels are all of the General Electric standard pattern, provided with circuit breakers, ammeters, etc.

The 10,000-volt panels are provided with single-pole oil-break switches, mounted in separate brick cells, about 10 ft. back of the panels themselves. The switches are provided with overload relays, and in the panels themselves are mounted horizontal, edgewise, black oxydized finish, ammeters, voltmeters, power factor indicators, and one round-pattern induction recording wattmeter. The bus-bars back of the panels are heavily insulated and carried on an insulated iron frame-work. All of the 10,000-volt feeders enter the station overhead and are connected with a suitable number of lightning arresters of the Wirt type. At this station there is also an air compressor for use in connection with the Magann air storage system.



PLAN OF SUB-STATION AT BALLSTON

Thomson recording wattmeter. The 10,000-volt operating switchboard is placed in a gallery above the low-tension boards, and is equipped with oil switches, ammeters, etc.

TROY SUB-STATION

The Troy sub-station of the railway company is located at the intersection of the Loudonville Road and the Troy-Schenectady Turnpike. The building is one-story and cellar, 26 ft. x 70 ft. The station is built of brick and is thoroughly fireproof in construction. The floor is of concrete with a granolithic top. The apparatus consists of three 300-kw rotary converters operating at 760 r. p. m. The transformers are of the three-phase air blast type, and are two in number, each of 330-kw capacity. Each converter is also provided with a reactive coil in the alternating-current side for the purpose of regulating the voltage. Part of the cellar is made into an air blast chamber for the transformers, while in the other part of the cellar the cable work and wiring is carried on insulators fastened to the walls and converter foundations. The switchboard is of black enamelled slate, and is made up of three direct-current feeder panels, two direct-current rotary panels, two alternating-current rotary panels and three 10,000-volt panels. The low-

This air-compressor is operated by a 20-hp induction motor belted to it.

ALBANY SUB-STATION

The Albany sub-station is a one-story frame structure with cellar, occupying a space 45 ft. sq. The lot on which it stands is 75 ft. x 100 ft. The apparatus installed in this sub-station is similar to that in the Troy sub-station.

BALLSTON SUB-STATION

This plant is in process of construction, and is intended to furnish current for the operation of the Ballston division of the railway company. The following apparatus is in process of manufacture by the General Electric Company:

Three 300-kw, 40-cycle compound-wound General Electric rotary converters running at 800 r. p. m.; three air blast 220-kw transformers, provided with double secondary windings, one blower set consisting of a 2-hp, three-phase induction motor, direct coupled to a 35-in. Buffalo forge fan; two 45-kilo-volt-ampere air blast reactive coils; one 20-hp three-phase induction motor with two pulleys for operating a Magann compressor, and the necessary switchboard panels for the above apparatus.

NEW DOCK STREET SUB-STATION

The property on which the new Dock Street sub-station is built has a frontage on Dock Street of 180 ft., while the distance on the rear next to the New York Central Railroad Company's tracks is 368 ft. The depth of the lot is 165 ft. The new sub-station is 165 ft. 8 ins. front by 45 ft. 2 ins. deep, and is of brick and steel construction, thoroughly fireproof throughout. The station is without a cellar for the reason that at times of freshets water from the Mohawk River and Erie Canal overflows, and would, in all likelihood, flood the cellar. The outside walls of the basement are faced with brown stone and the basement itself is divided off by means of brick partition walls into air blast chambers, bus-bar compartments and oil-switch cells.

On the first floor is located all of the transforming apparatus, and this floor is of steel and concrete construction, and is finished as a "terrazza" floor. The railway apparatus to be placed in this sub-station consists of two 600-kw, 600-volt, six-phase, 40-cycle rotary converters, together with two 90-kilo-volt-ampere air blast static transformers; two 300-kw, 600-volt, three-phase, 40-cycle rotary converters, and two 45-kilo-volt-ampere air blast reactive coils, and six 110-kw, 10,000-volt primary 40-cycle air blast transformers. Space has been left for a future 600-kw rotary converter.

All of the 10,000-volt bus-bars, etc., are placed in the basement between brick and concrete barriers, and each phase is thoroughly insulated. The transmission and primary lines leading to the transformers are electrically operated by means of the General Electric type-H oil switches,these switches being placed in brick cells. The switchboard panels are placed on the opposite side of the station from the Form H switches, and the operating voltage is reduced by means of potential and current transformers so that at the switchboard panels it will not be greater than 150 volts. The current for operating the Form H switches is furnished by means of a storage battery, built by the Electric Storage Battery Company, of Philadelphia, and consists of fifty-five type E-9 cells. The 10,000-volt bus-bars are arranged so that they can be sectionalized by means of knife disconnecting switches. All of the switchboard panels are of black enamelled slate, and the instruments have the marine finish. Each of the three-phase incoming line panels has a capacity of 4000 kw at 10,000 volts, and each panel contains the following:

One horizontal edgewise ammeter, one horizontal edgewise voltmeter, one double-pull overload relay with lamp for indicating the open and closed position of the oil switches, one controlling switch for type-H oil switches, together with the necessary current and potential transformers and static dischargers.

There are two three-phase outgoing line panels with a capacity of 1500 kw at 10,000 volts, and each panel contains one horizontal edgewise ammeter, one polyphase induction recording wattmeter (railway pattern), together with relays, controlling switches, indicating lamps and current transformers and static dischargers.

Each of the three-phase rotary converter panels is equipped with a power factor indicator and horizontal edgewise ammeter and a three-phase induction recording wattmeter, together with overload relay, controlling switches for type-H oil switch, indicating lamps and secondary transformers.

The lighting of the Dock Street power house has been worked out with a view of providing against any possible failure of current. The ordinary lighting will consist of twenty-four arc lamps, placed on brackets fastened to the sides of the wall and lighted by means of current from the ordinary lighting circuits of the company. As an emergency lighting a number of incandescent lamps will be mounted on the roof girders and will be fed from the railway circuit. Should both the railway and lighting fail, arrangements have been made for placing a number of lights on the storage battery.

The station will be provided with a traveling crane having a capacity of 15 tons, and will be arranged in such a manner that the track for this crane extends outside of the building under an archway, so that teams driving under this archway may be unloaded directly by the crane.

It will be seen that the transmission and distribution system employed provides against almost every possible contingency, and practically insures the company against shut downs. When current is transmitted from Spier Falls additional protection will be afforded, and the flexibility of the system will be correspondingly increased. This combination of generating plants, supplying current at different points, insures a better distribution, and has furnished the engineers opportunity for improving the regulation as well.

It may be said that the character of the service required of the Schenectady company makes it an unusually interesting study for street railway managers, and that the results of its operation have been a revelation to experienced transportation men. This is especially true of the express and freight department, in which the facilities of the company have been overtaxed from the beginning. The method of handling this traffic most advantageously has been a subject for considerable discussion; there still seems to be difference of opinion. Local conditions, of course, have much weight in determining the most practical method. Although the company has a well-defined policy on this subject, further developments with the growth of the business will be awaited with interest. One important feature of this service is the handling of fruit and garden truck. The quickness of transit and the relative freedom from the jolting incident to hauling by teams brings small fruit to the market in good condition.

ORGANIZATION

The company maintains a very complete system of records and accounts. The general manager has constantly before him tabulated statements of all equipment and the condition, and these are brought up to date at frequent intervals. All operating expenses and receipts are figured on a basis of eighteen-hour cars per day, and each item of expense is charged to its proper account. A detailed statement for each month, together with similar statements obtained from well-known roads employing the same system, is posted for comparative purposes in the office of the general manager. The operating expense sheet for the month of May, 1903, gives the receipts per eighteen-hour car as $51.62, which is claimed to be higher than the receipts of any other similar proposition in the country. The operating expenses are given at 60.9 per cent of the gross receipts. The figures do not include the lighting business or the express business, as these are operated as separate organizations.

Officers of the company are: Hinsdill Parsons, president; E. F. Peck, general manager; James O. Carr, secretary-treasurer; J. J. Magilton, auditor and assistant treasurer; C. C. Lewis, chief engineer; F. G. Sykes, electrical engineer; C. F. Coffin, manager gas department; E. J. Ryan, manager express department; Frederic Smith, superintendent; J. H. Aitkin, purchasing agent. Directors: Hinsdill Parsons, E. F. Peck, E. W. Rice, Jr., G. E. Emmons, F. O. Blackwell, H. C. Wirt, J. R. Lovejoy, A. L. Rohrer, W. L. K. Emmett.

INDEPENDENT WATER-POWER DEVELOPMENT

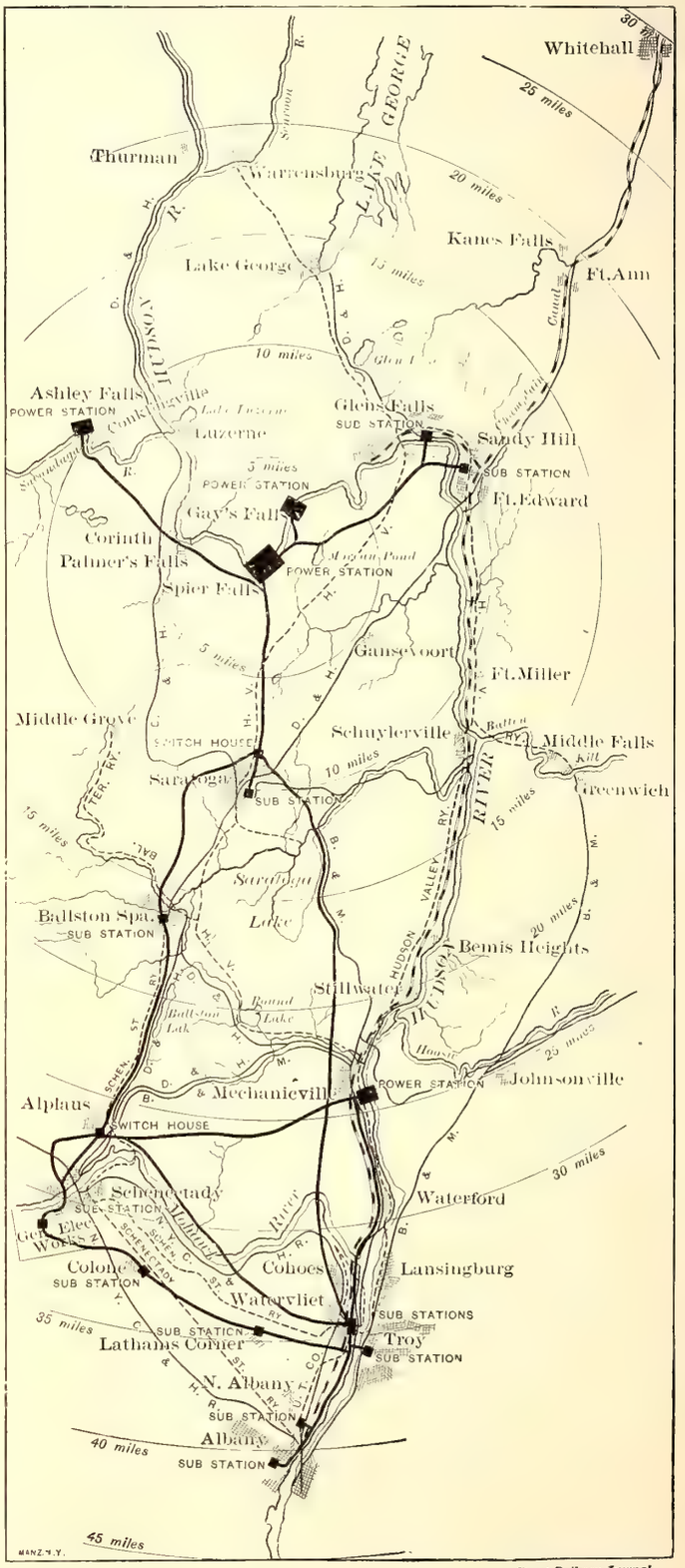
The development of water-powers in the Hudson River Valley has revolutionized the methods of power generation and transmission for several of the leading electric railway properties in Eastern New York, and plans now being worked out promise still further to displace steam plants.

Much of this development has been due to the efforts of the Hudson River Water-Power Company and its subsidiary companies, the Hudson River Electric Company and the Hudson River Power Transmission Company.

At the present time the largest water-power plant in operation in the valley is that of the Hudson River Power Transmission Company. This company was organized in 1897 to erect and maintain a dam on the Hudson at Mechanicsville, for the development of water-power, and to generate and sell electric current. The plant was completed and placed in operation in October, 1900. The station is a substantial brick and steel structure, erected at the west end of the concrete dam, which is 850 ft. in length. The installation consists of fourteen pairs of Stilwell-Bierce water-wheels, directly connected to seven 750-kw General Electric generators. There is also an auxiliary steam plant of 1250 hp, together with switchboard, transformers and other apparatus necessary for handling the current. The company's transmission lines extend to Troy, Albany and Schenectady. A large portion of the output is utilized by the General Electric Company and the Schenectady Railway Company. The company also has a long term contract with the United Traction Company of Albany, under which the latter utilizes from 3600 hp to 4000 hp, at the rate of $20 per horse-power per year. A number of manufacturing plants at various points are also supplied by Mechanicsville.

At Spier Falls, near the foot of Mount McGregor, 40 miles north of Albany, the Hudson River Electric Company will shortly place in operation a plant which will exceed in volume any similar plant in the East, and will be second only to the plants at Niagara Falls and Sault Ste. Marie. The transmission lines will be longer than any east of the Rocky Mountains. Current will be furnished for electric light, power and railway operation in Albany, Troy and Schenectady, and a number of smaller places. This system will be connected in with that of the Mechanicsville system, and all clients will thus be enabled to receive power from either or both systems. The dam is located in the Hudson, between Mount McGregor and another spur of the Adirondacks; and the river is raised 50 ft. above the old bed, and then dropped through water-wheels with a head of 80 ft. The dam is 1820 ft. long, about 100 ft. maximum height above bed rock, and contains 180,000 cubic yards of masonry. The dam extends down to bed rock the entire width of the river and is anchored at each end in the solid ledge of the mountain side. Stone laid in concrete with close joints forms the regular construction of the main dam. A large amount of excavation was necessary, and compressed air has been used extensively in the work, the tools being operated by alternating-current motors, taking current from the water-power at Mechanicsville, 23 miles south. The minimum flow of the river at Spier Falls is about 2000 cu. ft. per second, but during the flood seasons this is sometimes increased to 50,000 cu. ft. per second. This great variation between high and low water will be reduced by storage dams at several lakes near the head waters of the river. An in-take canal was formed by a dam 403 ft. long at right angles to the Saratoga end of the river section. From the intake, ten penstocks carry the water down to the power house which extends along the river bank.

The power house is a one-story brick structure, 70 ft. 10 ins. x 392 ft. inside. The house is divided lengthwise, into two rooms by a brick wall 6 ins. thick. Across the upper end of the building is the transformer and switchboard room, and the remainder is divided by the wall mentioned into generator and wheel rooms. The foundations are of concrete, and the rock is excavated under the building so as to give a depth of



MAP OF HUDSON RIVER ELECTRIC POWER TRANSMISSION SYSTEM

14 ft. of tail water. Beneath the floor of the wheel room is an opening 21 ft. 6 ins. wide, and extending the entire length. Across this opening is placed 36-in. box girders, spaced on 14 ft. centers, and between pairs of these girders the water-wheels are mounted. Water passes from the canal through ten steel tubes of 12-ft. diameter. Before entering the house these tubes

pass through a heavy masonry retaining wall that protects it from water on the side toward the canal. Each of the ten tubes connects with a wheel case that contains a pair of turbine wheels, mounted on a horizontal shaft. In eight of these tubes the turbines are rated at 5000 hp each, under a head of 80 ft., and in the other two cases the wheels are rated at 3400 hp. The larger wheels are direct-connected by shaft extending through into the generator rooms to generators rated at 2500 kw, while the smaller wheels will drive 2000-kw generators. The generators are of the revolving field type, three phases, 40-cycle, and built by the General Electric Company. They are capable of sustaining 25 per cent overload indefinitely, and an efficiency of 95 per cent at full load is guaranteed. The water-wheels were manufactured by the S. Morgan Smith Company, of York, Pa., and the Swain Manufacturing Company, of Lowell, Mass. Each pair of wheels is governed by Lombard and Sturgiss governors, belted to the shaft. To each of the two cases containing the 3400-hp wheels there is connected a small wheel case, whose turbines drive two 125-volt, 150-kw exciters for the main generators.

From the foregoing, it may be stated that the total capacity of the water-wheels is 46,000 hp, and the total capacity of the main generators 24,000 kw or 32,000 hp. Cables are led from the generators to a room beneath the switchboard end of the building. In this room is the low-potential switchboard equipped with standard apparatus and the bus-bars. From this room the lines run to an air-tight chamber, under the transformers.

There are thirty 833-kw and seven 607-kw General Electric air-cooled transformers. The three-phase, 40-cycle current generated is raised to a pressure of 26,500 volts by the transformers. To the rear of the transformers are the high potential, transformer, selector and bus sectionalizing switches, and the line oil switches. Along the river side of the building is the operating board, containing meters for each machine, and the feeder lines. There are also auxiliary switches operating the switches on the low-tension board, and in the high potential chamber. There are also switches on pedestals, adjoining each machine, so that any machine may be cut in or out independent of the others. Included in the layout is a carpenter shop, a boiler house containing boilers for steam heating and for thawing-out purposes; a machine shop for light repairing, and a general storehouse and an office building.

The transmission lines consist of five circuits designed for 30,000 volts, the voltage for the house being 26,500 volts. The lines are of 000 bare wire, strung on heavy porcelain insulators, placed equalaterally on locust cross-arms. The poles are of chestnut and spaced 90 ft. apart, each line consisting of two circuits. These lines transmit to sub-stations located at Glens Falls, Fort Edward, Saratoga, Ballston, Schenectady and Watervliet; all of these stations are under construction. In Saratoga and Ballston the company has lighting franchises and the stations are to be equipped with both lighting and railway apparatus.

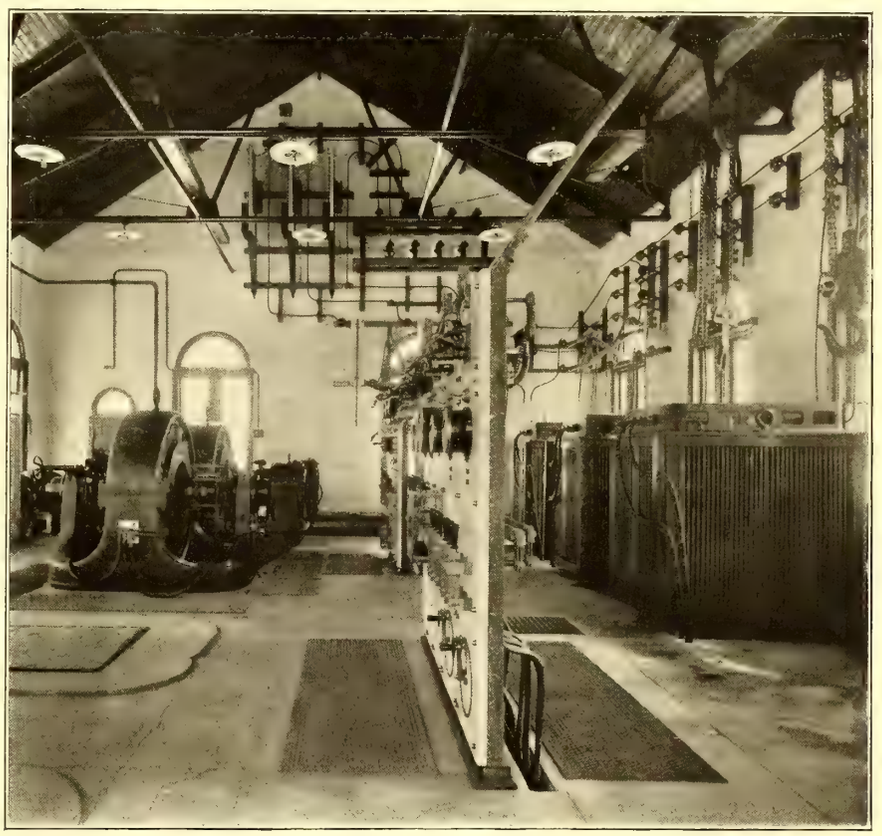
The development of this water power cannot but have a most stimulating effect on the industries of this region.

THE UTICA & MOHAWK VALLEY RAILWAY

The Utica & Mohawk Valley Railway Company, which, although not connected directly with the systems reaching Saratoga, may be classified very properly as belonging to that region, presents some unique features in its power equipment that are worthy of note from an engineering point of view.

The system comprises 87.8 miles of track, 94 motor cars, and 61 other cars, besides the power and sub-station equipment which is here described. The company will own and operate practically the entire street railway systems of Utica, Rome, Little Falls, Herkimer, Mohawk, Ilion, Frankfort, Clinton, New Hartford, Deerfield, Oriskany and Whitestown. Numerous extensions are now in progress.

Power is obtained from the Utica Gas & Electric Company, and is delivered in Utica over that company's 20,000-volt, 60-cycle, three-phase transmission line. Part of the power is



FRANKFORT SUB-STATION

utilized in Utica through rotary converters, and the balance is transmitted to the Frankfort and Little Falls sub-stations, eleven and twenty-one miles to the east, respectively, and to the Oriskany sub-stations, twelve miles to the west.

The Utica sub-station was designed originally for three 500-kw rotary converters, and the other sub-stations for three 300-kw outfits, but as the first instalment comprised only eight 300-kw machines, these were distributed among the stations then ready: Four in Utica, two in Oriskany and two in Frankfort. The Little Falls station was not in operation at that time, but has recently been equipped with two 300-kw converters, one being new and the other one taken from Utica, where it was replaced by a new 500-kw machine. All of the 300-kw rotaries in the Utica sub-station will eventually be displaced by 500-kw units, and will be removed to the other sub-stations.

The Utica sub-station is equipped with three Westinghouse 550-kw oil-insulated, self-cooling transformers connected in delta, receiving the 20,000-volt, three-phase current and re-

ducing it to 360 volts for use on the Westinghouse rotary converters, delivering direct current at approximately 600 volts. The wiring is so arranged that in case of trouble any transformer can be disconnected in a moment and the rotaries operated on the remaining two transformers connected in V.

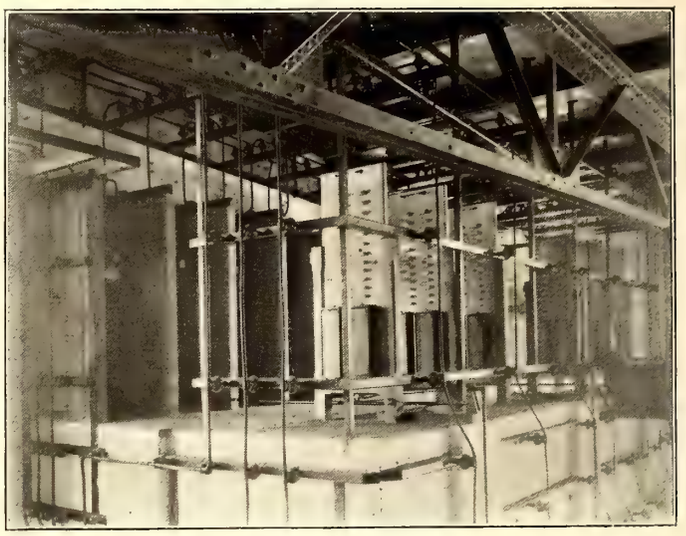
The rotaries operate from a common set of bus-bars, both alternating current and direct current, and have no choke coils or inductance in the alternating-current leads other than that coming from ordinary wiring, which in this case is practically negligible. The rotaries carry their loads under these conditions without sparking and with no shifting of load from one machine to the others, the division being equal over all ranges.

The switchboard is made up of the usual alternating-current and direct-current rotary converter panels, alternating-current load panel and direct-current feeder panels. The alternating-current panels are mounted by themselves, and the direct-current panels form a separate switchboard. The boards are of blue Vermont marble and are equipped with the latest types of Westinghouse instruments, switches and circuit breakers.

The Frankfort, Little Falls and Oriskany sub-stations each have the same equipment of transformers, consisting of three 330-kw oil-insulated, self-cooling units. The general arrangement of these stations is the same as that of the Utica sub-station, except in the matter of switchboards. These differ in that the feeder panels are placed on the left of the direct-current rotary converter panels. This arrangement permits of as many alternating-current and direct-current rotary converter panels and direct-current feeder panels as may be desired without disturbing in any way those already installed.

All the stations are protected by Westinghouse low equivalent lightning arresters and static interrupters, and although the lightning has been exceptionally severe during the last season, no difficulty has been experienced in any of the stations of the railway company due to this cause.

Stick type circuit breakers or fuse switches are placed in the 20,000-volt lines as they enter each sub-station. They have proved very effective in cases of short circuit, either on the lines or in the stations.



LIGHTNING ARRESTERS

The entire equipment of all the substations was furnished by the Westinghouse Electric & Manufacturing Company, and was installed under its supervision.

The cars operating between Rome and Little Falls, a distance of about 40 miles, are equipped with four No. 56 Westinghouse railway motors and air brakes. The smaller double-truck cars are fitted with four No. 68 railway motors.



INTERIOR MAIN STATION AT UTICA, SHOWING ROTARIES, TRANSFORMERS AND SWITCHBOARD

STANDARD PRACTICE IN CITY TRACK CONSTRUCTION

THE specifications and drawings presented in this article show the types of track construction adopted as standards for present work by fourteen of the large street railway companies of the country. These include specifications of track for down-town paved streets and for outlying streets which may be unpaved or paved with macadam or similar pavement. As a resume of the most advanced practice of the country in track construction, and as presenting methods of construction adopted as a result of the experience not only of one management, but of many, this collection of data should be of more than ordinary value. Before entering into a general description and comparison of methods, the types of construction adopted by the various companies will be specifically described. In this description the practice followed in New York and Brooklyn will not be given, as it was given in detail in the "New York number" of the STREET RAILWAY JOURNAL, published in October, 1901, but the practice of fourteen other prominent city railway companies will be described. For this information the publishers of this paper are indebted to the courtesy of the engineers of track construction and managers of the respective companies for their great courtesy in supplying the information. The publishers realize that the practice of other companies than those mentioned below contain many features which are worthy of commendation and study, but were obliged, on account of the space available, to confine themselves to the cities mentioned, which, as a whole, represent the largest systems in the country outside of New York and Brooklyn.



COMPLICATED TRACK AND SPECIAL WORK CONSTRUCTION IN NARROW STREETS IN BOSTON

UNITED RAILWAYS & ELECTRIC COMPANY, BALTIMORE

The United Railways & Electric Company, of Baltimore, considers Lorain Steel Company 107-lb. No. 333 its standard, although it is also laying some Pennsylvania Steel Company, section No. 200. These 9-in. grooved rails are for construction in paved streets. They are laid on Georgia pine ties, of dimensions 6 ins. x 8 ins. x 8 ft., spaced 2 ft. between centers. The ties are tamped up with 3 ins. of gravel. No other ballast or concrete is used. The standard distance between track centers is 10 ft., although this is reduced when necessary in narrow streets. The rails are in 60-ft. lengths, and are laid with broken or alternating joints. No tie-plates are used, but tie-rods are placed every 6 ft. Angle-bar joints have been used recently. On girder and grooved rails these are 22 ins. long with eight bolts. All joints are between ties.

For macadamized roads this company's standard rail is Pennsylvania Steel Company No. 200. For exposed T-rail it formerly used Pennsylvania section No. 7, but within the last year has adopted A. S. C. E. standard 60-lb. T-rail. This T-rail is spiked to hewn chestnut ties 6 ins. thick, with a face of from 6 ins. to 12 ins. These ties are 8 ft. long, placed 2 ft. between centers. The ballast is 4 ins. deep under the ties, and is filled in between the ties to the base of the rail, sloping off to the roadbed 18 ins. outside of the ends of the ties. The rails are in 30-ft. lengths, laid with broken joints and no tie-plates.

The standard bond for city streets is a tinned No. 0 copper bond wire, fastened to the rail with channel pins. Some of the heavy bonding is done with No. 0000 wire. The standard bonding on exposed T-rail on suburban lines is No. 0 tinned copper wire, fastened with channel pins.

BOSTON ELEVATED RAILWAY COMPANY

The rail used in Boston paved streets is somewhat in the nature of a compromise between a girder and a grooved rail. It has a groove, but the lip of the groove, as seen by the accompanying section, is ½ in. lower than the head of the rail. The groove is of a form which will not retain dirt, but offers considerable inducement to vehicle wheels to follow the rail.

Several sections of track construction used in Boston are illustrated. For track construction in paved streets, if the

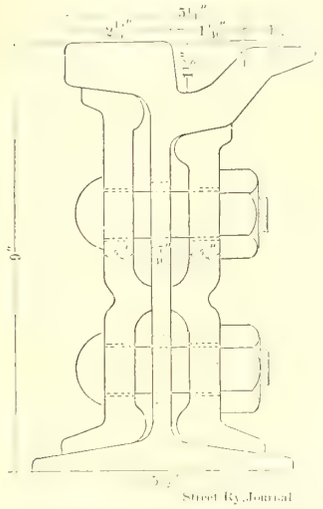
pavement of the entire street is laid on a concrete base, the ties, which are 6 ins. x 8 ins. x 6½ ft., are bedded for their entire length in concrete, and the concrete is carried down to the bottom of the ties and throughly tamped under the base of the rail between ties. If the pavement is not laid on concrete the ties are bedded and tamped in gravel. The gravel is brought up to the top of the ties, and granite blocks are used for paving, except on reservations, where tracks are filled in with loam within 1 in. of the top of the rail. The ties are placed 2 ft. 6 ins. between centers.

It has been the custom heretofore to break joints in laying track; but it has recently been decided that there is no marked advantage in such construction. The joints are now laid opposite. Tie-plates are omitted in all paving in brick or asphalt on a concrete base. Where the paving is granite a cast-iron tie-plate about 1½ ins. in thickness is used, so that the height from the tie to the top of the rail is about 10 ins. No concrete is placed under the ties, as it has not been found any advantage. The track construction is securely bonded to the rest of the street by the fact that the tie is bedded in the concrete and the rail rest upon the concrete. If there is any settling of the street the track, of course, goes with it; but this would occur in any event, even if there were concrete under the tie. The joints are angle-bar joints, having twelve bolts. The

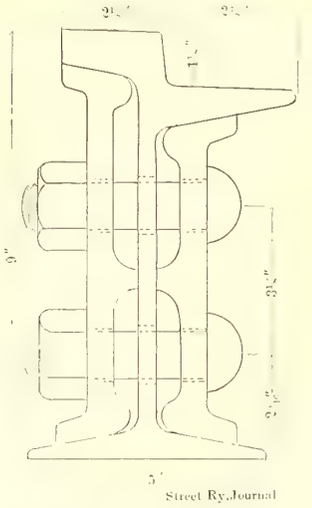
RAIL COMPOSITION SPECIFIED IN BOSTON

	Per Cent	Per Cent
Carbon	.50	.60
Manganese	.80	1.00
Sulphur, not to exceed		.08
Phosphorus, not to exceed.		.08
Silicon	.10	.15

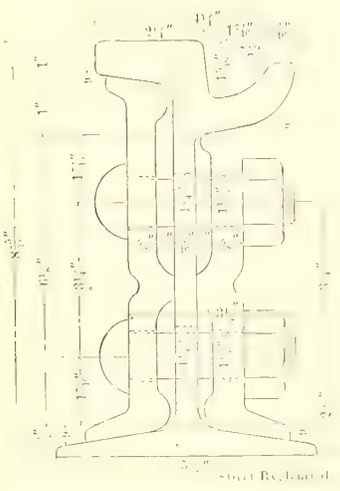
Rails having carbon below .50 per cent will be rejected.
Rails having carbon above .62 per cent will be rejected.
Steel for rails made by Bessemer process.



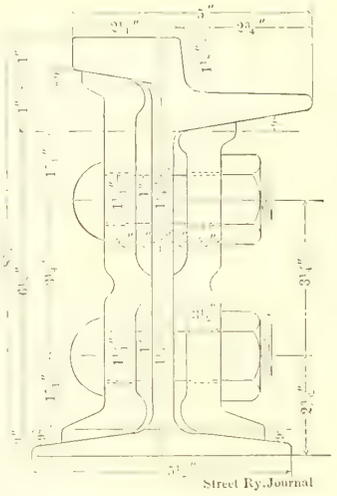
STANDARD GROOVED RAIL IN BALTIMORE



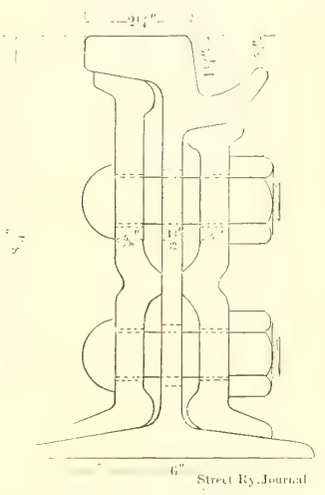
STANDARD GIRDER RAIL IN BALTIMORE



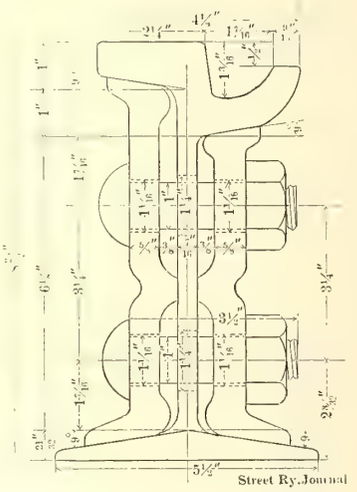
STANDARD GROOVED RAIL IN BOSTON



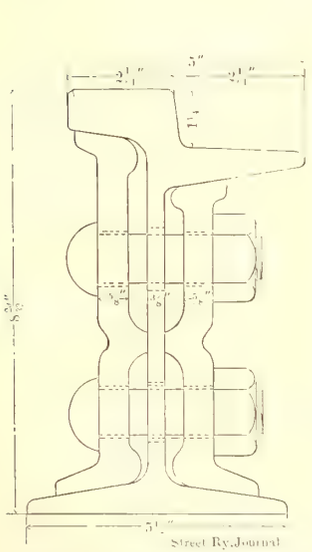
STANDARD GIRDER RAIL IN BOSTON



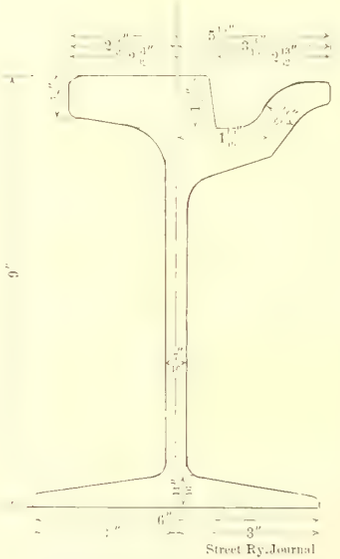
STANDARD GROOVED RAIL IN BUFFALO



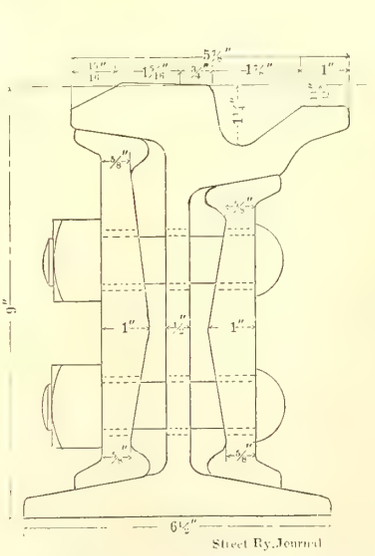
STNDARD GROOVED RAIL IN CLEVELAND



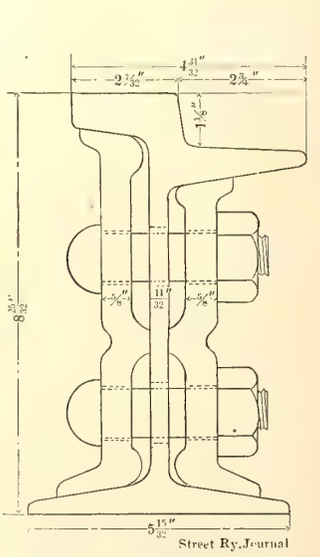
STANDARD GIRDER RAIL IN CHICAGO



STANDARD RAIL RECOMMENDED FOR CHICAGO



STANDARD GROOVED RAIL IN PHILADELPHIA



STANDARD GIRDER RAIL IN PITTSBURG

form of construction used in outlying streets where a reservation has been made alongside the roadway, so there is no paving, is to lay a 7-in. T-rail, Pennsylvania section, No. 206. The object of the deep T-rail is to give a depth of 8 ins. of loam over the ties for raising grass. The composition of rails is specified in the table on the opposite page.

Most of the recent bonding has been with protected rail-bonds. The company is now experimenting with soldered bonds.

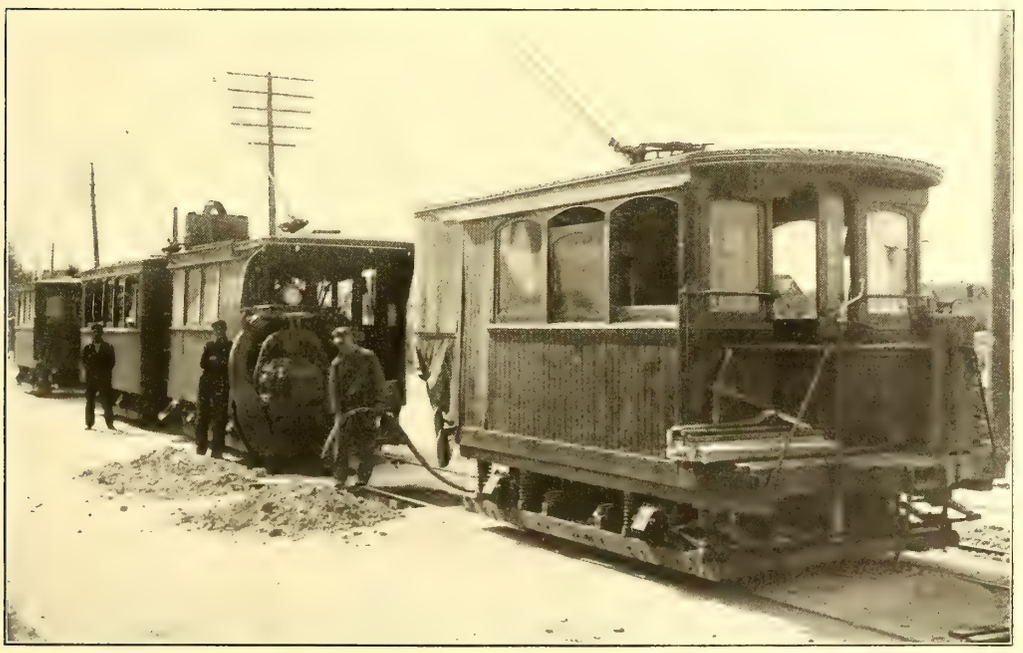
The company finds that the life of untreated ties is from four to five years in loamed reservations, and twenty years or longer under pavement.

BUFFALO RAILWAY COMPANY

The Buffalo Railway Company has an unusually high percentage of new and standard track construction. In paved streets a 94-lb. section, No. 313, of the Lorain Steel Company is the standard. This is a rail with rather narrow groove, with the lip of the groove 5/8 in. below the head of the rail. The track construction of this company is notable because of the fact that electrically welded joints are its standard.

Two forms of track construction are employed, both of which depend mainly on concrete to support the rails. Where granite block paving is permitted the full width of double track, including devil strip, the track is supported on a solid bed of concrete extending about 8 ins. below the base of the rail.

The track is held to gage and partially supported by ties placed every 5 ft. Every other tie is of metal, the others being of wood. In places where asphalt paving is laid in the devil strip the concrete beam form of construction is employed. A wedge-shaped beam of concrete, 18 ins. wide at the top and 8 ins. deep, is laid under each rail. Ties are placed every 5 ft.



SAND BLAST CAR AND ELECTRIC TRACK JOINT WELDING APPARATUS IN BUFFALO

Concrete is tamped under every other tie at the time the concrete stringers are laid. The remaining ties support the track during construction when the concrete is being laid, and are laid on tamped stone. The paving in this case between the rails is supported simply on sand foundation except where it is above the ties. Both forms are illustrated on the following page.

For suburban or outlying streets a 9-in. girder rail has been extensively employed for paved streets. In macadam and dirt roads a 6-in. Shanghai T-rail, weighing 72 lbs. per yard, is used. If the track is exposed A. S. C. E. standard T-rail is laid. The spacing of ties on suburban work is 2 ft. between centers. The ties are white oak, 6 ins. x 9 ins. x 8 ft. They



ELECTRICALLY WELDING RAIL JOINTS IN BUFFALO

are laid on broken stone ballast 8 ins. deep. No tie-plates are used, but rail braces are used on the outside of each rail and on curves.

The composition of rail specified is:

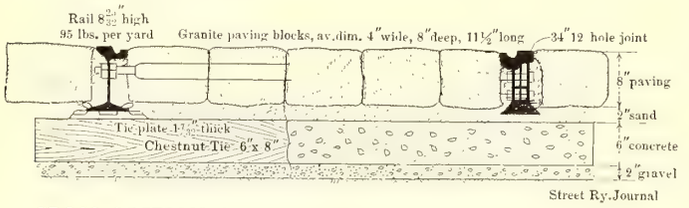
	Per Cent	Per Cent
Carbon	.43	.53
Phosphorus, not to exceed.		.10
Silicon, not to exceed		.20
Manganese	.80	1.10

Bonding is unnecessary on the electrically-welded track, as the conductivity of the joint is so high and the percentage of breakages so low. As special work at frogs and crossings is not electrically welded to the balance of the track it is bonded with bonds having electrically-welded terminals. On suburban work bonds of the protected type applied with a screw compressor are used.

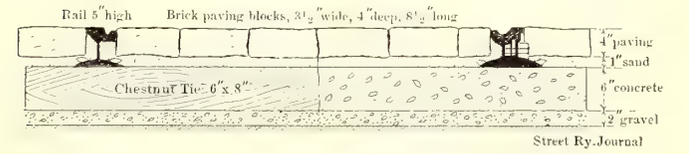
As the introduction of a successful electrically-welded track practically makes the life of a rail limited only by the wear of the head, some calculations have been made at Buffalo as to the probable wear of rails. On some track ordinarily having cars on 2-minute headway (but during the Pan-American Exposition having cars on 30-second headway) the wear has been found to be 1/8 in. in four years.

The company now has over 100 miles of electrically-welded track. The electric welding process, as carried on at Buffalo when begun in 1899, was notable as being the first application on a large scale of a successful method of electrically welding rail-joints, although the first experiments with this particular

method were made at Johnstown in 1897. Track construction in Buffalo stands alone to-day as an example of the most extensive application of electrically-welded rail-joints. The joint



CROSS SECTION OF STANDARD 9-IN. TRACK IN BOSTON

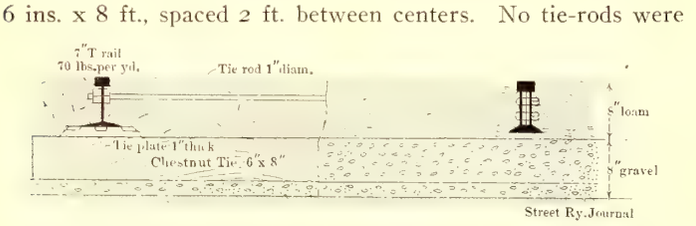


CROSS SECTION OF STANDARD TRACK WITH 5-IN. RAIL IN BOSTON

plates are welded to the web of the rail by means of bosses on the plates, which limit the area of the welding to the area of the bosses, and so insure a high temperature at the point of welding. There is one boss directly at the joint between the rails, and in addition a boss at each end of the joint plate. The center bosses are welded first and those at the ends afterwards. In the welding five cars are employed. One of these is the welding car proper, which carries the welding clamps and welding transformers. The second carries a rotary converter, which receives direct current from the trolley and supplies alternating current to the welding transformer. The third car has a motor-driven booster for raising the trolley voltage whenever the drop is so great that there is danger that a successful weld will not be made. The fourth car is a sand-blast car, which cleans the rails before welding. The fifth car carries a motor with emery wheels for grinding off any inequalities in the joint after it is completed. The number of breakages in the electrically welded track in Buffalo has been very small. In fact, on recent work the breakage is so small as to be hardly worth mentioning, being but a very small fraction of 1 per cent. The details of the electric welding process were given in the Street Railway Journal of June, 1899, and September, 1899.

CHICAGO CITY RAILWAY COMPANY

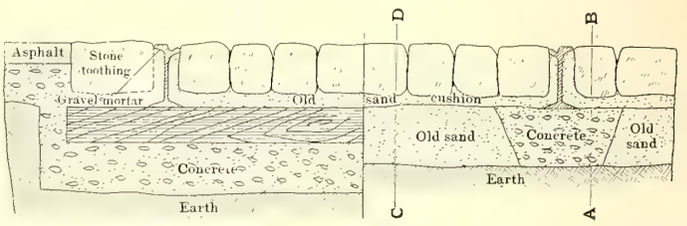
The Chicago City Railway Company on the last track laid employed a 9-in. girder rail with wide tram for vehicle wheels. This rail weighed 95 lbs. to the yard, being Lorain Steel Company's section 297. These were laid on white oak ties, 6 ins. x 6 ins. x 8 ft., spaced 2 ft. between centers. No tie-rods were



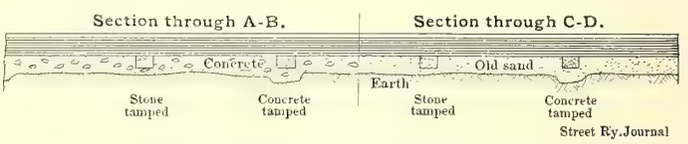
STANDARD SECTION OF TRACK WITH T-RAIL IN RESERVATIONS IN BOSTON

used, but malleable cast-iron tie-plates with braces hold the track to gage. The ties rest on sand. The joints are cast welded. This was the company's standard construction until recently. It is possible that in the future in paved streets this company will use concrete stringer construction without ties, but at present writing this is uncertain, since the matter of the extension of the company's franchises is now under consideration and is not settled. It is in order to mention in this connection that the report of Bion J. Arnold, as expert for the city of Chicago, to investigate the transportation problem of Chicago, recommended that in well-paved and clean streets a grooved rail of the form shown on page 330 be adopted as the standard. This rail would be, to a large extent, self-cleaning. The object of the bevel on the head is to allow dirt to slide off the head of the rail.

As to bonding, a good cast-welded joint is considered by this company sufficient to furnish electrical conductivity, but a copper supplementary wire is run, since there is a city ordinance requiring it. For getting around special work Crown bonds are used. Although no very accurate figures are avail-



CROSS SECTION OF TRACK ON CONCRETE BEAMS WITH WOOD TIES IN BUFFFALO

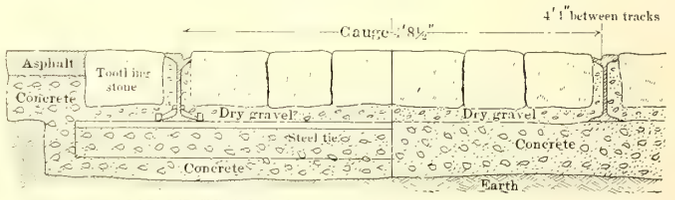


LONGITUDINAL SECTION OF ABOVE

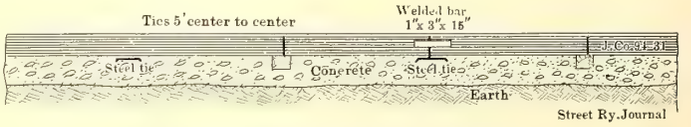
able as to the life of track and rails, Richard McCulloch, assistant general manager, has estimated approximately that a certain piece of girder-rail track was worn out after the passage of 3,000,000 cars, that is, the head was worn so that the car wheel flanges touched the tram of the rail. The wheel flanges used on this road are unusually shallow, being but 5/8 in.

CLEVELAND ELECTRIC RAILWAY COMPANY

The standard for Cleveland track construction is now a rail similar to that used in Boston, except in streets where the tracks run along a grass plat, as along the boulevards. The track is laid on ties that are placed 2 ft. between centers, except that three are placed under each joint. The joints are staggered. Three inches of concrete are placed under the ties. Two kinds of joints have been used extensively, the cast-welded joint and the twelve-bolt 36-in. angle-bar. On a boule-



CROSS SECTION OF TRACK ON CONCRETE BEAMS WITH STEEL TIES IN BUFFALO

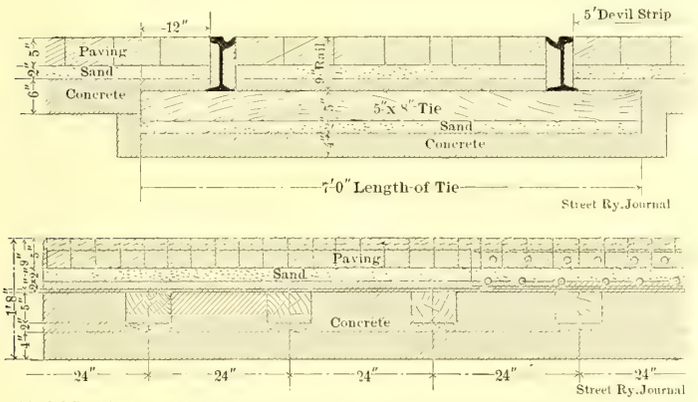


LONGITUDINAL SECTION OF ABOVE

vard line recently constructed 80-lb. standard A. S. C. E. rail in 30-ft. lengths was employed. This construction is shown by the accompanying engraving. The bonds used are single or double No. 0000 protected leaf bonds, 10 ins. and 12 ins. long, placed under the fish-plates. Some 90-lb. girder rail has been down nine years, under a 3-minute service. This has cast-welded joints. It is said to be good for another nine years.

DENVER CITY TRAMWAY COMPANY

The Denver City Tramway Company has always been a company which has given special attention to good track work. This was one of the first companies to employ the T-rail successfully in paved streets where the traffic is heavy, and was the first to use what is commonly known as the Shanghai or high T-rail. Its standard rail for down-town service is a 72-lb. 6-in. Shanghai rail, in 60-ft. or 62-ft. lengths. A section of this rail with the standard joint is shown herewith, together with a section of the track construction. The track is laid on Texas heart-pine ties, 6 ins. x 8 ins. x 6 ft. They are laid an unusually short distance apart, being 21 ins. from center to center. They are laid in gravel ballast, which surrounds the ties and extends 8 ins. below them, except in paved streets, where concrete is used between the ties. In preparing the trench care is taken that the ground is thoroughly settled. The usual method is to flush the trench thoroughly with water and then roll it with heavy rollers. The ties are first shovel-tamped from end to end, and then tamped with iron tamping bars. During the last four or five years the plan has been adopted of painting all rails with one or more coats of asphaltic paint, because Denver soil is more or less impregnated with alkali and mineral salts. This paint has retarded corrosion and electrolysis very much.



CROSS AND LONGITUDINAL SECTION OF TRACK CONSTRUCTION ON LAKE AVENUE, IN CLEVELAND

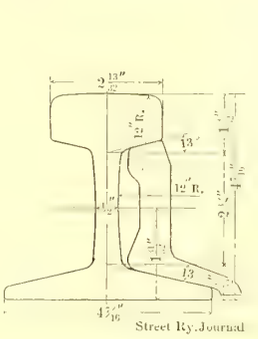
For outlying unpaved streets standard A. S. C. E. 65-lb. T-rail, in 60-ft. lengths, is used.

The standard bond for the 72-lb. Shanghai rails in the paving is the Brown plastic bond. For 65-lb. rails in unpaved streets the bond used is the Ohio Brass Company's flexible copper and the Crown flexible copper, both of which have given good results. All copper contracts on bonds are amalgamated before application by the use of the Brown's solid alloy. It is found that this prolongs the life of the bond, and also increases the conductivity. The standard joints are shown in connection with the standard rails, being ordinary four-bolt angle-bars. All track is laid in cool weather, with rails butted tightly together. The rails give out much sooner when expansion is allowed for than when laid closely butted together. As to life of track and ties good Texas heart-pine ties will last from seven to twelve years in Denver. White oak ties have been in for fifteen years, and are still good. Red and black oak ties are good for six to eight years. Native pine and spruce will last from four to seven years. The life of the rail depends upon the nature of the joint. With a tight joint and well-ballasted track, supposing that the ties are in good shape, a 72-lb. Shanghai rail, it is thought, should last thirty years in Denver. The composition of the 72-lb. Shanghai rail follows:

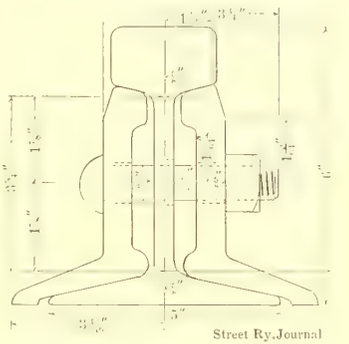
	Per Cent	Per Cent
Silicon	.10	or over
Phosphorus	.10	or less
Carbon	.46	.56

DETROIT UNITED RAILWAY COMPANY

The Detroit United Railway Company lays a narrow grooved rail in paved streets. The last rail laid was 90-lb., section No. 317, of the Lorain Steel Company. Some of the first experiments in the United States with tracks supported by concrete stringers in place of ties were made in Detroit. The first construction of this kind was laid on concrete stringers only 6 ins. thick. These were not strong enough to support the rail and the present construction uses concrete stringers 12 ins. thick by 18 ins. wide. The concrete stringer is brought up around the web of the rail high enough so that brick paving can be laid with but a thin cushion between the paving bricks and the concrete. The upper part of the concrete stringer is, of course, continuous with the concrete foundation of the asphalt or brick paving. Now that concrete stringers 12 ins. thick are used, and the stringers are made a part of the concrete foundation of the paving, no trouble has been experienced from lack of sufficient support. Some of the earlier construction, where paving was not entirely removed and concrete was laid in trenches under each rail without having any foundation in common with the paving, was not a success.

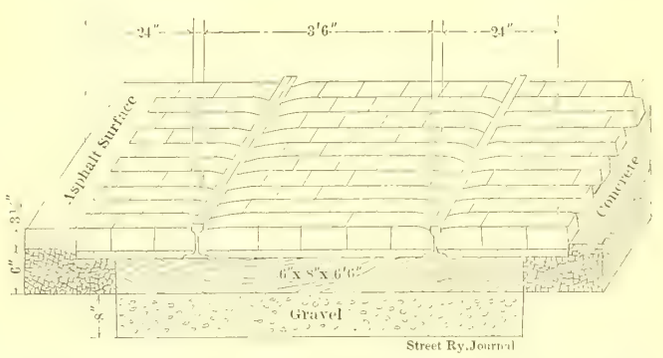


STANDARD T-RAIL FOR UNPAVED AND SUBURBAN STREETS, DENVER.



STANDARD RAIL FOR PAVED STREET IN DENVER.

For holding the track to gage a wooden tie is now placed every 30 ins. Formerly a metal tie every 10 ft. was all that was laid to maintain the gage. The present construction, therefore,



ISOMETRIC DRAWING OF STANDARD TRACK CONSTRUCTION WITH T-RAIL IN DENVER

with its closely spaced ties, is a partial abandonment of the plan of depending entirely on concrete stringers for track construction. "Continuous" rail-joints are used extensively.

Bonding has been done with various types of bonds, Crown bonds being very popular with the management.

As to the life of track, one example can be cited which is on Woodward Avenue, near the Campus Martius, where cars operate during some parts of the day under 1-minute headway. This track had been laid thirteen years up to 1902, when it was practically worn out, as the wheel flanges were touching the

bottom of the grooves. The depth of the flange on new wheels of the Detroit United Railway is 5/8 in.

In the city track construction which has been done this year by the Detroit United Railway a novel concrete mixing outfit devised by John Kerwin, superintendent of track, has been used. Two views of this outfit are shown herewith.



CONCRETE MIXER USED IN TRACK CONSTRUCTION IN DETROIT

In the process followed in Detroit there are no piles of cement, stone or sand dumped on the street. The car shown in both views in the foreground is the one which is equipped with the concrete mixer. The mixer is driven by a motor, which is supplied with current through a fish-pole connection with the trolley line, as seen. The two cars seen in the rear are supply cars for bringing sand and stone. There is a track on each car, and when the three cars are coupled together the tracks on the three cars are connected by fish-plates. When the supply cars are empty they are taken away, and two more open ones shoved in in their place. A small dump-car operates over the tracks on the cars, and the cement, stone and sand for the concrete is dumped into this car. The car holds a cubic yard of stone, ½ yd. of sand and ½ barrel of cement. The sand is placed in the car first. The cement is spread on top of the sand. This is done on the second car of the train. The small dump-car is then backed into the rear car and loaded with stone. This stone car has a false bottom, which is high enough to allow the small car to pass under. The men then raise the false bottom, which allows the stone to drop into the small car. After the car is filled it is pulled up the incline to the big hopper of the concrete mixer by means of a cable driven by the motor and controlled by the lever on the operator's stand. The machine turns out a batch of concrete every 5 minutes. The small car placed in front of the machine has a loose bottom, so that the men can distribute the concrete evenly the entire width of the roadbed.

This small car is pulled by a horse to where the concrete is being put under the track. Water is brought in a hose from a nearby hydrant. A boy on the controlling platform operates the water valves. The tank seen on the far side of the mixer is for measuring the right amount of water for each batch of concrete. The machine is operated with nine men, and it is considered that it saves about $20 a day in labor. The concrete is mixed in a revolving drum, which is 8 ft. in diameter and 4 ft. long. The whole outfit was built last winter in the shops of the track department of the Detroit United Railway, and is mentioned later to be Mr. Kerwin's design.

INDIANAPOLIS TRACTION & TERMINAL COMPANY

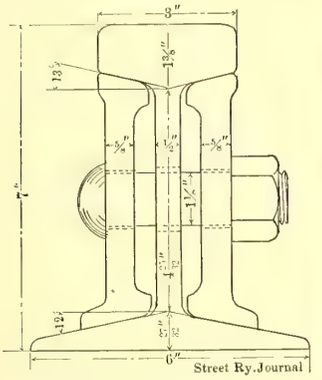
The Indianapolis Traction & Terminal Company practically has two standards of track construction in paved streets, one employing girder rail, Lorain, 93-lb., No. 206; the other a new special rail section, 91-lb., No. 375. The girder rail is laid on streets where only city cars will pass. The new special 91-lb. rail mentioned is a high T-rail with a wide head, and has been designed, like the Milwaukee rail mentioned later, to be easily paved to, and yet to permit the passage of interurban cars with deep wheel flanges, of which there is a large number entering Indianapolis over the city system.



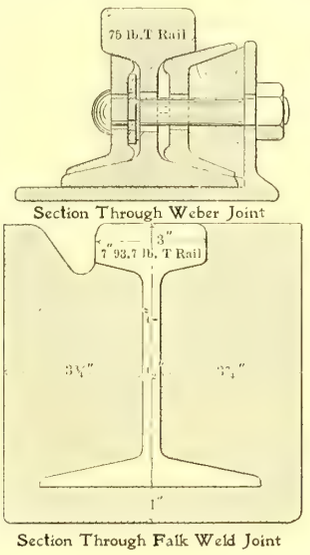
CONCRETE MIXER USED IN TRACK CONSTRUCTION IN DETROIT

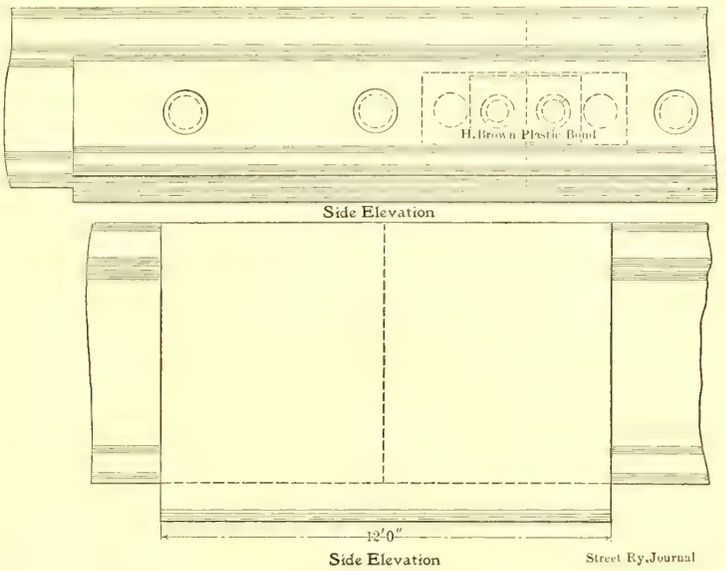
The standard rail for this service is 7 ins. high, and has a head 2¾ ins. wide, to reduce amount of overhang of wide-tread interurban car wheels. For outlying unpaved streets 70-lb. standard A. S. C. E. T-rail is laid. This company's standard tie is 6 ins. x 8 ins. x 7 ft., of white oak. The ties are laid 2 ft.

2 ins. between centers, and ballasted with gravel concrete, which extends 6 ins. under the tie, surrounds the tie, and is brought to within 4½ ins. of the top of the rail. Some track has also been laid with ties spaced 10 ft. between centers, with a concrete beam 20 ins. wide and 9 ins. deep under the rail, and extending to within 5½ ins. of the top of the rail. The management seems to favor the regular tie construction first described. On the Shanghai T-rail and on ordinary T-rail continuous rail-joints are used with four bolts.



STANDARD T-RAIL IN MILWAUKEE





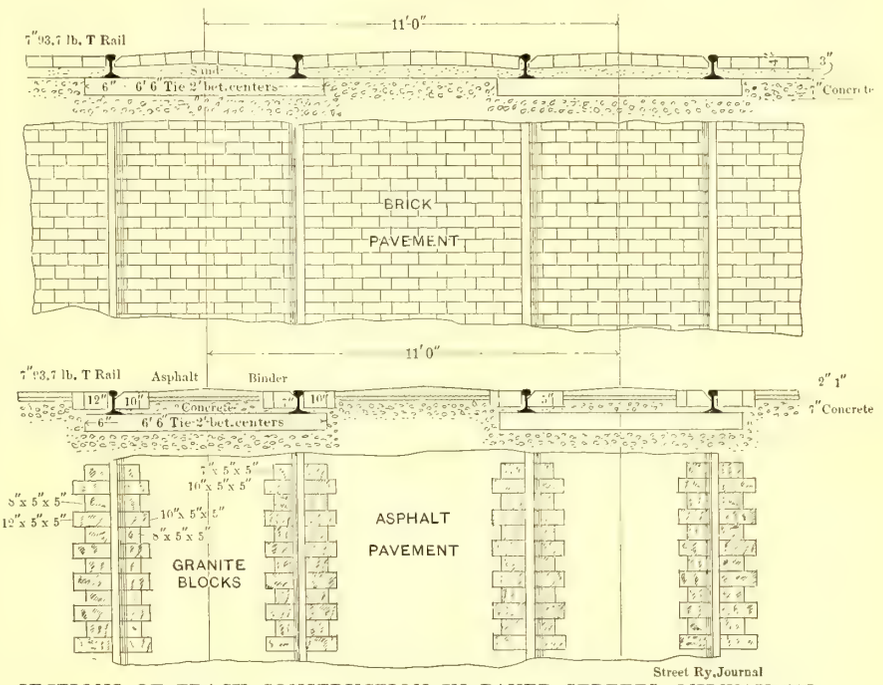
STANDARD CAST WELDED JOINT USED IN MILWAUKEE

The standard bonds are No. 0000 protected bonds, 10 ins. long under the fish-plates, also No. 0000 28-in. wire cable bond over the fish-plates. The bonds are applied with a screw compressor. The track is cross-bonded with No. 0000 wire every 500 ft. between the rails of one track, and every 1000 ft. is a cross-bond connecting the four rails of the double track.

THE MILWAUKEE ELECTRIC RAILWAY & LIGHT COMPANY

The Milwaukee Electric Railway & Light Company some time ago succeeded in securing the approval by the city authorities of T-rail construction for paved streets, with results beneficial both to the company and the public. Recently a special new design of T-rail has been adopted as the standard for all future work. A section of this new design is illustrated herewith. It is 7 ins. high, and in many respects does not differ materially from the Shanghai T-rail which has been used extensively in other Western cities. The principal feature of note is the wide head, which is no less than 3 ins. in width. The idea in having such a wide head is that in the future interurban cars should be equipped with wheels having treads and flanges more nearly approaching the standard steam railroad wheel tread than is now common. With a rail having the head 3 ins. wide a car wheel with a tread 3½ ins. wide could be used without having the wheel seriously overhanging the rail and bearing on the pavement. Of course, the T-rail also admits of as deep a car-wheel flange as may be desired.

Plans and sections of this company's standard track construction in asphalt pavement and in brick pavement are here shown. Track is laid on 6-in. x 8-in. and 6-ft. 6-in. ties, placed every 2 ft. Six inches of concrete are tamped under each tie and the paving foundation consists of 6 ins. of concrete as shown. No tie-rods are used, as this rail has a very broad base and tie-rods are liable to cause a weak spot in the paving. All joints in the various tracks are cast-welded, a peculiar form of joint being used which facilitates paving. The joint is rectangular in form without any of the curved lines which have made cast-welded joints difficult to pave to satisfactorily. In asphalt streets granite toothing blocks are laid alongside of each rail. In Milwaukee the city pays for the original laying of the pavement and the company pays for the maintenance of the pavement between its tracks and 12 ins. outside its tracks. Granite toothing blocks extend out 12 ins., or to the limit of the distance that the company must maintain paving.



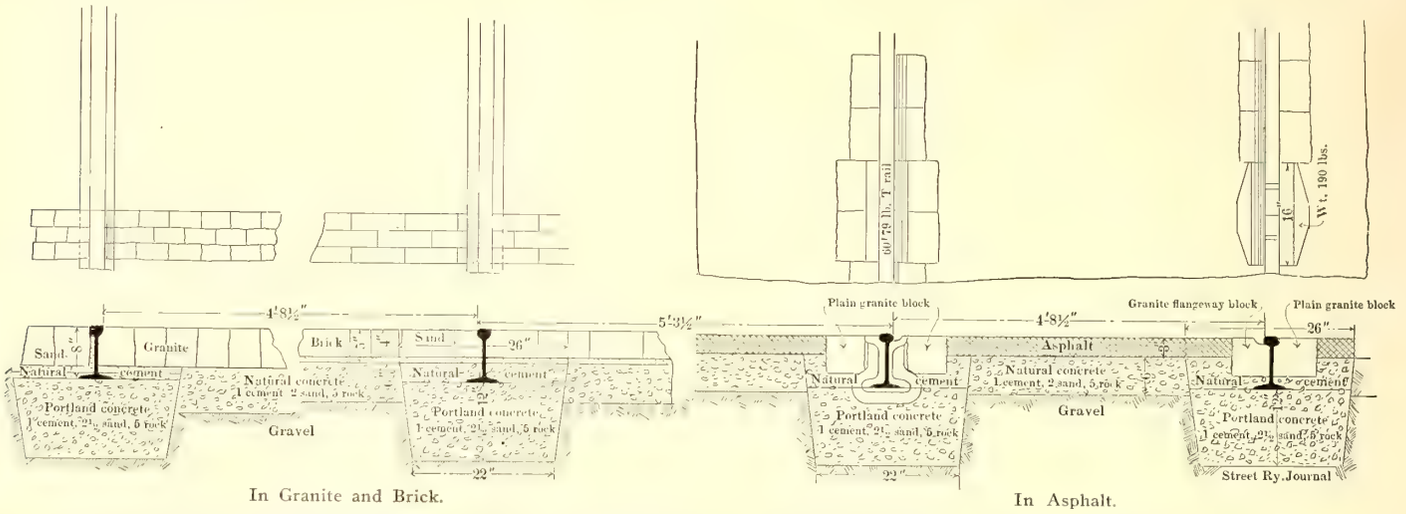
SECTIONS OF TRACK CONSTRUCTION IN PAVED STREETS, MILWAUKEE

On unpaved suburban roads 75-lb. standard A. S. C. E. T-rail is laid. On this track the Weber joint is used, with Brown plastic rail-bonds. Cast-welded track is not bonded, as the iron is poured hot enough to make a true weld between the joint and the rail.

TWIN CITY RAPID TRANSIT COMPANY, MINNEAPOLIS AND ST. PAUL

The track construction of the Twin City Rapid Transit Company, of Minneapolis and St. Paul, in down-town paved streets

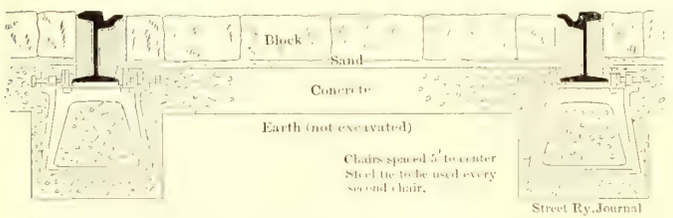
has been notable for several years, because it was one of the first roads to lay a T-rail in streets paved with asphalt in a city where girder rail had been the rule before. Sections of the standard track construction are shown herewith. The rail used streets ties, spaced 2 ft. between centers, are used. These ties are 6 ins. x 8 ins. x 8 ft. A 6-in. concrete base of natural cement is placed between and around the ends of the ties, and on this a sand cushion is spread. The brick or stone paving is



In Granite and Brick. In Asphalt.

STANDARD TRACK CONSTRUCTION IN BRICK AND ASPHALT PAVED STREETS—TWIN CITY RAPID TRANSIT COMPANY

is 8-in. Shanghai T, weighing 79 lbs. to the yard. The concrete beam which supports each rail is 22 ins. to 24 ins. wide and 12 ins. thick under the rail. This is Portland cement concrete. The base of the rail rests directly on this. Around and above the base of the rail is placed 3 ins. of natural cement, if the paving is of brick, and less if the paving is granite. The sections illustrated show the track in asphalt, brick and granite



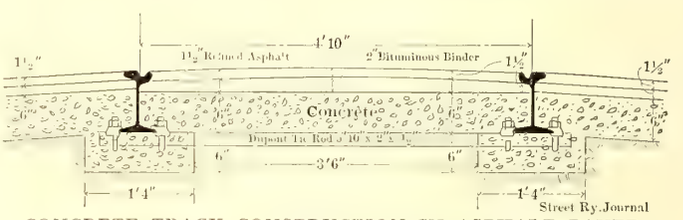
CONCRETE TRACK CONSTRUCTION—PHILADELPHIA RAPID TRANSIT COMPANY

set and grouted with Portland cement grout.

For suburban construction a 5-in. 80-lb. A. S. C. E. standard T-rail is adopted. Ties, 6 ins. x 8 ins. x 8 ft., are spaced 2½ ft. between centers. Continuous rail joints are used on this track. Atkinson bonds are standard on this work.

PHILADELPHIA RAPID TRANSIT COMPANY

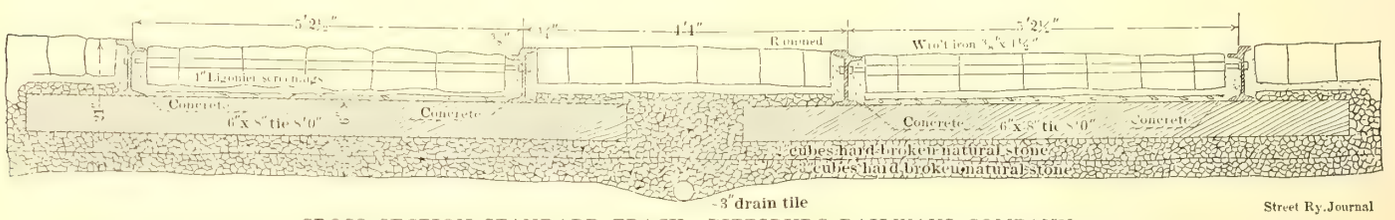
The Philadelphia Rapid Transit Company uses for its



CONCRETE TRACK CONSTRUCTION IN ASPHALT PAVED STREET—ST. LOUIS TRANSIT COMPANY

paving. A cast-welded joint 16 ins. long and weighing 190 lbs. is employed. This joint is of somewhat unusual shape, as it extends out from the head of the rail so as to make a substitute for paving at that point. On the inner side the joint has a flange way, which gives the effect of a grooved rail at the joint. The object of this peculiar form of joint is to facilitate paving around the joint and to provide that there shall not be a weak point in the paving at the joint. The rails are purchased in 60-ft. lengths. On old construction tie-rods were used to hold the track to gage, but recently some track has been laid without, with good results, although the non-use of tie-rods is not well enough established to be called standard.

The spaces between and around the paving blocks are filled with Portland cement grout, and fourteen days is allowed for the concrete to thoroughly set before allowing any traffic whatever upon the rails. In less substantially paved standard track construction in streets having heavy traffic a grooved rail known as Lorain Steel Company's section 371, which weighs 137 lbs. to the yard. Where the travel is lighter Lorain, section 206, weighing 93 lbs. to the yard, is used. This latter section is also used for suburban service if the streets are paved. For unpaved suburban streets A. S. C. E. standard 90-lb. T-rail is used. Track in paved streets is now being laid



CROSS SECTION STANDARD TRACK—PITTSBURG RAILWAYS COMPANY

on concrete stringer construction, a section of which is here illustrated. Chairs are spaced 5 ft. apart. A steel tie is used in connection with the chairs at every second chair, or every 10 ft., and provision is made on these chairs for the adjustment of the gage. The concrete stringer extends 15 ins. under the base of the rail. The foundation of the paving between the tracks is a bed of concrete 6 ins. thick. The concrete stringers are 17 ins. wide. All rails are laid with broken joints. The zinc joint previously described in the Street Railway

JOURNAL of April 18, 1903, page 589, has been very successful, although it can hardly be called the standard joint for the company's use as yet. This joint consists of rolled steel joint plates surrounding rail-web and base, between which and the rail a filling of zinc is poured. Track construction in the past has been laid on 5-in. x 9-in. x 8-ft. ties, spaced 2 ft. between centers. Where zinc joints are used no bonds are necessary. On other track a protected form of bond, about No. 0000, is used. The composition of rails, as specified in the contracts of the company, follows:

	Per Cent	Per Cent
Carbon	.45	.55
Phosphorus, not over		.10
Silicon		.20
Manganese	.80	1.00

As to the wear of rails experience in Philadelphia seems to indicate that under the heaviest traffic there the life of the ordinary girder rail is not over ten years.

PITTSBURG RAILWAYS COMPANY

The Pittsburg Railways Company uses a 90-lb. girder rail, Lorain section, No. 206, in 60-ft. lengths in its construction. This is laid on ties, and the ties are on a foundation of broken stone. This broken stone is in two layers. The upper layer is in 12-in. cubes and the lower layer in 3-in. cubes. The foundation extends to a depth of 21 ins. below the top of the rail. The ties are 6 ins. x 8 ins. x 8 ft. Concrete is used around the rail to fill in the space between the head and base of the rail. The rails are laid directly on the ties, and tie-rods are used. Cast-welded rail-joints are now being laid. Ties are spaced 24 ins. between centers. For suburban service 80-lb. T-rail and Lorain Steel Company's 78-lb., section 206, have been used. Two protected rail-bonds are used at joints where the rails are not cast-welded, and cross-bonds are placed every 80 ft.

UNITED RAILROADS OF SAN FRANCISCO

The standard rail in San Francisco is a 9-in. girder rail, Lorain Steel Company's 109-lb., No. 340, for basalt block pavement, and for bitumen paving on concrete foundation a 7-in. girder rail weighing 96 lbs. per yard, Lorain, section 357. For between centers. The "Servis" tie-plate is used and redwood ties. Rails are purchased under two different specifications as to composition. The light rails, weighing under 70 lbs. to the yard, have compositions specified as follows:

	Per Cent	Per Cent
Carbon	.38	.48
Phosphorus, not to exceed.		.10
Silicon, not to exceed		.20
Manganese	.70	1.00

For rails weighing 90 lbs. to 100 lbs. per yard the specifications are:

	Per Cent	Per Cent
Carbon	.45	.55
Phosphorus, not to exceed.		.10
Silicon, not to exceed		.20
Manganese	.80	1.00

Nearly all joints are cast-welded. As to life of ties, ties with broken stone ballast underneath and with sand or gravel between and over the ties, will last from twelve to fifteen years. If they are placed in loam, or in a soil that holds moisture, they last from seven to ten years.

ST. LOUIS TRANSIT COMPANY

The St. Louis Transit Company lays track, as shown by the cut on the opposite page, using a concrete beam under each rail and a Du Pont tie-rod, which is in the nature of a metal tie, to hold the track to gage. These tie-rods are placed every 6 ft. and clamped to the base of the rails, thus preventing all tilting. The concrete stringer supporting the rail is 8 ins. x 18 ins. The foundation of the pavement, the bottom of which is flush with the base of the rail, is a bed of concrete 6 ins. thick, on top of which the asphalt is placed. The standard rail is a 9-in. grooved rail, either the 100-lb. section, No. 363, of the Lorain Steel Company, or the 98½-lb. section, No. 241, of the Pennsylvania Steel Company. The rail-joints now being used are "Continuous" and angle-bar.

For suburban service the St. Louis Transit Company uses a 95-lb. 9-in. girder rail. In dirt streets ties are laid to support the track. In Telford pavement concrete supports the track. The track is bonded with No. 0000 bonds, with compressed riveted heads made by the company. A protected bond is used on surface track. A large number of old rails are used as a supplementary return circuit in the neighborhood of the power house.

The accompanying table summarizes some of the principal points in the track construction of the various companies whose work has been briefly described in the foregoing article.

TABLE OF TRACK CONSTRUCTION IN PAVED STREETS IN FOURTEEN CITIES OF THE UNITED STATES

CITY AND NAME OF COMPANY	Kind of Rail for Paved Streets	Kind of Joints	Manner of Supporting Track—Ties or Concrete Stringers	Manner of Holding Rails to Gage	What Bed Under Ties	What Bed Around Ties
Baltimore—United Railways & Electric Co.	Grooved	Angle bar (8 bolts)	Ties 6 in. x 8 in. x 8 ft.	Tie rods 6 ft. apart	Sand	Sand
Boston Elevated Railway Co	Grooved	Angle bar (12 bolts)	Ties 6 in. x 8 in. x 6 ft. 6 in.	Tie rods	Gravel	Concrete
Buffalo Railway Co.	Grooved	Electric welded	Concrete bed and concrete stringers.	Ties 5 ft. apart	Concrete	Concrete
Chicago City Railway Co.	Girder	Cast welded	Ties 6 in. x 8 in. x 8 ft.	Brace tie plates	Gravel	Gravel
Cleveland Electric Railway Co.	Grooved	Cast welded and 12-bolt angle bars	Ties 5 in. x 8 in. and 5 in. x 7 in.	----------	Concrete	Concrete
Denver City Tramway Co.	Shanghai T	4-bolt angle bars	Ties 6 in. x 8 in. x 6 ft. 6 in.	Tie rods	Gravel	Concrete
Detroit—United Railway	Grooved	Continuous	Concrete stringers	Ties 30 ins. apart	Concrete	Concrete
Indianapolis Traction & Terminal Co.	Girder and new Shanghai T	Continuous	Ties 6 in. x 8 in. x 7 ft.	Tie rods	Concrete	Concrete
Milwaukee Electric Railway & Light Co.	New Shanghai T	Cast welded	Ties 6 in. x 8 in. x 6 ft. 6 in.	Ties	Concrete	Concrete
Minneapolis—Twin City Rapid Transit Co.	Shanghai T	Cast welded	Concrete stringers	Tie rods 10 ft. apart	----------	----------
Philadelphia Rapid Transit Co.	Grooved	Zinc	Concrete stringers	Special chair and tie rod	----------	----------
Pittsburg Railways Co.	Grooved	Cast welded	Ties 6 in. x 8 in. x 8 ft.	Tie rods	Broken stone	Broken stone
San Francisco—United Railroads	Girder	Cast weld	Ties 6 in. x 8 in. x 8 ft.	----------	Concrete (bitumen paving), Broken stone (block paving)	Concrete, Broken stone
St. Louis Transit Co.	Grooved	Angle bar and continuous	Concrete stringer	Dupont tie rod	----------	----------

GENERAL CONCLUSIONS

Looking at electric railway construction in the paved streets of our larger cities to-day, as outlined in this article, it is seen that the methods of the different companies which have been described here are at considerable variance in some respects. One of the most noticeable differences is in the use of concrete stringers as the principal support of the rail in some types of construction, and the retention of regular tie construction by other companies. Although there are still many companies which employ ties instead of stringers for rail supports, the use of concrete stringers is on the increase, so that it may be said there is a decided tendency toward concrete stringer construction in this country at the present time. It is less than ten years since concrete stringers were first used in the United States, although it is and has been the most common construction in England for some time. Several of the roads enumerated in this article as using concrete stringers have only recently adopted it. It is difficult to draw a hard and fast line of distinction between concrete stringer construction and construction in which ties afford the main support of the rails, because some construction is in reality a combination of the two methods. Where ties or tie-rods are placed at intervals of 10 ft. they can have but little to do with forming a support of the rail, and their use in such cases is confined mainly to holding the track to gage and surface while the concrete is being put in and is hardening. In such a case there is no question but that the track should be classified as concrete stringer construction. When, however, ties are placed more frequently—5 ft. apart or less—they may have much to do with supporting the track as well as in holding it to gage during construction.

Where ties are used it will be noticed that some companies tamp concrete to a considerable depth below the ties, while others simply surround the tie with concrete. One prominent example of this latter form of construction is that of the Boston Elevated Railway Company. The experience of this company has led its management to believe that concrete is unnecessary under the ties if they are surrounded with the concrete which forms the foundation of the paving. Experience at Denver has led to the same conclusion, and the concrete is not extended below the ties in the Denver construction. Extraordinary precautions, however, are taken at Denver to see that the earth and gravel below the ties are thoroughly settled before the track is laid.

Experience both with ties and with concrete stringer construction has taught that the foundation of the track and paving should be as nearly identical as possible, and that the bed, if of concrete, should be thoroughly bonded together. What failures of concrete stringer construction have occurred seem to have been due almost entirely to lack of common foundation between the track and paving.

Methods of holding the track to gage where concrete stringers are used instead of ties are considerably at variance. At Detroit metal ties were used in the most approved construction until recently, when they have been abandoned in favor of wood ties. At Philadelphia and at St. Louis tie-rods, which are almost analogous to metal ties, but without the large bearing surface of a tie, have been adopted. Tie-rods in both the Philadelphia and in the St. Louis construction are below the base of the rail, and hence do not interfere in any way with the paving. At Minneapolis track has been laid both with and without tie-rods, and no final conclusion has been reached. An ingenious combination of metal and wooden ties has been made in Buffalo, where, on some of the construction, every other tie is of metal. The wooden ties form the support for the track while the concrete is being poured and tamped under the rails and metal ties. In Buffalo in one form of construction there adopted the company has carried the concrete stringer idea to the extreme, and has made one solid bed of concrete the entire width of the track, instead of laying a beam under each rail only. The other Buffalo construction in which concrete stringers are laid under each rail is notable for going to the other extreme. These concrete stringers are not bonded to the concrete which forms the paving foundation, and, in fact, there is no concrete except under rails and the ties, which are 5 ft. apart.

Taking everything into consideration, it is likely that the success or failure of concrete stringer construction will depend partly on how good a foundation there is under the street to begin with. In this connection it is pertinent to mention the practice which has been adopted in the reconstruction of track at Kansas City. Here the question of whether concrete stringer or tie construction shall be used is answered by the kind of foundation upon which the track is to be laid. In a street where the paving is on a good concrete foundation, and settling has taken place for years, concrete stringers are used, and form a part of the general street foundation. If the paving is without a substantial foundation, which is frequently the case on some of the outlying streets, ties are laid.

Comparing the practice of to-day with that of ten years ago, the increasing use of grooved as a substitute for girder rails is noticeable. The increase in the number of cities where T-rails are used in paved streets is also a matter of note, and should be a matter of congratulation. Of the cities on the list, Denver has always used T-rail. At Minneapolis, St. Paul, Milwaukee and Indianapolis the T-rail has been introduced in place of the girder rail, formerly required in those cities. There is certainly no cause for complaint on the part of the people of those cities, as the surface of the street in which T-rails are used is much better than it would be with a girder rail. From the company's standpoint the life that it is possible to obtain from the T-rail is much greater than could be obtained from the girder, assuming, of course, that the wear of the rail-head rather than the giving down of the joints determines the life of the rail. With interurban car wheels having deep flanges but little wear can take place on an ordinary girder or grooved rail before the cars are running on the wheel flanges. This condition exists on some of the track in several cities to-day. With the T-rail the amount of wear that can take place before the track is worn out entirely is independent of the car wheel flanges. The T-rail is a center-bearing rail, and with the wide base of a Shanghai T-rail there is but little tendency for the rail to tip over and get out of gage. As far as presenting a smooth street surface for vehicles is concerned the T-rail, when properly paved to, is practically as good as the grooved rail, and has the advantage that the groove will never clog with ice or dirt so as to interfere with the operation of the cars. There is the possibility that under the extremely heavy traffic on some of the narrow streets of our greatest cities a T-rail construction would permit of too rapid deterioration of the paving next to the rail, although this is as yet largely a matter of theory, as the T-rail has been notably successful wherever given a fair trial.

The grooved rail, as adopted in American cities, has usually been modified considerably from the grooved rails common in Europe. The narrow grooves used in Europe, and those laid several years ago in this country, were, exactly as street railway men anticipated, failures from an operating standpoint, as the grooves were so narrow that they became clogged with

dirt upon the slightest provocation. The girder rail was extensively used in this country as a compromise. It made a considerable break in the smooth surface of the street, but to compensate for this there was a tram on which the wheels of an ordinary vehicle could run and find a smooth track. Some have attributed the original adoption of the girder rail to the desire of street railway companies to maintain their paving in good shape by maintaining an iron track for vehicles; others to the desire of the companies to keep team traffic moving at a brisk pace ahead of the cars rather than to have it delayed by the poor paving which was common in American cities several years ago, and which has not altogether disappeared yet. Be this as it may, the street railway manager of the last ten years has realized that the team traffic which takes to the rails is responsible for no small share of the rail wear, and is, furthermore, responsible for an immense amount of delay, because of the unwillingness of drivers to leave the track when once their wagons are in it.

It is evident that there are many aspects to the rail question. A municipality might urge the adoption of a grooved rail because of the unbroken street surface which it permits. On the other hand, it might be urged on behalf of the municipalities that the use of the girder rail relieves the paving from much wear. From the standpoint of the operating street railway man the girder rail is good, because it always insures a clear flangeway, which can never become clogged. It is bad, because of the inducement it offers to teams to follow the tracks, and thus delay cars and cause excessive track wear. These two objections have become very serious during the last few years in some cities, and while a grooved rail is not altogether ideal yet it is undoubtedly true that it tends to relieve the trouble from delays of traffic caused by the slowness of teamsters in leaving the track, and it always tends to keep the team traffic away from the track, if the balance of the street has good paving. If the street railway company maintains the paving between the tracks this tends to reduce the wear on the paving, so that the grooved rail is not altogether bad from an operating standpoint, especially if it has a wide, self-cleaning groove, as have most of the recently laid grooved rails. With a grooved rail having such a shape of rail that the dirt will be forced out by the car-wheel flanges, rather than packed in the bottom of the groove, there seems to be little trouble.

The street surface with a grooved rail and with a T-rail around which there is proper paving, is practically the same from the standpoint of the public. From the company standpoint, if the street traffic is very heavy the maintenance of paving might be greater with the T-rail than with the grooved, but in all other respects the T-rail is better, because it is cheaper in first cost than a grooved rail of equivalent stiffness, and has possibilities of many more years of life than the grooved rail. For cities where the entrance of interurban cars is becoming very important, not only to the companies but the cities themselves, earnest consideration should certainly be given to a form of track construction which is well adapted for interurban car wheels having a safe depth of flange. At Indianapolis, which is one of the most important interurban centers in the United States, and where a magnificent interurban terminal depot is now being erected in the heart of the city, and at Milwaukee, where similar conditions exist, it was wisely concluded by all concerned that a form of construction should be adopted which would be suitable for interurban cars, and which would permit of track once laid being operated over by interurban cars for many years without disturbing the street for relaying track. The result has been the form of T-rail track construction which has been outlined before in this article. The T-rail sections for Milwaukee and for Indianapolis are both of very recent origin. Both have wide heads, in conformity with the wide treads of interurban car wheels. The rail used at Philadelphia and the one proposed by Bion J. Arnold as standard for Chicago, both have heads which are beveled so that the wheel tread does not bear on the full width of the head when the rail is new. The section proposed by Mr. Arnold has a very marked bevel, amounting to 5-32 in. in a width of 11-16 in. The reason given by Mr. Arnold for advocating this form of head is that it provides for car wheels with broad treads, and that the beveled surface at the back of the tread will prevent the wheel from crushing or wearing the pavement where the pavement comes in contact with the railhead. This point might, perhaps, be stated more clearly by saying that the chances that the paving will get in the way of the car wheels is lessened by the form and width of the railhead, and if car wheels less than the width of the head are used the presence of the bevel allows of some little rail wear before a lip begins to form on the outer part of the rail head. At any rate, this new rail also provides for wide-tread wheel, although not as wide as the new sections of T-rail to be used at Milwaukee and at Indianapolis. In this connection it is interesting to note that the first Shanghai T-rails, which were designed by Mr. Beeler for use on the Denver lines, had what was then considered a wide head to present a bearing surface to the whole width of the car-wheel tread ordinarily used in city service. One possible use of a bevel on the outer edge of a rail head, as in the proposed Chicago rail, would be to insure a place into which dirt could slide from the head of the rail, even if the paving were slightly higher or exactly flush with the top of the rail. This feature is provided for in a very pronounced manner by the rail used at Kansas City, which is a center-bearing girder rail with a narrow tram on each side of the head. The only use of the outer tram is to insure a clear space next to the head of the rail into which dirt will fall from the head of the rail, and to prevent paving from being brought into interference with the wheels.

Practice is fairly well divided between welded joints and joints employing bolts. Some of the roads on the list have made cast-welding an absolute standard for paved streets, but the majority have considerable track with both bolted and cast-welded joints. It is claimed by some that cast-welding changes the character of the steel at the joints, so that the joints do not wear the same as the rest of the track, and will in time hammer down. Other companies have noticed nothing whatever of such an effect. The earlier troubles with defective electric welding seem to have been entirely overcome in the work done at Buffalo, where electric welding is the standard, and has been put into such extensive use. Troubles with excessive joint depreciation, which were so common ten years ago, do not seem to be as serious with bolted joints as formerly, probably owing to the very much heavier rails now common and the better character of the foundation. Nevertheless, it is probably true that where welded joints are used a somewhat lighter rail can be satisfactorily employed than if bolted joints are used, since a good welded joint so nearly approximates the strength of the unbroken rail. The joint being experimented with at Philadelphia, in which zinc is used to make a tight fit between the joint plates and the rail, seems to be giving good satisfaction, and the results will be watched with considerable interest. If successful this joint will be a happy compromise between the welded joints, which require such a large amount of apparatus for their manufacture on the street, and bolted joints, which are easily installed but more likely to require attention after being once in place.

STANDARD OVERHEAD CONSTRUCTION IN CITY STREETS

SINCE the general change of motive power from horse and cable traction to electric traction, interest has somewhat died out in overhead construction in large cities, as this construction has usually proceeded along tolerably familiar lines. Nevertheless, an investigation of the standard types of overhead construction adopted by fourteen of the principal street railways of the country shows that there are points of difference which make the study and comparison of methods worth while.

UNITED RAILWAYS & ELECTRIC COMPANY OF BALTIMORE

This company uses round trolley wire in sizes No. 0 and No. 00. Span wire is 5-16 in. galvanized stranded wire. Overhead feeders are 500,000 circ. mil cables and No. 0000 solid conductors. The standard poles are 5-in. and 4-in., two-section, steel tubular. Terra cotta conduit, with 3-in. ducts is used. Feeders and trolley wire are calculated for a maximum drop of voltage of 10 per cent.

BOSTON ELEVATED RAILWAY COMPANY

The standard trolley wire of the Boston Elevated Railway Company is No. 00 round wire. Span wires are 5-16 in., galvanized iron, 7 strands. Feeders are triple braided, waterproof copper wire, with a maximum size of 1,000,000 circ. mils. For straight line work a three-section steel tubular pole is used, weighing from 700 lbs. to 800 lbs., with sections 6½ ins., 5½ ins., and 4½ ins. For locations requiring a stronger pole, one with sections 7½ ins., 6½ ins. and 5½ ins., and weighing 950 lbs. to 1050 lbs., is used. For curves, an 8½-in., 7½-in. and 6½-in. pole, weighing 1450 lbs. to 1500 lbs., has been adopted, while, of course, on the elevated division the third rail is used. One of the accompanying views shows the point at



CORNER EUTAW AND BALTIMORE STREETS, SHOWING OVERHEAD CONSTRUCTION

which the change is made from the overhead to the third rail. The company has several types of conduits, the standard being



VIEW ON CLARK STREET, NEAR ADAMS, CHICAGO, SHOWING STANDARD OVERHEAD CONSTRUCTION IN DOWN-DOWN STREETS

a single-duct vitrified tile conduit laid in concrete. The company considers a 20 per cent drop in voltage under maximum load conditions the greatest drop permissible, this being on the outlying feeder sections.

BUFFALO RAILWAY COMPANY

The Buffalo Railway Company uses a No. 00 round trolley wire, with ⅜-in. stranded span wires. The largest feeders are 500,000 circ. mil. They are covered with waterproof insulation. Camp single-duct conduits 3 ins. in diameter are standard. A drop in voltage of 20 per cent is considered the maximum allowable under any circumstances.

CHICAGO CITY RAILWAY COMPANY

The Chicago City Railway Company uses No. 00 round trolley wire, with galvanized stranded span wires ⅜ in. in diameter. The largest feeders are 500,000 circ. mil copper with waterproof insulation. The last conduit was American vitrified conduit in multiple ducts. The standard poles for straight line work weigh 900 lbs., and are in three sections, 7 ins., 6 ins. and 5 ins. in diameter, respectively. On curves an 8-7-6-in. pole is used. The practice is now to put two strain insulators in the span wire between the trolley hangers and the poles. The company makes its own brass work for overhead fittings. The Knox hanger, with a clip which is fastened to the trolley wire by hammering, has been the standard for many years. In laying out new overhead work to be fed from sub-stations, a maximum drop in voltage of 15 per cent in the direct-current feeders would be calculated. At the present time the company's system is being fed from direct-current stations, which are likely to be soon superseded, so that the company's present practice is hardly a criterion of what it would be with a reconstructed system.



AT FAYETTE AND NORTH STREETS, BALTIMORE



INCLINE AT NORTH STATION, BOSTON, SHOWING CONNECTION BETWEEN SUBWAY, SURFACE AND ELEVATED TRACKS

CLEVELAND ELECTRIC RAILWAY COMPANY

The Cleveland Electric Railway Company uses No. 00 hard-drawn round copper trolley wire. On narrow streets the standard span wire is 5-16-in double galvanized steel stranded wire, and for wide streets ⅜-in. wire. All new feeders are 1,000,000 circ. mil. The standard pole is a three-section pole, 7 ins., 6 ins. and 5 ins. in diameter, weighing about 620 lbs. On curves a 1600-lb. pole, 8 ins., 7 ins. and 6 ins. in diamter, has been adopted. The company has no conduits. Plans are shown herewith of the company's standard side pole construction, and also some bracket construction recently put up.

DENVER CITY TRAMWAY COMPANY

The Denver City Tramway Company uses No. 0 round trolley wire. Span wire is 5-16 in. for double track, and ¼ in. for single track spans. The largest feeders are 500,000 circ. mil stranded copper, with waterproof triple braid covering. The only underground conduit used is for about 300 ft. from the power house. The maximum drop in voltage for which the lines are calculated is about 10 per cent. A very accurate alignment of the trolley wire is maintained on curves, and cars operate around curves at higher speed than is usual in most cities.

DETROIT UNITED RAILWAY COMPANY

The Detroit United Railway Company has tried several kinds of trolley wire, and is now using No. 00 round copper wire. Span wires are 5-16 in. on all straight-line cross-

span work, but some ¼-in. span wire is used for pull-overs on special work. The largest cables are 1,000,000 circ. mil, of which a great number are in use, and good results are being obtained. The pole spacing is not over 110 ft. on such lines. The latest standard construction is with 675-lb. iron poles, 30 ft. high, well set in concrete. Every eighth span is a feed-in span of No. 00 copper. All feeders are placed on iron cross-arms. An attempt is made to keep line loss below 20 per cent.



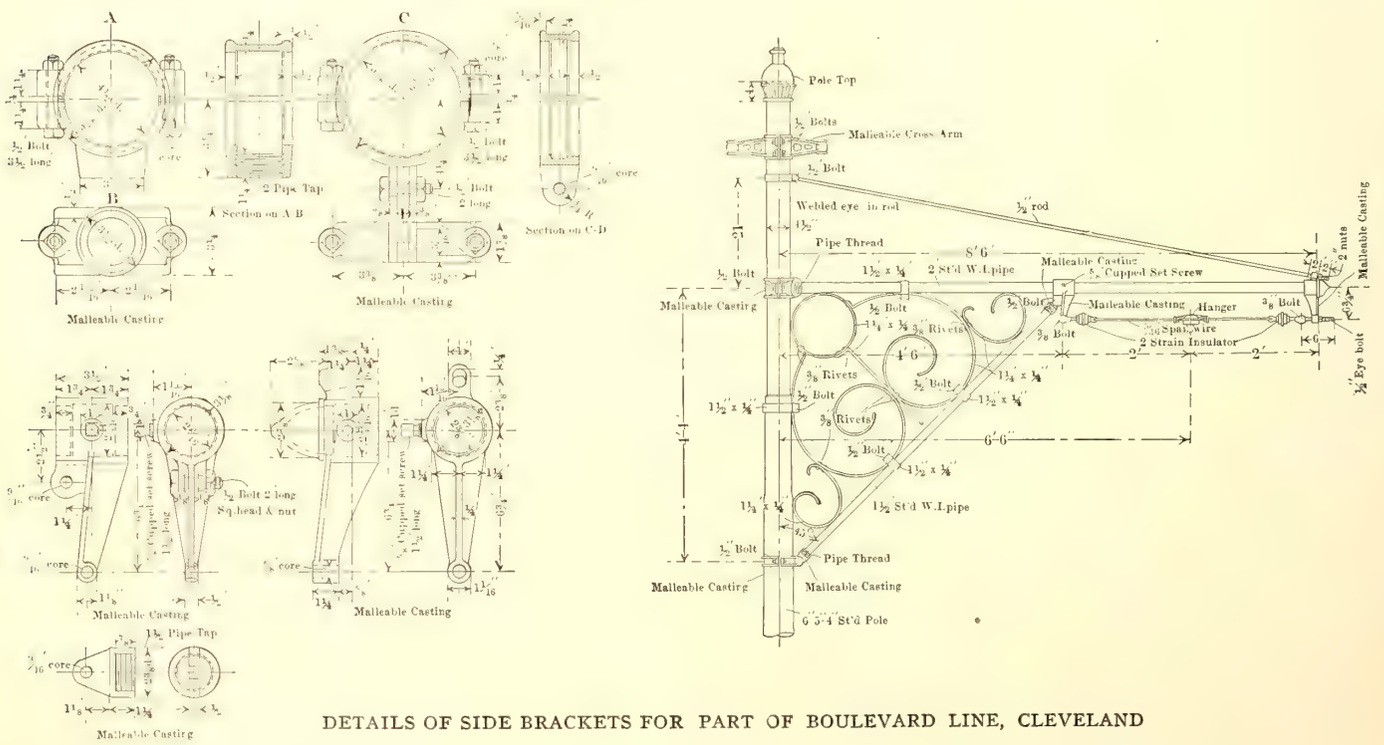
VIEW OF CLIFTON BOULEVARD, CLEVELAND, SHOWING PART OF 5½ MILES OF DOUBLE TRACK ROAD RECENTLY BUILT BY THE CLEVELAND ELECTRIC RAILWAY COMPANY

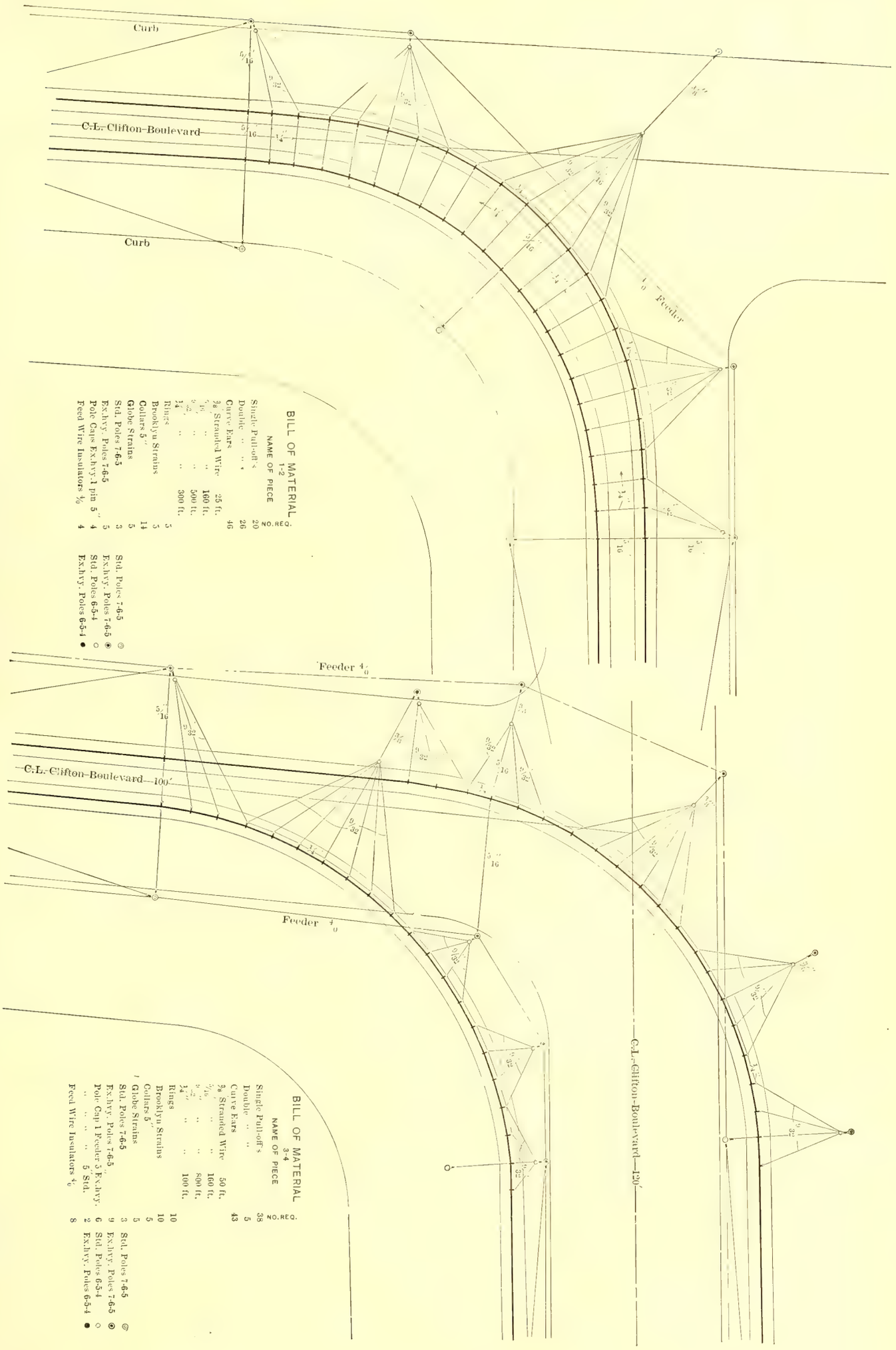
INDIANAPOLIS TRACTION & TERMINAL COMPANY

The standard overhead construction of the Indianapolis Traction & Terminal Company is now side-pole construction, although a large number of center poles are still in use. The trolley wire is No. 00 round wire. The size of the span wire varies from ⅜ in. to ⅝ in., according to the width of street and strain. The standard form of overhead construction is illustrated herewith. A strain insulator is placed in the span wire next to each pole. The straight line hangers are galvanized wire next to each pole. The straight line hangers are galvanized iron. The poles are in three sections, weighing 600 lbs. for straight line work, and as high as 1400 lbs. at corners. The largest feeder cables are weather-proof copper wire, of 500,000 circ. mil section. The maximum permissible drop in voltage for ordinary operation is considered to be 20 per cent. A plan of the overhead construction, corner of Illinois Street and Washington Street, the principal street railway center of the city, which all cars pass, is shown on page 344.

THE MILWAUKEE ELECTRIC RAILWAY & LIGHT COMPANY

The standard construction of the Milwaukee Electric Railway & Light Company differs in a number of details from the construction adopted by the majority of city roads. Figure 8


A
B
C
D
½ Bolt 3½ long
2 Pipe Tap
A Section on A B
Malleable Castirg
Malleable Casting
Section on C D
Pole Top
½ Bolts
Malleable Cross Arm
½ Bolt
Welded eye in rod
½" rod
Pipe Thread
8'6"
1½ x ¼ 2 St'd W.I.pipe
Malleable Casting
⅝ Cupped Set Screw
Malleable Casting
Hanger
⅜ Bolt
⅜ Spool wire
2 Strain Insulator
2 nuts
Malleable Casting
½ Bolt
Malleable Casting
1¼ x ⅛ ⅜ Rivets
⅜ Bolt
1' 6"
⅜ Rivets
½ Bolt
1½" x ¼"
⅜ Rivets
6'-6"
1½ St'd W.I.pipe
Pipe Thread
Malleable Casting
Malleable Casting
6' 5-4 St'd Pole
½" Eye bolt
Malleable Casting
Malleable Casting
Malleable Casting



PLAN OF OVERHEAD WIRES AT CURVES ON CLIFTON BOULEVARD, CLEVELAND

Street Railway Journal

have become accustomed to it. The span wire is ½-in. double galvanized stranded wire. All the feed wires inside of the city limits have been placed under ground in the shape of 1,000,000-circ. mil, paper-insulated, lead-covered cables. Outside of the city limits considerable aluminum overhead feed wire has been employed. Although large in section, the aluminum feeders weigh less for a given conductivity than copper feeders, and consequently put less strain on a pole line which carries a given amount of current. The conduit into which the underground feeders are placed is Camp single-duct vitrified tile. Poles for straight line work in the city are two-section steel tubular poles, 8 ins. and 7 ins. in diameter, weighing approximately 850 lbs. each. They are 28 ft. long. The poles are set in concrete.

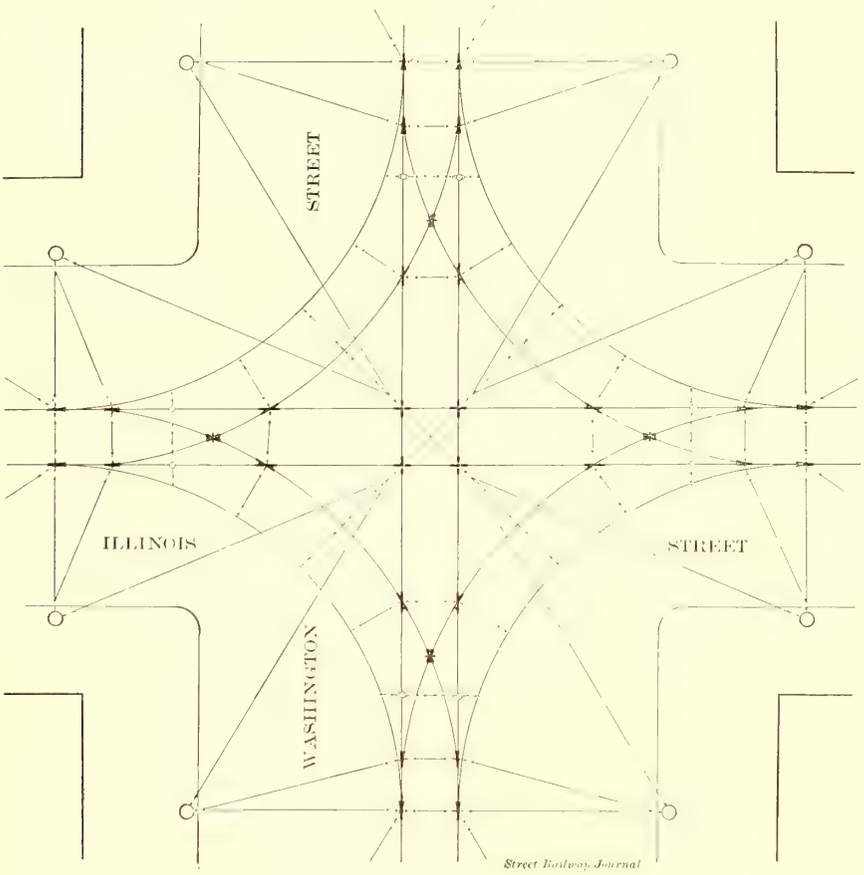


DIAGRAM SHOWING COMPLICATED CONSTRUCTION, CORNER ILLINOIS AND WASHINGTON STREETS, INDIANAPOLIS

It will be seen from these specifications that the overhead work in Milwaukee in general is somewhat heavier than prevails in other cities. The most radical change from ordinary line work adopted in Milwaukee, however, is the abolition of insulating trolley wire hangers. The trolley wire hangers are entirely of metal. The insulation is all obtained by strain insulators in the span wire, of which there are two in series between each pole, and the trolley wires. The trolley wire hangers are made up similar in appearance to an ordinary trolley wire hanger, with the omission of the insulating bolt. By making a trolley wire hanger purely mechanical and not depending upon it for electrical insulation, it can be made, of course, very substantial. This, together with the use of figure-8 wire, has reduced the troubles from the trolley wire hangers becoming loose or defective to practically nothing. For strain insulators, two Johns-Manville ball strain insulators are placed in each span wire. Every one of these insulators is tested in the shop, both electrically and mechanically, before it is put on the line. For new construction, span wires are made up in the shop, cut the proper length, so that there is no assembling to do on the line.

TWIN CITY RAPID TRANSIT COMPANY, MINNEAPOLIS AND ST. PAUL

The Twin City Rapid Transit Company uses figure-8 wire, equivalent to No. 00 round wire. The span wire used consists of three strands of No. 11 galvanized iron wire. The largest overhead feeders are 500,000-circ. mil, copper-insulated, with triple braid. Underground conduits are McRoy multiple duct vitrified clay. The company uses a peculiar form of trolley wire hanger of its own manufacture, in which insulation is secured by a stick of wood which is supported in the middle from the bracket or span wire, and on each end of which the trolley wire clips are supported. This was described in the Street Railway Journal of April 5, 1902. The company has a very heavy direct-current feeding system, and aims to maintain the maximum drop of voltage on its lines to within 5 per cent.

PHILADELPHIA RAPID TRANSIT COMPANY

The Philadelphia Rapid Transit Company uses No. 00 trolley wire. The standard poles are shown by the engraving on page 346. Feeders are almost entirely under ground, in the shape of paper-insulated and lead-covered cables. The largest cables are 1,500,000 circ. mil. For overhead work the cables are triple braid insulation, 500,000 circ. mill in size. The lines are laid out for approximately a 10 per cent drop in voltage for the load which it is estimated will occur on the line. When the load overruns this, of course the drop is greater. Direct-current feeders have an insulation 5-32 in. thick, of saturated paper, and a lead covering of the same thickness. For straight line work a round-top bell trolley wire insulator is used, with soldered ears 15 ins. long, and weighing 14 ounces.



JUNCTION HOWARD AND FAYETTE STREETS, BALTIMORE, WITH TOWER WAGON AT WORK

The poles have a sleeve which fits over them at the ground line to protect them against rust at that point. On the Chicago Union Traction lines, a cast-iron sleeve, fitting loosely, was put at the ground line. Between the sleeve and the pole pitch was poured.

PITTSBURG RAILWAYS COMPANY

The standard trolley wire of the Pittsburg Railways Company is No. 00 round. The span wire is 5-16 in. seven-strand galvanized iron wire. Iron poles on straight line work are 7 ins., 6 ins. and 5 ins. in diameter for heavy work, and 6 ins., 5 ins. and 4 ins. for lighter work. The feeder poles are 31 ft. long, and those not carrying feeders 28½ ft. long. Both copper and aluminum overhead feeders have been used to a considerable extent. The company attempts to maintain the drop of voltage on its lines within 50 volts.

UNITED RAILROADS OF SAN FRANCISCO

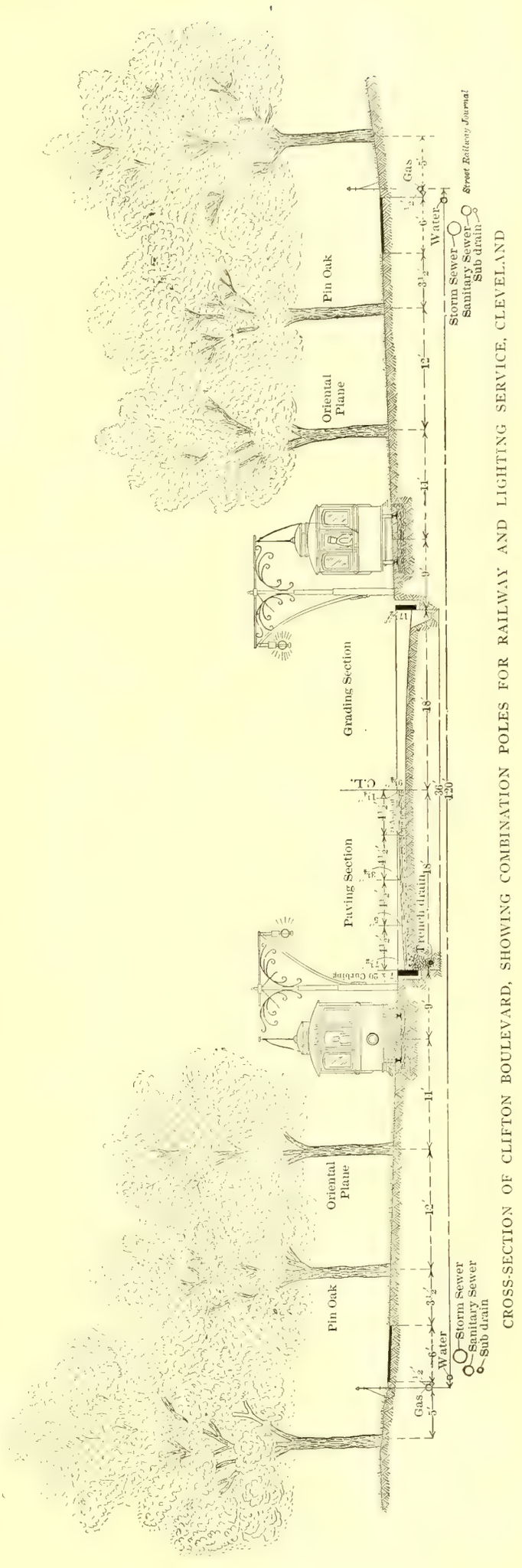
The United Railroads of San Francisco have several kinds of trolley wire, including No. 0 hard-drawn copper, Nos. 0 and 00 phono-electric, No. 0000 grooved hard-drawn, and figure 8 of 330,000 circ. mil section. The span wire adopted for future construction is 5-16-in. galvanized stranded wire. The largest feed wire is 1,000,000 circ. mil copper. For straight line work iron poles 7 ins., 6 ins. and 5 ins. in diameter are standard. For outlying streets wooden poles 8 ins. at the top and 12 ins. at the bottom, 30 ft. long, of redwood, are standard. The company attempts to maintain the drop in voltage within 20 per cent.

ST. LOUIS TRANSIT COMPANY

The St. Louis Transit Company uses as standard on its new work No. 00 round trolley wire. The span wire is seven-strand 5-16-in. double galvanized steel wire. The maximum size of feeders used in overhead work is 1,000,000 circ. mil. The standard poles for straight line construction are 6 ins. and 5 ins. in diameter, and 7 ins. and 6 ins. in diameter, with weights 545 lbs. and 650 lbs. These are in 28-ft. and 30-ft. lengths. On curves, 1025-lb. poles are used. The conduits are cement-lined iron pipe. Trolley wires are insulated by a Johns joint strain insulator at the pole, and by a trolley wire hanger with wooden insulation of the company's own manufacture, and described in the STREET RAILWAY JOURNAL for Aug. 8. These trolley wire hangers have an insulating bolt in which a cone-shaped piece of wood furnishes the insulation. The ear for holding the trolley wire is 15 ins. long, and is clinched or hammered to maintain the wire. No solder is used. The voltage at the power station is kept at 600, and ordinarily the drop on the city lines does not exceed 500 volts.

GENERAL CONCLUSIONS

Center pole construction has practically become obsolete for city work. There are plenty of cities where center poles are still used, but the number in use is on the decrease rather than on the increase. Although they are more sightly than the side pole and span wire construction, street railway companies have found them objectionable on account of danger that accidents will occur by passengers and employees being struck with the poles, on account of the small clearance between the car and the center pole. Wire netting is necessary to protect all windows or other openings where there is a possibility that passengers or employees will stick out heads or arms where they might be struck in passing center poles. This netting in itself is objectionable, and even where it is present, it is not always practicable to so completely "cage in" the passengers and employees that they never get hurt in this way. Center poles are also somewhat of an obstruction to team traffic, and sometimes prevent teams from clearing the track as soon as they other-



CROSS-SECTION OF CLIFTON BOULEVARD, SHOWING COMBINATION POLES FOR RAILWAY AND LIGHTING SERVICE, CLEVELAND

wise would. Center-pole and track construction has also been the source of considerable trouble, through the rigidity of the brackets and consequent breakage of the trolley hangers. This objection has been overcome by various flexible types of brackets and also by trolley hangers not so much affected by the hammering of the trolley wheels against the rigid bracket hangers, as were the old types. In interurban bracket construction, where poles have been placed far enough from the car, this construction is all right.

There has been a general increase in the strength, both mechanically and electrically, in overhead construction. Double insulation between the trolley wire and a steel pole is now common, where formerly a single insulation was used. In some cities three insulators are in service between the trolley wire and steel poles, one at the trolley wire hanger and two strain insulators in the span wire. One radical move introduced at Milwaukee is doing away with insulation at the trolley hanger entirely, and depending on the insulation of two strain insulators and the span wire. This is a very substantial construction, and permits of a trolley hanger which can be made very strong mechanically. The only objection which might be urged to it would be that the span wires are alive inside of the strain insulators. This objection is not of much practical weight, because if a foreign wire falls across the span wire it is almost certain to come also in contact with the trolley wire, because it will slide along the span wire until it strikes a trolley wire.

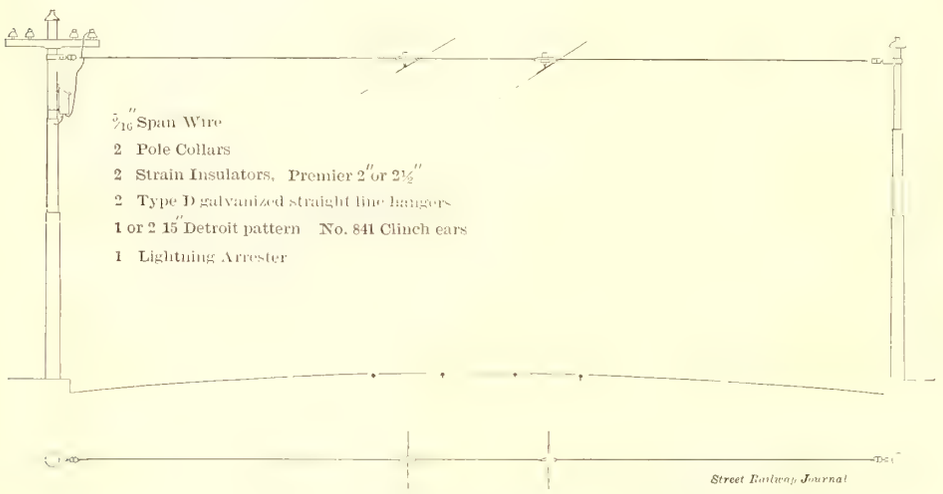
Practice is fairly well divided between two-section steel poles, as against three-section poles. Aluminum feeders do not seem to have found extensive use as yet for city direct-current work, although one company reports very favorably on it for use in outlying districts where their apparent great size is not objectionable. The lighter weight of aluminum for given conductivity relieves the pole line of considerable weight and makes aluminum popular with linemen who first object to it.

Figure-8 trolley wire does not seem to have met with favor in the majority of places, but companies which have adopted it have thoroughly trained line crews to handle this class of work. Certainly little fault can be found with the quality of the overhead construction done by companies which have adopted it.

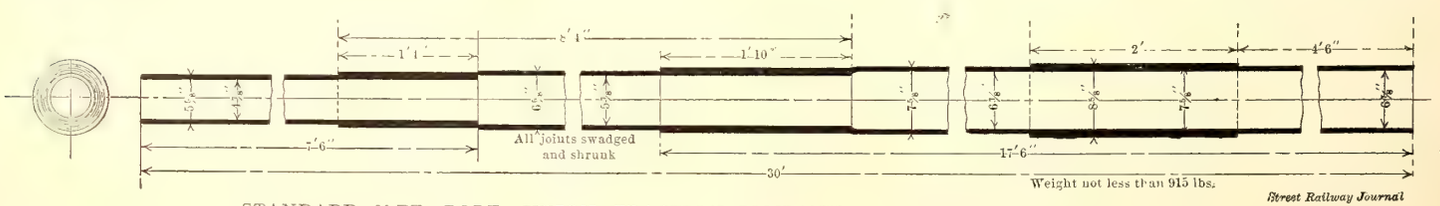
Another variation from common practice is the use of wood for insulators and hangers by the St. Louis Transit Company. Many small companies have used wood at various times within the past few years from motives of economy, and it was used in some of the early roads, but the St. Louis Transit Company is probably the first large city company to adopt this construction for its regular work.

TABLE OF OVERHEAD CONSTRUCTION

	Kind of Trolley Wire	Size of Span Wire	Kind and Maximum Size of Feeders (Overhead)	Lightest Poles for Straight Line Work	Number of Insulators between Trolley and Pole	Type of Underground Conduit	Volts Drop for which New Lines are Calculated
Baltimore United Rys. & Elec. Co..	Round 0 & 00	5/16 in.	500,000 cm copper	5-4 in.	2	Terra cotta	50
Boston Elevated Ry	Round 00	5/16 in.	1,000,000 cm copper	750 lb. 6½-5½-4½ in.	2	Single duct terra cotta	100
Buffalo Ry	Round 00	3/8 in.	500,000 cm copper	.....	2	.....	100
Chicago City Ry	Round 00	3/8 in.	500,000 cm copper	900 lb. 7-6-5 in.	3	Mult. duct terra-cotta	75
Cleveland Electric Ry	Round 00	5/16 in.	1,000,000 cm copper	625 lb. 7-6-5 in.	..	.....	125
Denver City Tramway Co.	Round 0	5/16 in.	500,000 cm copper	.....	2	.....	50
Detroit United Ry	Round 00	5/16 in.	1,000,000 cm copper	675 lbs.	2	.....	100
Indianapolis Traction & Term'l Co.	Round 00	3/8 in.	500,000 cm copper	600 lbs.	2	.....	..
Milwaukee Electric Ry & Light Co	Fig. 8 = 000	½ in.	.....	850 lbs. 8-7 in.	2	Single duct tile	..
Minneapolis Twin City R. T. Co..	Fig. 8 = 00	3-11	500,000 cm copper	.....	2	Multiple duct tile	25
Philadelphia Rapid Transit Co.	Round 00	....	.....	915 lbs. 8-7-5 in.	2	.....	50
Pittsburg Rys. Co	Round 00	5/16 in.	1,500,000 cm aluminum	.....	..	Cement lined and single and multiple duct tile	50
San Francisco United Railroads	All kinds in use	5/16 in.	1,000,000 cm copper	7-6-5 in.	2	.....	100
St. Louis Transit Co	Round 00	5/16 in.	1,000,000 cm	545 in. 6-5 in.	2	Cement lined iron pipe	100



STANDARD OVERHEAD CONSTRUCTION SPAN WORK WITH STEEL POLES, INDIANAPOLIS

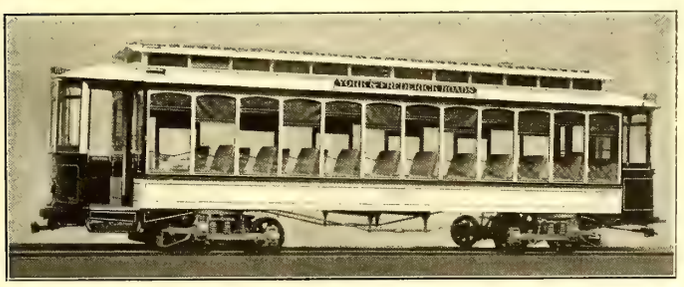


STANDARD 30-FT. POLE, UNION TRACTION COMPANY, PHILADELPHIA

STANDARD PRACTICE IN ROLLING STOCK FOR CITY SERVICE

THE main object of this article is to put into convenient form for reference and comparison a brief description of each of the standard cars for city service adopted by fourteen of the larger city street railway systems of the United States, to the end that an idea of the general trend of practice in rolling stock may be obtained. An acquaintance with the rolling stock in one or two cities or in a certain locality is apt to result in a very different opinion as to the trend of modern practice than a broad view of the situation the country over. It is this broad view that this article is intended to afford.

By way of explanation it should be said that in this article no attempt has been made to include anything but the latest adopted standard cars of each company on the list. Every company has considerable variety in its rolling stock. Few companies have not seen fit to change their standard type of car from time to time, in order to keep pace with the progress of the electric railway art. The tendency has been ever toward larger cars. On nearly every road can be seen, from the cars in service during busy hours, the history of the growth of rolling stock during the past ten years, beginning with the single truck, 5-ton to 7-ton cars, built originally for horse traction, and ending with the long double-truck cars, equipped with four motors each, and weighing from forty to fifty thou-

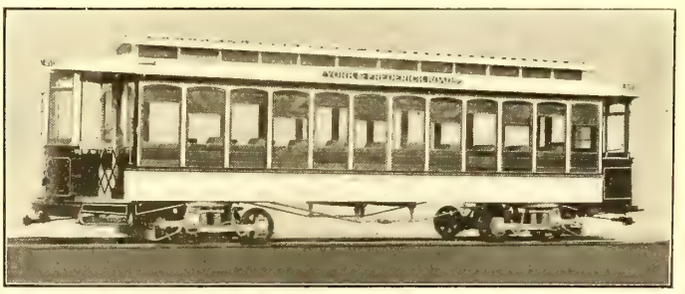


STANDARD SEMI-CONVERTIBLE CAR USED IN BALTIMORE

sand pounds. It is but natural to inquire what will be the ultimate limit of this increase in the size of cars. With each increase it has been the prevailing opinion among street railway men that larger cars would not be advisable; but in spite of this, the growth has been going on steadily. Are the present largest cars enumerated in the following pages the limit of size for city service? Will still larger cars be used, or will there be a reaction to shorter cars?

Speculation on these on these points is probably useless. The increase in size of cars for use in large cities has, of course, been made possible by the freedom from the limitations of horse traction. It was not thought when electric traction first came in that long cars were desirable in large cities. It was argued that they would be slow to load and unload, and would necessitate slow schedules. Experience seems to have demonstrated to the contrary, however, and other considerations have made the adoption of long cars hard to resist by the management of any large city system. The long car carries more people with a given expense for motorman's and conductor's wages than does the short, but what is still more important, the easy-riding qualities of the long car, due to the use of double trucks, make it very popular. To be sure, if long cars are to be run fairly well loaded all day, the headway between cars on a given route must be considerably longer between long cars than between short cars, and it may not be desirable to increase the interval a passenger may wait for a car.

The force of this objection depends mainly on the size of the city. In a small city this has practically prohibited the intro-

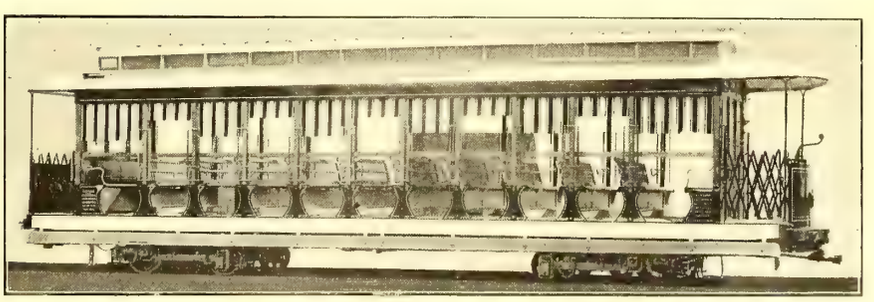


STANDARD SEMI-CONVERTIBLE CAR USED IN BALTIMORE

duction of long cars, because there are usually not enough passengers to fill even short cars operated on an uncomfortably long headway. In large cities there is sufficient traffic, so that cars are well filled when operated on short headway in any event, be they long or short, so that this objection does not hold.

When a long car is extremely crowded during rush hours there is no doubt much missing of fares by conductors. On this point it is argued that no well-managed company wants to operate its cars so extremely crowded, for more reasons than one, and that they will be so operated only a very small part of the time. This is usually true, although it is a matter frequently beyond the company's control. However, a full discussion of the question of long vs. short cars, or short cars and trailers would require a separate article, and, perhaps, be useless, since the long car has come into such general use in the largest cities, and conditions are so generally unsuited to it in small cities.

Following are the descriptions of standard cars used by fifteen companies for heavy city traffic, accompanied by a table giving the principal dimensions. In each case, what is called



STANDARD OPEN CAR USED IN BALTIMORE

the standard city car, or cars, of any company are the types of cars most recently adopted by that company, without reference to any of the older rolling stock which that company may have in service. The principal dimensions are put in tabular form for convenience in reference.

UNITED RAILWAYS & ELECTRIC COMPANY OF BALTIMORE

The standard closed car of the United Railways & Electric Company of Baltimore measures 28 ft. over end panels, 38 ft.



END VIEW OF STANDARD BOSTON CLOSED CAR

over crown pieces, and has a width over sills and panels of 7 ft. 6 ins., and over posts at belt rail of 7 ft. 10 ins. The side sills are 4¾ ins. x 7¾ ins., and are plated inside with ⅝-in. x 7-in.



COMBINATION MAIL AND PASSENGER CAR USED IN BOSTON

steel, turned at the end sills and bolted to them. The end sills are 4¾ ins. x 6⅞ ins., and the center and intermediate posts 3½ ins. x 5⅞ ins. The crown pieces are 2¼ ins. x 18 ins. The platforms are 5 ft. long, and are provided with a dash extending around one side. The four platform timbers are 8 ins. deep, and the outside timbers are reinforced with angle-iron. A somewhat novel feature has been introduced in the platforms by fastening on the top of the regular platform flooring wooden strips 2 ins. wide, with ½ in. space between them. These strips are similar to those used in the inside of the car but are run crossways instead of longitudinally. The object is to drain the water from the platforms, and they certainly make a very dry and clean looking platform. The cars, which weigh 21,760 lbs. without passengers and motors, are mounted on maximum traction trucks and are fitted with portable vestibules. The end door is set slightly to the side nearest to the step, so as to make the interior easy of access and exit.

The standard twelve-bench open car of the company has the following dimensions: Length over crown pieces, 38 ft. 9 ins.; distance from center of corner posts over crown pieces, 3 ft. 8 ins.; width over sills, 7 ft. 5 ins.; width over posts at belt rail, 7 ft. 10 ins. The side sills are 4¾ ins. x 7 ins., and are plated with ⅝-in. x 9-in. steel; the crown pieces are 2¾ ins. x 12 ins., and the cross joints are 3½ ins. x 6¼ ins. This car is fitted with a 9-in. running board with folding step irons. The top of



STANDARD CLOSED CAR USED IN BOSTON

the running board from the rail head is 18½ ins., and the distance from the step to the following is 16 ins. These cars are also mounted on Eureka maximum traction trucks, and weigh without passengers and motors 23,100 lbs.

BOSTON ELEVATED RAILWAY COMPANY

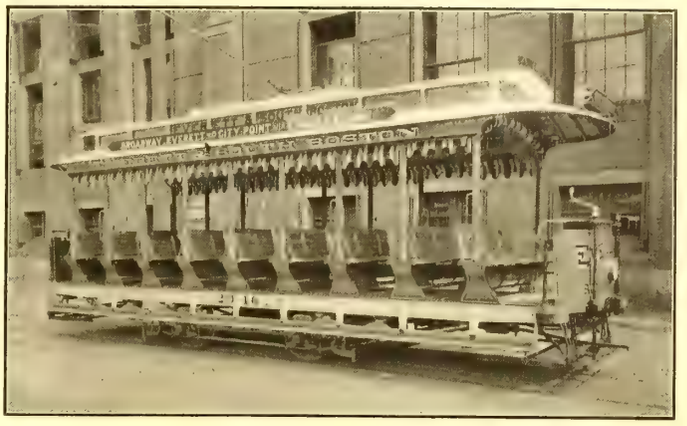
The standard closed car of the Boston Elevated Railway Company is one having a 25-ft. body, with platforms about 4 ft. long. The width at the sills is 6 ft. 8 ins., and the width at the belt rail 7 ft. 6 ins., curved panels being used. The step is 16 ins. from the rail. The step is 13 ins. below the platform and the platform 7 ins. below the car floor. This car seats thirty-four passengers on longitudinal seats. It weighs 24,660 lbs., complete, without passengers. A number of maximum traction trucks are used, although the more recent practice is toward center swivel double trucks. For summer use the standard is a twelve-bench open car, which is approximately the same size as the standard closed car. The dimensions of all



STANDARD TWELVE-BENCH OPEN CAR USED IN BOSTON

these cars can be seen on the accompanying table. These open cars weigh a little less than the closed cars, but in general they correspond very closely to the closed cars. There is also a standard nine-bench open car on single trucks, the dimensions of which are given in the table.

The Boston Elevated, like many others, does not attempt to operate the same type of car on every route, as some forms of car are better suited to certain classes of traffic than others. The company, however, does aim to standardize the equipment operated from each large car house, and carries this to a point where, as a rule, each car house is supplied with car equipments, such as trucks, motors, etc., of the same make. The practical advantages of this plan in the way of a minimum quantity of repair and renewal parts, etc., are apparent. The standard cars



STANDARD NINE-BENCH OPEN CAR USED IN BOSTON



STANDARD CLOSED CAR USED IN BUFFALO FOR CITY SERVICE

referred to above are those which, on the whole, have proved themselves best suited to the traffic conditions in Boston.

BUFFALO RAILWAY

The standard closed car of the Buffalo Railway, which is now part of the International Traction Company, is a double-truck car with a 30-ft. 6-in. body and a length over all of 40 ft. 8 ins. The platforms are 4 ft. 3 ins. These cars weigh 29,180 lbs. without motors and 40,180 lbs. with motors. They have side seats, with a seating capacity of forty passengers. The latest practice is to equip these with air brakes. A number of electric brakes are in use at Buffalo, also. The company has a separate equipment for summer use. The standard summer car is on double trucks, and has a length of 42 ft. 11 ins., seating eighty-four passengers on fourteen benches. These cars are equipped with four motors each, and weigh 27,424 lbs. without motors, or somewhat less than the closed cars.

CHICAGO CITY RAILWAY COMPANY

The Chicago City Railway Company has begun to equip its lines with a semi-convertible car which has attracted considerable attention the country over. This car is probably the most expensive of any of the cars enumerated in this list of standard city cars, on account of its size, weight and interior finish. It is, as can be seen, the heaviest car on the list, weighing, empty, about 48,000 lbs. It represents the extreme of the present tendency toward long, heavy cars.

The car body is 34 ft. long, length over all 48 ft. 2 ins., the platform being 6 ft. 5 ins. In

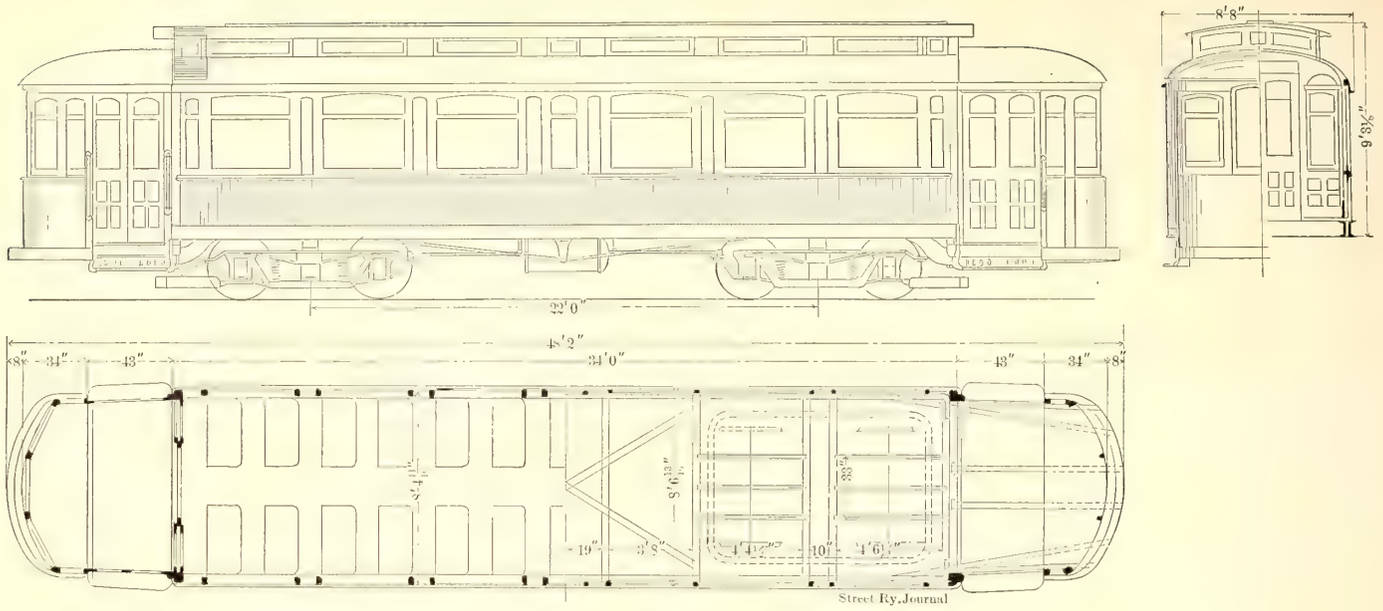


STANDARD FOURTEEN-BENCH OPEN CAR USED IN BUFFALO



STANDARD SEMI-CONVERTIBLE CAR USED BY THE CHICAGO CITY RAILWAY

order to get plenty of room in the center aisle between the cross seats which are used, the car bodies have been made very wide, as local conditions permitted this. This width of the car bodies, together with the fact that the backs of the seats are made narrower than the bottoms, gives a comparatively wide aisle, much better suited to carrying a standing load during



PLAN AND ELEVATIONS, SEMI-CONVERTIBLE CAR—CHICAGO CITY RAILWAY

rush hours than the majority of aisles to be found in cross seat cars.



STANDARD CLOSED CAR USED IN CLEVELAND

These cars have double channel iron sills under each side of sufficient strength, so that no other longitudinal sills are needed, which gives a clear space for the trucks and the car bottom, which permits of a low-hanging car body. This, together with a 10-in. rise from the platform to the car floor, makes but a single step between the street and the platform. The Chicago City Railway has been putting on a large number of these new cars, and they have proved so popular that it is probable they will be used in great numbers in the reconstruction of Chicago street railways, which is soon to come about. This is the type of car recommended in the report of B. J. Arnold on the Chicago transportation problem. The St. Louis & Suburban Railway also uses a large number of this type. It is a semi-convertible car, adapted for use in both summer and winter. The sashes lower into the space between the sheathing and the inner wall.

In order to permit a low window-sill, which is desirable with a semi-convertible car, there is a space between the two channel irons which form each side sill, and the lower part of the sash when the window is down occupies this space. Both platforms are long, and the long, low step, together with the wide aisle, makes the car one which discharges and receives passengers quickly. The opening at each end has double sliding doors, and is the full width of the aisle when both doors are open. The doors are independent of each other, however, so that one door can be opened without disturbing its mate. For the exit of one passenger it is not necessary to open both doors, but at transfer points both doors can be opened and passengers can enter or leave the car two abreast.



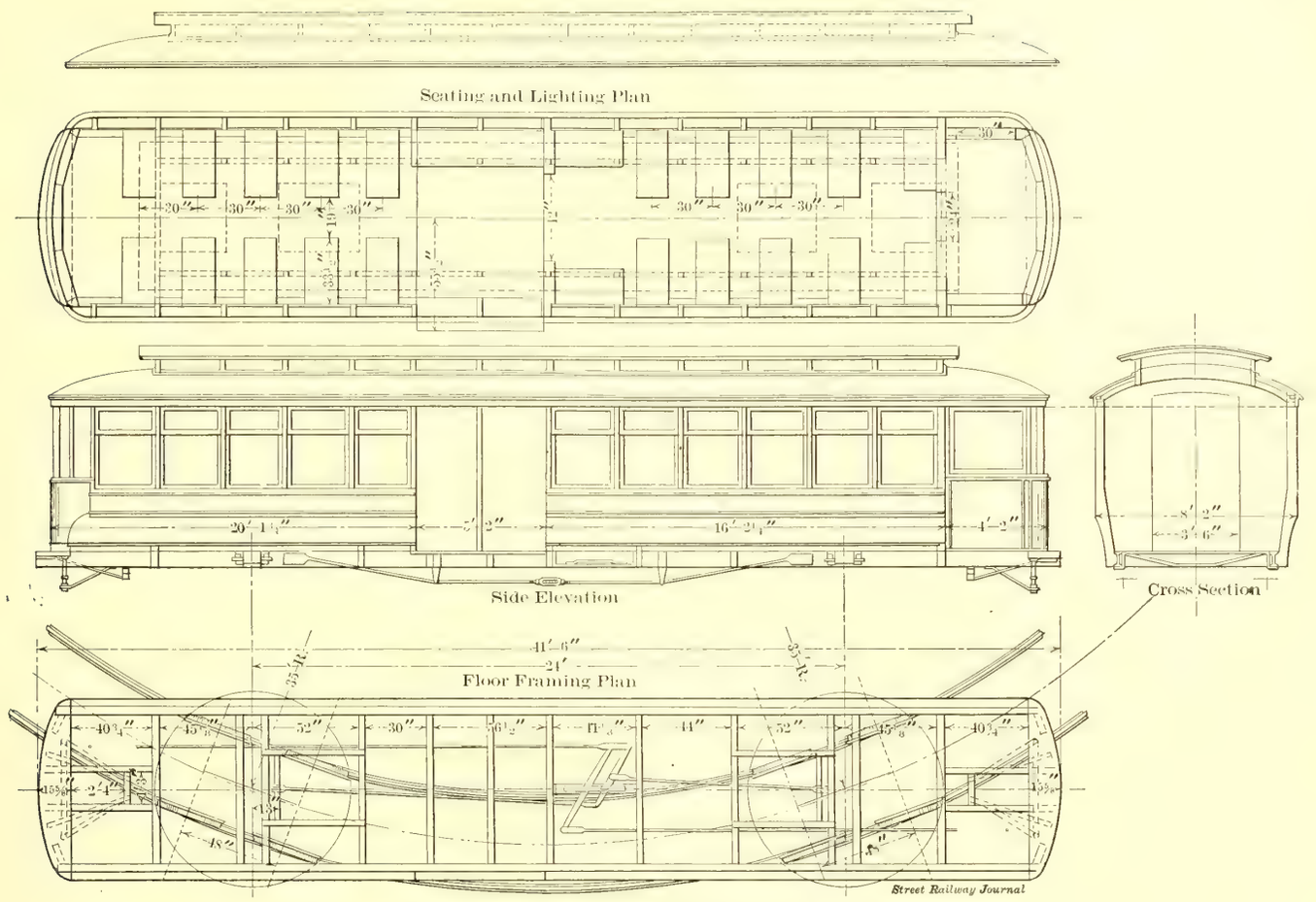
STANDARD FOURTEEN-BENCH OPEN CAR USED IN CLEVELAND



STANDARD FOURTEEN-BENCH OPEN CAR, INSIDE CLOSED PANEL, USED IN CLEVELAND

CLEVELAND ELECTRIC RAILWAY COMPANY

The Cleveland Electric Railway Company in its last orders specified longitudinal seat cars, 43 ft. over all, with 30-ft. body, for use on double trucks. The weight is 28,000 lbs. Hand brakes are used. The rear platform is 6 ft. long, and of the Detroit type, with a space separated by a railing from the entrance, to accommodate a large standing load on the rear platform. The front platform is kept closed at all times, and is 5 ft. long. On this car

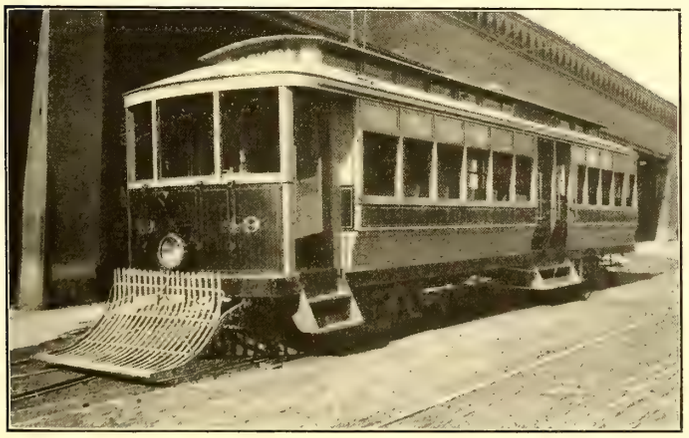


PLAN AND SIDE ELEVATION OF COMBINATION CAR USED IN DENVER

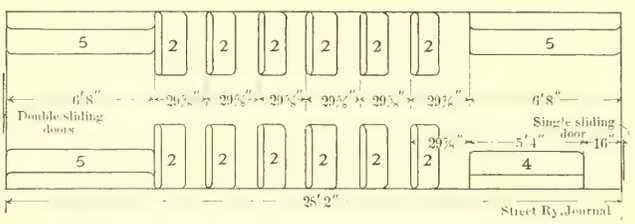
two steps are required to get to the platform, these steps being 17 ins. and 13 ins. in height, respectively. There is a rise of 8 ins. from the platform to the car floor. This is a car suited only for winter use. For summer, fourteen-bench open cars are used. These are about the size of the Buffalo cars, seating eighty-four passengers. They are somewhat heavier, weighing 40,000 lbs. They are equipped with hand brakes. Two steps are required.

DENVER CITY TRAMWAY COMPANY

At Denver an entirely different car is found from that used in the Eastern and Central States. It could be called a compromise between the closed car of the East and the combination car of the Pacific coast. In dimensions it corresponds very closely to the other larger cars in use over the country. It has no rear platform, and nothing which could possibly be called such, although there is a space at the rear of the car which corresponds to a platform. The passenger entrance is at the side. The forward part of the car is a closed body for non-smokers. It is equipped with cross seats, and can be converted into an open car in summer by lowering the windows. The rear of the car is provided with similar windows, but is designed to be used more as an open compartment than is the front compartment. The entrance being at the side between the two compartments, loading and unloading is easier than if there was only an exit at the rear platform, though, of course, the conditions in this respect are practically equivalent to what they would be in a car with both front and rear platforms open. There is this in its favor, however, that the side entrance is more easily watched by the conductor, and, further, it is not likely to be crowded with standing passengers, as a platform would be. It is not a place where people naturally desire to stand, as they would on a platform at front or rear. The Denver car certainly has many points to recommend it, especially for a climate like that of Denver, which is of a character between that of the Eastern and Central States, where there is great variation in temperature, and that of the Pacific coast, where the temperature varies so little. This car serves admirably as a summer car, and yet affords protection during the brief sharp cold spells which sometimes occur in Denver.



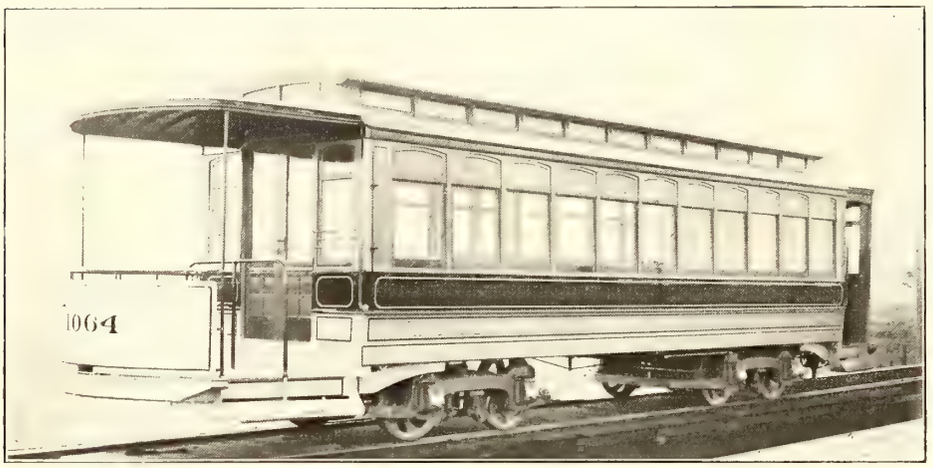
STANDARD COMBINATION CAR USED IN DENVER



SEATING ARRANGEMENT OF DETROIT CAR

DETROIT UNITED RAILWAY

The Detroit United Railway Company, on its city lines, has in the past operated mainly single-truck cars of the old-style open and closed types. Recently large orders placed by it have been for the semi-convertible type of car, with center aisle and cross seats, which can be used summer and winter. These cars are mounted on double trucks of 4½ ft. wheel base. The bodies are 28 ft. 2 ins. long; the length over all, 41 ft. The seating capacity is forty-three. The majority of the seats are cross seats, though at each end of the car are longitudinal seats, to give more room around the entrance. The front platform is 5 ft. 6 ins. long, and has a compartment for the motorman and a hot-air heater separate from the passenger entrance. Passengers can enter and leave by the front platform without in any way disturbing the motorman. The rear platform is 6 ft. 6 ins. long, and, of course, is of the Detroit type, with provision for a large standing load, and a passenger entrance partitioned off from the balance of the platform by a railing.



STANDARD SEMI-CONVERTIBLE CAR USED IN DETROIT

INDIANAPOLIS TRACTION & TERMINAL COMPANY

The Indianapolis Traction & Terminal Company has recently made extensive additions to its rolling stock in the shape of double-truck cars suited for both summer and winter use. It can hardly be said, however, that this company is working entirely in the direction of the semi-convertible car, since the open car is used to such a great extent for extra heavy traffic during the summer, that it is a question whether it will ever be entirely superseded by the semi-convertible type. The double-truck semi-convertible cars, one of which is illustrated herewith, has a length of body of 32 ft.; length over all, 45 ft. The rear has a 6-ft. Detroit type platform. At the forward end is a motorman's cab, which is closed off so that passengers can enter the car by the forward platform without interfering with the motorman.

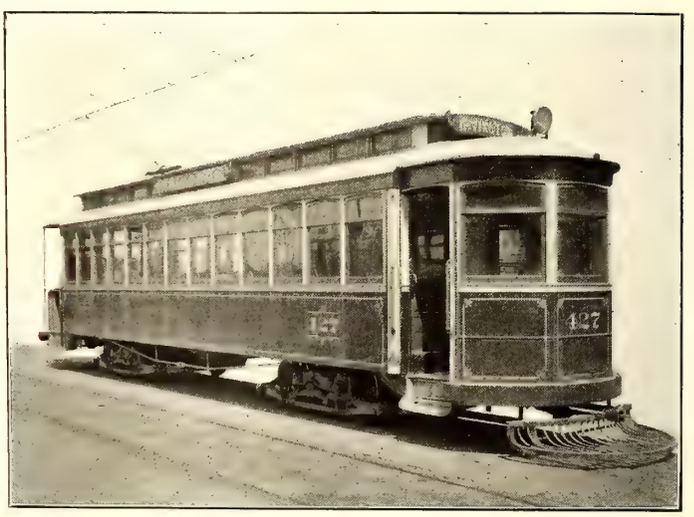


STANDARD SEMI-CONVERTIBLE CAR USED IN MILWAUKEE

The car is of large seating capacity, accommodating fifty-two passengers. A Baker hot-water heater is placed in the motorman's cab. Part of the seats are longitudinal and the balance cross seats. As seen from the engraving, the Indianapolis car has straight sides and sheet steel panels. This is the only company among those enumerated in this article that is now using sheet steel panels in place of wood. The general arrangement of the platforms is similar to that of the Detroit car, which has been heretofore illustrated. Air brakes are employed. Other dimensions and particulars of this car can be obtained from the table. The company also employs a large number of open cars on single trucks. These have a length of 34 ft. 5 ins. over all. They have twelve benches and seat sixty persons. The other dimensions are obtainable from the table.

THE MILWAUKEE ELECTRIC RAILWAY & LIGHT COMPANY

The Milwaukee Electric Railway & Light Company about seven years ago adopted a standard car for use the year round,



STANDARD SEMI-CONVERTIBLE CAR USED IN INDIANAPOLIS

and this car, with improvements in details with each successive new order, has remained the standard ever since. It is probably true that no other company in the United States has maintained so nearly a standard car for so long a period of time, and it speaks well for the wisdom shown in the selection of a car in the first place that so few changes have been found necessary. Of course slight improvements are made in each new order. The car is simply a carefully designed type of semi-convertible car, of the style here illustrated. Some small improvements have been made over the car shown. The car was first equipped with two motors, but about six years ago the use of four motors was begun, this being the pioneer company to adopt four motors for city service. This practice has been continued ever since. The car seats forty-four passengers, all the seats being cross seats, except that there is a longitudinal seat in each corner of the car.

There is one step between the ground and platform, and a rise from the platform to the car. This, when first introduced, was somewhat of an innovation, as previous to the time this car was designed cars on center-swivel trucks which would accommodate four motors on 33-in. wheels and have the platform low enough so that there was no need of more than one step between the platform and the ground were almost unknown. The use of four motors with a low car floor was made possible by a skillful design of the car sills and platform, together with the design of an M. C. B. type of truck, which had a low frame, and which would permit of as low car sills as the wheels would clear. An M. C. B. truck so designed that the frame would not be higher than the wheels was developed for use at Milwaukee, and has since found favor in other places, notably under the Chicago car, before illustrated.

The latest order of city cars for Milwaukee will have 29-ft. bodies, and will be 41 ft. long over the bumpers. The platforms are 5 ft. long. The width of the car body at the belt rail is 8 ft. 5 ins. The new cars will differ from the car illustrated herewith by having the window-sills 4 ins. lower. Double side sills will be used to allow the sashes to be lowered between them. This will make the car more nearly an open car when the windows are lowered in summer. Owing to the narrow bridges in Milwaukee, it is necessary to put wire netting at each window in the summer when the windows are open. Although this general type of semi-convertible car was first used in large numbers on maximum traction trucks at St. Louis, it was first used with four motors at Milwaukee, and was there first introduced in large numbers as a uniform standard car. The influence of the practice in both of these cities as regards the adoption of the semi-convertible type of car has been considerable.



STANDARD SEMI-CONVERTIBLE CAR USED IN PHILADELPHIA

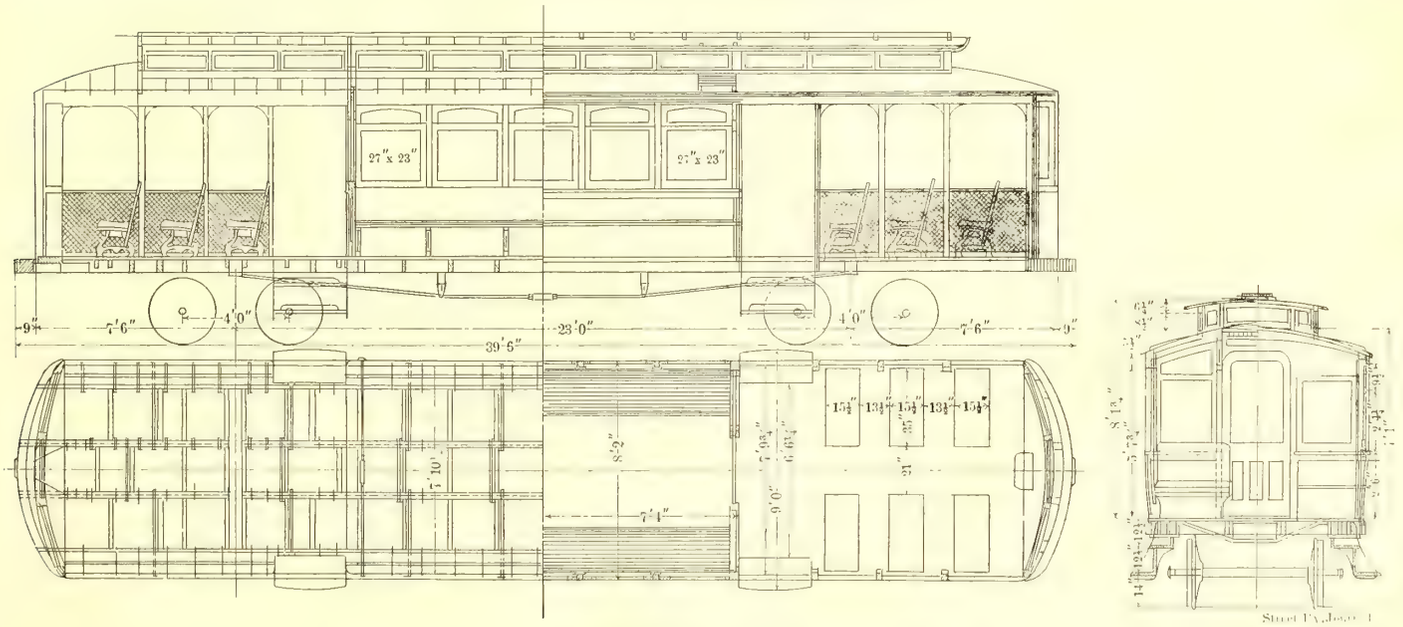


STANDARD DOUBLE-TRUCK CLOSED CAR USED IN PITTSBURG

TWIN CITY RAPID TRANSIT COMPANY, MINNEAPOLIS AND ST. PAUL

The Twin City Rapid Transit Company, operating all the lines in Minneapolis and St. Paul, is another company which has come to the semi-convertible car as the most satisfactory type for general city use. It also has a number of open cars which are brought into service for the extra heavy traffic to parks and other resorts in the summer. For general city service, however, the company has gradually been working toward a car which is reasonably well adapted to all seasons. The Twin City car approaches more closely an interurban car than the majority of city cars included in this list. The car floor is high, and requires two 18-in. steps and a 5-in. riser from the platform to the car. As to seat-capacity, the car is equal to the Chicago and Indianapolis cars, which seat fifty-two. The front part of the car has cross seats, there being fourteen of these. The rear part of the car has side seats, to facilitate entrance and exit.

One notable feature about these cars is the solid double floor. There are no openings nor trap-doors with which to get at the



NEW STYLE CALIFORNIA TYPE CAR, SAN FRANCISCO COMPANY

motors. All the work on motors is done from the pit, or by taking the trucks out from under the bodies. The double floor is mainly for the object of warmth in winter. The cars have

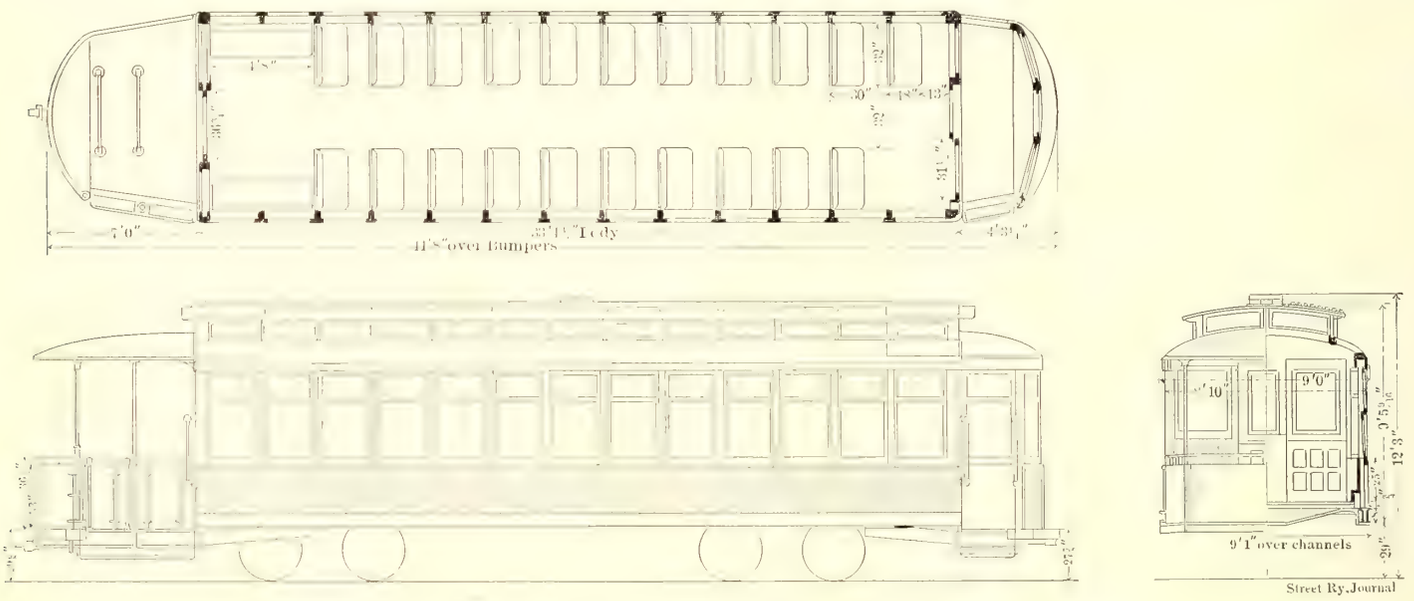


STANDARD COMBINATION CAR USED IN SAN FRANCISCO

double windows in winter, and are heated with hot water, so that in spite of the cold climate, they are very much more comfortable vehicles than are to be found in some of the cities where the winters are not so severe. The standard open cars mentioned have center aisles, and are entered by the rear platform, just as a closed car would be. The sides are permanently closed with wire netting. All the Minneapolis cars have the Minneapolis gate, which is opened and closed by the motorman for the entrance and exit of passengers. This gate is kept closed at all times, except when the car is standing still. All these cars are equipped with straight air brakes. The weight of the semi-convertible or closed car is 43,000 lbs., and that of the open car, 26,500. The former is equipped with four motors and center-swivel trucks, and the latter with two motors, and with maximum traction trucks. The seating capacity of both is the same, being fifty-two persons.

PHILADELPHIA RAPID TRANSIT COMPANY

The recently adopted standard car for the Philadelphia Rapid Transit Company is a semi-convertible car, 38 ft. over all, with 28-ft. body. The company in Philadelphia was one of the first of the Eastern companies to come to the semi-convertible type, although it is the last company on the list to make the change from the ordinary closed type with longitudinal seats. The Philadelphia car is somewhat in the nature of a compromise between the large cars of Minneapolis and Chicago and the shorter cars of Buffalo and Boston. The platforms are of moderate length, being 4½ ft. The car bodies are low enough so that but one 13-in. step is needed to reach the platform, with an 8-in. rise from platform to car floor. This car seats forty passengers, and weighs, without load, about 32,000 lbs.



PLAN OF STANDARD SEMI-CONVERTIBLE CAR—ST. LOUIS TRANSIT COMPANY

TABLE SHOWING PRINCIPAL DIMENSIONS OF STANDARD OPEN AND CLOSED AND SEMI-CONVERTIBLE CARS

Number	City and Name of Company	Single, Double or Maximum Traction Trucks	Length of Body	Length Over All	Length of Platforms	Width of Car Body at Sills	Width of Car Body at Belt Rail	Height Side Top Rail from Floor	Height of Step from Rail	Height from Step to Platform	H'ght Riser from Platf'm to Car Floor
1	Baltimore—United Rys. & Electric Co	M. T.	28 ft.	38 ft.	5 ft.	7 ft. 6 in.	7 ft. 10 in.	6 ft. ⅛ in.	15 in.	13½ in.	7¾ in
2	Boston Elevated Railway Co	M.T.and double	25 ft.	33 ft. 3 in.	4 ft.	6 ft. 8 in.	7 ft. 6 in.	5 ft. 7 in.	16 in.	13 in.	7 in.
3	Buffalo Railway Co	Double	30 ft. 6 in.	40 ft. 8 in.	4 ft. 3 in.	7 ft. 8½ in.	8 ft. 2 in.	6 ft.	16 in.	13¼ in.	8 in.
4	Chicago City Railway Co	Double	34 ft.	48 ft. 2 in.	6 ft. 5 in.	8 ft. 8 in.	8 ft. 8 in.	5 ft. 8 in.	16 in.	12 in.	10 in.
5	Cleveland Electric Railway Co	Double	30 ft.	43 ft.	5 ft. and 6 ft.	6 ft. 6 in.	8 ft. 2 in.	6 ft. ⅛ in.	17 in.	2 steps 17 and 13 in.	8 in.
6	Denver City Tramway Co	Double	36 ft. 4 in.	41 ft. 6 in.	Side entr. 5 ft. 2 in.	7 ft. 3½ in.	8 ft. 2 in.	6 ft.	14½ in.	2 steps 11 and 12 in.	3½ in
7	Detroit—United Railway Co	Double	28 ft. 2 in.	41 ft.	6 f.6 in.5 f.6in	8 ft. 1 in.	8 ft. 1 in.	-------	14⅝ in.	13¼ in.	10 in.
8	Indianapolis Traction & Terminal Co	Double	32 ft.	45 ft.	6 ft.	8 ft. 4 in.	8 ft. 7 in.	6 ft.	17 in.	12 in.	9 in.
9	Milwaukee Electric Railway & Light Co	Double	29 ft.	41 ft.	5 ft.	8 ft. 1 in.	8 ft. 5 in.	-------	------	----------	-----
10	Minneapolis—Twin City Rap. Tran. Co.	Double	33 ft. 1 in.	45 ft. 2½ in.	5 ft. 3 in.	8 ft. 5⅞ in.	8 ft. 5⅞ in.	5 ft. 10⅜ in.	16 in.	2 steps 18 in.	5 in.
11	Philadelphia Rapid Transit Co	Double	28 ft.	38 ft.	4 ft. 6 in.	7 ft. 9½ in.	8 ft. 3 in.	5 ft. 10 in.	15⅞ in.	13 in.	8 in.
12	Pittsburg Rys. Co	Single	19 ft. 11 in.	30 ft.	4 ft. 5 in.	6 ft. 7½ in.	7 ft. 2 in.	5 ft. 9½ in.	16 in.	12 in.	8 in.
		Double	30 ft.	42 ft. 8 in.	5 ft. 6 in.	8 ft, 6 in.	8 ft. 6 in.	5 ft. 10 in.	15 in.	13 in.	10 in.
13	San Francisco—United Railroads	Double	California type 38 ft.	39 ft. 6 in.	Two side entrances, 2 ft. 8 in.	8 ft. 2 in.	8 ft. 2 in.	5 ft. 7¾ in.	14 in.	2 steps of 12½ in.	None
14	St. Louis Transit Co	Double	33 ft. 4¾ in.	44 ft. 8 in.	3 ft.6⅝in.&7 ft	9 ft. 1 in.	9 ft.	6 ft.	14¾ in.	13 in.	13 in.

PITTSBURG RAILWAYS COMPANY

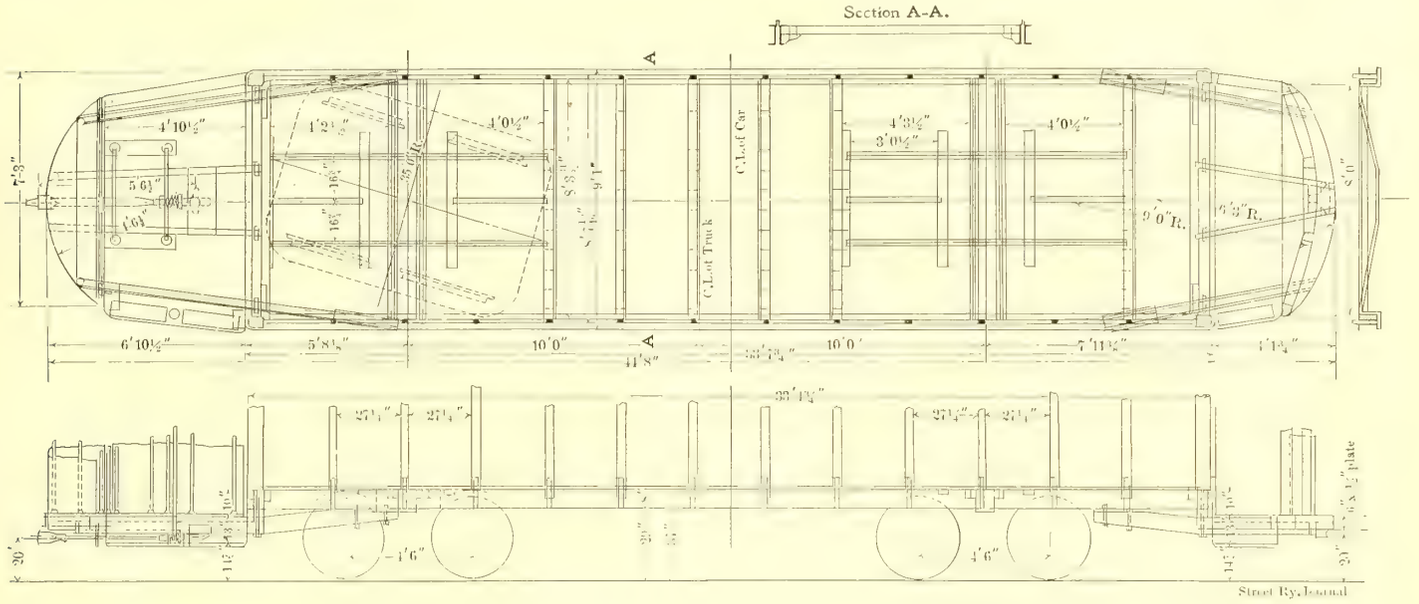
This company has three standard types of cars, viz., a single and a double-truck closed car and a single-truck open car. With the latter an open trailer is usually run. The company does not have any double-truck open cars, as the width of the streets through which the cars run does not permit of their use.

The most recent cars ordered by the Pittsburg Railways Company are double-truck cars, 42 ft. 8 ins. over all, with 30-ft. bodies. They have side seats and are very wide, being 8 ft. 6 ins. at the sills. They have long straight sides. A Westinghouse magnetic brake is used on these cars.

The single-truck closed cars have a body length of 19 ft. 11 ins., and a length over all of 30 ft. They are considerably narrower than the double-truck cars, being only 6 ft. 7½ ins. wide at sills and 7 ft. 2 ins. wide at the belt rail. Both single and double-truck closed cars are fitted with longitudinal seats. The single-truck open cars are 24 ft. 3 ins. over all, 7 ft. 10 ins. wide and have eleven benches.

UNITED RAILROADS OF SAN FRANCISCO

In San Francisco the United Railroads have retained the California type of combination car, which is so generally in use on the coast. The older type of car had longitudinal seats facing outward on the open parts of the car at either end. On the new cars the seats on the open part will be cross seats with center aisles, an arrangement made feasible by the adoption of air brakes in place of the long lever hand brake which is used on the older cars for regular service stops. Owing to the grades of San Francisco, both track and wheel brakes are put on all cars. The new car is 39½ ft. over all. The entrances are at the side, as indicated on the plan on page 353. The closed part of the car has side seats. The seating capacity is forty-four, and the weight, without passengers, 33,500 lbs.



PLAN OF BOTTOM FRAMING, ST. LOUIS TRANSIT COMPANY

ST. LOUIS TRANSIT COMPANY

As St. Louis was the original battle ground of the semi-convertible car, in fact, a city where in former days, before consolidation, when competition was strong between the lines, there was an extensive trial of dozens of different styles of cars, the final result of the evolution is interesting. It might almost be said that all of the street railway systems of St. Louis were equipped with semi-convertible cars before the majority of the large city roads in the United States had begun to realize that such a car was anywhere near feasible for heavy city traffic. There was a theory at one time that a car with cross seats and a narrow center aisle could never by any possibility be a success for heavy city traffic. Nevertheless, the hot competition between rival companies in St. Louis previous to the consolidation of a majority of these companies caused the various managements to seek anything in the way of rolling stock that would

CLOSED CARS USED IN FIFTEEN LARGE CITIES IN THE UNITED STATES

Closed and Semi-Convertible Cars.				Open Cars									
Cross or Side Seats	Seating Capacity	Weight Complete Without Pass'g's	Kind of Brakes	Single, Double or Maximum Traction Trucks	Length Over All	Width Over All	Height Side Top Rail from Floor	Height Running Board from Rail	Height from Running Board to Floor	Number of Benches	Seating Capacity	Weight Complete Without Pass'g's	Kind of Brakes	Number
Side	46	‡21,760	Hand	M. T.	38 ft. 9 in.	7 ft. 10 in.	6 ft. 1 in.	18½ in.	16 in.	12	60	‡23,100	Hand	1
Side	34	24,660	Hand	Single,	29 ft. 4 in.	7 ft. 6 in.	5 ft. 5 in.	19½ in.	15½ in.	9	45	15,080	Hand	2
Side	40	40,180	Straight Air	M. T. and double	34 ft. 2 in.	7 ft. 6 in.	5 ft. 5 in.	19½ in.	16 in.	12	60	22,073	Hand	2
Cross	52	48,000	Air	Double	42 ft. 11 in.	8 ft. 9½ in.	5 ft. 7 in.	§12¾ in.	§12 in.	14	84	34,924	Air & hand	3
Side	34	28,000	Hand	Double	43 ft.	8 ft. 2 in.	6 ft. 1 in.	2 steps 13⅝ in.	12 in.	14	84	40,000	Hand	5
Cross	48	34,000	Straight Air	*	*	*	*	*	*	*	*	*	*	6
Side and cross	43	------	Storage Air.	*	*	*	*	*	*	*	*	*	*	7
Side and cross	52	32,000	Air	† Single	† 34 ft. 5 in.	†7 ft. 10 in.	‡5 ft. 8 in.	†18 in.	†16 in.	†12	†60	‡18,000	† Hand	8
Cross	44	------	Hand	*	*	*	*	*	*	*	*	*	*	9
Side & 14 cross	52	43,000	Straight Air	M. T.	‡41 ft. 6¾ in.	‡8 ft. 3⅛ in.	‡5 ft. 7½ in.	------	------	‡26	‡52	‡26,500	‡ Hand	10
Cross	40	32,000	Straight Air	*	*	*	*	*	*	*	*	*		11
Side	30	‡17,100	----------	Single	24 ft. 3 in.	7 ft. 10 in.	--------	17½ in.	16 in.	11	55	----	Magnetic	12
Side	50	‡32,600	Magnetic	Double	34 ft. 2 in.	7 ft. 10 in.	--------	------	------	11	--	----		
Cross outside Side inside	44	33,500	Straight Air wheel and track	*	*	*	*	*	*	*	*	*	*	13
Cross	50	40,000	Storage air	*	*	*	*	*	*	*	*	*	*	14

* Same cars summer and winter. † The long closed semi-convertible car is also used in summer. ‡ Also uses semi-convertible car in summer. § Two 12-in. steps
‡ Weight without motors.

increase the popularity of the road. It was discovered that long, double-truck cars, or what is now called the semi-convertible type, were extremely popular, and once the use of these was introduced, various companies were forced by competition to adopt them. However, it should not be considered that, until the present, there was anything like a standard type of car in use in St. Louis, though many varieties of the same general type were in use in large numbers. The recent large order placed by the St. Louis Transit Company for new equipment, preparatory to handling World's Fair traffic, has necessarily settled what is to be the standard car of the St. Louis Transit Company for some time to come. This is a car, 44 ft. 8 ins. over all, with body 33 ft. 4 ins. long. The seating capacity is fifty persons. It is of the semi-convertible type, adapted for use the year round. It has cross seats 32 ins. wide, except that there are two side seats at the rear end. The cars are mounted on center-swivel short wheel base trucks, with two motors on each truck. The width of the car is practically 9 ft., being about the same at the sills as at the belt rail. These cars also have the channel bottom construction, whereby channel irons act as side sills, and form the principal support of the car bottom. The front platforms are 3½ ft. long, and are intended only for the motorman, and for entrance to, and exit from, the car. The rear platform is a modification of the Detroit platform, which has provision for a large standing load, and is worth special attention. It is 7 ft. long, and is divided into three divisions by hand rails. The division next to the door is intended to be kept clear for exit of passengers. The other divisions are for the standing load. The object of the second hand railing is to offer a convenient support to those who are standing on the platform. The railing which divides that part of the platform set aside for the entrance from the balance of the platform has an opening at one point in which the conductor can stand. Some previous railings were simply bent to form a niche at one point, which was intended for the conductor; but the opening in the railing was found better.

GENERAL CONCLUSIONS

Next after the increase in length and weight of cars, which is the most marked present tendency in connection with street railway rolling stock, the increasing popularity of the semi-convertible car is most noticeable. The semi-convertible car has been adopted in Chicago, Denver, Detroit, Indianapolis, Milwaukee, Minneapolis, Philadelphia and St. Louis. The old plan of having closed box cars with longitudinal seats for winter use, and open cars for summer use, is adhered to in Boston, Baltimore, Buffalo, Cleveland and Pittsburg, and as well, it might be added, in New York city, where the combination car is also used to some extent. San Francisco, also, has the combination car, which is a compromise between an open and a closed car, and which is the generally accepted car for use on the Pacific coast. Of the companies enumerated in the table, those at St. Louis and at Milwaukee were the first to extensively use the semi-convertible equipment for both summer and winter. The other companies have only recently made large purchases of this type of car. Going outside of the companies enumerated in the table, it is to be noted that at Kansas City and at New Orleans the semi-convertible car has also been adopted. It might be thought that in an extremely warm climate like that of New Orleans an open car would be the only one feasible. So far is this from being the case, however, that before the semi-convertible car was introduced it was customary to operate closed cars in New Orleans the year round, because of the severe thunder showers which occur so frequently, and which come up so quickly in the summer, and which make open cars very unpleasant. The semi-convertible car was found to be a very happy compromise between an open and a closed car. In northern latitudes, as at Milwaukee and Minneapolis, the early adoption of the semi-convertible car was partially brought about by the fact that there are so few days in the year when an entirely open car is altogether desirable. It was considered better to have a car which would more nearly suit average conditions than the old open and closed equipments.

There are two main reasons which have been responsible for the adoption of the semi-convertible car. One is that the public likes it, and the other is that it offers the companies a means of maintaining both a summer and a winter equipment without the necessity of investment in a double set of car bodies, and the expense of changing from summer to winter equipments. The reasons the public likes the semi-convertible car are, that when closed it is a cross-seat car, which is pleasanter to ride in than the closed longitudinal-seat car; it affords better protection in stormy weather than an open car, and can carry a standing load, which does not as seriously interfere with those occupying seats as would a standing load in a longitudinal-seat car. To be sure, the average semi-convertible car does not give the passenger as great a sense of freedom or of being out in the open air as do most open cars, but this is counter-balanced by the advantages they present in bad weather. There is another point in favor of the semi-convertible car which is not frequently touched upon, but it is one which the passenger appreciates nevertheless, and that is that a passenger can board the car quickly and select a seat at leisure after the car has started without the inconvenience attending the securing of a seat in a well-filled open car. On an ordinary open car, and with the fast schedules and short stops common in large cities, there is likely to be both annoyance to the passenger and delay of the car through failure of the passenger to discover a vacant seat the instant the car stops. The more active passengers will mount the running board and find seats after the car starts, but with women and children this is not feasible, and on some roads is not allowed. Such passengers like a car which is accessible from one end to the other when the car is in motion, without the use of the running board. The ordinary open car may be compared to the compartment passenger cars of England, and the semi-convertible, to the American steam railroad coach. The compartment type of car was at one time considered an improvement over the American elevated railway coaches, because of the facility of loading and unloading through so many doors. Experience demonstrated, however, that considerable time was lost by passengers going from one compartment to another trying to find or decide upon a seat. The same comparison holds between a semi-convertible car and an open car.

This is not intended as an argument for or against the open car, but simply a statement showing the reasons why the semi-convertible car, with some of its drawbacks, is finding increasing use. That it has certain drawbacks, none can deny. When used as a closed car it has not the capacity for a large standing load that an equivalent length of old-style closed car with longitudinal seats would have, and the seating capacity is no greater than that of the longitudinal-seat car of the same length. Compared to an open car, the semi-convertible car has not the seating capacity that an open car of the same length would have. As to freedom from accidents, the semi-convertible car has considerable advantage over the open car with running board. The conductor and motorman can watch the two entrances of a semi-convertible car more closely than they can watch the whole length of the running board on an open car, and there is

not the danger that passengers will fall when entering or leaving at the step that there is when entering or leaving by a running board, especially if there is a step in addition to the running board, as is likely to be the case with double-truck open cars.

Assuming that a road is equipped with a sufficient number of semi-convertible cars to handle the maximum load which will occur during the closed car season, what is to be done to provide for the additional loads which usually come during the open-car season? This is a question that is answered by the majority of companies using these cars, by having open cars to bring out for extra summer traffic. Such traffic comes only in pleasant weather, in any event, so that the open car, which incidentally has a large seating capacity per foot of length, is best adapted for this class of work. Companies which have adopted the semi-convertible car are generally retaining the best of their old open cars for use in the summer, especially for summer resort traffic and pleasure riding on hot evenings. In St. Louis a car which is practically without a roof has been extremely popular. This car has an awning, which is commonly rolled up. It seats ninety-six persons, and is much sought after on warm evenings.

Although the present practice in railway work, as shown in this article, is entirely toward long cars, it must not be inferred that railway managers are entirely unanimous in their belief in this type of car for all classes of work. It is undeniable that a sentiment has arisen within the last year or two among several progressive managers toward the use of shorter cars with trailers, the principal object being the resulting reduction in power. Whether this fact will result in the actual introduction and trial of trains of this kind remains to be seen. Such an experiment would certainly be of interest.

Regarding the type of seats used, it seems to be the opinion of many managers that the cross-seat car is for all lines, except those where the greater part of the business is a short-haul traffic, the coming style of all-the-year car. This is evidenced by the quantity of cross-seat cars that are being built at the present time, not only for combination city and suburban service, but also for city street service. Philadelphia is a striking example of the change from longitudinal to cross-seats, and the last 600 cars built for this company have all been made with this style of seat. In St. Louis the experience has been exactly the same, and where this system of cross-seats is employed the semi-convertible car is, of course, particularly adaptable.

Cross-seat cars, with their short centers to the seats, provide greater seating capacity than the longitudinal-seat cars, which is a point in their favor, and, again, passengers can be carried to a very much better degree of satisfaction to themselves than in the case of the longitudinal-seat cars, particularly where the ride is a long one. On the other hand, the cross-seat cars have not the actual carrying capacity of the longitudinal-seat cars.

The objection to the cross-seat, center-aisle car, that the aisles were so narrow that it was difficult for persons to pass in them, has been overcome by increasing the width of the cars whenever this was possible, and by making the backs of the seats 2 ins. narrower than the bottoms.

The increase in the weight of cars during the past few years is somewhat astounding to those who have not paid particular attention to this feature. Not only has the total weight per car increased, but the dead weight per passenger has also increased. On the single-truck motor cars, common eight years ago, the dead weight per passenger averaged about 600 lbs., unless the cars were of unusually heavy construction, or for some local reason were provided with extra heavy motor equipment. On the cars enumerated in the table accompanying this article, the dead weight per passenger for the closed and semi-convertible cars is in the neighborhood of 800 lbs. The Chicago City Railway car weighs over 900 lbs. per passenger. The dead weight, figured on the basis of seating capacity, perhaps is not entirely fair, because the standing room provided on the Chicago City Railway car is considerably more than on other cars which weigh less and seat the same number of passengers. The Chicago car has wide aisles and very long platforms at both ends.

In the matter of platforms, there is even more variety than in the car bodies themselves. The Detroit type of platform is used also in Cleveland, Toledo, Indianapolis and St. Louis, in addition to the city where it originated. In connection with the Detroit type of platform on the rear of the car, a front platform, providing for entrance of passengers and yet having a separate compartment independent of the passenger entrance for the motorman, is commonly used. In Denver the platform as a means of entrance to a car has been done away with entirely, and a side entrance substituted. In San Francisco the side entrance is also used, in connection with the combination car. A side entrance car is also used at Des Moines, Ia. The length of platform, where the Detroit platform is not used, is seldom more than 5 ft., the average being, perhaps, 4 ft. 8½ ins. The opinion of railway managers is not fully in accord in favor of the Detroit platform, particularly in the case of single-truck cars, where it creates in the minds of passengers a wish to stand on the platform instead of in the car. The objection, of course, is that this practice throws the weight at the very worst point, i. e., at the extreme end. On the other hand, the platform is popular because it solves the smoking problem, and also permits those who wish to ride in the open air to do so and make their seats available to others.

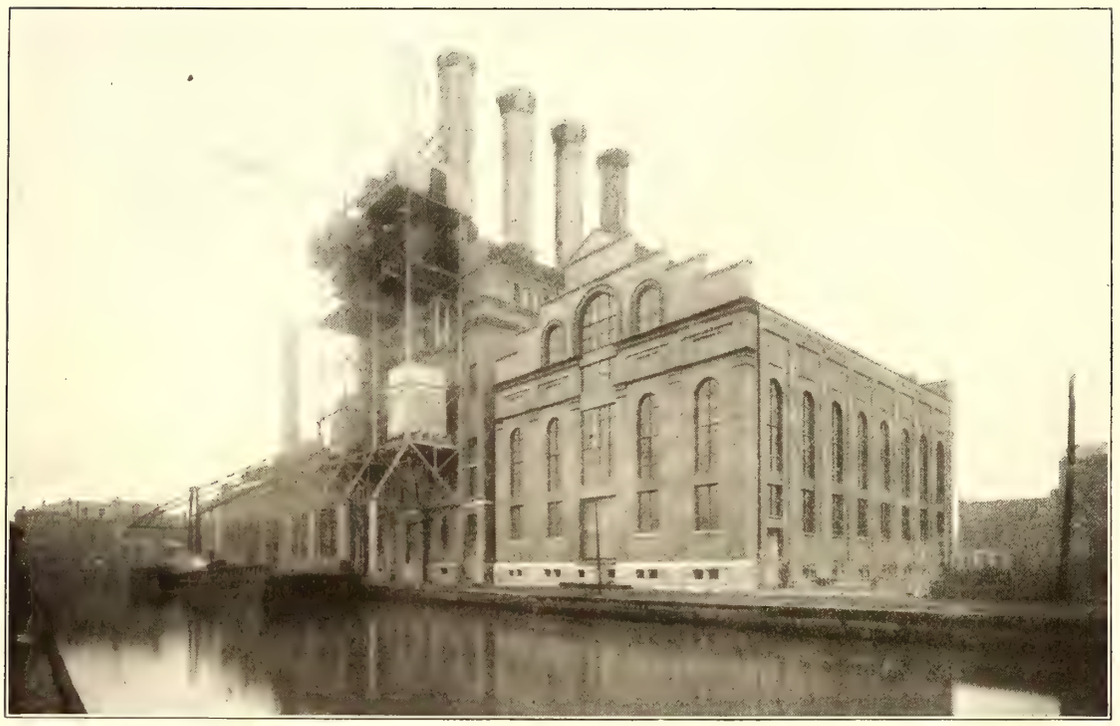
Sheet steel panels do not seem to have come into very general use. At Indianapolis and Los Angeles they are the standard construction. The extremely dry climate in Los Angeles during the summer, which causes a shrinkage of wood panels, is responsible for the adoption there. They were formerly used at Detroit, but wood is now employed there instead.

The increase in height of car floor, which necessarily came with the change from single-truck to double-truck cars, has, of course, necessitated more steps to get to the car floor. This has been commonly provided for by having one step between the platform and the street, as formerly, and increasing the height of the step or riser from the platform to the car floor. Some companies, however, have preferred to make two steps from the platform to the ground, bringing the platform nearer the level of the car floor. The height from the rail to the top of floor is, of course, dependent largely upon the style of motor that is used. Where center pivotal trucks with 30-in. wheels are used, perhaps the most general practice is to make the first step from the rail line to the top of the tread measure 16 ins., and the second step to the platform of the car 13½ ins. This allows an 8-in. step out of the car, the distance from the track over the floor being 37½ ins. The distance from the car floor to the top of the platform is usually made 8 ins.

The straight air brake with a motor-driven compressor is the most generally accepted method of braking long heavy cars. One notable exception to this is the St. Louis Transit Company, which is equipping all its cars with straight air brakes, to be supplied from storage tanks, which tanks are filled at compressing plants located at the ends of each route. This will be the first extensive application of the storage air system in a large city. The new Detroit cars use storage air brakes, while in Pittsburg a magnetic track and wheel brake is used.

POWER EQUIPMENT FOR CITY ROADS

THE equipment for supplying power to the majority of the large city railway systems of this country is the result of the gradual growth of the business, and for that reason it is usually not what would be installed if the various companies had begun operation in recent years, after modern methods of electric traction had been evolved. For example, the great electric railway power stations in New York city were planned and erected after electric railway power equipment had undergone about fifteen years of development. Outside of New York city, however, there is practically no place in the country where the electric railway system is of such recent construction. The usual problem before the management of a large street railway company is to make the best of what equipment is already installed, while enlarging the plant along lines which will be in the direction of true progress, and will not involve the entire throwing out of the power equipment after a few years. In order to do this statistics collected from the principal roads of the country show that the usual method of settling the problem has been to retain direct-current power houses and distributing systems for the greater part of the power supplied to the system, and to add alternating-current generators which supply sub-stations feeding more distant portions of the system, and thus make it possible to extend the system in all directions without undue investment in copper or excessive line loss.



EXTERIOR OF PRATT STREET STATION, BALTIMORE

City power house equipment in the United States has gone through three stages of development. In the first stage, belted or rope-driven generators were in use. Frequently the stations were run non-condensing with simple engines, and, taken altogether, power-house practice did not make use of all economies, even at that time, available for the production of steam power as cheaply as possible. Frequently these belted stations were poorly located as regards coal and water supply, and also so designed that they could not be readily extended. For these reasons there was an almost entire abandonment of old stations, beginning about ten years ago, when large direct-connected units of from 500 to 2000 kw were coming into use. Some companies were able to utilize the same buildings and land for the new stations, but in many cases these new stations were built on new locations better suited to economical power production. With the building of direct-connected stations favorably situated as regards coal and water supply, came the second stage of electric railway power-house construction. The third stage has been made possible by the introduction of alternating-current distribution at high voltages. Incidentally it has brought with it, in many cases, an enormous increase in the size of power house, because of the large area which any one power house can serve. This, in itself, brought up many new problems, especially as regards the freedom from breakdowns and the isolation of one part of a large generating station from other parts of the same station. Of this latter stage in electric railway construction, the Metropolitan Street Railway power house in New York marked the beginning.

A fair idea of the general condition of power equipment of a number of the leading American street railway companies may be obtained from the accompanying tables, one of which is a general table, giving the total capacity of stations supplying city lines in kilowatts, the total capacity per mile of track, the total capacity per car operated on maximum schedule, and the kilowatt-hours per car mile for one year. The second table applies especially to the more recent generating stations erected by the various companies. The third table relates to some of

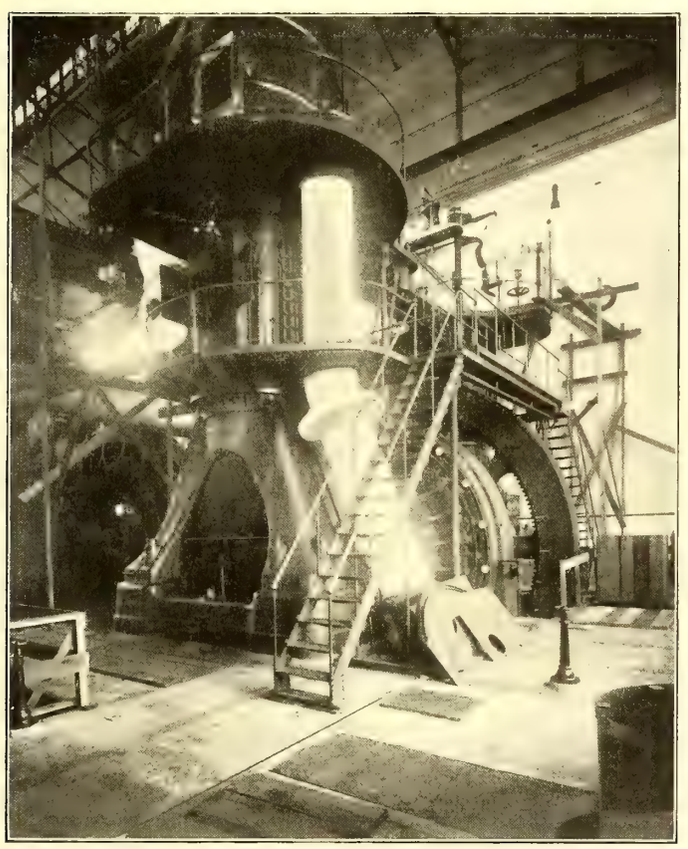
TABLE I.—POWER DATA FROM 14 AMERICAN STREET RAILWAYS

	Total Capacity, all Stations, in Kw	Total Capacity in Kw per Mile of Track	Total Capacity per Car Operated on Maximum Schedule, in Kw	Kw Hours per Car Mile for Year	Remarks
Baltimore—United Rys. & Electric Co	16,879	47.7	28.3	1.7	
Boston Elev. Ry. Co (for surface lines only)	29,475	75.	21.8	2.39	See note *
Chicago City Ry	11,580	66.	20.	2.07	¼ equip., 44 ft. cars
Cleveland Electric Ry. Co	19,712	88.	----	2.06	
Denver City Tramway Co	7,000	43.7	31.1	2.10	
Detroit United Ry. Co	11,400	60.	28.	----	
Indianapolis Traction & Terminal Co	5,500	45.	----	1.9	
Milwaukee Electric Ry & Lt. Co	15,000	115.	50.	----	
Minneapolis—Twin City Rap. Trans. Co.	----	----	----	2.7	Water & st'm power
Philadelphia Rap. Trans. Co	31,200	65.7	20.	1.66	
Pittsburg Rys. Co	19,200	47.6	----	2.72	
San Francisco—United R. Rs	8,335	45.	23.1	----	
St. Louis Transit Co	29,300	81.	32.5	2.91	Very fast schedule

* Output for surface cars assumed as 80 per cent. of total

the latest large engines. The companies included on this list are the United Railways & Electric Company, of Baltimore; the Boston Elevated Railway Company; the International Railway Company, which controls the Buffalo Railway Company's system; the Chicago City Railway Company, the Cleveland Electric Railway Company, the Denver City Tramway Company, the Detroit United Railway Company, the Indianapolis Traction & Terminal Company, the Milwaukee Electric Railway & Light Company, the Twin City Rapid Transit Company at Minneapolis and St. Paul, the Philadelphia Rapid Transit Company, the Pittsburg Railways Company, the United Railroads of San Francisco, and the St. Louis Transit Company. The New York and Brooklyn companies are omitted because of the extended description of their practice in this paper two years ago.

As said before, direct-current generation and distribution still supply by far the greater part of the power in these cities, as



GENERATING UNIT, LINCOLN WHARF STATION, BOSTON

well as in numerous cities which might have been included on this list. Nevertheless, alternating-current distribution is used to a limited extent by the majority, and by a few it is being introduced extensively. A brief review of the power situation in each city will be in order in connection with these tables, and as supplementary to them.

In Baltimore, previous to the consolidation of all the electric lines under the United Railways & Electric Company, there were nine direct-current power stations. The operation of so many direct-current plants was, of course, fatal to economy, and it was decided to provide for the needs of the present and the future by building a new power station adjoining the old Pratt Street power station, and to use alternating-current generators in this station, which would generate and transmit at 13,000 volts to the sub-stations, many of which would be located at the old power station. In Baltimore, therefore, alternating-current distribution will supply the greater part of the

TABLE II.—STATISTICS OF POWER STATIONS OF ELEVEN LARGE STREET RAILWAY SYSTEMS

City and Name of Company.	Normal Capacity of Station in Kilowatts	Max. Capacity of the Station in Kilowatts	Size Engine Room in Sq. Ft.	Sq. Ft. per Kw in Engs. Room (Nominal)	Size Boiler Room in Sq. Ft.	Sq. Ft. per Kw in Boiler Room	Number of Chimneys	Height of Chimney and Diameter of Flue	Mechanical or Natural Draft	Type of Condenser	Type of Economizer	Type of Feed Water Heater	Type of Mechanical Stoker	Type of Fuel Conveyors	Date of Completion of Station	Company's Designation of Station
Baltimore—United Rys. & Electric Co	12,000	16,000	11,790	.98	12,361	1.03	4	200 ft. and 13½ ft.	Natural	Barometric and jet	None	Closed and open	Roney	Keilholtz	1903	Pratt St.
Boston Elevated Ry. Co	12,900	17,200	24,360	1.89	.....	1.25	1	252 ft. & 13 ft. 8 in.	Natural	Barometric, jet and surface	Green	Closed	Hand fired	Elec. loco.	1898–6	Central
	8,100	10,800	8,192	1.01	10,480	1.29	1	251 and 13 ft.	Natural	Jet	Green	Closed and open	Roney & Acme	Hunt	1902	Main
	4,300	5,800	8,866	2.06	9,000	2.09	1	200 ft. and 10 ft.	Natural	Barometric and jet	Green	Closed	Acme	Link belt	1896 and 1902	Lincoln Wharf
																Charles-town
Cleveland Electric Ry. Co	6,100	8,200	9,120	1.4	16,412	2.6	2	232 ft.	Natural	None	None	Closed	Murphy	Carl&McCn	1902	Cleveland Elec.
Denver City Tramway Co	5,600	8,400	16,200	2.13	10,800	1.42	4	240 ft. and 11 ft.	Natural	Jet	Green	Closed and open	Stirling chain grate	McCaslin McCaslin	1903	.....
								240 ft. and 11 ft.	Natural							
								25 ft. and 9 ft.	Mechanical							
Detroit United Ry. Co	4,000	5,300	15,795	3.9	14,674	3.66	1	180 ft. and 11½ ft.	Natural	Jet	None	Closed and open	Murphy	Hunt	1895	A
	5,500	7,900	15,209	2.6	15,209	2.6	1	185 ft. and 10 ft.	Natural	Jet	Green	Closed and open	Murphy	.....	1895	B
Indianapolis Traction & Terminal Co	5,000	7,500	14,348	2.59	7,720	1.05	2	{ 160 ft. and 7 ft. 1 in.	Natural	Jet	None	Open	Roney	Hunt	1903	.....
								{ 175 ft. and 10 ft. 1 in.								
Minneapolis—Twin City Rapid Transit Co	21,000	30,600	17,340	.82	21,675	1.	2	225 ft. and 16 ft.	Natural	Jet	None	Open	Underfeed	McCaslin	Under cons.	.....
Philadelphia Rapid Transit Co	7,500	10,000	16,128	2.15	14,112	1.88	2	170 ft. and 11 ft. 6 in.	Natural	None	None	Open	None	Link belt	1894 and 1898	No. 1
	3,750	4,500	12,228	3.27	16,128	4.30	1	60 ft. and 9 ft.	Mechanical	Jet	American	Closed	None	Link belt	1894	No. 2
	5,000	6,000	11,520	2.30	11,520	2.30	2	160 ft. and 7 ft. 7 in.	Natural	Jet	None	Open	A. Box & Co.	Link belt	1894	No. 3
Pittsburg Rys. Co	6,400	8,500	16,560	2.58	10,400	1.63	8	130 ft. and 7 ft.	Natural	Jet	None	Closed	Roney	McCaslin	....	20th St.
	13,500	18,000	34,281	2.54	34,281	2.54	10	130 ft. and 7 ft.	Natural	Jet	None	Closed	Murphy	Not decided	Under cons.	Brunot Island
San Francisco—United Railroads	9,600	12,800	13,776	1.4	19,363	2.0	1	152 ft. and 14 ft. 8 in.	Mechanical	Surface marine type	Green	.....	Burn fuel oil	.....	Under cons.	North Beach
St. Louis Transit Co	15,450	20,540	23,243	1.5	25,252	1.7	4	(3) 160x7½ (1) 202x14	Natural	Surface with cooling towers	.....	Excelsior	Green	McCaslin	1901	Central
	6,906	9,210	20,813	2.2	20,813	2.2	1	202 ft.	Natural	Surface with cooling towers	.....	Excelsior	Green	McCaslin	1901	Northern

mileage in that city, since the conditions were favorable to such a change. It was imperative to do away with the small-uneconomical plants, and the large alternating-current power station was the natural outcome of the situation.

all its lines with direct current from five direct-current power houses. The Chicago City Railway Company contemplates the building of a large alternating-current power station on the Chicago River, at Thirty-Ninth and Halsted Streets, as soon

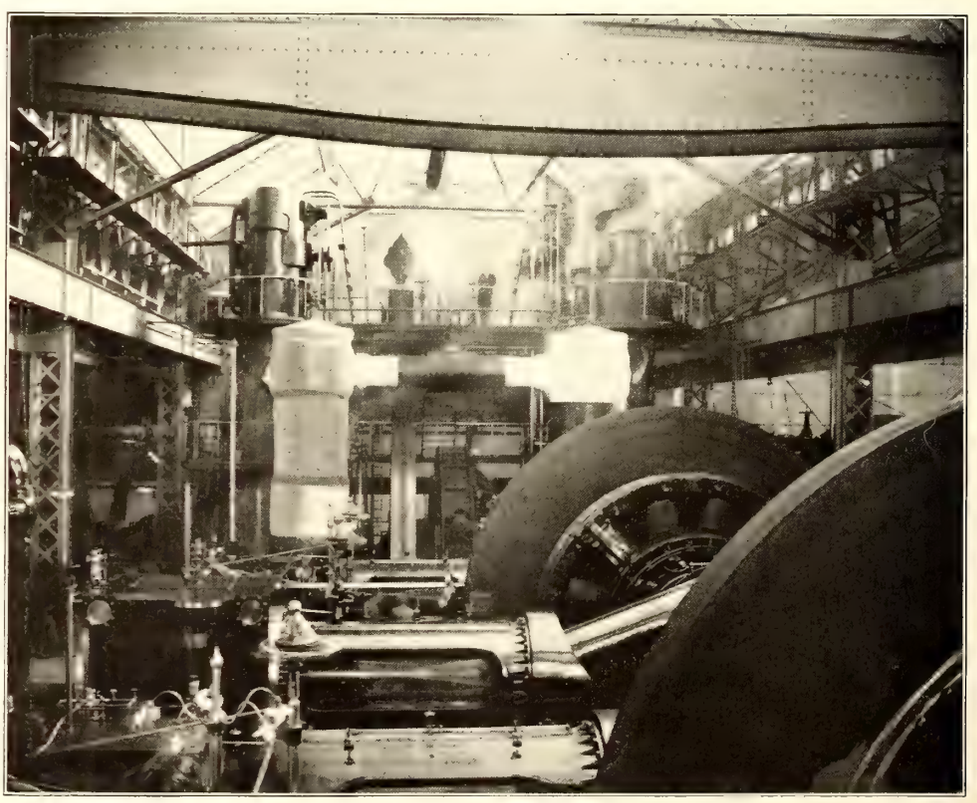
TABLE III.—STATISTICS OF ENGINES USED IN POWER STATIONS OF ELEVEN LARGE RAILWAY SYSTEMS

City and Name of Company.	No. of Units	Size of Generator, Kilowatts	Rated H. P. of Engines	Type of Valves	Make of Engine	Size of Cylinders	R. P. M.	Steam Pressure, Lbs.	Lbs. Coal per Kw Hour	Cost Coal per Station
Baltimore—United Rys. & Electric Co	6	2,000	3,000	Corliss	McIntosh & Seymour	33 in. and 68 in. x 56 in.	94	165	3.5	Pratt St.
Boston Elevated Ry. Co	3	2,700	4,000	Corliss	Providence & west'h'se	44 in. and 88 in. x 60 in.	75	160	3.5	Lincoln wharf
Cleveland Electric Ry Co	--	2,400	3,500	Corliss	Reynolds vertical	40 in. and 68 in. x 60 in.	75	160	----	Clev. Elec. Ry
	--	1,600	2,250	Corliss	Reynolds horiz	32 in. and 64 in. x 60 in.	75	150	----	Cleq. City Ry
Denver City Tramway Co	5	(3) 800	(3) 1,300	Greene-Wheelock-Hill	(3) Green-Wheelock	23 in. and 52 in. x 48 in.	100	175	4.5	--------
		(2) 1,600	(2) 2,700	Corliss	(2) Reynolds)	32 in. & 68 in. x 60 in. / 32 in. & 64 in. x 48 in.	75 / 94			
Detroit United Ry. Co	2	1,500	2,000	Corliss	Filer & Stowell	32 in. and 64 in. x 60 in.	--	------	----	B
Indianapolis Traction & Terminal Co	--	1,200	1,925	Corliss	Reynolds horiz.	32 in. and 60 in. x 60 in.	80	140	----	--------
Minneapolis—Twin City Rap. Trans. Co	1	3,500	6,000	Corliss	Reynolds horiz.	46 in. and 94 in. x 60 in.	75	175 (sup.)	*	*
Philadelphia Rapid Transit Co	5	1,500	2,000	Corliss	Wetherill & Co.	26 in. & 40 in. x 48 in. / 28 in. & 40 in. x 48 in.	80	145	----	No. 1
Pittsburg Rys. Co	8	800	1,560	Corliss	Penn. Iron Wks.	30 in and 54 in. x 48 in.	80	------	----	20th St.
	6	1,500	2,000	Corliss	Providence	32 in. and 62 in. x 54 in.	--	------	----	Brunot Isl'd
San Erancisco—United Railroads	4	(8) 1,200	4 080	Marine	Union Iron Wks.	32 in. & 52 in. & 80 in. x 42 in	136	200	*	*
St. Louis Transit Co	4	2,250	3,400	Corliss	Fulton	36 in. and 70 in. x 60 in.	75	150	3.3 kw hrs. per gal. oil	

* Station not finished

At Boston, the Boston Elevated Railway Company, which operates both surface and elevated lines, has always adhered to direct-current distribution. In fact, this company has the most notable large direct-current distribution system in the country. Its policy has been to erect a number of large direct-current stations as required from time to time by conditions, and to enlarge each of these as the traffic grew. It has in all eight power stations. Its central power station is the outgrowth of the original central power station, erected when electric traction was first introduced. This original station is now maintained as an auxiliary to the central power station. It contains thirty-six 50-kw generators. In the same station are six 1200-kw generators, two of 1500 kw and the one of 2700 kw. The company has altogether five 2700-kw direct-current generators in its various power houses. About 20 per cent of the capacity of this company's stations is used to supply elevated lines, and 80 per cent to supply surface lines. The total capacity of the eight stations is 36,844 kw, of which 29,475 may be considered as devoted to surface lines, and this is the figure given in the table. This would leave 7369 kw available for the use of the elevated lines. The kilowatt-hours per car mile on the elevated lines is 4.2. The power station capacity in kilowatts per mile of elevated track is 460.

In Chicago, the Chicago City Railway still supplies its electric lines from two power stations, which belong to the first stage of electric railway power station development, as outlined heretofore. These stations contain simple engines and rope-driven generators, and since they hardly come within the range of modern power-station practice, particulars are not included in the tables. The Chicago Union Traction Company supplies as its franchise extensions shall have been definitely arranged for. This will probably be a steam turbine station, although plans are not fully determined upon. About one-quarter of the company's rolling stock is double-truck cars, 44 ft. over all, weighing 48,000 lbs. without load. The balance of the equipment consists of single-truck motor cars, weighing about 16,000 lbs. without load. These facts should be taken into account in considering the kilowatt-hours per car mile. The station capacity given includes the capacity of a 750-kw storage battery.



INTERIOR OF CENTRAL POWER STATION, BOSTON

In Cleveland, until recently there were two companies, which have recently been consolidated under the Cleveland Electric Railway Company. There are, therefore, two direct-current power stations, one of which is used to supply the eastern lines, and the other the western lines. The Cleveland Electric Rail-

way power house contains some old belted apparatus, which is held as a reserve, and also has as large a direct-current generator as is to be found outside of the Boston power houses. No alternating current is used in Cleveland.

The Denver City Tramway Power Company, which supplies the Denver City Tramway Company with power, has recently built a new power station, which is a combination alternating and direct-current plant. The Denver City Tramway Company has some very long suburban lines, which are supplied by sub-stations. The main distribution in the central part of the city is by direct current. This company's rolling stock consists almost entirely of double-truck cars.

The Detroit United Railway supplies its city lines from two power houses adjoining each other. The power houses are good examples of the best power house engineering of seven years ago. The interurban lines of this company are supplied from other stations. An extensive storage battery auxiliary is in use.

At Indianapolis, the distribution is entirely by direct-current from the West Washington Street power house. This power house was begun in 1894, and has been added to from time to time, as required.

The Milwaukee Electric Railway & Light Company has a railway and lighting power house on the river near the business portion of the city. This supplies direct current for all the lines in the city of Milwaukee. A temporary power station, containing vertical engines driving alternating-current generators, is now being put into commission. The plans of this company contemplate the erection of a large alternating-current generating station, in which it is but natural to suppose that steam turbines will be employed, if the experience of other companies with them is satisfactory. Direct-current distribution will be retained for most of the city lines.

At Minneapolis and St. Paul, the Twin City Rapid Transit Company has the use of a water-power plant of 7500-kw capacity, but this is not now sufficient; and a steam plant with an ultimate capacity of 21,000 kw is being built. At present, however, only one 3500-kw unit will be installed. The steam plant adjoins the water-power plant, which is between Minneapolis and St. Paul, but somewhat nearer Minneapolis. The station voltage is 3450 volts, three-phase, at which voltage power is transmitted to a sub-station in Minneapolis. For transmission to St. Paul, the voltage is raised to 13,000. Storage batteries are employed in the sub-stations.

The Philadelphia Rapid Transit Company has three principal power houses, all of which generate direct-current. It is also building a temporary power plant at Second Street and Wyoming Avenue, containing two 1000-kw three-phase General Electric generators. The station will generate and transmit at 13,200 volts. The entire transmission will be underground. This station will transmit to two sub-stations. It will, of course, supply only a small portion of the power required by the system.

At Pittsburg, the Pittsburg Railways Company operates eight direct-current stations, the least economical of which will be shut down on the completion of the new alternating-current station on Brunot Island on the Ohio River. Extensive storage battery auxiliaries have been used in Pittsburg for the last five years.

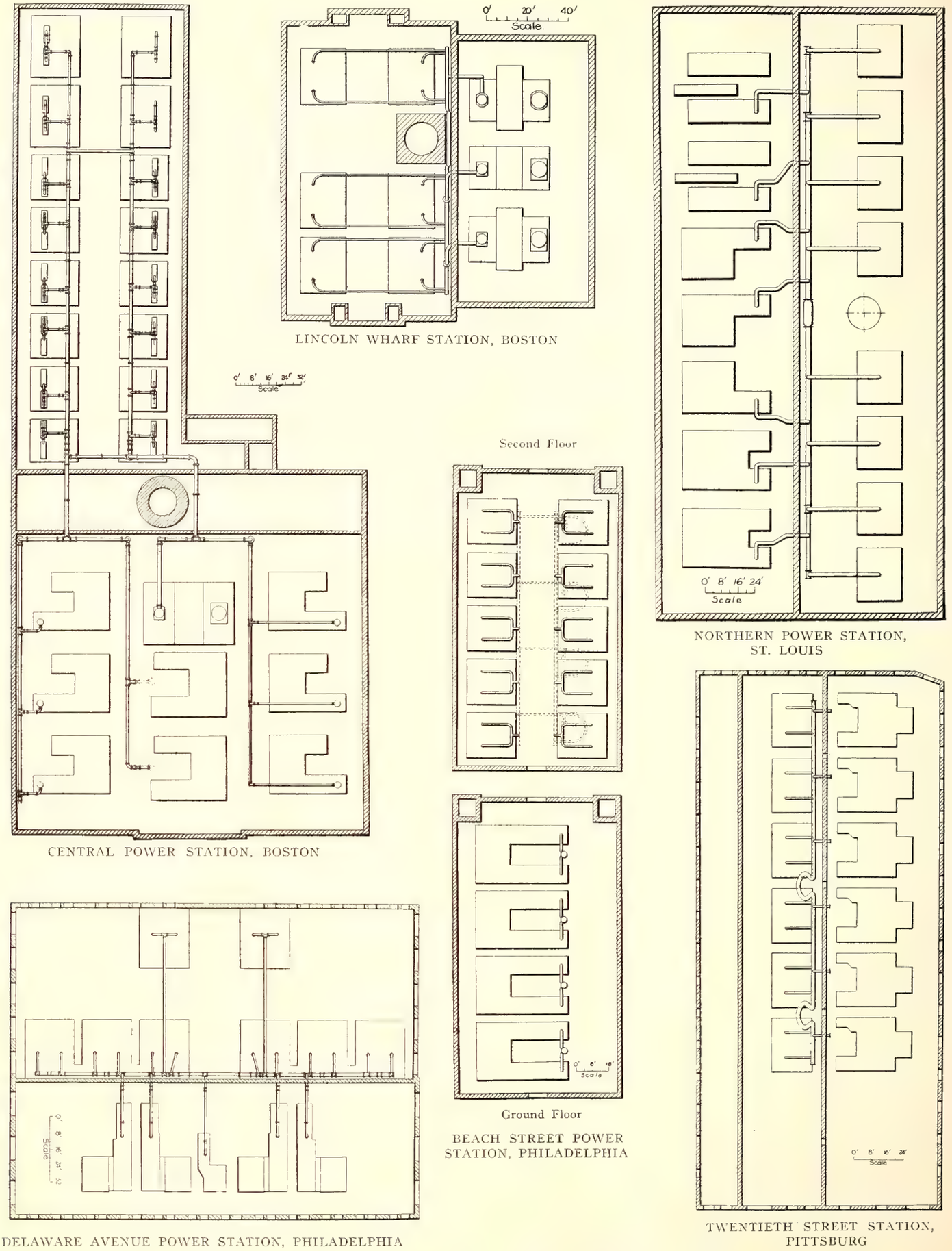
The United Railroads of San Francisco have five cable power stations and five electric power stations in operation. A new alternating-current power station is being built in a favorable location for securing coal and water. The completion of this station will make it possible to shut down all but one of the electric plants now being operated, and will do away with the necessity for purchasing power, which is now being done to supplement the power supplied by the company's power houses. Oil is the fuel used in San Francisco, this being the only large company in the United States, except that at Los Angeles, to use fuel oil instead of coal.

At St. Louis, the St. Louis Transit Company inherited five fairly good direct-current power houses from its predecessors. With the idea of consolidating affairs, the station at Park and Vandeventer Avenues was enlarged, to make the largest direct-current power station in electric railway service in the United States. The output of this station is 30,000 amps., all of which passes through one recording watt meter. At the same time that this central power station was being remodeled to its present size, what is known as the Northern power station was built to supply the northern part of the company's territory, and also to generate alternating current for transmission to sub-stations at such points as might seem desirable. After these stations were built, it was found necessary, however, to continue some of the best of the older generating plants, so that the consolidation idea has not been entirely carried out. Preliminary plans were drawn up recently for a large alternating-current station in East St. Louis, across the river, where coal can be obtained cheaply and without the danger of coal blockades, which danger is always present in St. Louis, because of the limitations to traffic imposed by the necessity of bringing all coal across the river on two bridges. This project was abandoned, however, and a contract entered into with the Union Electric Light & Power Company, which is building a mammoth generating station on the banks of the Mississippi River, not far from the business portion of St. Louis.

From this review of the situation it will be seen that in the majority of the cities there are direct-current plants sufficiently modern to admit of the production of current at a cost nearly as low as it can be produced in the latest type of station. Alternating-current stations for supplying a large proportion of the load are in use, or under construction in New York, Kansas City, Baltimore and San Francisco. Combined direct and alternating-current stations, where direct current is used to supply the greater part of the system, and where distant parts are supplied by alternating current, are in use at Brooklyn, Denver, Milwaukee, Philadelphia, Pittsburg and St. Louis. At Buffalo and at Minneapolis and St. Paul, water-power is used to such an extent that most of the current is transmitted at high potential, and supplied to the railway system through rotary converter sub-stations. In both cases auxiliary steam plants are maintained for carrying peak loads.

There is considerable difference between the lay-out of a large alternating-current station, in which nearly all the power for supplying the system is concentrated, and the lay-out of smaller direct-current plants. It is not entirely a difference due simply to the difference in the size, although this has much to do with it. It is partially a difference due to the realization by engineers that the concentration of an immense amount of generating apparatus under one roof makes possible interruption of service to a much greater extent than would be possible where a number of stations are in operation. The plan of isolation of one section of a station from another is being very thoroughly carried out in large plants. Special precautions were taken in the first large alternating-current stations for the isolation of high-tension bus-bars from each other, and the separation of the generators into groups, so that trouble with one group would not affect the other. Next after the spread of trouble on high-tension lines, interruptions are most

to be feared from the steam piping and boiler-room end of the plant. In fact, the whole plan of connecting large generators, struction of very large power houses. With the introduction of units as large as 5000 kw, there is not the necessity for perma-



PLANS OF SEVERAL LARGE CITY POWER STATIONS, SHOWING LIVE STEAM PIPING AND ARRANGEMENT OF BOILERS AND ENGINES; SCALE, 1-64 IN. EQUALS 1 FT.

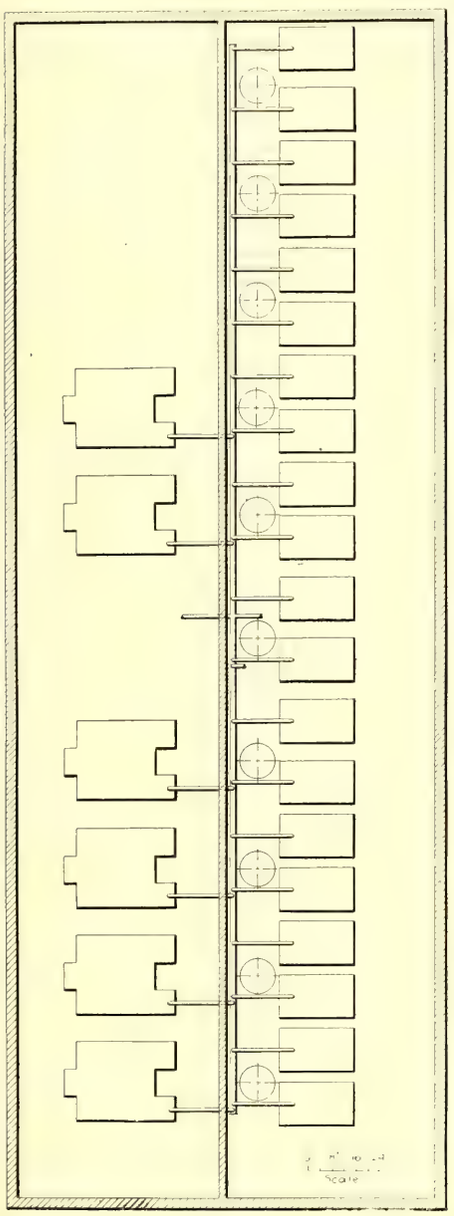
engines and boilers in parallel permanently on the same bus-bars and pipe lines has been thoroughly abandoned in the con- nent multiple operation of the entire station that there used to be with the smaller units. There is a tendency on the part of

those now designing stations with units this size to make each unit with its boilers a section of the station by itself, capable of being operated in parallel with other units, but only through the medium of steam piping and electrical connections, which can quickly and effectively be opened. In several stations better provisions have been made for isolating electrical troubles than have been made to prevent the spread of trouble due to a break in the steam piping at any one point. The difficulty in preventing the spread of trouble from steam pipes is due mainly to the fact that it is frequently impossible to reach essential valves to shut off steam from the broken part, as long as steam is escaping. Electrically operated valves are now being introduced, which will reduce this danger.

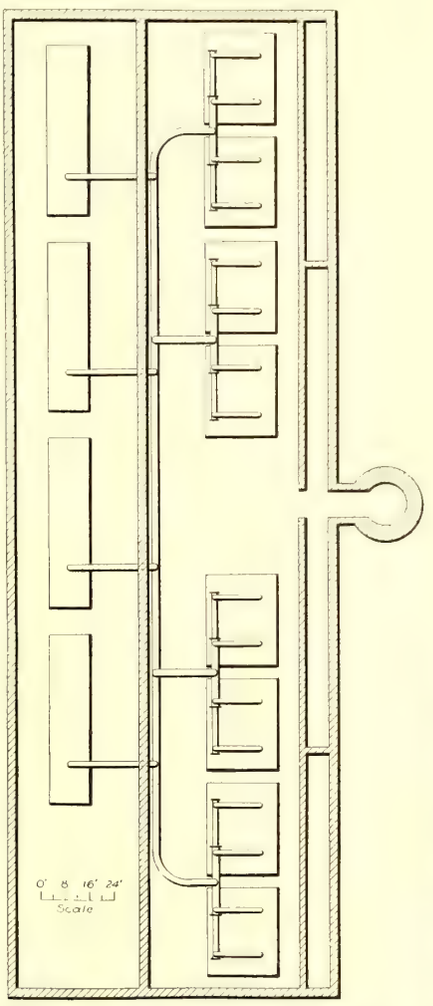
The immense quantity of coal required by the largest stations makes it necessary to devote a great deal of attention in the design of the plant to facilities for storing coal and for handling it rapidly, as well as to the railroad yards adjoining the plant, if coal is received by rail.

Whatever the policy adopted by a company for the supply of current to its lines in the future, and whatever the method of taking care of the growth of the system, every company which has been operating for a number of years finds itself with old apparatus on its hands. This apparatus is naturally kept in operating condition as a reserve, and to carry the load at times of extra heavy traffic. Even though the old apparatus is uneconomical, the company can much better afford to kept it as a reserve than install newer apparatus to lie idle the greater portion of the year.

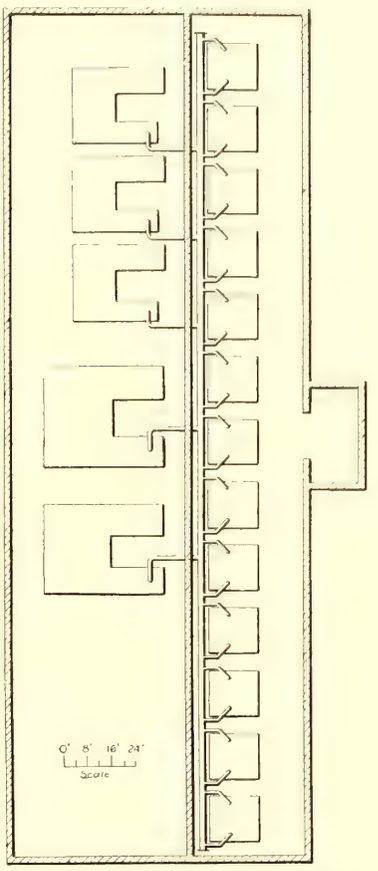
In a steam turbine plant radical changes have to be made in design, as the boiler room must be much larger, in proportion to the generator room, than in an engine-driven plant. The plan usually followed in the few large steam turbine power stations that have been designed, has been to place boilers on both sides of the generator room, although one notable exception to this is the plant of the Commonwealth Electric Company in Chicago, where the boilers are placed on one side of the generator room only, and are all on the ground floor.



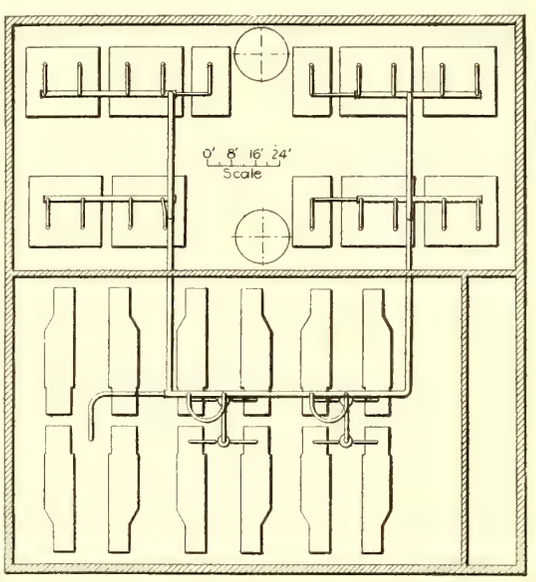
BRUNOT ISLAND POWER STATION
PITTSBURG



NORTH BEACH POWER STATION,
SAN FRANCISCO, CAL.



NEW CENTRAL STATION, DENVER



THIRTEENTH AND MT. VERNON STREETS
STATION, PHILADELPHIA

PLANS OF SEVERAL LARGE CITY POWER STATIONS, SHOWING LIVE STEAM PIPING AND ARRANGEMENT OF BOILERS AND ENGINES; SCALE, 1-64 IN. EQUALS 1 FT.

POSSIBLE ECONOMIES IN CENTRAL STATION AND DISTRIBUTION SYSTEMS

BY PHILIP DAWSON

THE growth during the last few years of the applications of electricity has been so rapid that at the present day there are not many branches of mechanical industry in which electric energy does not play a very important part. Hence, large stations for the production and distribution of this most important form of power are springing up on all sides. One of the most important, if not the most important, sphere for the use of electricity has been found in its application to mechanical traction, in which branch enormous strides have been made during the last decade.

When considering the problem of the economical production and distribution of electrical energy, there are two more or less distinct lines along which it is possible to seek for a solution. The first consists in making improvements in the existing type of machinery employed, such as the introduction of coal-handling apparatus, mechanical stokers and labor-saving devices generally, to replace the manual labor formerly employed. The second consists of radical changes in the system employed, as, for instance, the substitution of rotary prime movers, such as steam turbines, for the reciprocating steam engine, or possibly in future times dispensing with steam boilers entirely, and using gas engines driven by producer gas. It is quite within the bounds of possibility that the future may bring forth some form of gas turbine which may prove more economical than anything which we have at the present day.

This article is primarily intended to deal with the general subject of power station economy, particularly in connection with the design of systems intended for the production and supply of energy to electric tramways and railways, but at the same time it must also have a considerable bearing on the design of any power-producing plant. It is not the intention of the author in this article to attempt to lay down the law as to what should be done in any particular case, but rather to consider with an impartial and unprejudiced mind the general trend of modern practice both in Europe and America, as exemplified by the attempts which have been made by the engineers of various nationalities to obtain greater economy and improve working conditions generally.

Although, as has been stated above, this article does not treat exclusively of electric traction power plants, yet it is intended to apply particularly to this branch of engineering, and this fact will naturally have considerable influence in dictating the type of machinery to be employed. It is impossible to hope for the best results if power plants are designed simply to produce electric energy, without due consideration of the purpose for which the power will be used. Any traction system is composed of a number of parts or sections, which, however excellent they may be individually, will never produce a satisfactory result unless they all harmonize and work in with one another. If one portion is weak or inefficient the whole system suffers accordingly, so it should be the endeavor to bring each part to the highest possible pitch of perfection, but unless there is unity and concord all this will be lost.

Thus, it should never be forgotten that the power plant and distribution system of a railway, important as it undoubtedly is, is, after all, only a means to an end, and should be treated as such. The chief object of a railway is to earn money by carrying passengers as expeditiously and cheaply as possible. In all attempts to improve the economy of such system, only that true economy which embraces the whole general condition of affairs should be followed, and not that kind which deals with minute and isolated points, whilst completely disregarding the welfare of the whole.

In looking round at the different engineering practices of Great Britain, the United States of America, and the Continent of Europe, one sees that though there is a certain resemblance between them, there is likewise a marked individuality, and that each has its own peculiar characteristics. Also, when one looks back upon what used to be the standard practice in each of these countries it is obvious that there has been a considerable interchange of ideas, which have been begotten, not only by their own experience, but also of a careful study of the successes and failures in different countries, and that these ideas have been applied to their own special cases in the light of the knowledge thus gained. In some instances this has been carried almost too far, and there has been a tendency to forget that local conditions vary enormously, and should be carefully considered.

A very great improvement in power-station operation has been brought about by the introduction of the numerous labor-saving devices now in common use. A large majority of these have had their birthplace in the United States, and were first installed and operated there, but have since been adopted by other countries. One of the most prominent instances of labor-saving apparatus is to be found in the very complete machinery for handling coal and ashes, now usually considered a necessary adjunct of any large power station. In a considerable number of the most modern stations the coal is untouched by hand from the time when it arrives in the trucks or barges, to the time when it is fed into the furnaces of the boilers, and it is also automatically weighed in the course of its progress. The empty buckets of the conveyor are commonly employed to remove the ashes from the boilers and deposit them outside the station. The saving of time, labor, and cost resulting from the mechanical handling of coal, is very considerable, and, owing to the fewer times that it is handled, the damage to the coal is reduced to a minimum. The installation of coal-handling apparatus is now almost universal practice.

Mechanical stokers are also pretty generally used, and of these there are a very large variety. In Great Britain the moving chain grate type is very largely used, though there are numerous other types in operation. Continental practice inclines toward the use of hand stoking in preference to mechanical, especially in Germany, where the cheapness of labor may possibly have some influence in the matter.

This, however, would seem to ignore the fact that one great advantage of mechanical stokers is that much cheaper coal may be burned, and that the nuisance from smoke is greatly decreased owing to the more perfect combustion.

In the matter of boilers there have been no very drastic changes or radical departures from former practice during the last few years. In the United Kingdom the Babcock & Wilcox

type of water-tube boiler is much favored, and this type of boiler is being installed in a large majority of the new power plants which are being erected. At the present day boilers of this class are in operation in some 30 per cent of the total electric tramway stations of Great Britain; most of these boilers are of the pattern first designed for land work, but latterly there has been a tendency to adopt a special type intended primarily for marine purposes, which occupies less space than the land type. The chief difference in the construction of the land and marine type of boilers, is that in the land type the steam and water drum (or drums) runs longitudinally from the front to the back of the boiler, in the same direction as the water-tubes, whereas, in the marine type this drum is placed across the front headers, at right angles to the tubes and the upper ends of the rear headers are connected to the drum by horizontal tubes. Also in the marine type the water-tubes slope downward from back to front, instead of upward, as in the land type. Excellent results have been obtained with these boilers. Cylindrical boilers of the Lancashire, Cornish or Scotch marine type are not often installed in large plants nowadays, unless for some special, and generally local, reasons.

Continental practice is, in the main, radically different in this respect, from that either of Great Britain or the States. Here we find the predominating boiler to be of the two-story type, usually consisting of one cylindrical boiler mounted on the top of another; the lower one is frequently of the Lancashire type, while the upper one consists of a plain cylindrical shell with smoke tubes. The water-tube type of boiler is not as much in evidence on the Continent as in Great Britain and the United States.

Mechanical draught is typical of American practice, though not by any means universal in that country. Indeed, America is the proud possessor of some of the largest and tallest smoke-stacks in the world. The practice of using forced or induced draught is, however, steadily spreading, and certainly has in many cases important advantages to recommend it. The first cost is usually much less than that of a large chimney, it is more flexible in use, and, in the event of extensions being required, can be increased to the extra capacity necessary with far greater ease, and it is particularly useful where economizers are employed.

When we come to consider steam engine practice of the present day, there are various interesting points to be observed. British practice with but few exceptions leans strongly toward the vertical engines of early days.

Originally American engines were as universally horizontal as English engines are vertical, but latterly, for large units, they have been coming round to the British way of thinking, and the vertical type represents their standard practice. At the present day the standard engine of both countries for heavy traction work is the vertical cross-compound, slow-speed engine, with the generator mounted between the cylinders, although, as mentioned further on, steam turbines are finding great favor for large alternating current units. Triple-expansion engines are not common for this class of work.

The general trend of German practice nowadays appears to be toward horizontal engines. At one time a large number of vertical engines of the so-called "steeple" type were built, but the complication of, and necessary attention required by, the Sulzer type of valve gear which is so much used, rendered such engines difficult and expensive to operate. There are, nevertheless, a large number of vertical engines installed in Continental power stations.

There is a very defined and marked difference in the design of Continental engines, and those of either Great Britain or America, which is largely a matter of national characteristics. Almost all British and American engineers have an ingrained desire for simplicity, and will never use two parts, if by any means one part will answer the same purpose, regarding machinery as a means to an end which should be approached as directly and expeditiously as possible. The Continental engineer, on the other hand, seems to look on a mechanical device as an end in itself, and fairly revels in a complexity of parts. This is abundantly evident in the complicated and intricate valve gears which one sees on German and Swiss engines. They work well and give good results, and have stood the test of many years' running, but one cannot help wondering if it is really necessary for them to be so complicated, and whether the same result could not have been obtained in a simpler manner.

In England and America the Corliss valve, which originated in the latter country, is very largely employed, especially in America. On the Continent the poppet valve is more common. This is mainly due to the fact that superheated steam is more exclusively used on the Continent than elsewhere, and Corliss valves do not work satisfactorily with it. There can be little doubt but that superheated steam tends toward economy, and it is most probable that in the course of time its use will spread and extend in a marked degree. England was the first country where experiments with superheated steam were carried out, some forty years ago, but the many obstacles in the path of would-be users led to the subject being practically shelved. One of the chief causes of failure was the fact that the lubricants then employed could not stand the high temperature, and decomposed with disastrous results. The soft packing in glands and stuffing boxes also gave considerable trouble. Since then, however, Continental engineers have taken up the subject, and by dint of hard work and experimenting have removed most of the difficulties in the way of the use of superheated steam. Mineral oils are now used, which can stand the high temperatures involved, and metallic packing has replaced the older soft packing, thus doing away with the destructive effects in this direction.

In the opinion of the writer, one of the chief advantages, if not the greatest, obtained by using superheated steam, is that initial condensation of steam in the cylinder is done away with, and also the re-evaporation of the condensed water during the later stages of expansion, and while exhausting.

The table on page 366 gives some results which were obtained at the Berlin Electricity Works on a Sulzer engine, with various degrees of superheat, and may be of interest.

Forced lubrication is essentially characteristic of British practice. It was originally applied exclusively to high-speed engines, but it has since been extended to slow-speed engines as well, with most favorable results. Forced lubrication has recently been applied by the author to some engines put in by him for the South Lancashire Tramway system. These engines are of German make, constructed by the Augsburg Nürnberg Maschinenfabrik, and the makers were at first most reluctant to employ this method of lubrication. The results, however, have been so good that they have since become quite converted to the system, and are now perfectly satisfied.

Most engineers are looking very hopefully toward the steam turbine as a factor in central station economy, both in first cost, space occupied, and cost of operation, and there seems little doubt but that considerable advances in this direction will be made before very long. The steam turbine was first established as a commercial success in Great Britain by the Hon. Mr. Par-

sons, and the turbine which bears his name is now well known in most civilized countries. America has followed suit, and has produced in the Curtis turbine a rival whose progress will be watched by all engineers with the greatest interest. These turbines are being installed for the first time in the United Kingdom in the power house of the Yorkshire Power Company.

Turbo-generators of 5000-kw capacity, of the Parsons type, are also being installed in the power houses of the Metropolitan and Metropolitan District Railways, which will supply power for the electric operation of the Inner Circle.

Turbines are also being installed in the power house which will supply electric energy for working the electric railway lines around New Castle.

There is distinct economy to be obtained in the use of steam turbines, not only in operating expenses, but also in first cost. They occupy less space than reciprocating engines of the same power; in the larger sizes the floor space required with turbines of the Parsons type is only one-half or even one-third that of vertical steam engines and the headroom required is extremely small. The Curtis turbine, though taking up more headroom than the Parsons turbine, occupies even less floor space than the latter. As a consequence of this, where turbo-generators are installed, the engine room does not require to be nearly so large or costly, and owing to the superior lightness of the parts, the engine room cranes need not be so powerful. Turbines are especially suitable where it is desired to build the power station in two stories, since, owing to the entire absence of vibration, the boilers can be put on the ground floor and the turbines on the floor above; there are many engineers who have a very great objection to putting the boilers above the engines, and hold that such a method is bound to give trouble sooner or later. There are, however, several power stations which have been built on this principle, with very satisfactory results.

In the matter of cooling towers, British and Continental practice, taken as a whole, are very similar, and somewhat opposed to that of the United States of America. In the last case it is most common to use towers in which the water is cooled by artificially produced draughts, by means of fans, either driven by steam or electrically. On the Continent, however, it was found that better results were obtained by means of natural draught towers, of which the Klein cooling tower is a typical example. This tower is of German origin, but has been somewhat extensively introduced into England, where it has found considerable favor. The whole apparatus is made of wood; the hot water is allowed to trickle over the surface of a number of wooden strips set close together, and arranged in the base of a wooden shaft or chimney. The draught thus produced draws a current of cold air through the wooden strips and effectually cools the water owing to the large surface of the latter which is exposed to its action. A certain quantity of water is lost by evaporation, but a good deal of this is condensed in the upper and cooler parts of the chimney.

In some situations a cooling tower may play a very important part in the problem of economical working. Much of the good resulting from economical steam engines will be nullified if the condensing arrangements are faulty, and it is impossible to maintain a good vacuum with an insufficient supply of cooling water. Cooling ponds are very simple, but also somewhat inefficient, unless of very large area.

A characteristic feature of Continental practice is seen in the preponderance of auxiliaries directly connected to the main generating units. Thus, in the majority of cases the air pumps are driven directly from the main engine, usually either from the tail rod of the piston, or by a crank-shaft. Also it is common practice to mount the exciter armature on the shaft of the main generator. There is doubtless a good deal which might be brought forward in defense of these practices, but the independent auxiliaries adopted by British and American engines alike, appear to be a far more convenient arrangement and to possess very considerable advantages over the method in vogue on the Continent.

It is not the intention of the author in this article to go deeply into the question of how best to drive auxiliaries, nor to touch otherwise than lightly upon the vexed question of the relative merits of steam and electricity for this work. In most large stations it is generally best to effect some sort of compromise, some of the units being driven by steam and others by electricity. Much has been said and written affirming or denying, according to the point of view, the saving and economy effected by electrically driven auxiliaries, but it is practically impossible to generalize upon the subject, as it is one of those in which conditions and circumstances peculiar to each case may completely alter the whole complexion of affairs, making, in one case, steam, and in another, electricity, preferable.

As regards accumulators, Continental, and more particularly German, engineers are far more lavish in installing them in power stations than is the case in either England or America. Some reason for this trait may lie in the very extensive use of triple expansion engines for traction purposes, which do not give their best results under variable loads, so that large batteries of accumulators are used so as to equalize the load as far as possible. Most American and British engineers are agreed, however, that under ordinary circumstances, it is better to dispense, as far as possible, with heavy batteries in large traction power stations, and there are many arguments in favor of their view of the case. For one thing, the larger the system operated, the more uniform the load is likely to be, and in any case, a modern generating plant can take care of very considerable fluctuations without either damage to itself or serious loss of efficiency. Furthermore, when dealing with large units, a small percentage variation in the load means a very considerable amount of power, and a very large and expensive battery would be required to produce any appreciable effect, and the extra cost entailed, both in original outlay and upkeep, is so large that any ultimate economy resulting from

TESTS OF 3500-HP SULZER ENGINE AT THE BERLIN ELECTRICITY WORKS

(Horizontal, Four-Cylinder, Triple-Expansion, Double-Tandem Engine	Highly Superheated Steam			Medium Superheated Steam		Dry Saturated Steam	
Steam pressure at throttle in lbs. per sq. in	181	180	181.5	181	185	177	184
Temperature of steam at high pressure cylinder throttle, per cent	314.36	316.1	312.28	225.8	224.96	201.1	201.1
Superheat at throttle, per cent.	122.7	124.65	120.49	34.2	32.3	10.35	8.8
Speed of engine in revolutions per minute	83.5	83.0	82.8	83.7	83.5	83.4	83.9
Indicated horse-power of engine	2516.1	2507.1	2506.4	3684.2	3406.1	2760.4	2513.4
Brake horse-power of engine	2252	2242	2243	3423	3144	2447.5	2249
Mechanical efficiency, per cent	89.5	89.5	89.5	92.9	92.3	90.3	89.5
Feed water consumed per hour, lbs	22,831	22,733	22,756	43,855	40,106	31,755	29,054
Steam consumed per I. H. P. hour, lbs	9.074	9.07	9.079	11.903	11.774	11.716	11.162
Steam consumed per B. H. P. hour, lbs	10.138	10.139	10.145	12.812	12.756	12.974	12.919

its use is extremely problematical. In small stations accumulators are very useful, and several examples could be pointed out in Great Britain and the United States where their installation has been productive of considerable economy of working.

But though practically all English-speaking engineers hold the same view, that as regards accumulators in large power stations, their room (and they occupy a good deal) is preferable to their company, yet it must not be supposed that there is no sphere of action for accumulators in connection with large power installations. Where, as is so often done nowadays, the power is generated at high pressures in a central station and transmitted for transformation and distribution to various substations, it has been found that accumulators in the latter, used in connection with the rotaries or motor generators, give excellent results. They equalize the load on the rotaries and consequently the load on the high-tension feeders also, thus enabling smaller cables to be used than would otherwise be possible, as they can be worked nearer their maximum capacity. This method of procedure has been followed out by the writer in the power distribution scheme for the South Lancashire Tramway system, for which he and his partners are the engineers.

A great improvement in the ease and economy of operation of accumulators has been brought about by the introduction of the reversible boosters. By the use of these useful machines the output of the battery is automatically varied to suit the demand, without the use of the complicated and rather unsatisfactory arrangement of automatic switches which was formerly required. These boosters are not so much used in America as they are on the Continent and in Great Britain, where there is little doubt their utility will soon be even more generally recognized than it is at the present day. An interesting example of a reversible booster is to be found in the power station of the Orleans electric tramways, where gas engines are employed; the booster installed there was one of the first of this kind to be used in practical everyday working.

Many engineers are looking eagerly and hopefully forward to the time when the gas engine shall displace the steam engine, and, although at the present moment the latter may be said to be holding its own, such rapid strides have been made of recent years that there is no saying exactly what may be in store for us in the near future. The old gas producers (and the future of gas engines is inseparably bound up with that of gas producers) labored under the great disadvantage of requiring anthracite coal, but the more recent ones, such as the Mond producer, has overcome this disadvantage and burns ordinary coal, which is a most important step forward.

The extent of our present knowledge on the subject does not yet seem to be sufficient to justify discarding the tried and trusty steam engine for the somewhat uncertain gas engine; and there are several difficulties to be overcome before the latter will be deemed suitable for installation in large and important power stations. Despite the toil and labors of that hardworking body, "The Gas Engine Research Committee," there is still much concerning the internal working of a gas engine that is wrapt in mystery. However, this branch of engineering is receiving great attention at the present day, both in England and on the Continent, and considerable advances may be reasonably expected in the course of the next few years.

There is a very vexed question which has been occupying the attention of engineers of all countries, viz., the question of the best voltage at which it is safe to operate motors. In Great Britain, till quite recently, 500 volts has been the maximum pressure permitted by the Board of Trade, but, owing to the probable introduction of electric traction on British railways the subject has recently been reopened by the "Standardization Committee," which is now sitting in London. It has practically been decided that for railway work 600 volts should be allowed, but the Board of Trade has indicated that this is the very highest pressure which they can sanction. On the Continent of Europe, as much as 750 volts has been permitted, but it is questionable whether any very material advantage will be gained thereby, in view of all the difficulties which this additional pressure will introduce in the design of railway motors. To reap the full benefit from high pressures necessitates an alternating current motor.

Polyphase electric traction was first introduced on the Continent of Europe, and more particularly in Switzerland, where the local conditions were found to especially favor this system. The railway between Burgdorf and Thun, which was built by Messrs. Brown and Boveri several years ago, was equipped on this principle, and many other mountain railways have since been built in Switzerland. The results, as far as is known, have been satisfactory, but it must be borne in mind, that in these cases the number of trains or cars operated is comparatively small, and the question of repairs is therefore not of much consequence; furthermore, the electrical energy is in most instances generated by water-power, so that any amount of waste of energy is not felt, as it would be were coal used for generating purposes. The question of long-distance railways is one which has recently come to the fore, and, although in the United States there are several lines operated by continuous current motors, the engineers of all countries are agreed, that in order to render electric traction on long-distance lines feasible, some system of alternating-current motors will have to be adopted; in this connection Messrs. Ganz & Company, of Budapest, have carried out a series of experiments culminating in the equipment of the long-distance road between Lecco and Sondrio, which has already been described in the pages of the Street Railway Journal, and the efforts of American engineers to develop a single-phase motor for long-distance roads are being watched with the greatest interest by all European engineers.

In conclusion, it may be stated, that owing to the very large increase in the size of power stations, engineers and managers on both sides of the ocean are beginning to realize the importance of every economy which can be effected, no matter how small. Thus, in order to be able constantly to supervise the control and operation of a station the writer's firm now makes a practice of installing their hot-wells on scales, so that at any moment the amount of steam used per kilowatt can be ascertained. Automatical apparatus is now available to record not only the temperature, but also the composition of gases escaping up the chimney, and coal-weighing machines are supplied which automatically register the amount of coal consumed by each boiler.

The writer believes that as regards large steam plants for polyphase work, the future lies with the steam turbine and high-pressure water-tube boiler, forced lubrication, superheated steam, independent auxiliaries driven electrically, and all labor-saving appliances, in the shape of coal and ash handling apparatus, combined with mechanical stokers. Under certain conditions, particularly in the neighborhood of blast furnaces, the gas engine may render great services, but we must learn more about this branch of engineering before it is possible to say exactly what position the gas engine of the future will hold.

MODERN REPAIR SHOP METHODS

BY RICHARD McCULLOCH

THE descriptions and data here given are taken from the practice of the Chicago City Railway Company. It is not intended to claim for this company any superiority either in methods or economy of repairs, but the data here given will indicate to some extent what may be accomplished in heavy city railway work. This company having outgrown its old shops has recently built and equipped an entirely new plant, requiring an investment in buildings and machinery of something over $450,000. A ground plan, showing the general arrangement of the shops, reproduced from an article descriptive of these shops which appeared in the STREET RAILWAY JOURNAL for March 7, 1903, is given in Fig. 2. The equipment is such as to lead one to expect great economy, but wages are too high in Chicago to realize this expectation. This company operated during the year 1902, 206 cable trains, 125 double-truck, four-motor, electric cars, and 402 single-truck, two-motor electric cars. It has one central repair shop and six car houses, in which car repair work is done.

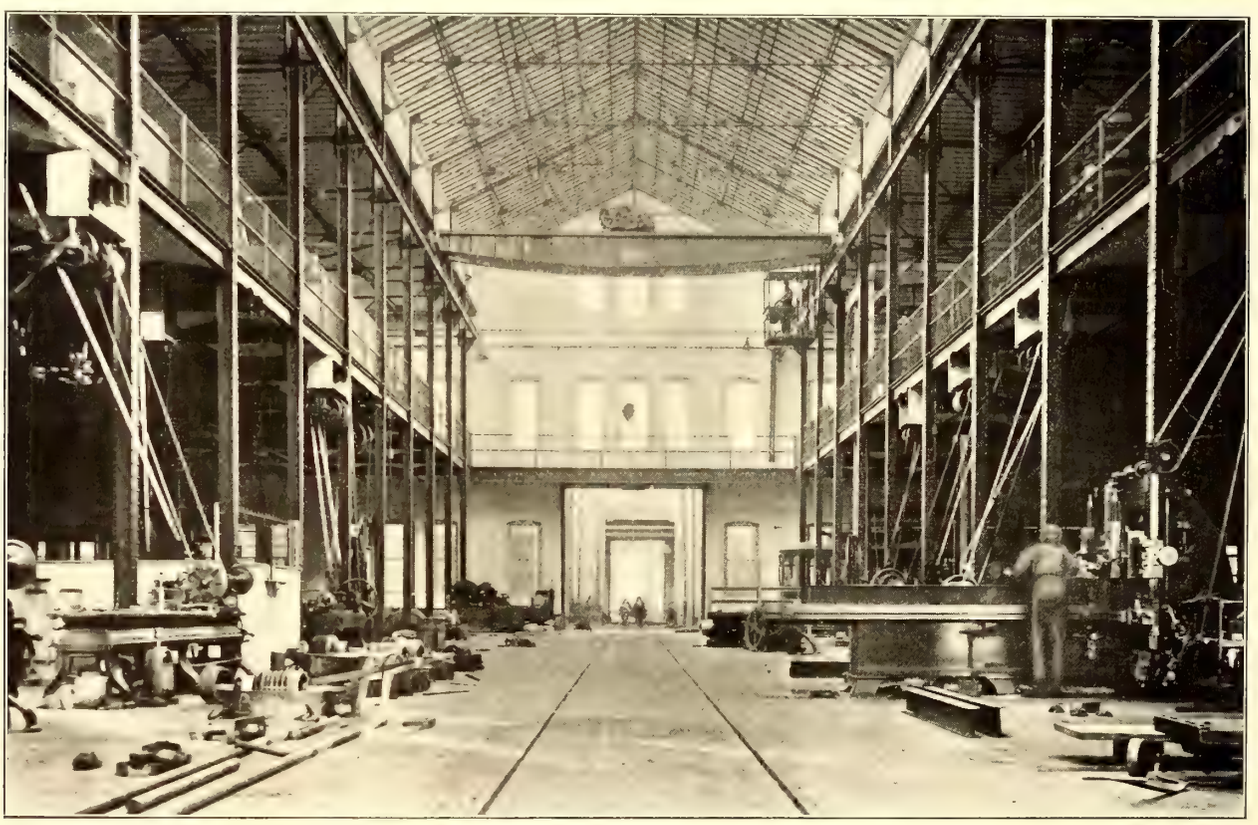


FIG. 1.—MAIN BAY OF MACHINE SHOP—REPAIR SHOP OF CHICAGO CITY RAILWAY

The various classes of work done at the car houses are: Inspection and cleaning of electrical equipment; adjustment and overhauling of brakes; renewal of wheels and truck parts; inspection of grips; minor repairs to car bodies, such as replacement of broken windows and car fittings; minor repairs to electrical equipment, such as renewal of motor bearings and brushes; renewal of controller parts, renewal of trolley bases, poles and wheels, and repairs to car wiring. As a general rule the work done at the car houses consists of inspection, cleaning, oiling, renewals, and replacements, it being the intention to confine all genuine repair work to the shops.

The following tools form the equipment of each car house:

Two hydraulic pit jacks.
Two two-ton chain blocks.
One portable forge.
One anvil.
One post drill.
One grindstone.

The necessary hand tools, such as hammer, wrenches, chisels, punches, etc.

In the car house, where double-truck cars are cared for, there is added to this equipment a motor driven oil pump, furnishing oil to five sets of oil jacks for raising bodies off the trucks. It is intended to dismount and thoroughly inspect and clean every electrical equipment each ninety days. The cost of dismounting, inspecting, cleaning and overhauling the truck, motors, and electrical equipment of double-truck, four motor cars, is $8.00; and of single-truck, two-motor cars, $4.00.

The organization of the repair shop department consists of a master mechanic in charge of all repair work, both at the shops and car houses, with the following foremen:

One assistant in charge of repair work in car houses.
One foreman in charge of the machine shop.
One foreman in charge of the blacksmith shop.
One foreman in charge of the foundry.
One foreman in charge of the electrical repairs.
One foreman in charge of tin work, saddlery and upholstering.

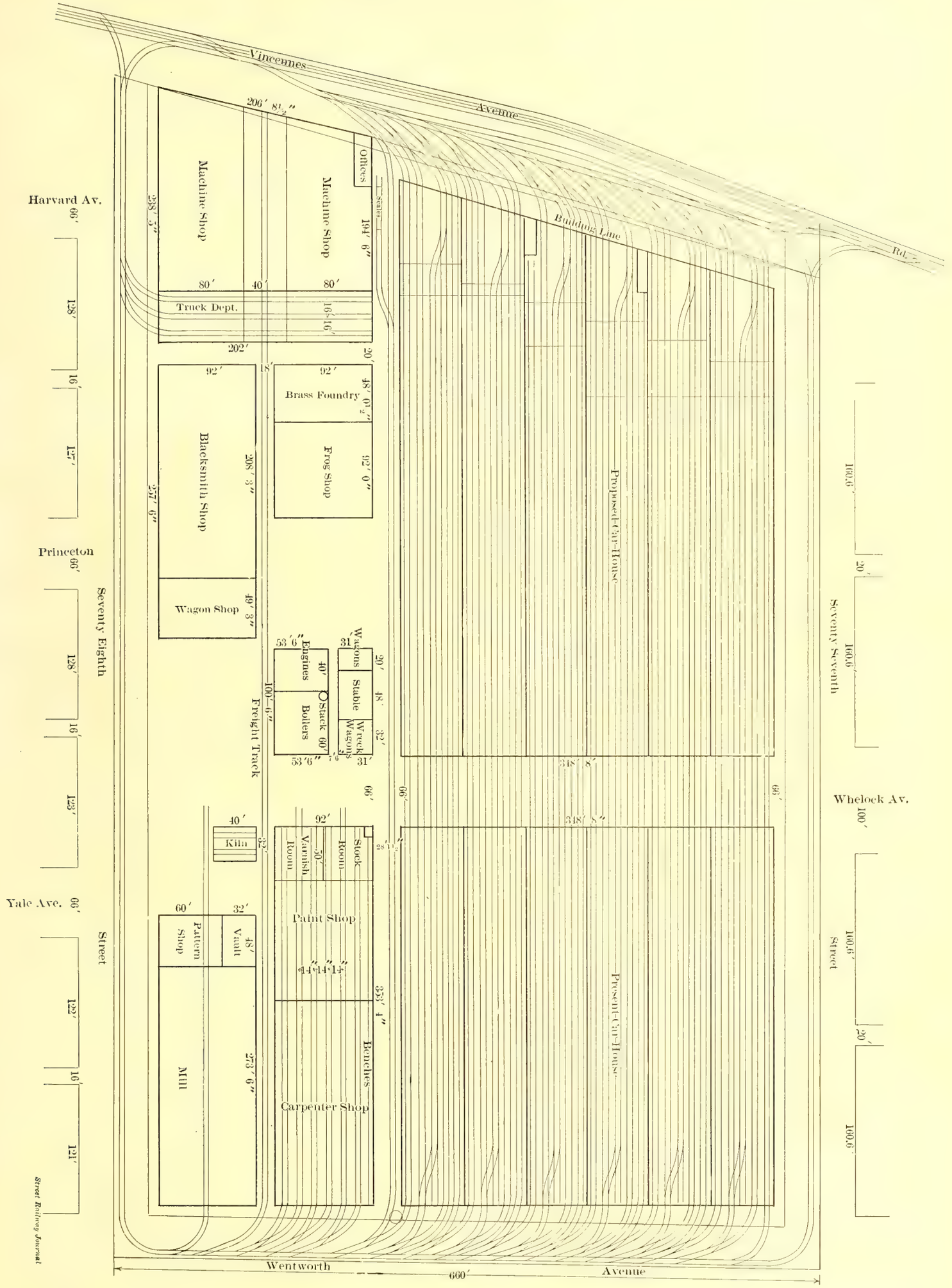


FIG. 2.—PLAN SHOWING ARRANGEMENT OF NEW REPAIR SHOPS AND CAR HOUSE OF THE CHICAGO CITY RAILWAY

One foreman in charge of the wood mill.
One foreman of truck repairs.
One foreman of car body repairs.
One foreman of painting.

The total number of men in the repair shop and in the car houses engaged in repairs, varies from 300 to 350, according to the time of year. Work at the repair shops is carried on during nine hours. The working day during five days in the week is slightly longer than nine hours, allowing the shops to close two hours earlier Saturday afternoon. Each workman registers the time of entrance and departure on a time clock placed at the shop door, and the time so registered serves as a basis for the pay roll.

Table No. 1 shows the classification of the operating expense accounts used in charging up shop time. This schedule is printed on card board and posted conspicuously in the various departments of the shop, so that each foreman and each workman may know to what number any work should be charged. Construction accounts and any particular job for which it is desirable to keep the time separately are given special numbers.

Table No. 1.—Classification of Expense Accounts in Charging Up Shop Time in Repair Shops Department

ACCOUNT NO. 1.—MAINTENANCE OF TRACK AND ROADWAY

Charge No.

101 Item A. Shop work on rails, rail fastenings, welded joints, etc.
102 Item B. Shop work on steam railroad crossings.
103 Item C. Shop work on street railroad crossings, cross-overs, curves, frogs, guard-rails, run-offs, switches, switch-mates, turn-outs, etc.
105 Item E. Shop work on material for fences, bridges, culverts, trestles, subways, tunnels, viaducts, etc.
106 Item F. Shop work on track tools.

ACCOUNT NO. 2.—MAINTENANCE OF ELECTRIC LINE

107 Item A. Shop work on poles and pole-fixtures, overhead line appliances, etc.
108 Item B. Shop work on rail-bonds, underground line appliances, etc.
109 Item C. Shop work on line tools.

ACCOUNT NO. 2 A.—MAINTENANCE OF CABLE TRACK AND CONDUIT MACHINERY

110 Item A. Shop work on yokes, slot-rails, iron frames and covers, sand-plates, etc.
111 Item B. Shop work on cable-pulleys, shieves, pit machinery, etc.

ACCOUNT NO. 2 B.—MAINTENANCE OF CABLES

112 Item A. Shop work on tools for splicing tables, appliances for handling cables, etc.

ACCOUNT NO. 3.—MAINTENANCE OF BUILDINGS AND FIXTURES

113 Item A. Shop work on material and fixtures for electric power-plant buildings.
114 Item B.—Shop work on material and fixtures for cable power-plant buildings.
115 Item C. Shop work on material and fixtures for all other buildings.

ACCOUNT NO. 4.—MAINTENANCE OF STEAM PLANT (ELECTRIC)

116 Item A. Shop work on engines, engine parts, appliances and fixtures.
117 Item B. Shop work on cranes, hoists and other engine-room appliances.
118 Item C. Shop work on boilers, boiler-fittings and appliances, pumps, heaters, tanks, etc.
119 Item D. Shop work on coal and ash-conveying machinery and other boiler-room appliances.
120 Item E. Shop work on piping and steam-fitting, valves, etc.
121 Item F. Shop work on other steam plant equipment.

ACCOUNT NO. 4 A.—MAINTENANCE OF STEAM PLANT (CABLE)

122 Item A. Shop work on engines, engine parts, appliances and fixtures.
123 Item B. Shop work on cranes, hoists and other engine-room appliances.
124 Item C. Shop work on boilers, boiler-fittings and appliances, pumps, heaters, tanks, etc.
125 Item D. Shop work on coal and ash-conveying machinery, and other boiler-room appliances.
126 Item E. Shop work on piping and steam-fitting, valves, etc.
127 Item F. Shop work on other steam plant equipment.

ACCOUNT NO. 5.—MAINTENANCE OF ELECTRIC PLANT

128 Item A. Shop work on generators.
129 Item B. Shop work on switch-boards and switch-board appliances.
130 Item C. Shop work on storage batteries, transformers, boosters, etc.
131 Item D. Shop work on other electric plant equipment.

ACCOUNT NO. 5 A.—MAINTENANCE OF CABLE PLANT

132 Item A. Shop work on cable winding machinery.

ACCOUNT NO. 6.—MAINTENANCE OF CARS

(Passenger Cars and Mail Cars)

133 Item A. Shop work on trucks and truck parts, including truck-frames, truck-sides, wheels, axles, pedestals, oil-boxes; brakes and brake appliances, life-guards, fenders, etc.
134 Item B. Shop work on car-bodies, including platforms, vestibules, roofs, bonnets, window-sash; sand-boxes, gates, grab-handles, and all fixtures and appliances attached to the platform, except brakes, brake-appliances and fenders.
135 Item C. Shop work on car-fixtures and trimmings, including headlights, signs, gongs and bells, curtains and curtain fixtures, seats and covering for seats, stoves and stove-parts, electric heaters, electroliers, lamps, Pintsch gas equipment, stationary fare-registers, brass fixtures and trimmings, wire screens and all fixtures and trimmings inside of the car.
136 Item D. Car painting.

ACCOUNT NO. 7.—MAINTENANCE OF ELECTRIC EQUIPMENT OF CARS

(Passenger Cars, Mail Cars, Work Cars, Snow Sweepers and other Snow Equipment)

137 Item A. Shop work on motors and motor-parts, including armatures, fields, commutators, brush-holders, gears and gear-cases, pinions, bearings, motor-frames and parts, etc.
138 Item B. Shop work on trolleys and trolley-parts, controllers and controller-parts, appliances for power, lighting and heating circuits, including circuit-breakers, cut-out boxes, lightning arresters, rheostats, etc., and all car-wiring.

ACCOUNT NO. 7 A.—MAINTENANCE OF GRIPS

139 Item A. Shop work on grips, grip-parts, appliances and fixtures.

ACCOUNT NO. 8.—MAINTENANCE OF MISCELLANEOUS EQUIPMENT

140 Item A. Shop work on water and sprinkling cars, sand-cars, supply-cars, coal-cars and all other work cars.
141 Item B. Shop work on salt-cars, snow-plows, sweepers, scrapers and all other snow equipment.
142 Item C. Shop work on wagons and vehicles.
143 Item D. Shop work on harness equipment.
144 Item E. Shop work on other miscellaneous equipment.

ACCOUNT NO. 9.—MISCELLANEOUS SHOP EXPENSES

145 Item A. Shop work on repairs and renewals of shop machinery, tools and appliances.
146 Item D. Shop superintendence, including wages of superintendent and timekeeper.
147 Item E. Miscellaneous shop labor, including wages of engineer, oiler, electric light man, watchmen, tool boy, teamster, etc.

MISCELLANEOUS ACCOUNTS.—NOS. 23, 23 A, 24, 27, 33.

383 (23—Item I) Shop work on track-cleaning tools.
384 (23A—Item C) Shop work on tools for cleaning cable conduit.
388 (24—Item C) Shop work on tools for removal of snow and ice from tracks.
390 (27—Item B) Shop work on printing presses and appliances.
202 (28—Item B) Shop work on repairs and renewals of office furniture and fixtures.
408 (33—Item A) Shop work on "damage" wagons and vehicles. (Wagons and vehicles damaged by collisions with C. C. Ry. Co. cars.)

Table No. 2.—Subdivision and Itemization of Pay Rolls for the Year 1902

DEPARTMENT NO. 5.—REPAIR SHOPS DEPARTMENT.

Item.	Employees	Wages and Salaries	Per Cent
1. Pattern department	5	$3,318.13	2.3
2. Foundry department	8	5,252.05	3.7
3. Blacksmith department	21	12,663.32	8.8
4. Woodworking department	11	7,514.81	5.2
5. Machine department	36	21,661.35	15.1
6. Tinning department	17	10,690.33	7.4
7. Painting department	40	22,612.94	15.7
8. Car truck department	27	15,780.56	11.0
9. Car repairing department	39	23,546.95	16.4
10. Motor repairing department	20	11,307.17	7.9
11. Miscellaneous shop labor	9	5,422.38	3.8
12. Superintendent, assistant superintendent, timekeeper	3	4,020.00	2.7
	236	$143,789.99	

DEPARTMENT NO. 7.—CAR HOUSE DEPARTMENT

Item	Employees	Wages and Salaries
1. Clerks	16	$12,384.83
2. Watchmen, car pushers, car placers, etc., elevator men	49	36,655.77
5. Car cleaners	63	41,060.61
6. Lamp and headlight tenders	12	7,133.99

7.	Car stove firemen	16	3,970.00
8.	Wreck wagon crews	14	10,615.47
9.	Other car house employees (not engaged on repair work)	18	10,591.78
11.	Stablemen	3	1,522.31
		191	$123,934.76

DEPARTMENT NO. 7.—CAR HOUSE DEPARTMENT (SHOPS)

Item		Employees	Wages and Salaries
1.	Foremen	5	$4,436.75
3.	Car inspectors, motor inspectors and cleaners (electric)	15	10,188.73
4.	Car inspectors, grip inspectors and cleaners (cable)	9	6,709.39
10.	Other car house employees (engaged on repair work)	86	62,981.50
		115	$84,316.37

Table No. 2 shows the division of the pay roll for the year 1902, according to occupation. It may be interesting to note that the machine shop, car repairing and painting departments are about equal and are the largest items, being each more than fifteen per cent of the total.

Table No. 3 gives the amounts of the labor accounts for the shop and car houses. Of the shop pay roll, car repairs are only 61.5 per cent, construction accounts forming 11.4 per cent, power plant repairs 3.4 per cent, and track and line repairs 4 per cent.

Table No. 4 gives an itemization of the repair accounts.

Table No. 3.—Distribution and Charge of Pay Rolls for the Year 1902

DEPARTMENTS OF REPAIR SHOPS—CAR HOUSE (SHOPS).
DEPARTMENT NO. 5.—REPAIR SHOPS DEPARTMENT

	Account	Amount
1.	Maintenance of track and roadway	$3,288.16
2.	Maintenance of electric line	1,668.83
2A.	Maintenance of cable track and conduit machinery	822.10
2B.	Maintenance of cables	248.73
3.	Maintenance of buildings and fixtures	1,934.46
4.	Maintenance of steam plant (electric)	1,695.57
4A.	Maintenance of steam plant (cable)	924.02
5.	Maintenance of electric plant	1,331.36
5A.	Maintenance of cable plant	637.80
6.	Maintenance of cars	58,300.50
7.	Maintenance of electric equipment of cars	17,144.04
7A.	Maintenance of grips	5,350.48
8.	Maintenance of miscellaneous equipment	6,498.84
9.	Miscellaneous shop expenses	24,038.08
14.	Miscellaneous supplies and expenses of power plant (electric)	1.07
20.	Wages of car house employees	32.00
22.	Miscellaneous car service expenses	1,104.22
23.	Cleaning and sanding track	23.13
27.	Printing and stationery	2.85
28.	Miscellaneous office expenses	346.01
29.	Stores expenses	1,315.60
30.	Stable expenses	2.75
32.	Miscellaneous general expenses	611.88
33.	Damages	23.43
1016.	Track elevation	10.93
1017.	Boulevard intersections	2.20
1026.	Construction of new car house at Seventy-Seventh Street and Wentworth Avenue	1,469.17
1027.	Track and electric line construction in new car house at Seventy-Seventh Street and Wentworth Avenue	222.23
1029.	New booster for Forty-Ninth and Oakley Avenue electric power plant	24.34
1030.	Reconstruction of Wentworth Avenue tracks from Sixty-Third Street to Seventy-Ninth and Halsted Streets	6.00
1032.	Reconstruction of Archer Avenue car house	31.56
1033.	New storage battery for Twenty-First and State Street power plant	132.21
1035.	Rearrangement of overhead and underground feeders	6.86
1036.	Construction of new boiler house at Fifty-Second Street power plant	148.88
1037.	Installation of five new boilers at Fifty-Second Street power plant	240.79
1038.	Construction of Sixty-Ninth Street tracks from Sixty-Ninth and Vincennes Road to Sixty-Eighth and Cottage Grove Avenue	247.11
1040.	New electric power plant at Twenty-First and Dearborn Streets	340.89
1041.	Construction of new repair shop buildings at Seventy-Seventh Street and Wentworth Avenue	9,339.11
1042.	Installation of new coal conveyor at Forty-Ninth and Oakley Avenue electric power plant	6.93
1044.	Removal of general repair shops	4,100.62
1046.	Reconstruction of Archer Avenue tracks from State to Ashland	114.25
		$143,789.99

The wages paid in this shop are as follows:

	1902 Cents per hour			1903 Cents per hour		
Machinists	27½	30		30	33	
Machinists' helpers	17½	20		20	22½	25
Blacksmiths	27½	31⅝		30	3	
Blacksmiths' helpers	19⅜			22		
Brass moulders	25	30		25	30	
Armature winders	25	27½	33	25	27½	33
Electrical helpers	10	15	18	10	15	18
Tinners	26¼	27½		26¼		27½
Harness makers	25			25		
Wood mill workers	20	25	27½	20	25	27½
Cabinet makers	25	27½		25	27½	
Car washers (paint shop)	17½			17½		
Rough painters (paint shop)	20	22½		20	22½	
Varnishers and finishers	25			25		
Stripers and letterers	27½			27½		

	Rate per day of 10 hours 1902			1903		
Car house repairers	$1.75	2.00	2.25	$1.92½	2.20	2.47½

The machine shop is equipped with three-wheel boring machines, one-wheel grinding machine, one hydraulic wheel press, twelve lathes, two planers, two shapers, six drill presses, two turret drill presses, one turret lathe, one double bolt cutter, one six-spindle nut tapper. For large work there has been installed a two-center lathe, the centers swinging respectively 26 ins. and 48 ins. As work which requires a swing of 48 ins. is rather infrequent this lathe is kept normally at work on the 26-in. centers. The largest planer has a travel of 10 ft., and is a convenient tool for planing motor frames and large castings. The wheel grinder is used for grinding the flat spots out of old wheels which are good enough to send back to the car houses again. The turret drills are most convenient machines for performing a series of operations on small castings, such as trolley wheels, controller parts, etc. The bolt cutter and nut tapper are used very largely in working over old bolts or for making special bolts. Large numbers of bolts which are sent in on account of defective or worn-out threads, and would otherwise be scraped are sheared off, cut with new threads and made into shorter bolts. For standard parts jigs and templates are used as much as possible. Table No. 5 gives the cost of performing some of the usual operations in this shop. Fig. 1 is a view of the machine shop. In the arangement of the machinery it was intended that the tools for heavy work should

DEPARTMENT NO. 7.—CAR HOUSE DEPARTMENT (SHOPS) BY DIVISIONS

		Division No. 1	Division No. 2	Division No. 3	Division No. 4A	Division No. 4B	Division No. 5	Total
6	Maintenance of Cars	$5,210.73	$9,350.14	$6,209.04	$6,509.58	$9,769.47	$7,588.10	$44,637.06
7	Maintenance of Electric Equipment of Cars	.....	3,991.58	725.32	3,992.22	2,516.40	4,155.79	15,381.31
8	Maintenance of Miscellaneous Equipment	1.25	.....	8.10	.....	.....	4.40	13.75
9	Miscellaneous Shop Expenses	.....	912.50	940.85	836.75	991.60	900.00	4,581.70
20	Wages of Car House Employes	3,916.19	3,279.95	4,435.18	3,248.52	1,942.84	2,643.45	19,466.13
22	Miscellaneous Car Service Expenses	.....	.....	114.31	117.61	.....	.....	231.92
30	Stable Expenses	4.50	.....	.....	.....	.....	.....	4.50
		$9,132.67	$17,534.17	$12,432.80	$14,704.68	$15,220.31	$15,291.74	$84,316.37

be underneath the crane and beside the track, so that heavy material could be handled entirely by the crane.

The electrical department contains five machines for winding coils or banding armatures, a wire cleaning and taping machine and three armature coil taping machines. Armature coils are made in forms upon lathes, taped in the machines, dipped in varnish and thoroughly dried in a steam baking oven before being used. Burnt-out fields are allowed to accumulate until there are enough to work on. The exterior insulation is then stripped, the wire insulation burnt off, the wire retaped and rewound into a field in the taping machine. By using old wire for this purpose there is a saving of $1 to $3 in the cost of each field. The entire difference between the cost of old and new wire is not saved, because there is additional labor occasioned by the use of scrap wire, and an expensive tape is necessary for reinsulating the wire. No bad results have been noticed on account of the use of scrap wire. Before the exterior insulation is put on the field the coil is thoroughly baked in the oven. Table No. 6 shows the cost of some of the work done in the electrical department and also illustrates the difference in cost between field coils wound with old and new wire.

In the tin shop repairs to headlights, sand-boxes, oil cans, waste boxes, etc., and all the repairs to the galvanized iron work, gutters and down-spouts of the company's buildings are taken care of. The equipment consists of punches, rollers, shears and formers. A nickel plating and burnishing plant is operated in connection with this shop.

In the upholstering shop, repairs to harness, awnings, cur-

Table No. 4.—Operating Expense Statistics for the Year 1902

MAINTENANCE OF CAR EQUIPMENT (PASSENGER AND MAIL CARS)

MAINTENANCE OF CARS

Maintenance of cars (954 cars in 1902) (account No. 6)	$177,922.87
Maintenance of one car per annum	187.00
Maintenance of cars per car mile run	.545

ITEMIZATION OF ACCOUNT NO. 6—MAINTENANCE OF CARS

Item	Amount	Per Cent of Total
A. Repairs and renewals of trucks, truck parts, life guards, fenders, etc	$107,264.12	60
B. Repairs and renewals of car bodies	34,835.86	20
C. Repairs and renewals of car fixtures and trimmings	11,315.55	6
D. Car painting	24,507.34	14
	$177,922.87	100
Pay roll charges	$98,665.04	55
Other charges	79,257.83	45
	$177,922.87	100

DETAILS OF CAR PAINTING

Cars repainted	49
Cars revarnished and touched up	1,017
Repairs of cars painted	277
Amount expended for car painting per car (954 cars in 1902)	$25.69

ITEMIZATION OF CAR PAINTING.

	Amount	Per Cent of Total
Pay roll charges	$16,381.38	67
Other charges	8,125.96	33
	$24,507.34	100

MAINTENANCE OF ELECTRIC EQUIPMENT OF CARS (ALL CARS)

Maintenance of electric equipment of cars (Account No. 7) (527 equipments in 1902; 125 4-motor, 402 2-motor)	$70,733.12
Maintenance of electric equipment of cars per equipment per annum (Account No. 7)	134.00
Maintenance of electric equipment of cars per equipment per car mile run	.386

ITEMIZATION OF ACCOUNT NO. 7—MAINTENANCE OF ELECTRIC EQUIPMENT OF CARS (ALL CARS)

Item	Amount	Per Cent of Total
A. Repairs and renewals of motors and motor parts	$51,405.08	73
B. Repairs and renewals of trolleys and parts, controllers and parts, power circuits, etc	19,328.04	27
	$70,733.12	100
Pay roll charges	$26,866.76	38
Other charges	43,866.36	62
	$70,733.12	100

OPERATION OF ELECTRIC EQUIPMENT OF CARS

Operation of electric equipment of cars (527 equipments in 1902)	$14,918.88
Operation of electric equipment of cars per equipment per annum	28.00
Operation of electric equipment of cars per equipment per car mile run	.081

ITEMIZATION

	Amount	Per Cent of Total
(Account No. 20. Item D) Wages of car inspectors, motor inspectors and cleaners	$10,324.09	69
(Account No. 21. Item A) 37½ per cent of lubricants, waste and rags for cars	3,672.58	25
(Account No. 21. Item E) Trolley rope (50 per cent of Item E)	659.64	4
(Account No. 21. Item F) Commutator brushes	262.57	2
	$14,918.88	100
Pay roll charges	$10,324.09	69
Other charges	4,594.79	31
	$14,918.88	100

MAINTENANCE AND OPERATION OF ELECTRIC EQUIPMENT OF CARS

Maintenance and operation of electric equipments of cars (527 equipments in 1902)	$85,652.00
Maintenance and operation of electric equipment of cars per equipment per annum	162.00
Maintenance and operation of electric equipment of cars per equipment per car mile run	.467

ITEMIZATION.

	Amount	Per Cent of Total
Maintenance	$70,733.12	83
Operation	14,918.88	17
	$85,652.00	100
Pay roll charges	$37,190.85	43
Other charges	48,461.15	57
	$85,652.00	100

MAINTENANCE OF GRIPS

Maintenance of grips (172 grips in 1902) (Account No. 7A)	$22,391.67
Maintenance of grips, per grip per annum (Account No. 7A)	130.00
Maintenance of grips per cable car mile run	.157

ITEMIZATION.

	Amount	Per Cent of Total
Pay roll charges	$5,343.32	24
Other charges	17,048.35	76
	$22,391.67	100

OPERATION OF GRIPS

Operation of grips (172 grips in 1902)	$8,218.42
Operation of grips per grip per annum	48.00
Operation of grips per cable car mile run	.058

ITEMIZATION.

	Amount	Per Cent of Total
(Account No. 20. Item E) Wages of car inspectors, grip inspectors and cleaners	$6,749.39	82
(Account No. 21. Item A) 15 per cent of lubricants, waste and rags for cars	1,469.03	18
	$8,218.42	100
Pay roll charges	$6,749.39	82
Other charges	1,469.03	18
	$8,218.42	100

MAINTENANCE AND OPERATION OF GRIPS

Maintenance and operation of grips (172 grips in 1902)	$30,610.09
Maintenance and operation of grips per grip per annum	178.00
Maintenance and operation of grips per cable car mile run	.215

ITEMIZATION.

	Amount	Per Cent of Total
Maintenance	$22,391.67	73
Operation	8,218.42	27
	$30,610.09	100
Pay roll charges	$12,092.71	40
Other charges	18,517.38	60
	$30,610.09	100

Table No. 5.—Machine Shop—Cost of Performing Various Operations

Labor in turning axle, cutting key-way, boring wheels and pressing wheels on axle.

(a) 30-inch wheels fitted on 4-inch axle for No. 49 Westinghouse motor.

Turning axle, 2½ hours at 25c	$ .63
Cutting key-way, ½ hour at 30c	.15
Boring and fitting wheels, ½ hour at 33c	.16
Pressing on wheels, ½ hour at 20c	.10
Total cost	$1.04

(b) 33-inch wheels fitted on 4½-inch axle for G. E. 67 motor.

Turning axle, 3½ hours at 25c	$ .88
Cutting key-way, ½ hour at 30c	.15
Boring and fitting wheels, ½ hour at 33c	.16
Pressing on wheels, ½ hour at 20c	.10
Total cost	$1.29

Cost of trolley wheels.—Material.

100 brass castings, 3 lbs., at 15c	$45.00
100 graphite bushings at 10c	10.00
Labor.	
Boring and facing 100 wheels, 4 hours at 30c	1.20
Turning 100 wheels, 2 hours at 30c	.60
Pressing in bushings, 1 hour at 15c	.15
Total cost of 100 wheels	$56.95
Cost per wheel	.57

Re-bushing and turning old wheels.—Material.

100 bushings at 10c	$10.00
Labor.	
Pressing out old bushings, 1 hour at 15c	.15
Pressing in new bushings, 1 hour at 15c	.15
Turning, 2 hours at 30c	.60
Total cost for 100 wheels	$10.90
Cost per wheel	.11

Table No. 6.—Electrical Repair Department—Cost of Performing Various Operations

TABLE NO. 6.—ELECTRICAL REPAIR DEPARTMENT—COST OF PERFORMING VARIOUS OPERATIONS.

Note—These estimates are based on the following cost prices:
No. 4 d. c. c. magnet wire, 15⅞c. per lb.
No. 5 and No. 6 d. c. c. magnet wire, 16c. per lb.
No. 6 square d. c. c. magnet wire, 21½c. per lb.
No. 7 d. c. c. magnet wire, 17c. per lb.
No. 0.220 asbestos covered wire, 19c. per lb.
No. 9 d. c. c. magnet wire, 18c. per lb.
No. 10 d. c. c. magnet wire, 18c. per lb.
No. 11 d. c. c. magnet wire, 18½c. per lb.
Scrap magnet wire for re-insulating, 10c. per lb.
Commutator bars, 22c. per lb.
Amber mica, 95c. and $2 per pound, according to size.

	Labor	Material	Total
Rewinding No. 12 Wesinghouse armature	$5.00	$12.73	$17.73
Rewinding No. 49 Westinghouse armature	5.30	14.31	19.61
Rewinding No. 3 Westinghouse armature	6.46	13.75	20.21
Rewinding G. E. 800 armature	11.57	18.27	29.84
Rewinding G. E. 67 armature	6.71	18.60	25.31
Rewinding No. 5 Walker armature	7.89	16.09	23.98
Manufacturing one No. 12 Westinghouse field coil (new wire)	0.95	8.17	9.12
Manufacturing one No. 12 Westinghouse field coil (old wire re-taped)	1.19	6.94	8.13
Manufacturing one G. E. 67 field coil, new wire	0.79	10.07	10.86
Manufacturing one G. E. 67 field coil (old wire re-taped)	1.12	6.78	7.90
Manufacturing one No. 12A Westinghouse field coil, new wire	0.88	12.81	13.69
Manufacturing one No. 12A Westinghouse field coil (old wire re-taped)	1.47	7.95	9.42
Manufacturing one No. 3 Westinghouse field coil, new wire	0.97	8.63	9.60
Manufacturing one No. 3 Westinghouse field coil (old wire re-taped)	1.47	6.95	8.42
Manufacturing one No. 5 Walker field coil, new wire	0.86	9.15	10.01
Manufacturing one No. 5 Walker field coil (old wire re-taped)	1.10	7.82	8.92
Manufacturing one No. 49 Westinghouse field coil, new wire	0.86	8.10	8.96
Manufacturing one No. 49 Westinghouse field coil (old wire re-taped)	1.19	6.64	7.83
Manufacturing one G. E. 800 field coil, new wire	1.08	11.70	12.78
Manufacturing one G. E. 800 field coil (old wire re-taped)	1.45	9.85	11.30
Manufacturing No. 12 Westinghouse commutator.	1.51	13.15	14.66
Manufacturing No. 12A Westinghouse commutator	1.59	22.56	24.15
Manufacturing G. E. 800 commutator	1.59	11.66	13.25
Manufacturing No. 5 Walker commutator	1.51	8.57	10.08
Manufacturing No. 3 Westinghouse commutator	1.51	11.55	13.06
Manufacturing No. 49 Westinghouse commutator	1.72	19.88	21.61

Details of winding G. E. 67 armature—Material.

65 lbs. No. 9 magnet wire at 18c	$11.70
6 sq. ft. No. 20 manila paper	0.04
45 yds. No. 4 sleeving	0.32
234 yds. ¾-inch linen tape	0.94
3 lbs. No. 16 band wire	0.58
1½ lbs. solder	0.25
4 sq. ft. fibre	0.11
2 lbs. India mica	1.76
1½ lbs. ¾-inch friction tape	0.36
2 lbs. 1½-inch friction tape	0.49
1½ sq. yds. drilling	0.11
3 quarts voltalac	1.12
3 sq. yds. No. 10 empire cloth	0.78
¼ lb. glue	0.04
Labor—	
Winding armature coils, 2½ hours at 0.175c	0.44
Gluing armature coils, 6 hours at 20c	1.20
Taping armature coils, 2½ hours at 15c	0.37
Cutting, tinning, dipping coils, 3 hours at 17c	0.51
Stripping, rewinding, soldering armature, 12 hours at 0.275c	3.30
Turning commutator, ½ hour at 0.275c	0.14
Banding armature, 5 hours at 15c	0.75
Total cost of rewinding armature	$25.31

Details of winding G. E. 67 field coil—Material.

48 lbs. 0.220 asbestos covered wire at 19c	$9.12
1 sq. yd. No. 10 empire cloth	0.26
1½ sq. yds. sheeting	0.10
1½ lbs. friction tape	0.37
1 pint Monarch insulating paint	0.15
1½ sq. ft. No. 20 manila paper	0.01
½ pint P. & B. paint	0.06
Labor—	
Winding coil, 1 hour at 17½c	0.17
Insulating, 2¼ hours at 27½c	0.62
Total cost of field coil	$10.86

Table No. 7.—Operation of Blacksmith Shop for One Day—July 24, 1903

Hammering old car axles into 1¾-in. x 1¾-in. guards for track work. Nine hours' work.

Plant for doing this work, one oil furnace, one 1500 lb. steam hammer and appurtenances.

Estimated cost of plant—$2,500.

Material—	
1374 lbs. old axles at 9c	$12.37
35 gals. fuel oil at 4.5c	1.58
Labor—	
Blacksmith, 9 hours at 33c	2.97
2 helpers, 18 hours at 22c	3.96
Total cost of 132 ft., 1374 lbs., 1¾ ins. sq.	$20.88
Cost if purchased, 1374 lbs. at 2.15c	29.54
Saving by use of scrap	$8.66

Table No. 8.—Operation of Brass Foundry for Two Days—July 17 and 18, 1903

Castings made	No. of pieces	Weight
Grip dies No. 1	186	1860
Grip dies No. 2	296	1776
Grip jaws top	4	300
Grip beams	4	400
Controller parts	100	125
Shop repairs	8	15
Construction account	30	60
Total	628	4536

Average weight per casting, 7.23 lbs.

MATERIAL AND LABOR

Material—	
Brass—4301 lbs. at 13c	$559.13
Copper—338 lbs. at 14c	47.32
Zinc—10 lbs. at 5.65c	.56
Tin—90 lbs. at 28.35c	25.51
Fuel oil—125 gals. at 4.5c	5.62
Total cost of material	$638.14
Labor	24.44
Total cost of 4536 lbs	$662.58

Cost per pound, 14.6c.

To cover the cost of general superintendence, insurance, depreciation, repairs, etc., the sum of one cent should be added to this price per pound.

Cost of plant approximately, $3,000.

tains, etc., are made. Two power sewing machines are used.

A complete laundry, consisting of two washing machines, one extractor, one wringer and one ironing machine, is in use. One washing machine is used for washing towels and curtains, and the other for washing oily waste.

In connection with the upholstering shop a plant is maintained for the manufacture of rotary cane brooms for the electric sweepers. A great many of these brooms are made, as sweepers are used throughout the entire year for cleaning the right of way. A power machine is employed in this shop for splitting the cane.

The equipment of the blacksmith shop consists of eight downdraft forges, four oil-heating furnaces, one 1500-lb. steam hammer, one 600-lb. steam hammer, two Bradley hammers, one bulldozing and bending machine, one forging machine, three power punches and shears. The blast for the forges is furnished by an electrically-driven fan, and a suction induced by another fan takes away the smoke and gases through the hood over the fire, so that the air in the blacksmith shop is as pure as in any other shop. The air and smoke ducts consist of sewer pipe laid under the floor. One of the oil-heating furnaces serves the steam hammers, one the Bradley hammers, one the bulldozer and one the forging machine. A view of the forging machine, with the oil furnace beside it, is shown in Fig. 3. The advantages of oil for this work are that the heat may be perfectly regulated, that the furnace is ready for work within a few minutes after turning on the oil, that as soon as work is finished the supply of oil may be shut off, leaving no waste fuel as in the case of a large coke fire, that the manual labor involved in caring for the fire is small, that the capacity of the furnaces is so great that the machines served by the furnace may be kept in continuous operation without the necessity of the blacksmiths standing waiting for the iron to heat. The debated question of fuel economy is outweighed by these very evident advantages. The cost of hammering 1¾-in. x 1¾-in. iron out of broken or worn-out axles by means of the 1500-lb. hammer and oil furnace is shown in Table No. 7. Worn-out axles are also hammered out into switch tongues.

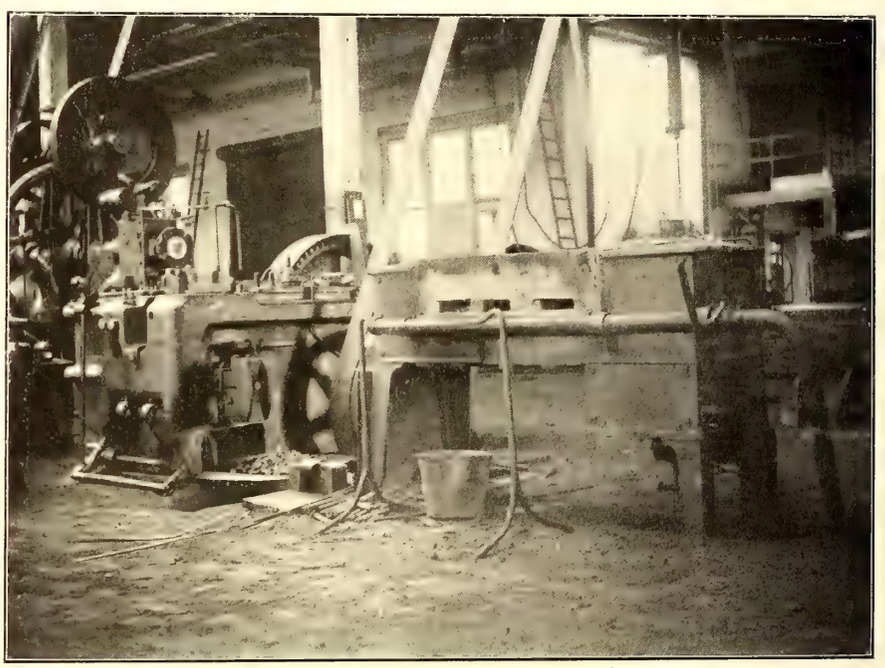


FIG. 3. FORGING MACHINE FOR MAKING BOLTS AND RIVETS, WITH OIL FURNACE BESIDE IT

Adjoining the blacksmith shop and under the same foreman is a frog shop, where special work for the track is made. A great deal of this consists of T-rail crossings, of which the Chicago City Railway Company has 385 to maintain, on account of the numerous grade crossings with the steam railroads. The equipment for this shop consists of two small saws, a rail bender, two drill presses and one frog and switch planer, with a stroke of 18 ft., all of which are motor-driven.

The equipment of the brass foundry consists of one power shears, one core-drying oven, two babbitting furnaces, and one oil-melting furnace, with a capacity of melting 500 lbs. on one charge. This latter furnace is arranged something like a Bessemer converter, swinging on trunnions for pouring. Table No. 8 shows the cost of producing brass castings in this shop. A view of the brass melting furnace is shown in Fig. 4.

A wood mill contains saws, planers, surfacers, molding, mortising and tennoning machines, and all the machinery necessary to make car repair parts out of rough lumber. In the wood mill is also located the pattern shop. The only power machine in the paint shop is a paint grinding machine driven by a small electric motor.

A printing establishment for printing transfers and stationery is operated by the company, and should be considered in connection with the shop although it is not located at the shop but at the general office. The cost of printing transfers is shown in Table No. 9.

The power for the entire shop is furnished by motors running on a 500-volt circuit. For special reasons it was considered best in this installation to build a small electric plant at the shop, and all the motors are normally run on a metallic circuit, but an emergency switch is provided, by means of which the shop load may be thrown on the trolley circuit in case the shop plant is not running. Beside the steam engines running the generators there is not a steam engine in the plant. Large machines are provided with individual motors, and the other machines are driven in groups from shafting, an effort having been made to group together those machines which are likely to be running at the same time. Thus, in the machine shop the small machines are divided into three groups, each group being driven by a separate motor. Individual motor driving for each machine would have been very expensive of installation, and would have necessitated very serious complications in the electric wiring to get changes of speed.

Having thus briefly given the equipment of the shops it would be well to take up some of the questions which present them-

Table No. 9.—Cost of Printing Transfers for the Year 1903

Total transfers printed, 131,183,500.
Estimated value of plant, $5,000.

Labor	$2,202.90
Paper	3,267.41
Ink	181.50
Wire staples	53.25
Plates	309.60
Sharpening knives	10.00
Other expenses	58.25
Apportioned rent	300.00
Light and power	125.75
Depreciation and insurance at 20 per cent	1,000.00
Interest on $5,000 at 4 per cent	200.00
Total cost of 131,183,500 transfers	$7,708.66
Total cost per 1000 transfers	5.88

selves in shop practice. The best shop practice should follow as nearly as possible the best manufacturing practice. The secret of diminishing cost in modern factory methods lies in the ability to put through large quantities of material of a similar nature at the same time, to do nothing by manual labor which may be done by machinery, to employ as much as possible automatic tools, and to drive these tools at their maximum capacity. It is not possible to do all of these things in a repair shop, the advantage of the factory being that the same general class of work is done at all times, and that certain men perform only one operation, while, except in the very largest shops, the great variety of work which must be done in a street railway repair shop limits the economies which may be effected by restricting the range of operation of the same workman. Obviously a great step toward decrease in shop cost is the standardization of parts. It may be impossible to standardize car bodies, trucks, motors and car equipment, but it is possible to standardize parts, such as journals, brasses, axles, wheels, car trimmings, trolley wheels, trolley poles and bases, car couplers, etc. A great step in this direction has been made by the steam railroads, and the American Street Railway Association has had a very thorough report from a committee on this subject.

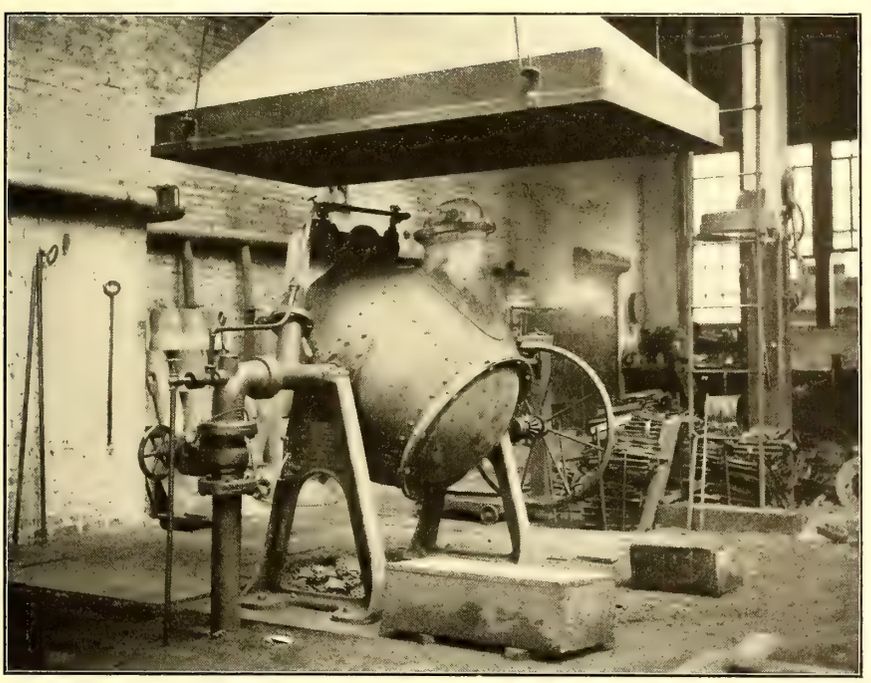


FIG. 4.—OIL FURNACE FOR MELTING BRASS

There may be a considerable difference of opinion between managers of different properties as to what is the proper standard, but there is no reason why standard parts should not be adopted on the same system or on several systems under the same general management. Having once adopted a series of standard parts a set of jigs and templates may be made in the shop and automatic tools installed which will reduce to a minimum the cost of any supplies manufactured in large quantities.

The work done in a shop may be divided into repairs of apparatus and renewals of worn-out apparatus. There is no escape from the repairs, but the matter of renewals usually involves the manufacture of certain parts, and the question often arises in street railway shops as to whether it is better policy to prepare to make these parts in the repair shops or whether it is better to buy them from manufacturing concerns. Master mechanics and foremen are inclined to rush unwisely into manufacturing, partly because of their desire to have a large shop and partly because they often deceive themselves as to the true cost of the articles manufactured by them, forgetting to charge such items as superintendence, insurance, depreciation, rent, etc., all of which enter legitimately into the cost price. No railway company should go into manufacturing unless it can be demonstrated that it can manufacture supplies much cheaper than it can buy them, and unless the demand for these supplies is so great that the plant bought for their manufacture and the men employed in their manufacture may be continuously employed. There are special instances of railroads located at a great distance from markets where the time necessary to get supplies makes it obligatory to manufacture certain articles, but these are the exceptions. If the question is fairly considered it will be found that, as a general rule, it is only the largest roads which can afford to manufacture at all.

It is difficult to arbitrarily enumerate the best shop methods because conditions vary in different parts of the country according to prices of labor and material, the equipment of each particular road, and the severity of the service. There is always the personal element, the executive and mechanical ability of the master mechanic and the foremen, which means success in its presence and mediocrity or failure in its absence, no matter what is the shop equipment. The following list enumerates briefly the matters to be looked after to insure the greatest economy in shop operation:

(1) The concentration of all the shops in one place and under one management.

(2) A simple organization by which there is a responsible head for each department, reporting to the shop foreman or master mechanic.

(3 The arrangement of the shops so that material progresses continuously just as in a well-arranged factory.

(4) Good light, heat and sanitary conditions throughout the shop. Men will always work better and more cheerfully when they are comfortable.

(5) Plenty of sunlight and the use of artificial light as little as possible.

(6) The handling of material, as far as possible, by hoists and cranes, facilitating the progress of material and avoiding the employment of skilled men at laboring work.

(7) A judicious working over of the scrap. Careful costs should be kept to determine in which cases this will pay and in which cases it will not.

(8) If manufacturing is done, the use of modern factory methods, such as manufacture in large quantities, the employment of automatic tools wherever possible, and the operation of these tools at their utmost capacity.

(9) The use of modern, improved machine tools. It is poor economy to use out-of-date tools, and it is poorer economy to use a man where a machine will do the work.

(10) The organization of some simple system of inspection and testing of apparatus before it leaves the shop. If the size of the shop does not warrant the employment of inspectors the foreman of the department or the general foreman himself should inspect and stamp each article so that the responsibility can always be located.

(11) The use of some simple system for periodically checking the cost of work done. This should be done fairly, however, and all items properly chargeable should be taken into account.

COMPOUND WOUND VS. SHUNT CONVERTERS

BY P. M. LINCOLN

It was not many years ago that the commercial success of the rotary was in doubt. Lack of flexibility in regard to voltage changes, the difficulty in starting, and most of all a tendency to hunt were looked upon as disadvantages that more than offset its smaller cost and higher efficiency as compared to a motor generator set. The engineer, however, attacked the problem, and, by means of various improvements, notably the grid damper, has succeeded in overcoming most of the inherent difficulties of the rotary. That his success has been complete is attested by the fact that the capacity of rotaries built by a single manufacturing company for Greater New York alone amounts to over 180,000 kw. This statement is more startling when it is considered that three years ago there were probably no rotaries of that capacity in operation in the whole world.

Except in specific cases the question with the engineer is no longer one between rotaries and motor generators, but one as to the particular kind of rotary. When the question has thus narrowed down to one of variety, one difference between types that is particularly apt to attract the engineer's attention is that between the compound and shunt rotaries. It is the particular object of this paper to discuss the advantages and disadvantages of the compound wound as compared with the shunt rotary. The advantages that will be discussed are:

First. The ability of the compound rotary to correct automatically for line drop.

Second. Beneficial reaction of the compound rotary on the generating system.

Third. Ability to obtain within limits any desired voltage characteristic from compound rotaries.

The disadvantages that will be taken up are:

Fourth. Somewhat greater complication.

Fifth. Greater liability of runaway condition.

Let us take up these points in order:

First. The ability of the compound rotary to correct automatically for line drop.

The ability to compound automatically is not always a necessity. If the amount of load to be carried as well as its time period can be foretold and the load changes are slow, the desirability of automatic compounding largely disappears. Such a condition obtains, for instance, where a rotary is used for incandescent lighting. In this case the adjustment of voltage needs to be so exact that the regulation by hand is usually a necessity whether compounding is used or not. If hand control be used for voltage regulation it may also be used for regulating the field of the rotary by the shunt, which, in compound rotaries, would be done automatically

When we come to the consideration of a railway load conditions are quite different. Here the load fluctuations cannot be foretold either in regard to time or amount, and are both sudden and violent in character; further, the maintenance of a given exact voltage is not nearly so important as in incandescent lighting. In this case the compound winding is usually indispensable if a constant or rising voltage characteristic is desired.

The compound winding is particularly necessary where the "drop" in the alternating-current system is considerable. This "drop" is the resultant of two elements, the ohmic and the inductive. The voltage at the collector rings of a rotary is further the resultant of the generator volts and the "drop." When the current taken by a rotary is lagging with respect to the e. m. f. supplied by the line, the inductive element of the line drop takes up such a position as to make the rotary voltage less than the generator voltage. The greater the angle of lag the greater subtractive effect has a given inductive "drop." On the other hand if the current taken by the rotary is leading with respect to the e. m. f. supplied by the line, the inductive element of the line drop takes up such a position as to increase the generator voltage. The greater the angle of lead the greater the additive effect of a given inductive "drop." The ohmic element of the "drop" is subtractive at all times, being a maximum when the angle between the current and e. m. f. is zero, and becoming less than this maximum as the angle departs from zero in either direction.

It is evident from these facts that if we can cause the current taken by a rotary to change automatically from lagging at no load or at small loads to leading at large loads we will automatically cause this inductive element of the "drop" to change from subtractive at small loads to additive at large loads, and thereby obtain compounding. To thus automatically change the angle between the current taken by a rotary and the generator e. m. f. is the function of the series winding of a rotary.

A somewhat fuller explanation of this last statement may be of interest. To generate a certain voltage at a given speed requires in any electrical machine, rotaries included, a certain magnetic flux through the armature, and to produce this flux a certain number of ampere turns is required in a rotary, or, for that matter, any other electrical machine. There exist two sources of excitation tending to force magnetic lines through the magnetic circuit—the field winding and the armature winding. If the excitation from the field windings of a rotary is not sufficient to produce the voltage that is supplied by the line, a current circulates in the armature in such a manner as to strengthen the field. The smaller the number of ampere turns furnished by the field winding the greater must be the assisting number furnished by the armature. This armature exciting or magnetizing current is lagging with respect to the e. m. f. of the line.

On the other hand, if the ampere turns in the field winding are more than sufficient to produce in the rotary the voltage supplied by the line a current circulates in the armature in such a manner as to oppose the field winding. The greater the amount of excitation furnished by the field winding the greater must be the opposing excitation furnished by the armature. This armature-demagnetizing current is leading with respect to the line e. m. f. The field ampere turns are automatically increased with the load by the series winding, and thus the current taken by the rotary may be changed from lagging at no load or light loads to leading at heavy loads.

In order to obtain an actual rise in voltage as the load increases it is usually necessary to insert an inductive resistance of some kind in the rotary circuit. It is usual to construct the transformers so that they are highly inductive and thus obtain the inductance for compounding.

In case the rotaries are operated directly from the generators it becomes necessary to insert choke coils in the rotary circuits in order to obtain compounding. It is evident, therefore, that when the benefits of compounding are desired it is necessary to use compound-wound rotaries together with suitable inductances in the rotary circuits.

This feature of automatic compounding is one of the principal advantages of the compound-wound rotary.

Second. Beneficial reaction of the compound rotary on the generating system.

An alternating-current system is peculiar in that the ex-

citation for its generators may be obtained not only from the field of the generators themselves, but also from the field of any synchronous machine attached to the system. It is well known that two alternators may be run in parallel, one with a very strong field and the other with a very weak field, and that the voltage of this combination will be somewhere intermediate between that which either would have been alone. Making one of these generators a motor or a rotary will not change the condition so far as excitation is concerned. Over-exciting a synchronous motor or a rotary will produce a leading current in the generator armature, which in turn reacts on the field in such a manner as to assist the excitation. A series winding on a rotary, therefore, automatically compensates or tends to compensate for the drop in generator voltage, which a given increment in the power taken by a rotary would otherwise cause.

In a system carrying both lighting and railway load on the same generators, this point is of the utmost importance. The writer has in mind a plant where rotaries to the capacity of over 2000 kw are connected to the same bus-bars as supply the light for a city of 75,000 inhabitants, and excellent service is being rendered to both branches of the system. The rotaries are all compound wound, and, in the writer's opinion, such a combination of services from the same generators without compounding the rotaries would be absolutely impossible.

It is evident, therefore, that the reaction of a compound rotary on the generating system may be of the utmost benefit.

Third. Ability to obtain within limits any desired characteristic from compound rotaries.

The effect of a given series winding may be reduced by any desired amount by the well-known method of shunting. The series winding is usually designed to meet the condition that requires the maximum strengthening of field that will be desired. Its effect can then be cut down to the amount required by shunting. Further, if a drooping characteristic is desired the series can be reversed so as to oppose the shunt winding. One instance in which such a characteristic might be valuable is in the operation of rotaries in parallel with a storage battery on a fluctuating load without a booster. With a sufficiently drooping characteristic the necessity for boosters in such a combination would be entirely done away with. The rotary could be made to carry practically a constant load, while the storage battery would alternately discharge on the peaks of the load and charge on the hollows. Such a layout would, of course, involve a very considerable fluctuation in the voltage supplied to the line, but this condition is a fault of the storage battery and not of the compound rotary. That a rotary can be made to meet such a condition is further proof of its greater flexibility.

Now to consider some of the points of disadvantage:

Fourth. Somewhat greater complication.

The greater complication consists only in the addition of a series coil. This makes necessary the addition of an equalizer and of the necessary switchboard apparatus to take care of this addition. At the worst it is far from a serious item. No one would think of giving up compound-wound direct-current generators in favor of shunt on these grounds, and the additional complication is in each case about the same. This point may, therefore, be thus briefly dismissed.

Fifth. Greater liability of runaway condition.

In the opinion of some engineers the increased possibility of obtaining a runaway condition is the greatest defect of the compound as compared with the shunt rotary. At first glance this defect appears to be a serious one, because when any compound rotary runs as a motor in normal direction the series coil acts against the shunt and tends to weaken the field. A careful analysis, however, will show that possibility of runaway on account of the series coil is extremely remote.

The simultaneous conditions that must be fulfilled in order that a runaway condition shall obtain are:

First. That the alternating-current end of the rotary be entirely disconnected.

Second. That the current to cause the runaway condition shall come from a source outside the direct-current bus-bars upon which the rotary is operating.

Third. That the direct-current operating the rotary as a motor must reach a value of at least full-load current and usually much more than full load.

To discuss these points more in detail:

First. It is evident that so long as the alternating-current end of the rotary is connected to the line the rotary can run at no higher than synchronous speed. It is impossible, therefore, to attain a dangerous speed under these conditions unless the speed of synchronism become dangerous—a condition with which the series coil has nothing to do. A runaway, therefore, must occur either before the rotary has been synchronized in starting up, after the rotary has been pulled off at the alternating-current end in shutting down, or during a period when the rotary is accidentally disconnected at the alternating-current end.

Second. All rotaries in a given sub-station feeding into the same system are invariably connected to the same bus-bars, positive, negative and equalizer. If one of these rotaries is running as a direct-current motor from the current supplied by the others the path of the current is practically all through the equalizer bus, and, therefore, not through the series coil of any of the machines. The direct path through the equalizer from the rotaries which are operating normally to the one running as a direct-current motor is shunted by the series coil of the rotary operating as a motor in series with the series coils of the other rotaries. The resistance of this series coil circuit is invariably sufficient to keep any large proportion of the current from taking this path. When running as a motor from current furnished by its own sub-station, therefore, a rotary acts practically as a shunt motor and the series coils do not enter the problem. In order to obtain a runaway condition, due to series coils, the direct-current producing that condition must come from a source outside the sub-station in which the rotary is running.

Third. Practically all rotaries will stand at least double normal speed with safety. Increase in speed, therefore, does not become dangerous until it has become twice the normal. In very few rotaries does the series field, under full load conditions, have more than half the ampere turns of the shunt. That is, with full-load ampere turns in the series winding opposing the shunt the resultant field strength is still one-half normal, and the maximum speed that can be attained with normal voltage will be no more than double, or within the limits of safety. But to attain even this condition requires the assumption that a motor running without load will take full-load current— a condition which is obviously absurd. Five per cent of full-load current would cover the losses at no load even in the worst cases. The rotary would, therefore, operate practically as a shunt motor.

In a question of this nature, however, prognostications of a theoretical nature should give place to results of practice. Among all of the thousands of compound rotaries now in use the writer has never heard of a single instance in which the series coil has caused a runaway.

RECENT TRACTION APPARATUS

NEW BLOCK SIGNAL SYSTEM FOR SINGLE-TRACK ROADS

A new block signal system which possesses a number of valuable features has been in use for over a year on the Tamaqua & Lansford Street Railway, of Lansford, Pa., a line operating 20 miles of track and about 1700 car miles every day. The system is automatic and allows the operation of double-headers, triple-headers, or, in fact, any number of extra cars with perfect safety. It also warns the motorman of any car, while he is passing through a block, if the system has become disarranged during the time since he passed the block signal, and also warns him if a car going in the opposite direction has entered the block in disregard of the signal. That these three advantages are of great importance in practical operation will be realized by the practical operating manager, and that they can be secured by a simple arrangement of electrical circuits is remarkable. The experience of the Tamaqua & Lansford Railway shows that the system is not affected by weather conditions, that the signals have been found to operate equally well in rain, snow and sleet, and that lightning has no ill-effects upon the system. They have been in operation in a number of the severest thunder storms that visit this section, but none of the apparatus has been injured by lightning, due to the protective devices used and the fact that the circuits are only momentarily in connection with the overhead work of the trolley, as will be seen by a study of the diagram which appears in this article.

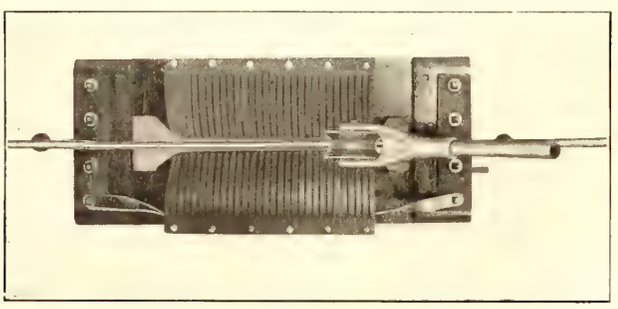


FIG. 2.—VIEW, LOOKING UP FROM BELOW, OF CONTACT MAKER

The general arrangement of the system is shown in Fig. 1. Each side of the signal turn-out is fitted with a contact-maker, illustrated in Fig. 2, and connected as shown in Figs. 1 and 3. This contact-maker consists of a sort of trough mounted on a wooden insulating block and composed of a double row of steel springs somewhat in the form of combs surrounding the trolley wire. One side is connected with the feed wire, as shown, and the other with the signal wire. The passage of the trolley wheel makes a circuit from one side to the other, and the entrance to the contact device is beveled to allow the easy automatic entrance of the wheel.

When the trolley wheel engages the contact device on entering a block it energizes an ingenious circuit controller which is shown in diagram in Fig. 1, and in detail in Figs. 4 and 5.

Normally, the signal circuit of an empty block is grounded at both ends. It includes a series of green lamps distributed along the block in any desired positions, and red lamps at the extreme ends of the block. The feed-wire connections to the signal circuit are normally open. The practical advantage claimed for this arrangement is that the signal circuit being normally dead, no accidental grounding through bad insulation, falling telegraph or telephone wires, etc., can energize the circuit and cause false signals. In case of any such accidental "ground" the system will still work on the entrance of a car into the block affected, but the dulling of the lamps in the portion shunted by the accidental ground will show the existence of trouble and help the repair gang to locate it without trouble.

Upon entering a block, a frog of special construction causes the trolley wheel automatically to take the right-hand branch of the divided trolley wire and engage the contact device thereon. The current supplied from the contact device operates the circuit controller at that end of the block. That cuts out the ground at that end of the signal circuit, and cuts in the feed connection at that end, as shown in dotted lines, Fig. 1. This causes all the green lamps to glow and also the red light at the far end of the block. The green lights show the motorman that the block ahead is clear, and the far red light shows the motorman of a car approaching the other end of the block, that the block is occupied by a car coming toward him.

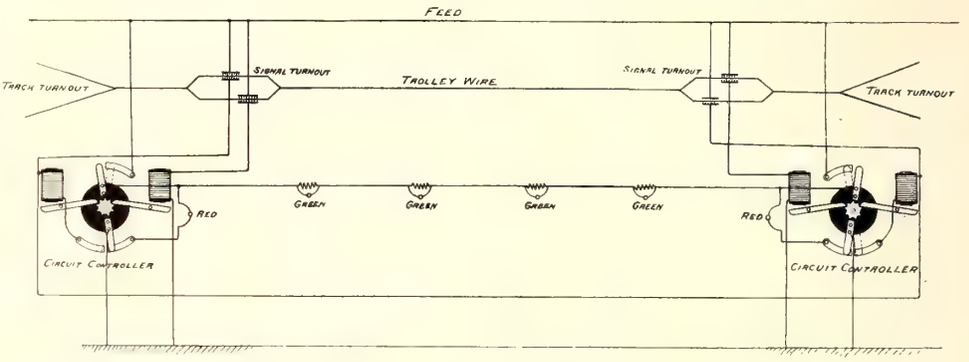


FIG. 1.—DIAGRAM OF CIRCUITS

If another car follows the first, the glowing green light and the absence of any red light show the motorman that a car is ahead of him going in the same direction, and if his instructions are to trail that car he goes into the block under control. This does not change the signals, but moves the circuit controller a notch further.

When the first car goes out of the block at the far end, it operates the contact device in the right-hand branch and sets back the controller at the other end, one notch. If it was the only car in the block, it cuts out all the lamps and puts things back in the position shown in full lines in Fig. 1. If there are one or more cars following in the block, each car sets the controller back a notch, but only the last one will put the lights out. If the motorman sees the red lamp glowing at the end of the block as he leaves it, he knows that another car is trailing him.

If a motorman overruns a red lamp danger signal and enters a



FIG. 3.—VIEW OF CONTACT MAKER IN OVERHEAD SYSTEM

block while a car is in it running in the opposite direction, it cuts out both grounds and extinguishes all the lamps. This notifies the motorman in the block that a car has entered it from the other end in defiance of the signals, or that the system is out of commission, and he must stop or feel his way out. If a car enters a block wrongfully through failure of brakes or for any other reason, backing out will reset the system in its proper condition.

Two types of lanterns are used: the one shown in Fig 6, which is only employed for the intermediate, tell-tale lights, and that shown on the pole, Fig. 7, in which are the red lights placed at the extreme ends of the blocks. Two lanterns of similar construction to those in which the red lights are contained, but with only one reflector, one lamp, and one green glass in each, showing its light toward the entrance of the block, are placed about four pole lengths away from the red lanterns and further in the block. The

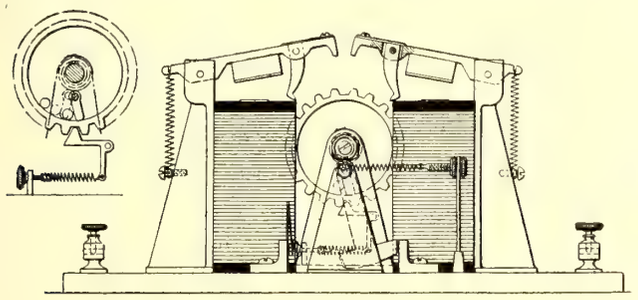


FIG. 4.—CIRCUIT CONTROLLER

arrangement of both of these lanterns is clearly shown in Fig. 7. In this view the red and warning green signals are shown on adjoining poles simply so that they could be more readily included in the picture. It will be understood, however, that in practical operation they are not so close together.

The peculiar and strong feature of the lanterns with reflectors and thin colored glass is that in strongest sunlight they present a markedly different appearance when the lamp is lighted from that shown when the lamp is out, and as signals can be read at a distance of an eighth of a mile in broad daylight. While these lanterns are simple they are nevertheless effective and are the result of many experiments to produce a better lamp signal for daylight use than is possible with the employment of lights and lenses, as has been the practice heretofore.

Fig. 6 shows one of the intermediate green lights. In the simplest and cheapest installation all of the lamps are in series, as shown in Fig. 1. A resistance is placed in a shunt around each lamp, except those in the red lanterns. The red lamps should be replaced when they have been in service for about half of their rated life hours, or say once a month, for if a red lamp burns out the circuit is arranged to go practically out of commission, in order to increase the factor of safety. The life of the green lamps, or those with the coil in shunt, is increased greatly by the shunt, and will usually be 3000 hours.

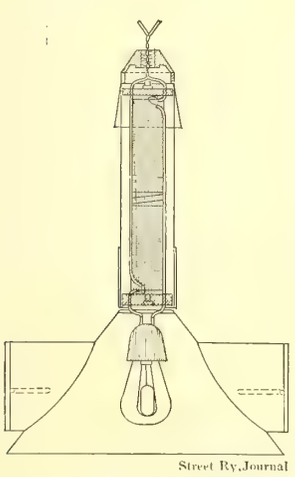


FIG. 6.—INTERMEDIATE LIGHT SIGNAL

It will be seen that the code of rules to be used with the system is most simple. Every motorman knows that a red light means danger and a green light means safety. Upon this it is only necessary to base six rules: (1) When light shows red, don't enter a block. (2) When light shows green, enter under control. (3) When no light shows, enter at will. (4) When lamps fail to light on entering a block, back out. Special rules for the running of cars when the signals of a block are wholly or partly out of order can be provided by the management to meet special conditions and systems of operation. (5) When lights go out while in block, proceed with extreme caution. (6) When light shows red upon leaving a block, look out for trailers.

If one of the green lamps burn out, the current passes through the shunt resistance, and the rest of the system remains unaffected, with the exception of a slight dimming of the lamps. If one of the red lamps burns out, it disables the system for cars entering the other end of the block, rule 4 applying. If both red lamps burn out, it disables the system completely until they are replaced.

When the cost of extra wiring is not prohibitive, the manufacturers advise connecting the green lamps in multiple. When the

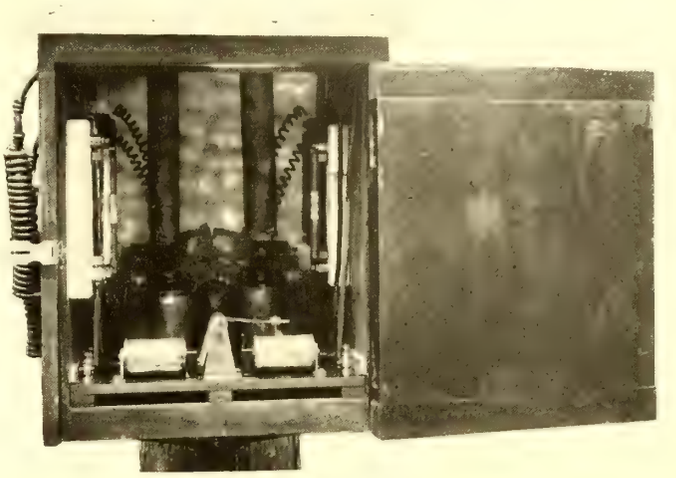


FIG. 5.—CIRCUIT CONTROLLER BOX OPEN

number of green lamps in any one block exceeds the voltage capacity of the signal current, the multiple connection must, of course, be used. With the multiple arrangement, one lamp main is connected up to the ground switch of the controller at each end. The other lamp main is connected to the feed switch at each end.

Semaphores may be used in addition to the lamps, if desired, and the manufacturers have a system in preparation in which the current, not dependent upon lamps for continuity, first sets the far signal and is then switched back to operate the near signal, thus securing the certainty that both ends of the block are guarded before



FIG. 7.—CAR AT BLOCK SIGNAL

a car enters it, and eliminating all possibility of accident through failure of the far signal to work.

This system was invented by Howell W. Souder of Tamaqua, and is being put on the Market by the Eureka Automatic Electric Signal Company, of Lansford, Pa.

NEW COMMUTATION TICKET

The National Ticket Company, of Cleveland, Ohio, is introducing a new form of commutation ticket that is meeting with considerable favor. It was originally designed for the Lake Shore & Michigan Southern Railway, and has since been adopted by several interurban electric railways. The agent's stub, coupons and contract are in one continuous strip folded conveniently for carrying in the pocket, and completely prevents manipulation by passengers, as coupons cannot be presented detached or old coupons inserted in new cover, as is often done with the old style commutation books. It has other advantageous features which are readily discernible upon examination of the ticket itself.

PROGRESS IN UNDERGROUND ELECTRIC RAILWAYS IN LONDON

In the entire field of electric traction no greater interest is shown in any plans than those which promise to revolutionize the system of intercommunication of the City of London. Substantial progress is now being made with the work of conversion, and it is expected that in the early part of 1904 electric trains will be running on some portion at least of the underground railways.



METROPOLITAN POWER HOUSE, WITH AMERICAN AND ENGLISH FLAGS ABOVE STACK

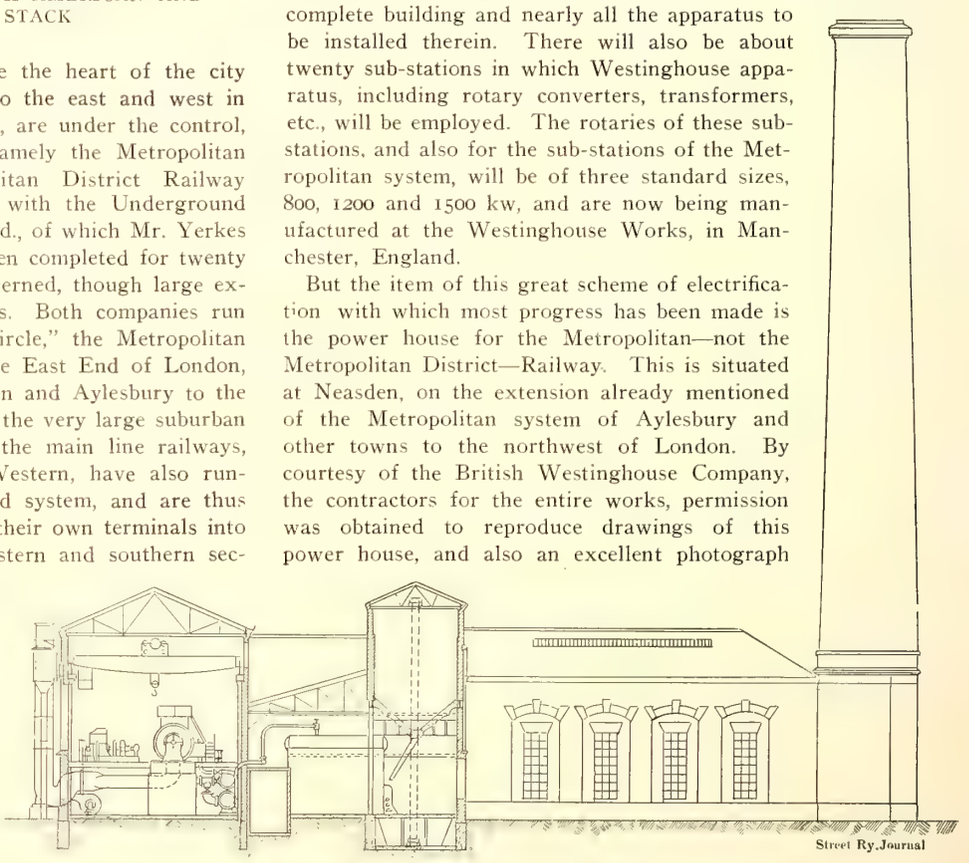
The underground lines which penetrate the heart of the city itself, and extend through the suburbs, to the east and west in particular, to a very considerable distance, are under the control, for the most part, of two companies, namely the Metropolitan Railway Company, and the Metropolitan District Railway Company. The latter is now connected with the Underground Electric Railways Company of London, Ltd., of which Mr. Yerkes is the master spirit. These roads have been completed for twenty years in so far as their city lines are concerned, though large extensions have been made on the outskirts. Both companies run trains on part of the so-called "Inner Circle," the Metropolitan running trains round the circle and to the East End of London, and also on a long branch line to Neasden and Aylesbury to the Northwest, while the District trains cover the very large suburban neighborhoods to the West. Several of the main line railways, notably the Great Western and North-Western, have also running powers on parts of the underground system, and are thus enabled to bring their passengers beyond their own terminals into the center of the city. The northern, eastern and southern sections are mostly cared for by the local trains of the main railways, whose terminals in these cases are for the most part more conveniently situated for the business districts. So much for the steam railways.

Next in turn is the rapidly developing tube railway system. There are at present three such lines in operation, all of course electric, namely, the Central London, the Waterloo & City, and the City & South London Railways. Of these the last was the pioneer, being indeed the first electric railway in Great Britain, and has now been working with uninterrupted success for a number of years. It runs from the city under the Thames and through the populous districts south of the river, having a total length of 6½ miles. The two side by side tubes, for the "up" and "down" trains respectively, are of considerably smaller diameter than those adopted in subsequent lines of the same character, and still smaller than the sizes which experts recommend for future tubes, namely 13′6″. The gage is standard, and the third rail of channel section, inverted, and secured by glass insulators to alternate ties. The rolling stock is of light character, the trains consisting of four carriages, capable of seating 130 passengers, and a locomotive. These latter develop 80 hp at 20 m.p.h, and are 32 in number. The first fourteen of these had series control, but all the others have the usual series-parallel arrangement. The average speed maintained is 14¼ miles per hour. This line has now been running regularly for nearly thirteen years, a fact which few Londoners, except those who daily use it, seem to realise.

The next London electric railway owed its inception to the enterprise of a main line railway company. The terminal of the London & South-Western railway, to which is brought daily an enormous local passenger traffic, is situated on the southern side of the Thames, at a considerable distance from the heart of the city. This drawback being recognized, powers were obtained for a tunnel railway from the terminal, known as Waterloo, to an underground station adjoining the Bank of England, the Stock Exchange, etc. This line has now been running about five years, and has fully justified the enterprise of its promoters. The rolling stock is of a much heavier character than that of the pioneer line, and locomotives are not used, the motors being mounted on the end cars, which are used as locomotives alternately according to the direction in which the train is running. The third tube railway now running, the Central London, is too recent to require description.

In addition to the foregoing there are numerous tube schemes in various stages of progress, a large proportion of them coming under the control of the same group as the District railway, viz.: the Underground Electric Railways Company of London. The electric power house being erected for all these lines, and also it is believed to feed part of the road jointly owned by the District and Metropolitan, is now being pushed forward by the British Westinghouse Company, which has obtained the contract for the complete building and nearly all the apparatus to be installed therein. There will also be about twenty sub-stations in which Westinghouse apparatus, including rotary converters, transformers, etc., will be employed. The rotaries of these sub-stations, and also for the sub-stations of the Metropolitan system, will be of three standard sizes, 800, 1200 and 1500 kw, and are now being manufactured at the Westinghouse Works, in Manchester, England.

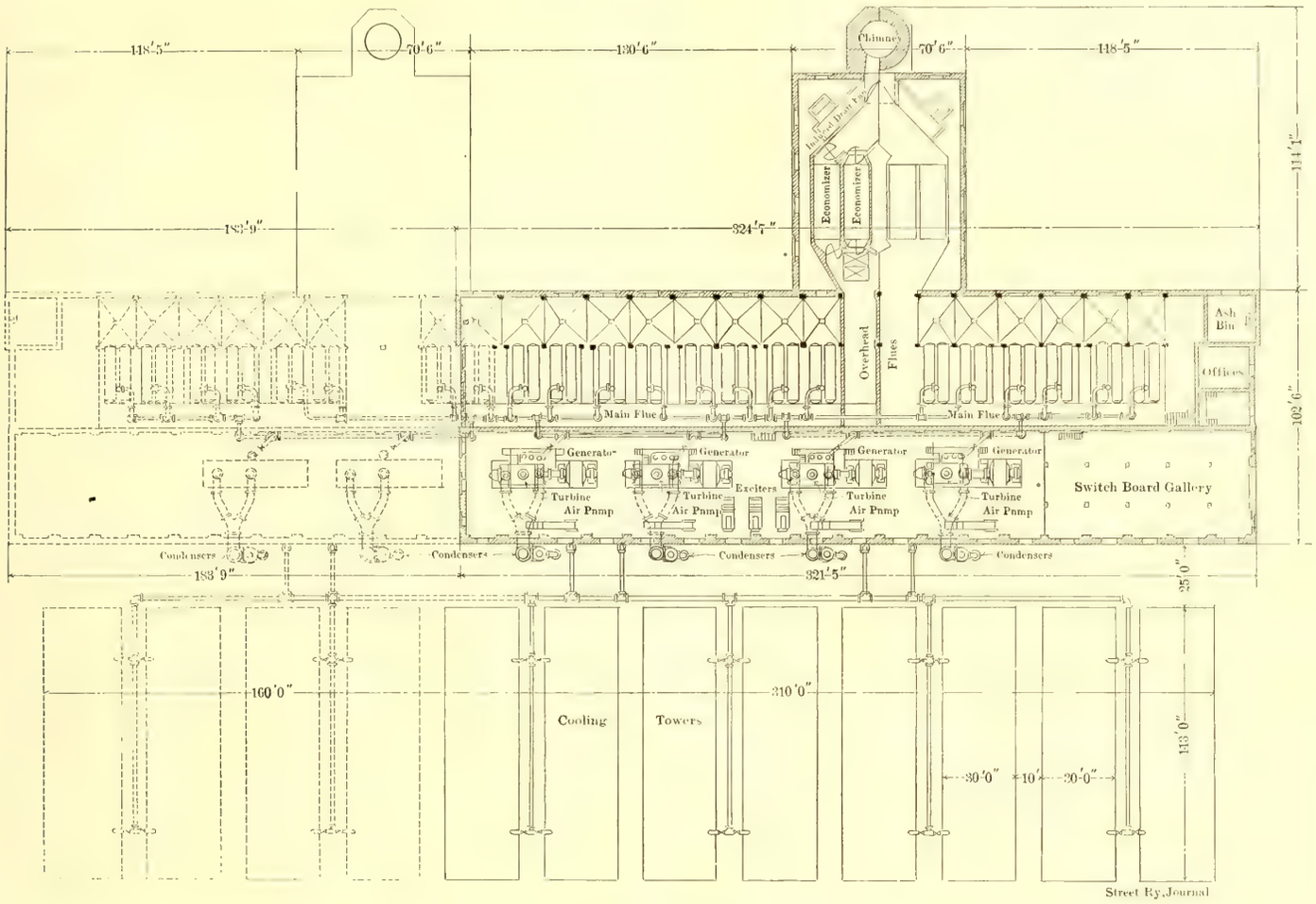
But the item of this great scheme of electrification with which most progress has been made is the power house for the Metropolitan—not the Metropolitan District—Railway. This is situated at Neasden, on the extension already mentioned of the Metropolitan system of Aylesbury and other towns to the northwest of London. By courtesy of the British Westinghouse Company, the contractors for the entire works, permission was obtained to reproduce drawings of this power house, and also an excellent photograph



CROSS-SECTION OF POWER STATION

taken during the process of building. The works are of particular interest as being the first instance of a large traction station employing only steam turbines. The turbines are of the Westinghouse parallel-flow type, steam entering at the center of the single cylinder and expanding through rows of blades to exhaust chambers at either end. Each turbine has its separate air-pump and

Alberger barometic condenser, while condenser water is supplied from two Klein cooling towers for each unit. The power station buildings are being constructed to contain four 3500 kw turbo-generator units, of which, however, only three will be put in at first. As indicated in the plan of the station, provision has been made for



PLAN OF POWER STATION, LONDON

a further extension to contain two more sets, with equivalent boiler plant and cooling towers and a second smoke stack. The first smoke stack, which is now, as will be seen, complete, is 200 feet high by about 15 feet internal diameter. The steam raising plant is to consist of 16 Babcock & Wilcox boilers, i. e., four to each turbine. The coal will be carried by an endless conveyor to the roof of the engine room, and then tipped into bins as required; from the bins it will feed down to the stoker hoppers by gravity. The main steam and exhaust piping will be located in the basement of the engine house, the condensing apparatus, with the exception of the air-pumps, being outside the buildings. The same conveyor will be used for handling coal and ash.

The turbines will drive alternating current generators of 3500 kw each, three-phase at 1000 r. p. m. They will be of the rotating field type, and will generate current at 11,000 volts for transmission direct without the interposition of step-up transformers. The switchboards will be at the end of the engine room, elevated on a gallery from which a clear view over the sets can be obtained.

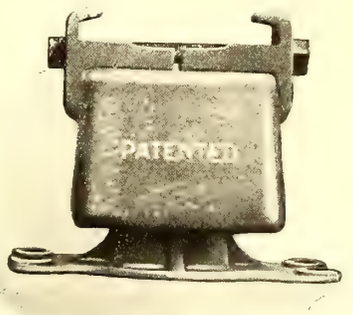
The entire layout of the power-house is convenient to a high degree, the compactness of the turbo-generators being very striking when compared with a plant of similar capacity using reciprocating engines and slow speed generators.

Orders have been issued to the officials of the Berlin underground and overhead railway to light all tunnels by wires wholly disconnected with the leads which supply current to the cars, and to install apparatus enabling train hands to cut off current anywhere and thus stop trains approaching the scene of an accident. The officials are also ordered to stop the overcrowding of cars.

VITRIFIED CONDUITS AND INSULATORS

The Standard Vitrified Conduit Company, of New York, has completed its factories at South River, N. J. These are said to be the largest of their kind in the world, and to produce more conduit than any six of the other conduit factories in the United States. This company manufactures conduits and third-rail insulators exclusively, and as it has unlimited quantities of pure stoneware clay on its premises, this advantage, combined with its experience in the art of clay working, should make the quality of its manufactures equal to, if not better, than any other conduit on the market.

The works are now in full operation, producing 100,000 ft. of conduit a day, and also manufacturing the Manhattan third-rail insulator. The company recently made over 43,000 insulators for the Scioto Valley Traction Company, in Ohio, and has done a large business with other street railway companies, especially in Pennsylvania, which have third rail systems. The Manhattan Railway Company, of New York, after a series of exhaustive tests, adopted the insulator, which is shown in the accompanying cut.. Most of the other third-rail systems which are using this type of insulator have adopted practically the same pattern.



MANHATTAN THIRD-RAIL INSULATOR

At the Convention at Saratoga, Sept. 4, 5 and 6, this company will be represented by B. S. Barnard, vice-president and secretary, with a thorough exhibit of its product.

NEW TRAMWAY SWITCH

The Keefer Car Switch Company, of Albany, N. Y., has recently placed on the market a railway switch which is operated from the car without stopping the latter, thus dispensing with switchmen besides saving time.

As shown in Fig. 1, this switch consists essentially of a bed-

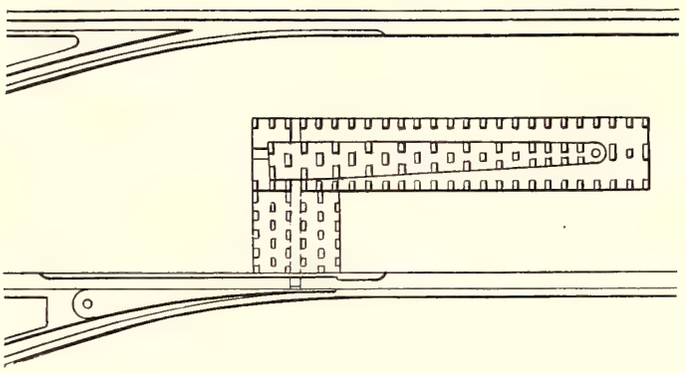


FIG. 1.—GROUND PLAN OF AUTOMATIC SWITCH

plate and a shifting block pivoted thereon. This shifting block is adapted to engage with a cross-bar running in a groove. By referring to Fig. 2 it will be seen that a lever carrying a shoe at the lower end is attached to the car. When this lever is in its normal position the shoe is not in contact with the shifting block, but upon pressing down the plunger which projects through the car platform, the shoe is brought in contact with the shifting block, which in turn engages with the cross-bar in the groove, thus throwing the switch.

By the use of this device the car platform is not affected by wrenching or otherwise by the operation of switching. The inventor of this switch has not only provided for the pull of the shoe from the front of the platform, but has also by adjustment of the cross-bar with the shifting block made it possible to use

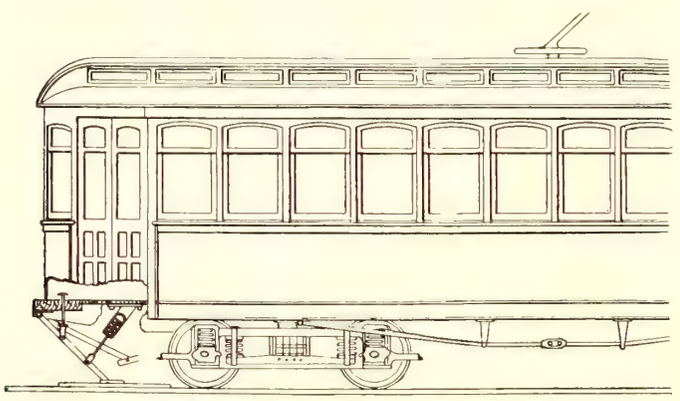


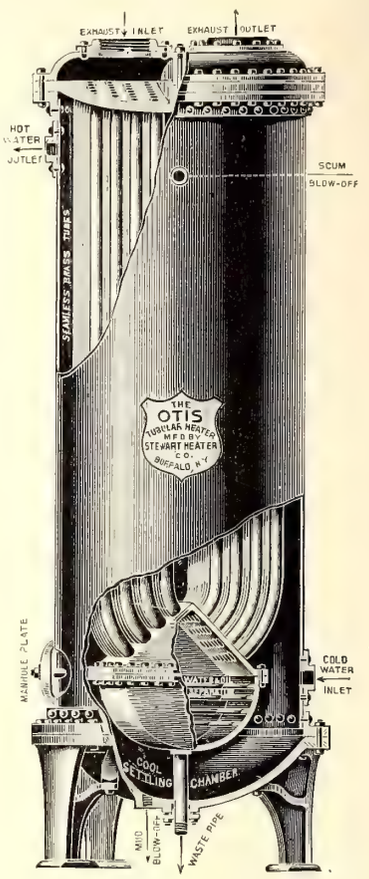
FIG. 2.—SIDE ELEVATION OF AUTOMATIC SWITCH

one set of plates regardless of the length of throw required. The switch is simple in construction, lies entirely on the surface, requires no weights or delicate adjustments, no connection with drain or sewer and may be attached to any switch point in use. The successful operation of the switch requires only that the motorman shall press his foot on the plunger when approaching a switch to see the switch point thrown in the desired direction.

FEED-WATER HEATER AND PURIFIER

The accompanying illustration shows an Otis feed-water heater and purifier, manufactured by the Stewart Heater Company, of Buffalo, N. Y. This device is used to thoroughly heat the feed water by the exhaust steam before it enters the boiler, to separate the mud and sediment from the feed water, and remove it easily and quickly from the heater; also to collect and carry off the scum from the surface of the water, and the condensation and oil from the exhaust.

The body or shell of heater is made of boiler iron or steel, the top end of which is riveted to a heavy cast-iron ring, with a projecting rim cast upon its outer surface, forming a flange, to which the tube sheet and top dividing plate is attached by one row of bolts. The lower end of shell is riveted to a heavy cast-iron conical bottom, which is supported by four legs, making a substantial base for the heater.



TUBULAR FEED-WATER HEATER AND PURIFIER

In operating the heater the exhaust steam enters the heater at the top, passes down one section of tubes into the enlarged space of water and oil catcher, where the water of condensation and oil is separated, then passes up through the other section of tubes, thus passing twice through the entire length of the heater, heating the feed water to the boiling point. The exhaust steam can then be used for other purposes or can be exhausted into the atmosphere.

The water enters the heater near the bottom, and passing upward in contact with the heated tubes, gradually becomes thoroughly heated, and is discharged as near the top as practicable without carrying the scum that is on the surface of the water into the boiler.

This heater is guaranteed to heat the feed water to the boiling point with the exhaust steam without causing any back pressure when the company's standard heater is used, and that all impurities in the feed water that will precipitate at that temperature will be deposited in the heater before the water enters the boilers. This heater will separate and carry off the water of condensation from the exhaust, and will extract the oil from the exhaust so that the exhaust steam can be used for heating purposes, and the condensation from the heating coils be returned to the boilers without injury to them. Scale will not accumulate in this heater, and all necessary cleaning can be easily and quickly done.

MOTOR COMPRESSORS FOR STREET RAILWAY SERVICE

Economy in the wrong place is extravagance, especially in the equipment of railways and cars. Probably in no part of the car equipment is this false economy more often practiced than in the air-motor compressor. Ample compressor capacity should be provided to meet not only the auxiliary appliances calling for the use of air, as well as the brakes, but also to provide against leaky pipes, temporary derangement of minor parts, and other accidents.

Another practice, the wisdom of which is questioned, is the enclosing of the motor compressor. While this reduces the noise somewhat, it is claimed that it is at the sacrifice of mechanical efficiency, and it is pointed out that whether the box is on or off, the noise to the occupant of the car is about the same, the extra noise being noticeable only to one outside, and that to no great extent.

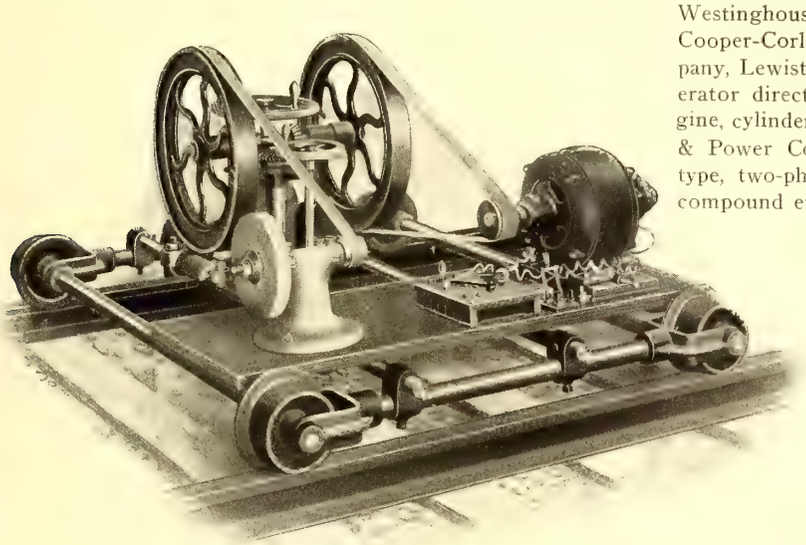
The generation of heat is inseparable from the compression of air. In stations where the service is continuous, a water jacket is usually provided to absorb the heat, but in street railway air-brake service the compressor is often boxed. Those who are opposed to this plan suggest that those parts of the compressor itself that become heated will be subjected to the draft of air and cooled, thereby increasing the efficiency and life of the machine. The interior of course must be protected from dirt and other foreign matter by providing means to render it practically dust proof, as,

for instance, making the casing integral with those parts which heat in running, in order that the casing may serve to aid in dissipating the heat generated.

It is along the lines here indicated that the motor compressors made by the Westinghouse Traction Brake Company are constructed. In the electric pump governor made by the same company, a simple diaphragm with pneumatic pressure and a slide valve is used instead of high resistance magnet coils. This company disapproves the use of magnet coils on the ground that they are easily damaged and liable to frequent break downs in service, while the slide valve, once fitted, rarely gets out of adjustment. It is similar to the slide valve used in the triple valves of this company's make. It is of very rugged construction and is not liable to easy derangement.

MOTOR-DRIVEN TRACK DRILLING MACHINE

The Ludlow Supply Company, of Cleveland, Ohio, has recently added manufacturing to its supply business, and is this year developing many devices for use in the construction of electric railways. One that it has made a specialty of is the Cleveland track-drilling machine, operated by hand or electric power.



MOTOR-DRIVEN TRACK-DRILLING MACHINE

The accompanying cut shows one of its machines operated by a 1-hp electric motor. It also shows the emery wheel attachment which the company is putting on nearly every machine this year. With this machine it is possible to drill a 2⅞-in. hole through a 70-lb. A. S. C. E. rail in from 30 to 35 seconds. The hand-power machine for the same purpose was illustrated in the STREET RAILWAY JOURNAL for Aug. 15.

Among the many street railways using these machines are the following:

Union Traction Company, Anderson, Ind.; Illinois Valley Traction Company, Ottawa, Ill.; Interborough Rapid Transit Company, New York; New York & Long Island Traction Company, Hempstead, L. I.; Pittsburg, McKeesport & Connellsville Railway, Pittsburg, Pa.; Cleveland, Painesville & Ashtabula Railway, Cleveland, Ohio; Northern Ohio Traction & Light Company, Akron, Ohio; Cincinnati & Columbus Traction Company, Cincinnati, Ohio; Dayton & Western Railway Company, Dayton, Ohio; Toledo & Western Railway Company, Toledo, Ohio; Detroit, Monroe & Toledo Short Line Railway, Detroit, Mich.; Ohio & Indiana Railway & Light Company, Angola, Ind.; Louisville Railway Company, Louisville, Ky.; Consolidated Railway & Power Company, Salt Lake City, Utah; Everett Railway, Light & Power Company, Everett, Wash.

RECENT RAILWAY INSTALLATIONS

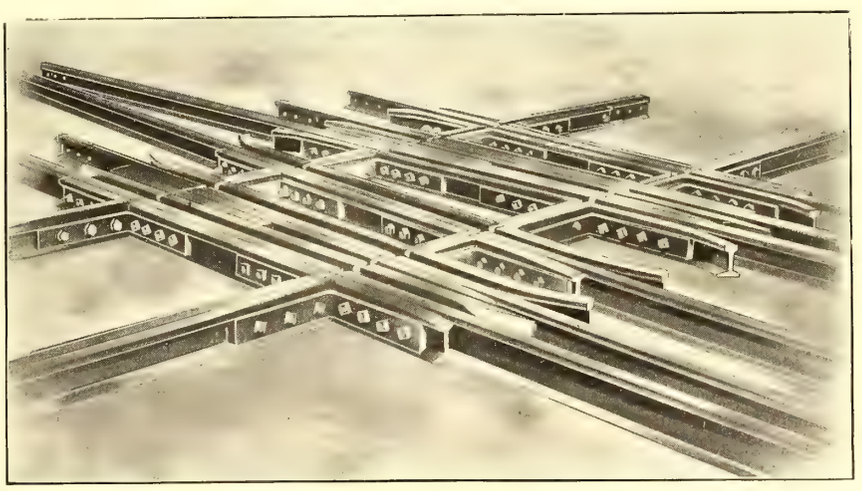
Rossiter, MacGovern & Company have just completed for the Hudson Valley Railroad Company, Glens Falls, N. Y., the installation of a 525-kw General Electric 10-pole generator direct-connected to an Allis-Chalmers tandem compound engine with cylinders 22 ins. and 42 ins. x 42 ins., running at 90 r. p. m. They have also installed the complete steam equipment, consisting of feed and water pumps, feed water heater, steam piping, condenser, etc. This complete unit was erected and in actual operation within forty-five days from signing contract. Rossiter, MacGovern & Company take considerable pride in this class of work. They will be very glad to have their friends visiting the Saratoga Convention inspect this unit, as they regard its not only as a fair example of the kind of apparatus they sell, but also of the class of construction work they are accustomed to install. In this connection they wish to call attention to the fact that they not only buy and sell street railway apparatus of all kinds, but are making a specialty of high-class construction work, turning the apparatus over to the purchaser in complete operating condition.

Among the several important contracts recently closed by this company with street railways are the following: Twin City Rapid Transit Company, Minneapolis, Minn., one 1630-kw. 100 r. p. m. Westinghouse generator direct-connected to cross-compound Cooper-Corliss engine; Lewistown & Reedsville Traction Company, Lewistown, Pa., one 375-kw, 215 r. p. m. Westinghouse generator direct-connected to Westinghouse tandem-compound engine, cylinders 23 ins. and 40 ins. x 20 ins.; Kokomo Railway Light & Power Company, Kokomo, Ind., two 300-kw, Stanley engine type, two-phase, 60-cycle generators connected to Russell cross-compound engines, together with condensers, switchboards, etc.; Montreal Terminal Railway Company, Montreal, Canada, twenty Westinghouse 12-A railway motor equipments complete.

SPECIAL RAILWAY CROSSING

The accompanying cut, which shows the crossing of an interurban electric railway with three steam railroad tracks, is fairly representative of the intricate construction necessary in crossing steam railroads where tracks are so closely arranged. The crossing illustrated was made by the Indianapolis Switch & Frog Company, of Springfield, Ohio.

Crossings of this design are built by this company with easer or reinforcing rail, which serves to carry locomotive tires and prevents their striking the abutting rails of the electric railway track, adding very materially to the life of the crossing and preserving the alignment. They are constructed with solid rolled steel filler and extra heavy corner irons and bolts, built for exacting service and heavy traffic.



SPECIAL RAILWAY CROSSING

This company has given special attention to the requirements of interurban railways and has furnished numerous railways throughout the country with entire equipments of special work, such as crossings, frogs, switches, stands, curves and car house layouts. It has recently completed the equipping of a new plant, the main building of which contains over 2 acres of floor space, and has added a line of new machinery and appliances which more than doubles its capacity.

SEMI-ACCELERATOR CARS FOR OMAHA & COUNCIL BLUFFS

The American Car Company recently sent to the Omaha & Council Bluffs Street Railway Company ten cars of its patented semi-accelerator type, like the one shown in the accompanying



INTERIOR OF OMAHA CAR

illustration. The remarkably rapid growth of these cities—there is a population of over 200,000 within 6 miles of the Union Station, of Omaha—has made it necessary to use every means to shorten the stops to the utmost extent. The illustration of the interior shows the position of the door on the left side, and as one can readily understand, not only is the distance between the door and the step shortened, but the passengers are kept from standing on the platform in the way of those passing in and out. The cars run in one direction only, and therefore the seats are arranged with stationary backs. At the rear end, which is chiefly used for ingress and egress, the longitudinal seat on



EXTERIOR OF OMAHA CAR

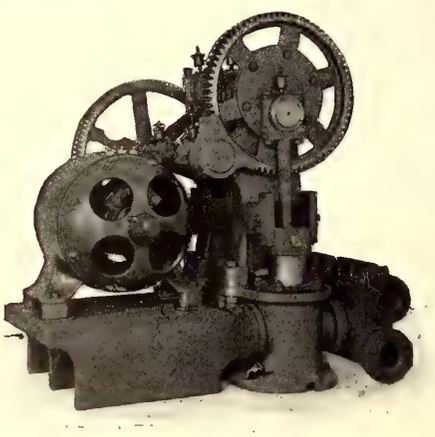
one side is 68 ins. long and on the other side (the door side) the seat is 51 ins. long. At the forward end there are no longitudinal seats. Space is made at the door by the use of a single seat at that side.

The windows are double, the upper sash being stationary and the lower arranged to drop into pockets which extend down between the double sills. The front platform is vestibuled and a hot water heater placed in the corner opposite the door. The interior finish is in natural cherry with birch ceilings, neatly decorated. The underframing of the cars is unusually powerful. The center sills are composed of I-beams extending the full length of the body and placed 15 ins. apart. The side sills are double 2¾ ins. x 7¾ ins. each, plated on the outside by ⅝-in. steel, and have upper and lower trusses, the upper truss rod of ⅜ ins. x ½-in. steel is gained upon the posts 16½ ins. from the floor. The four platform knees are plated with angle iron, the two center knees having the angle iron bent up and connected with the I-beam center sills back to the bolster. Angle iron bumpers of the Brill patented type strengthen and protect the ends of the platform. Distance from center to center of posts is 2 ft. 8 ins. Thickness of side posts is 3¼ ins., and thickness of corner posts 3¾ ins.

Level of cars over end panels, 34 ft.; length over crown piece, 45 ft.; from panel over crown piece, 5 ft. at front end and 6 ft. at rear; width over sills, including sill plates, 8 ft. 3¼ ins. From rail-head to step, 18 ins.; from step to platform, 14½ ins.; from platform to car floor, 9 ins. The cars are mounted on the American Car Company's M. C. B. truck No. 14, with 6 ft. wheel base, 33-in. diameter wheels, and are equipped with four 38-hp motors.

MOTOR-DRIVEN TRIPLEX PUMP FOR GENERAL SERVICE

The accompanying cut illustrates an electric triplex pump manufactured by the Deming Company, of Salem, Ohio, which man-



MOTOR-DRIVEN TRIPLEX PUMP

ufactures a very extensive line of pumps and other hydraulic machinery. This pump, which is built for 150 lbs. pressure, embodies the best results of many years' experience in designing and manufacturing pumping machinery. Pumps of this type are used in many mills, factories and power stations for tank and boiler feeding and fire service where economy of fuel is an important item. They are built for operation not only by direct or alternating current motors, but also by gas, gasoline and oil engines.

The construction varies in the different sizes, but embodies in each steel crank shafts in one piece; cut gearing; pinion shafts adjustable toward and from crank shafts; ample bearings; outside guided and outside packed plungers (plungers have no rubbing contact in the pump-base); large valve areas; suction and discharge openings on either end of pump, and in the large sizes the valve chamber can be attached to either side of base. When arranged for direct connection to electric motor, the pump is furnished complete with a sub-base and intermediate gearing for any make of motor, the motor pinion being always made of rawhide. The whole outfit is especially suitable where the installation must be made in a minimum amount of space. The increasing business of the company, particularly in power pumps, has recently necessitated an extensive addition to its former works.

TRACK AND MOTOR TESTING INSTRUMENTS

The improved testing instruments exhibited by R. W. Conant, of Cambridge, Mass., are attracting much attention, especially two of the latest, to be shown at the Saratoga Convention. The T-pole bond tester is shown in Fig. 1, as it appears when being used. The principle of this instrument involves the use of a telephone receiver, in which the sound is augmented by a special intensifying attachment devised by Mr. Conant. First contact is made at three points on the rail, giving two sections of equal length, one being solid rail and the other including the joint; then a resistance box is manipulated until no roaring is heard in the telephone, indicating that the electrical effect of the two sections of track on the telephone are then equal. This manipulation of the "balancing switch" takes about a second and its position then shows on a scale the ratio of the resistance of the joint section to the solid section of equal length.

The contact apparatus consists of a center pole with steel chisel welded to a socket at its lower end, to which are bolted by one thumbscrew two extension beams reaching out on the rail 3 ft. on either side. These carry two hardened steel chisels which are kept sharp by a hand-stone furnished and carried in the case of the instrument. The edges are set so as to extend in the direction of the length of the rail, while the center chisel edge is at right angles to the rail length.

The extension beams are of a light elastic wood and are tough and springy. The wrought steel knees, by means of which the extension beams are bolted to the center chisel, are permanently fastened to the beams in such positions that when the T is placed on the rail the outer chisels touch first, while the center chisel edge is about 2 ins. above the top of the rail. Then by resting the hollow of the foot on one side, near the center, the T is sprung down so that the center chisel rests firmly on the rail. This springing action forces the other chisels outwards with a scraping movement that cuts them into contact with the rail.

With the T-pole connected to the instrument and the telephone in position the operator places T-pole on rail with rail-joint under one beam. The instrument is started by switch at side, and the balancing switch is placed on the point numbered one. A roaring

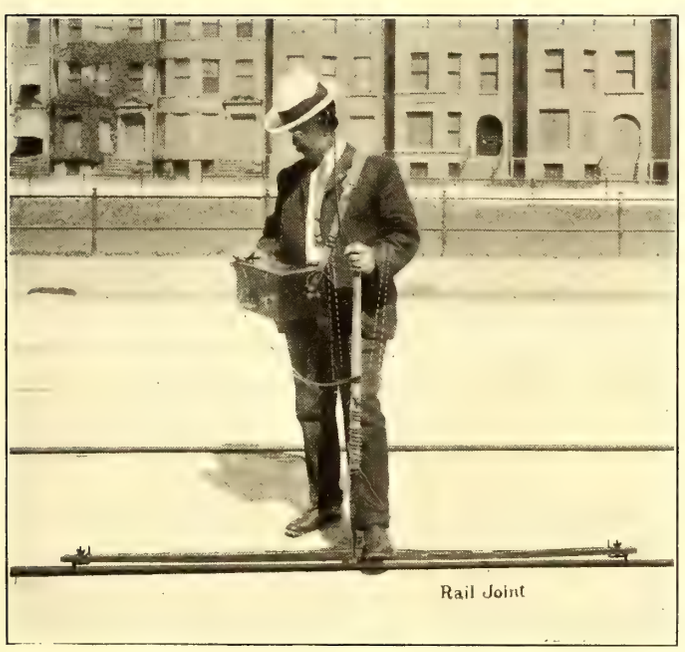


FIG. 1.—T-POLE BOND TESTER

sound in telephone indicates that balancing switch is to be moved to point of silence. When this has been done the number at which the switch stands is read off. This number shows the value of the resistance of the rail-joint in terms of the standard length of rail spanned, which is 3 ft. The instrument cannot be burnt out or injured by open joints and tests with one operator 1000 joints per day.

Fig. 2 illustrates the Conant motor tester in operation on a car. This instrument measures the magnetic strength of the motor coils and not their resistance, and defects, therefore, show up in their true relative importance as affecting the operation of the motors. Its construction is such that it can be readily operated by the car-house man, and its use does not involve any calculation or particular care in regard to making exceptionally good contact. All that is necessary is to push the contact awls through the flexible wire as it comes from the motor. It has been adopted by many street railways.

Its systematic use has developed some very interesting causes of motor trouble, among which may be mentioned the following: A field may be thoroughly baked out but does not always short circuit until it has run a few trips and heated up. After the short



FIG. 2.—USING MOTOR TESTER ON CAR

circuit has developed under some conditions the arc welds the turns together, and when the motor cools off it is still short circuited, but sometimes the jarring and contraction in cooling will cause the short circuit to temporarily disappear. The ability of the instrument to test while the motors are hot is therefore invaluable in such cases. This it is able to do since its indications are unaffected by resistance changes.

A short circuit caused by moisture, usually found in the lower spools, has not the same faculty of disappearing, presumably because the wires are held more tightly together, since but little of the insulation has been destroyed. These coils usually appear as good as new when first stripped, and it is not until a layer or two is unwound that a greenish coloring is noticed on the cotton and usually at the corner of the coil the two wires will be pitted and show where the arcing has welded them together.

Rewinding defects are of surprisingly common occurrence, such as insufficient insulation under the inside end of the field coil, use of improper soldering fluids, resulting in the deterioration of the insulation, etc.

Both the motor and bond testing instruments have been constantly improved in such particulars as experience has shown would result in increasing their durability. The Boston Elevated Railway Company and the Massachusetts Electric Companies are among the large railways extensively using these devices.

AMUSEMENTS FOR STREET RAILWAY PARKS

The degree of success attained in attracting summer traffic is an important factor in the earnings of many street railway companies, especially of those owning picnic grounds. In some instances such parks are managed directly by the railway company, but it is often found advantageous to permit some manufacturer of amusement devices to control such places at his own expense, the railway company receiving a part of the gross receipts.

One of the most successful builders and managers of amusement apparatus for railway parks is the Ingersoll Construction Company, of Pittsburg, Pa. The members of this firm—Frederick Ingersoll, president, and E. E. Gregg, secretary and treasurer—have had long and successful careers in this line of work as they have never offered any but legitimate attractions. This company makes the well-known figure 8 roller coaster and the Ingersoll

laughing gallery. The company states that it has found these two attractions to be great favorites with street railway managers, and believes that no picnic park is complete without one or both of them. The figure 8 roller coaster is said to be especially successful. As a proof of the company's confidence in its amusement devices wherever introduced, it is prepared to undertake the entire expense of constructing and maintaining an operating plant, agreeing to give to the park owners a certain percentage of the gross receipts.

The Ingersoll Construction Company has aranged to have a display of its novelties at the Saratoga Convention, and its exhibit will, no doubt, be found of interest and value to all connected with amusement enterprises.

NEW TYPES OF "ALL-WIRE" RAIL-BONDS

The Ohio Brass Company, of Mansfield, Ohio, manufacturer of the "All-Wire" rail-bond, will shortly announce, through a new catalogue, the placing on the market of a number of new types and forms of these well-known bonds.

The unit or "one-piece" principle on which these bonds are made is a very desirable feature, as by avoiding all cast or welded joints a greater degree of mechanical strength and electrical

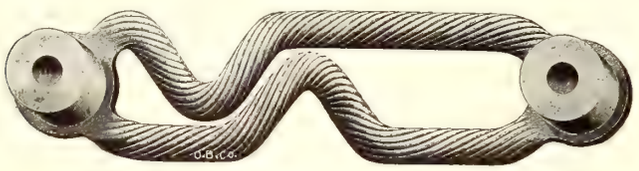


FIG. 1. TYPE F, FORM 5, "ALL-WIRE" BOND

efficiency is secured than would otherwise be possible. The weakest part of all bonds is the junction point between the terminals and strands, and, as the "All-Wire" bond has no joint at this point, the strength of the bond at this point is as great as at any other part.

The type-F bond, one form of which is illustrated in Fig. 1, is especially adapted for use under the fish-plate, and as the strand enters the terminals at points almost diametrically opposite, the bond holes may be located close to the bolt holes in the rails, so that a relatively short bond of this type can often be used to advantage.

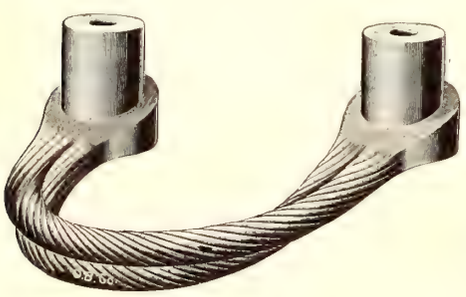


FIG. 2.—TYPE D, FORM 1, "ALL-WIRE" BOND

In Fig. 2 is shown the type-D, form No. 1, "All-Wire" bond, which is designed especially for use on elevated structures and third-rail systems, where the bond can be placed underneath the rails and close to their extremities. The taper in the head of the terminals is such as to compensate for the taper of the rail base.

The type-G bond, illustrated in Fig. 3, while somewhat different



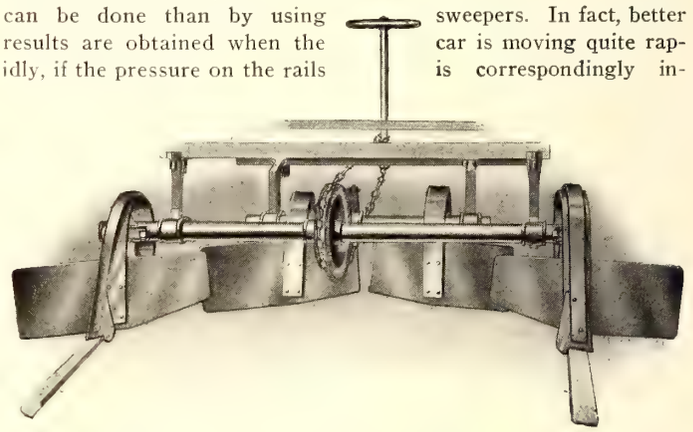
FIG. 3.—TYPE G, FORM 1, "ALL-WIRE" BOND

from the other forms of "All-Wire" rail-bonds, has the same fundamental principle in its make-up, being made of a number of strips of soft, cold-rolled copper, the ends of which are perfectly welded together, forming solid copper terminals. The bond is applied to the rail ends by being soldered to them, and special tools are furnished for cleaning the ends of the rails and soldering the bonds in place. The form illustrated is intended for use on the lower surface of the rail base, or the upper surface of the rail, where it will not interfere with the fish-plates. Another form of this bond is made which is designed for attaching to the outer side of the ball of the rails, or in some cases where space will permit, under the tram of girder rails. Where bonds of this type are properly soldered to the rails it is practically impossible for them to become loose, as only a violent and determined effort will detach them. This bond is claimed to possess a greater degree of flexibility than is possible in any other form of bond now on the market.

IMPROVED TRACK AND SNOW SCRAPER

The accompanying cut illustrates the well-known Kalamazoo track and snow scraper, manufactured by the Root Track Scraper Company, Kalamazoo, Mich. This scraper, which is easily handled by the motorman alone, is designed to clean all the snow from between the rails and 9 ins. outside the same, throwing it each way from the center. It will also thoroughly clean the top of the rail and groove.

With this scraper, the maker states, better and quicker work can be done than by using sweepers. In fact, better results are obtained when the car is moving quite rapidly, if the pressure on the rails is correspondingly increased. It deposits the snow farther from the track, not requiring large plows to clean up the banks thrown out. The cost of this device is said to be about one-twentieth of a sweeper for doing the same work, and there is no extra expense for labor and replacing worn-out brooms.



KALAMAZOO SCRAPER

The company claims that if this snow scraper is used on every fourth or fifth car, the others being equipped with its ordinary single-track scrapers, the motors will be fully protected from snow and the roadway kept in excellent condition.

The Hudson Valley Railway Company has given this company permission to place a "Kalamazoo" snow and track cleaner and an 18-in. single scraper on a car during the convention. Those present will therefore have the opportunity of witnessing practical tests of these devices.

A MODEL GEAR PLANT

Within the past two years the R. D. Nuttall Company, the well-known gear and pinion manufacturer, of Pittsburg, Pa., has expended a large sum of money for new machinery of the most advanced type and for improving its extensive works, so that it could properly take care of its rapidly increasing trade. The company now again finds it necessary to add to its equipment twenty-three of the latest type gear cutting machines as well as additional worm gear machinery, mills, lathes, etc., to correspond. In regard to the new gear cutting machinery, the company believes that this is the largest individual order for such machines ever placed.

The company has also made a corresponding increase in the capacity of its power plant, and when all of above machinery is in place its claim of operating the largest and most complete gear cutting plant in the world will be further verified.

SCRANTON OIL FILTER

In the accompanying Fig. 1 is shown a new oil filter which is being placed on the market by the Scranton Oil Filter Company, Scranton, Pa. In this apparatus the filtering material is composed of wicks, the filtering being pre-eminently capillary. Water is used in the outer compartment of the upper chamber,

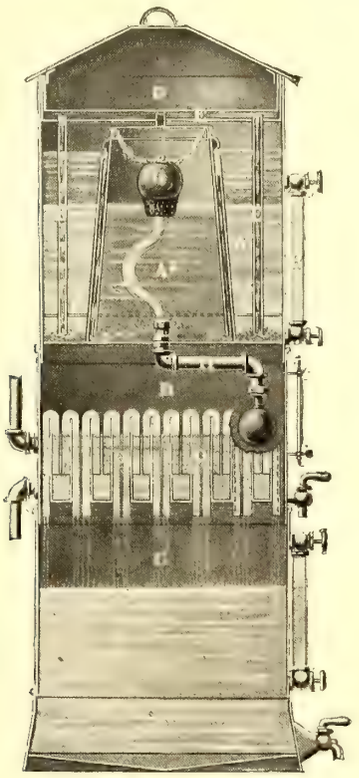


FIG. 1.—VERTICAL SECTION SCRANTON OIL FILTER

but not for filtering purposes; it is only used to agglomerate and precipitate entrained water which may be held in the oil. An original feature of the apparatus is the ability to double or treble the capacity of any size of filter by the insertion of one or more

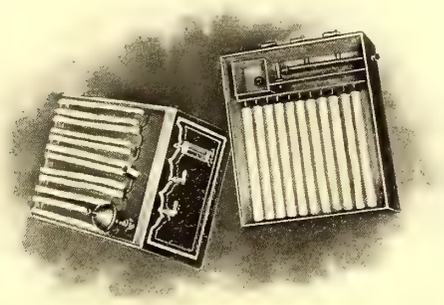


FIG. 3.—FILTERING TRAYS

trays of filtering wicks without interfering with any other part of the filter. Thus a filter of 60 gallons daily filtering capacity can be increased to a daily capacity of 120 gallons by the insertion of a second tray of wicks.

Fig. 1 illustrates a vertical section of a single style of filter. The entire filter consists of three separate sections; the base or lower section being the receptacle into which the purified oil falls after filtration, whence it is drawn off for use. The middle section contains the filtering wicks, where the principle of absorption, or capillary attraction, is applied in the final purification of the oil. This section is called the filtering tray, and in the middle thereof is constructed the heating chamber into which is affixed a steam coil with a heating capacity suited to the requirements of the tray. All the oil is heated in this compartment before it comes into contact with the capillary wicks. The upper or top section of the filter is called the receiving tank and consists of several members, the uppermost of which is called the hopper, into which the impure oil is deposited for filtration. From this hopper, by vertical tubes, the oil is conducted downward to the bottom part of

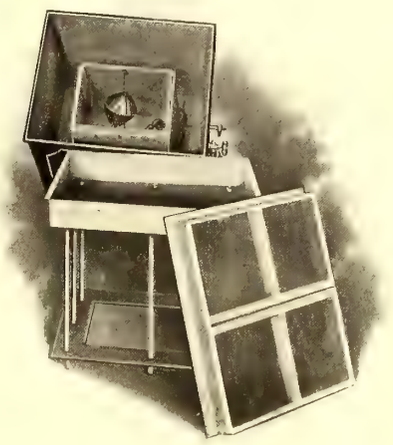


FIG. 2.—HOPPER AND DRIP PAN

the upper section, from whence it rises by specific gravity to the top of an inner receiving tank, where it passes through perforated openings into a sleeve by which it is again conducted to the bottom of the inner receiving tank, where, through a suitable opening, it rises to the top of the inner receiving tank. From this tank it is drawn down by a floating skimmer, sustained by the specific gravity of an air-tight, super-affixed sphere, through a flexible tube, and thence through a governor valve, into the wick chamber below and thence to the wicks themselves. The functions of the operations of the upper compartment of this filter are two fold,—first to separate from the oil all entrained water, and secondly to remove all such impurities as are of greater specific gravity than either oil or water. All water and other impurities thus separated are drawn off from time to time through a faucet. All such foreign matters as are of a lesser specific gravity than the oil pass down through the floating skimmer and the flexible tube to the filtering wicks where they are finally and entirely separated from the oil.

The manufacturers claim that the operation of this filter in purifying all kinds of lubricating oils is absolutely perfect, and that when the oil is drawn off at the base of the bottom tank for re-use it is chemically pure.

The details of the operating parts of the machine are shown by Figs. 2 and 3.

COUNCIL COMMITTEE'S REPORT ON TOLEDO FRANCHISE EXTENSION

The Council committee on street railways has advised the Council to kill the ordinance proposed for the Toledo Railways & Light Company for an extension of franchises for 18 years. The company offered six tickets for a quarter and universal transfers. The committee advises that the Council accept nothing less than three-cent fares and universal transfers, including the interurban lines as well as the city lines; also making it compulsory on the part of the company to extend the use of its tracks to all roads entering the city, together with regulations regarding street paving. The company declares that such an ordinance will not be accepted, and that it has made its best proposition. The sentiment of the Council appears to be to delay matters. The most important franchises of the company expire in seven years.

THE ANNUAL MEETING OF THE PENNSYLVANIA STREET RAILWAY ASSOCIATION

The next annual meeting of the Pennsylvania Street Railway Association will be held on Wednesday, Sept. 23, 1903, at the Park Hotel, Williamsport, Pa.

IMPROVED METHOD OF VENTILATION USED ON NEW CARS FOR LEICESTER, ENGLAND

Dick, Kerr & Company, Ltd., of London, England, have recently delivered to the Leicester Corporation a sample car built by the Electric Railway & Tramway Carriage Works, Ltd., Preston, Lancashire, which embodies features new and important in railway car construction. These features are principally an improved method of ventilation, and an improved design of interior finish, which have helped to produce a very satisfactory car a long way in advance of what has come to be universally known as the "Preston standard top-seat car."



FIG. 1.—UPPER PART OF CAR, SHOWING HINGED WINDOW

The provision made for ventilation will be readily understood from the accompanying Fig. 4, which shows a cross section of a top-seat tram car roof constructed to provide for an inlet of fresh air, and an outlet for the foul hot air that ascends to, and fills, the upper part of the car.

The inlet for fresh air is provided for through the usual line of hinged windows placed above the large fixed glass windows, universally used in recent tram car work. These hinged windows were first adopted by, and have since become an essential feature of, the Preston standard top-seat car. They are shown in the diagram at the points marked *A A*, and the circulation of the air that takes place from the outside into the car is shown by the arrows marked *B B*. These hinged windows, which are arranged in the outside walls of the car on each side, have proved to be the best means for the admission of fresh air into the car that has yet been devised, and it is said that they have been universally copied by all the principal car-builders throughout England in tram car work. With the use of these windows experience has shown that the only thing wanting for thoroughly ventilating a tram car was some provision for a further supply of fresh air from the outside into the car, and a means for the escape of the foul hot air, which ascends to the roof, and which cannot get out without interrupting the current of fresh air passing into the car through the hinged windows already referred to. This increased supply is provided for by a hinged sash on each side of the end door in each end of the car, marked on the diagram *F F*. These sashes can be opened in exactly the same way as the sash *A A* at the sides when additional fresh air is required. They are also provided with perforated louvre panels *G G*, on the outside, and being in the end of the car they admit of a large supply of fresh air passing into the car without interfering with the arrangement of colored signal lenses, and without allowing the admission of water in wet weather.





FIGS. 2 AND 3.—INTERIOR VIEWS OF CAR

The outlet for the foul air has been provided for by a recess made in the roof of the car, marked *C C*, which is just above the hinged windows above referred to. The circulation of the foul hot air through this recess to the outside is shown by the arrows marked *D D*. On the outside of the car on each side and connecting with this recess are fixed ventilators, marked *E E*, constructed in such a way that no air can pass into the car at these points, but the ventilators exhaust or draw the hot air out when the car is running. It will be noted that this recess *C C*, not only connects directly with the interior of the car, but that it also connects with the roof space *H H H*, between the millboard ceiling and the

main deck, and that this space, which in ordinary tram cars is a dead air space, without means of escape, is thoroughly ventilated by this arrangement.

If required, a further outlet for the hot air in the top of the car may be provided for by perforating the millboard ceiling to connect with this space and indirectly with the ventilators on the outside of the car.

It will also be noted that this exhaustion of the air by the ventilators through the recess and roof space is not arranged with any means for preventing their action and the escape of the foul

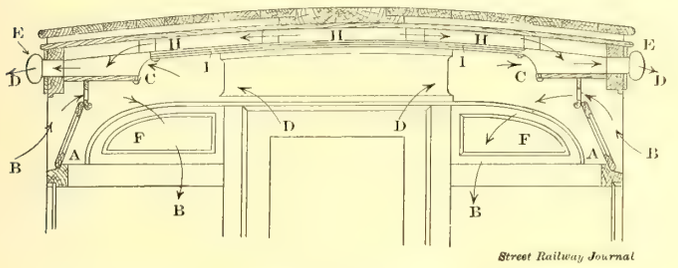


FIG. 4.—DIAGRAM OF VENTILATING ARRANGEMENT

hot air continually taking place. The effect of this construction and arrangement of ventilation is that the interior of the car is constantly provided with a circulation of fresh air into, and the foul air out of, at the points named absolutely without dangerous or annoying draughts.

The application of this principle of ventilation to the car lends itself to a very satisfactory treatment in the way of interior design and general finish, which adds very largely to its appearance. The accompanying photographs clearly show this. The woodwork connected with the interior finishing is done in oak and mahogany, and has been treated in an entirely original way, much to the advantage of its general appearance.

TRUSS PLANK HEATERS FOR CROSS-SEAT CARS

One of the improvements brought out recently by the Consolidated Car Heating Company, of Albany, is the use of a longitudinal heater for cross-seat cars attached to the truss plank instead of being placed under the seat itself. Fig. 1 shows the position under the seat of this heater, which is entitled Type No. 93. As will be seen from Fig. 1, it is carried along the side of the car, occupying about the same space on an electric car that steam pipes do in a railroad coach, but does not project so far into the car. In many cases sufficient heaters are furnished to extend the full length of the car. With this type of heater it is impossible to overheat the seats, the heaters being placed near the floor and a 30-in. section never being arranged for a consumption of more than 500 watts.

Fig. 2 shows three 30-in. sections of this heater, and the method of carrying the wire in a molding underneath the heaters. In some cases no leads are used and the wires for connecting the heaters are fastened to the heater coils before placing the cases in position; there are, therefore, no joints between the heaters and never any exposed wires.

This heater is used on a number of parlor cars, and where these cars have dark trimmings it is finished in copper bronze. Otherwise the case is finished in gold bronze.

The heater is used on Aurora, Elgin & Chicago Railway, Chicago & Joliet Railway, several of the new roads built by Westinghouse, Church, Kerr & Company, and on a number of other high-speed interurban railways.

THE ENGINEERING OF HEATING SYSTEMS

William H. Schott, engineer, Chicago, Ill., is making a specialty of the engineering of exhaust and live steam central station heating systems. The plants so far constructed by him have mostly been hot water heating systems, operating by exhaust steam from electric light and railway stations. Mr. Schott has special appar-

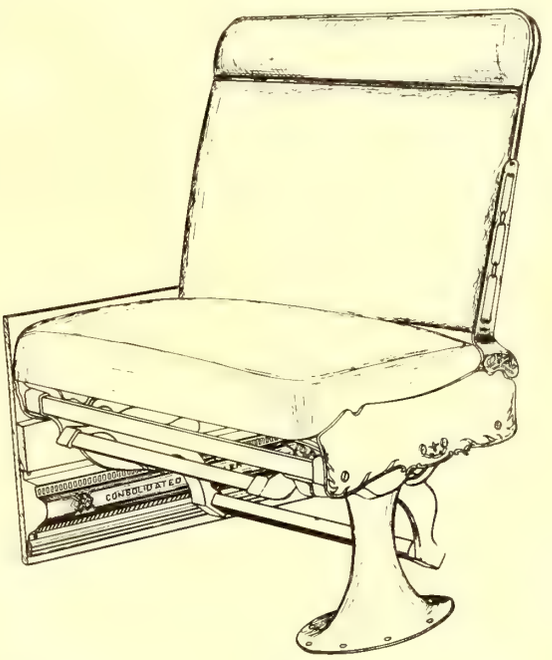


FIG. 1.—POSITION OF HEATER UNDER SEAT

atus of his own design which he uses in the plants he constructs, including a new hot water heater, pipe line construction in the street and piping of buildings. The buildings are connected in multiple across the hot water heating mains, but the radiators in each building are piped in series with a high-resistance by-path around each radiator. Another feature which goes to make the systems planned by him a commercial success is the use of an automatic pneumatic temperature regulating system, so that the temperature is regulated by thermostats in each room in the building, the air for the operation of the valves in connection with this system being supplied from the central station. This in itself means a great saving in the number of heat units which must be sent to each customer.

Mr. Schott designs his systems on a very low pipe resistance, that is, he uses large enough pipe throughout the entire system so that the amount of power required to circulate the water is small compared to some of the other hot water heating systems in use. This, of course, increases the cost of installation, but keeps down the cost of operation.

Mr. Schott aims to construct only successful heating plants, and does not hesitate to advise his clients against putting in hot-water or steam heating plants where his investigations do not convince him that such plants would be commercially successful.

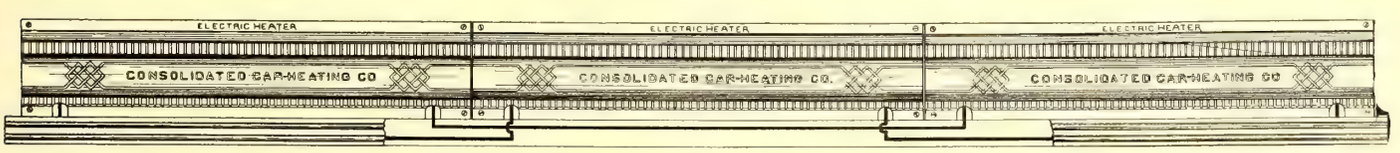


FIG. 2.—WIRING ARRANGEMENT OF HEATERS

Among the towns where heating plants have been installed according to this method are: La Fayette, Ind.; Elwood, Ind.; Peru, Ind.; Connorsville, Ind.; Galesburg, Ill.; Coshocton, Ohio, and Mt. Vernon, Ill. A plant is now being installed at Indianapolis, 3000 ft. from the business center of the city. It is primarily for steam heating, but will have an electric light plant in addition.

GRADE BUILDING MACHINE

An improved elevating grader has recently been put on the market by the National Drill & Manufacturing Company, of Chicago, Ill., which claims that its grader possesses certain features

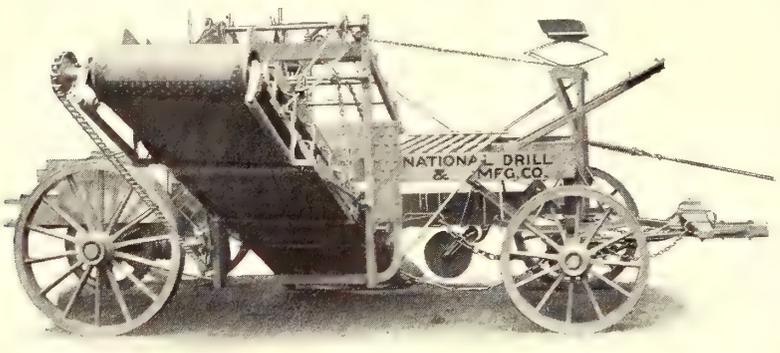


FIG. 1.—ELEVATING GRADER

which overcome many of the difficulties encountered in the operation of machinery of this class.

Those who are familiar with elevating graders in general, are aware that heretofore the entire draft of the plow has been brought either directly or indirectly on to the machine. This, of course, has been a drawback to its successful operation in many classes of soil, and has necessitated the expenditure of more power than should really be required to move the amount of earth handled.

The National elevating grader, as shown in Fig. 1, overcomes this difficulty. The draft of the plow itself is carrried direct on the evener, being transmitted by a heavy draft chain which passes the king bolt and is hooked to the plow standard. This chain is intercepted in front of the elevator by a spreader bar, which can be raised or lowered as the conditions require, thus regulating the angle of the pitch, assumed by the plow point. This is an important feature, particularly when plowing in hard ground. After a plow is gaged to the required pitch it is not necessary to give it any further attention, as the spreader beam holds it in position permanently.

This illustration also shows a turn buckle brace for adjusting the elevator, running from this side of the elevator hanger to the elevator itself. This is a valuable feature when it is necessary to straighten a belt which has stretched unevenly and is running crooked.

Fig. 2, the rear view of elevating grader, shows the hand wheels and levers for controlling and regulating the machine in operation.

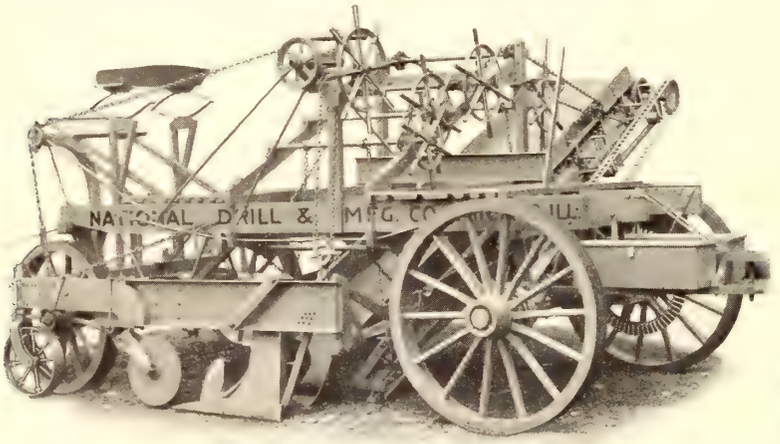


FIG. 3.—METHOD OF ADJUSTING PLOW

The center hand wheel is employed for spooling up the two lines of chain that tighten the belt. This is a decided improvement over the old method of tightening by lever, as it is absolutely unlimited in its scope. In fact, the makers claim that the only limit which this belt tightener has is the strength of the belt itself. Those who have operated elevating graders in wet, slippery soil, particularly when loading wagons, are fully aware of the difficulties which have been met in attempting to keep the belt tight, as it has invariably been the case that the belt would slip more or less as soon as the rollers became wet.

This illustration also shows the construction of the elevator. No truss rods are required underneath it, and therefore there is nothing to catch on the wagons which are driven under the elevator when the machine is used as a wagon loader, the outer end of the elevator being provided with rollers which act as a guard for the chain and prevent it from catching on the edge of the wagon box.

Fig. 3 shows the method of adjusting the plow so that it can throw a furrow on the carrier, no matter what the conditions of the soil may be. Frequently it is necessary to change the tilt of the plow so that the mould-board will scour. This has been done formerly by a complicated scheme involving a number of castings and bolts, which must be first loosened and the castings then adjusted until the proper pitch is found. On this machine, however, it is possible to tilt the plow at the will of the operator without requiring him to leave his position on the platform. This is accomplished by a hand lever on the extreme right, working in conjunction with a slide underneath the machine, and the tilting upright riveted to the rear end of the plow beam. It is, therefore, possible to adjust the plow to a fractional part of an inch and lock it in any position which

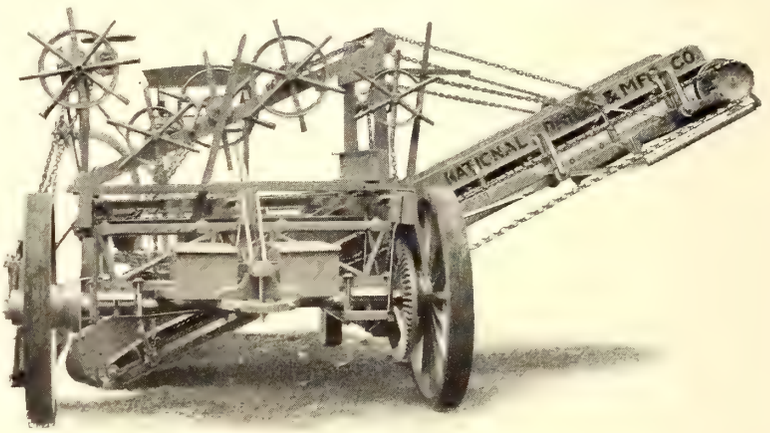


FIG. 2.—REAR VIEW OF ELEVATING GRADER

seems most effective. The general frame of the machine is built of heavy timbers, reinforced wherever required by steel rods and trusses, so that strength and durability are obtained. The elevator is carried above a yoke which forms a continuous tie underneath the elevator and prevents sagging of the frame. There are a number of other features in this machine which are interesting to those engaged in railroad or electric traction line construction, about which the manufacturer will be very willing to give information. This company also produces a full line of wheeled and drag scrapers, contractors' dump wagons, grading plows, etc.

ELECTRIC CAR HEATER

A new and very desirable style of car heater for large interurban electric cars has recently been placed on the



ELECTRIC CAR HEATER

market by the H. W. Johns-Manville Company. It is designated Wall Heater, class B, and is shown in the accompanying illustration. The construction of this heater is similar to the company's class K heater, which has been on the market for several years past and is used in cars having cross-seats. Each heater is 30 ins. long and 5 ins. high, held firmly in place by re-

constructed granite heads or supports located at each end of the heater. These irons support the resistance coils and furnish superior insulation, thereby preventing short circuits and the cutting out of resistance due to contact formed by sagging coils. The casing is very strong and ornamental and will stand foot pressure without injury.

THE SNOW REPLACER

The accompanying cuts illustrate the Snow car and locomotive replacer for which Wendell & MacDuffie, of New York, are exclusive Eastern agents. Replacers of this type weigh from 160 to

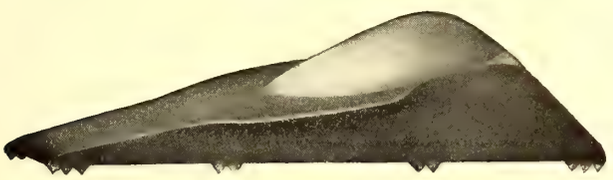


INSIDE FROG

210 lbs. per pair and are made of open hearth steel or air furnace malleable iron.

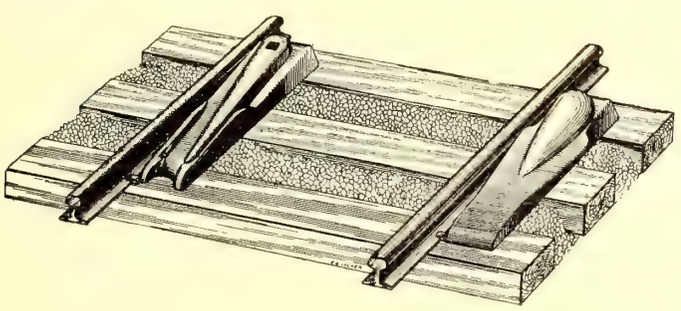
These replacers do not require clamps, and frogs will not turn over or push away from rails. They clear brake hangers, brake levers and sand pipes, and can be placed parallel or at an angle to the rails, according to the position of derailed trucks; nor will they break wheel flanges.

These replacers are reversed by simply moving the tongue in



OUTSIDE FROG

one frog, and as they are wedge-shaped they can be placed well underneath the derailed wheels. It is claimed that they will replace locomotives and cars quicker and surer than other similar devices. As the wheels are run up on their treads instead of their flanges, both wheels and frogs are saved from damage.



CAR AND LOCOMOTIVE REPLACER

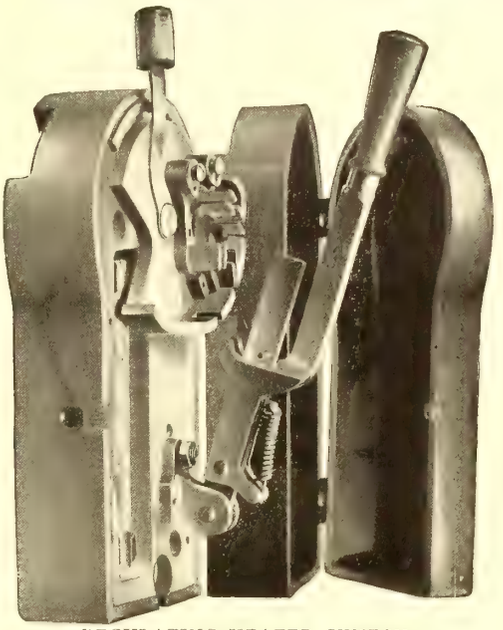
The maximum height is at end of replacers, thus reducing the grade by one-half up which wheels must mount in re-railing.

These replacers are standard on about forty large railroads and are in extensive use on hundreds of others.

The Lake Shore Electric Railway Company is attracting widespread attention because of the remarkable increase in its eornings. For the first nine days of this month the road earned $23,080, an increase of $10,060 over the same period last year. It is probable that the road will show a surplus this month of more than $10,000 over operating expenses, interest charges and taxes. Under the receivership about $350,000 were expended in betterments, and since the receivership about $125,000 have been expended.

REGULATING HEATER SWITCH

In order to meet the increasing demand of large electric cars requiring a greater number of heaters to satisfactorily heat them, the H. W. Johns-Manville Company has enlarged the three-point car heater regulating switch, shown in the accompanying cut, increasing its capacity to 60 amps., and mounting in the insulating



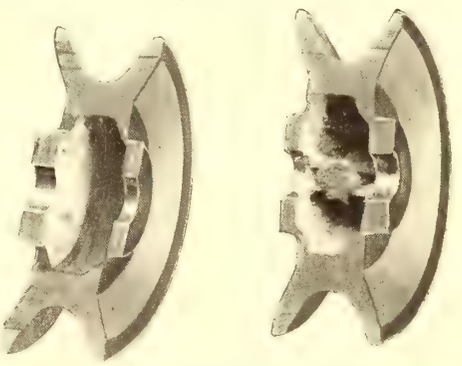
REGULATING HEATER SWITCH

base block a Sachs "Noark" enclosed fuse. This complete controlling and protective device is now combined and enclosed in an iron box, requiring less room than heretofore and being absolutely safe and reliable under all conditions. Closing the quick break knife blade automatically locks the switch, which is necessary before the cover of the box can be closed, and any movement of the regulator handles is prevented until the knife blade is released.

NEW TROLLEY WHEEL

The new C. B. & E. trolley wheel, shown in the accompanying cuts, will, it is claimed, outwear any other similar device heretofore in use on trolley systems. It is entirely self-lubricating, and requires no attention, except refilling the oil chamber. It is made by Collins, Bouchard & Emery, Bradford, Pa.

This wheel combines a graphite bushing with an automatic feeding oil chamber, which can be quickly filled when necessary without removing the wheel from the fork. There is no friction, no drip or other waste of oil, and no gumming of the pinion. It is econom-



SECTION OF TROLLEY WHEEL

ical, clean, possesses perfect conductive power, and requires no attention, except refilling with oil after once being properly in place.

This wheel costs but little more than the ordinary wheels now in use, and its life is said to be three times longer. It has been severely tested on long-distance suburban runs, fully meeting all the requirements. It is guaranteed to easily outclass in efficiency any other trolley wheel, and to thoroughly eliminate all the vexatious troubles usually caused by inferior trolley wheels.

NEW CARS FOR THE LAKE SHORE ELECTRIC RAILWAY

The first of ten handsome cars built by the J. G. Brill Company for the Lake Shore Electric Railway of Cleveland, Ohio, was given a trial trip over the lines on July 22. Officials of the railway and of the cities along the route with newspaper correspondents and others composed the party which made the entire trip from Cleveland to Toledo, a distance of 160 miles. There was no attempt to make fast time, but simply to note performance of the trucks under ordinary conditions and to acquaint the officials and others with the car and its appointments. About Sept. 1 regular trips will commence, running through cars from Cleveland in 4½ hours, which is practically the time taken by the steam railroads.



FIG. 1.—EXTERIOR OF LAKE SHORE CAR

The cars are divided in three compartments—passenger, smoker and baggage. The passenger compartment is equipped with a salon of standard character, having an oval window at the side. This compartment is 23 ft. 10 ins. long, and seated for thirty passengers. The seats are leather-cushioned, are extra high in the back and long in the seat. The interior is finished in natural cherry with ceilings painted "Pullman Green." Along each side of this compartment is placed a continuous brass rack for packages, and an electric light over each seat. A novel feature consists of a smoking compartment with a curved hardwood partition, the upper part of glass, as shown in the illustration of the interior and in the floor plan. The seats in this compartment are also upholstered in leather. This feature of the car will doubtless prove very attractive to travelers. The compartment is 9 ft. in length, and seats about twelve passengers. The floor is covered with zinc. The baggage compartment is 11 ft. 9 ins. long, and has a 40-in. sliding door on either side. The motorman's compartment, located in the forward right-hand corner of this compartment, is of ample size, as will be seen by the diagram. A hot water heater has its place in the corner of the baggage compartment. As the cars are intended to be run in one direction, one cab only is necessary. Entrance to the car is by the rear end, the platform being flush with the car floor. Three steps are used on each side, enclosed in folding doors and provided with trap doors. Swinging doors are provided between the compartments. The windows are arranged to raise in the regular steam car fashion. They are composed of a couple of sashes, the upper one of which is stationary. Three-bar brass window guards extend the full length of the passenger and smoking compartments. The corner posts at both ends of the car are double and have curved-glass narrow windows between. The vents have a separate opening to each, and between the passenger and smoking compartments is placed a transom, so that there is separate ventilation from the deck for the compartments. The length of the cars, measured over the vestibules, is 49 ft. 7 ins.; width over sills and sheathing, 8 ft. 6 ins.



FIG. 2.—INTERIOR OF LAKE SHORE CAR

Long leaf yellow pine side sills are double, and have ⅜-in. x 12-in. steel plates sandwiched between, for the full length of the body. The outer sill is 4 ins. x 8¾ ins., and the inner 2¾ ins. x 7⅞ ins., heavily bolted together through the plate. The center sills are 6 ins. x 7 ins., and inclose I-beams for the full length of the car. Intermediate sills are 4¾ ins. x 6⅞ ins., plated with ½-in. x 6-in. steel; the end sills of white oak are 5¼ ins. x 6⅞ ins. The needle beams are double-trussed, and 1½-in. diameter under-truss rods extend from bolster to bolster. The flooring is double, and the space between is filled with mineral wool to deaden sound, and at the same time increase the warmth of the car.

The cars are equipped with patented specialties of the builders' make, such as radial draw-bars, angle iron bumpers, "Dedenda" gongs, and "Dumpit" sand boxes. The trucks are the Brill No. 27A 2, capable of making the highest speed desired. Each car is equipped with four 75-hp motors. The wheels are 34½ ins. diameter, with steel tires; axles, 5⅜ ins. Weight of car and trucks without motors, 52,000 lbs.

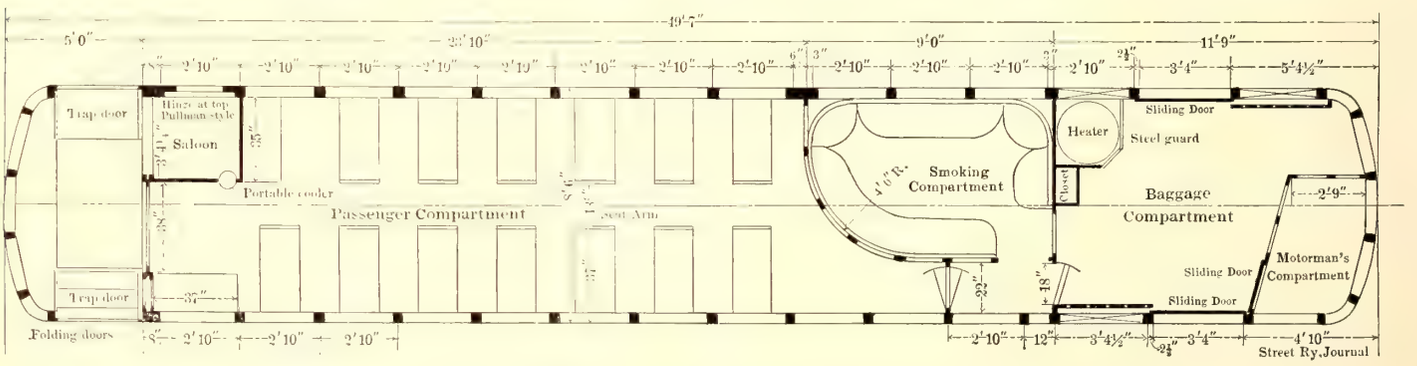


FIG. 3.—FLOOR PLAN OF LAKE SHORE CAR

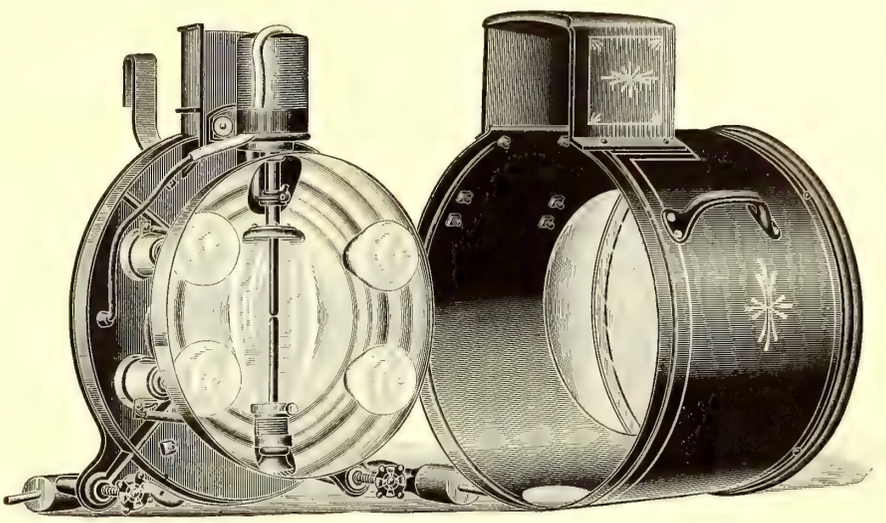
PROPOSED NEW CAR WORKS FOR CINCINNATI

Wm. H. Stewart, Jr., Union Trust Building, Cincinnati, is at work on the organization of a new $500,000 car company for Cincinnati, to build electric cars. A. L. Jacobs, formerly of the Pullman shops, is mentioned as the probable general superintendent.

COMBINATION ARC AND INCANDESCENT HEADLIGHT

The Globe Electric Manufacturing Company, Cleveland, Ohio, has placed on the market a combination arc and incandescent headlight, especially adapted for interurban and city railway service. Many electric railway companies object to the use of arc headlights, because of the intensity of the light while on city streets, and the inefficiency of dimming devices. The company's new type, known as the Climax, is adapted for both city and interurban service, since it is provided with an incandescent circuit, which may be utilized while in city streets. The change from arc to incandescent is accomplished by turning a two-point switch placed in the vestibule.

The lamp has one magnet coil, and the ring clutch mechanism is so simple that jarring has no effect upon its operation. The gas cap at the top of the globe is supported by a tube holding it in place. The globe holder and carbon holder are very simple, and will not get out of order. There are two separate reflectors, both having the same focus, a double reflector being necessary, because of the incandescent attachment. The front reflector is perfectly plain, and there is no shadowing whatever. Both reflectors are made of aluminum, which possesses several advantages over plated reflectors. The lamp has two adjustable bumpers which enables the motorman to lower or elevate the projected rays of light after the lamp has been set in focus. To reduce traveling of arc, ⅜-in. carbons are used. The lamp mechanism is fastened to a cast-iron back and the sheet steel casing is secured to the same by two screws.

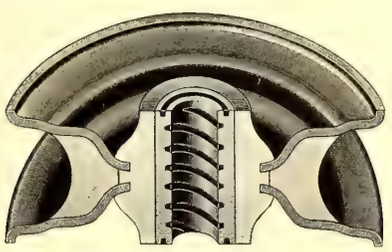


COMBINATION ARC AND INCANDESCENT HEADLIGHT

The lamp is 18 ins. high, 10 ins. deep and 14 ins. in diameter. No soldering or riveting is used in the construction. The solenoid is protected and covered by a cast-iron hood which is bolted to the casing. Owing to its simple construction the lamp is easily cleaned and trimmed. It will operate on currents from 1½ amps. up, and is claimed to be the most economical and efficient lamp of its type on the market.

BALANCED TROLLEY WHEEL

The Lumen Bearing Company, of Buffalo, N. Y., has just put upon the market an improved form of the Ideal trolley wheel, which is the result of experiments and tests extending over the past year.



CROSS-SECTION OF BALANCED TROLLEY WHEEL

The principal change from the old form is in the groove, which, being wider, allows a greater wearing surface and consequently a longer life, while the improved shape of the flange gives greater strength to withstand a blow and eliminates all liability of rubbing against the trolley wire.

While the life and efficiency of the Ideal trolley wheel has been greatly improved in the new form it still retains all the merits of a perfectly balanced construction which has given this wheel a reputation for its high mileage records.

It is said that a standard trolley wheel 1 ounce out of balance will exert a hammer blow of 4.8 pounds on the trolley wire when running at a speed of 20 miles an hour, and the same wheel if increased to a speed of 40 miles an hour will exert sufficient force to throw itself off the wire. To this is due the fact that wheels of the same composition often give vastly different results when run under the same conditions.

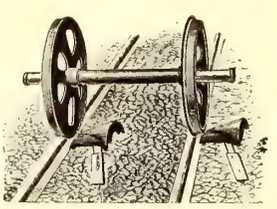
The effect of a trolley wheel slightly out of balance is especially noticeable in the bushing which wears much faster on the light side and soon throws the wheel out of true. This is often attributed to a defective bushing, but it is due to a lack of balance in the wheel.

The contact ring in the Ideal trolley wheel is made of pure lake copper, cast and hammered, which gives a density and uniformity impossible in an ordinary casting. The flanges are stamped from .095 dead soft, cold rolled and pickled steel, giving a maximum of strength and a minimum of weight, and are firmly held together by a Lumen bronze hub which is cast around them in a metal mould, insuring perfect uniformity and balance. The Ideal trolley wheel is adapted to fit any standard harp and is fitted with standard graphite bushings.

This wheel may be seen at the exhibit of the Lumen Bearing Company during the Saratoga Convention.

CAR REPLACER

The accompanying cut illustrates one of the motor and street car replacing frogs made by the B. E. Tilden Company, Chicago, Ill. These frogs will replace derailed cars to any rails by gravitation from replacers, as shown in the illustration, as soon as the car wheel comes up to an altitude equal to the top of the rails. It is immaterial whether cars be pulled ahead or backed up, because as the frogs are double enders the result is the same. They are complete self-holding motor car replacers. It is said that these replacing frogs will replace any rolling stock in about one-fourth the time consumed by other devices. This latter feature is of great importance when derailments occur, as serious traffic blockades are thereby avoided. It is suggested that no motor car should be run without these replacers being a part of its equipment, an electric switch being a part of each replacer. These replacers are in use on hundreds of steam and electric railways, among the latter being the following: Amsterdam Street Railway Company, Amsterdam, N. Y.; Austin Rapid Transit Railway Company, Austin, Tex.; Buffalo Railway Company, Buffalo, N. Y.; Boston Elevated Railway Company, Boston, Mass.; Brooklyn Rapid Transit Company, Brooklyn, N. Y.; Butte Electric Railway Company, Butte, Mont.; Citizens' Street Railway Company, Memphis, Tenn.; Denver City Tramway Company, Denver, Col.; Exeter, Hampton & Amesburg Street Railway Company, Exeter, N. H.; Fitchburg & Leominster Street Railway Company, Fitchburg, Mass.; Helena Power & Light Company, Helena, Mont.; Harrisburg Traction Company, Harrisburg, Pa.; Los Angeles Railway Company, Los Angeles, Cal.; Lowell, Lawrence & Haverhill Street Railway Company, Lowell, Mass.; Twin City Rapid Transit Company, Minneapolis and St. Paul, Minn.; Zanesville Electric Street Railway Company, Zanesville, Ohio.



CAR REPLACER

THE UNI SIGNAL SYSTEM

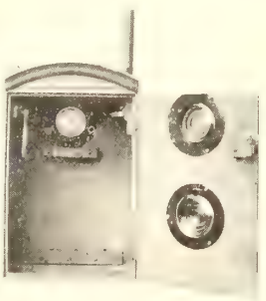
The Uni Signal Company, of Boston, Mass., has placed on the market a signal system for trolley railways, which consists of three parts, namely: the terminal box and lightning arresters, the signal box and signal movement, and the trolley switch. The terminal box, which contains the lightning arresters, is attached to the pole through external lugs cast on the box at such a height that the wires may directly enter the box. The wires enter the box through porcelain bushings as in transformer design. This terminal box is connected to the signal box by a 1-in. lined conduit pipe through which the signal wires lead to the same. The wires from the terminal box are lead three each on two sides of the box to two slate terminal boards with clips for enclosed fuses.

The signal box is attached to the side of the pole. This arrangement is used so that the green or safety signal lamp can be seen by the conductor after a car has passed the signal box, thus allowing him to check the motorman. In this respect the box is said to differ from all other signal boxes.

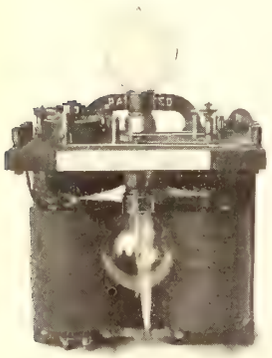
The signal movement is mounted on a cast iron frame which supports all its parts and also furnishes the means (through a handle cast integral with the frame) whereby the entire movement can be removed from the signal box. This is done by turning a lock button, which projects through the handle, and removing the six enclosed fuses from their clips, when the movement can be lifted out of the box. This permits easy and thorough inspection of the signal movement.



TERMINAL BOX



BOX WITH MOVEMENT REMOVED



SIGNAL MOVEMENT



BOX OPEN

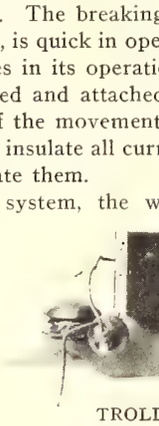
The signal movement, which does not contain a single spring, consists of three magnets, one switch lever, three contact disks, and one resistance plate, together with the necessary connections. There are two large magnets of semaphore design with internal armatures, thus allowing them to be attached directly to the back plate without loss of magnetization and also increasing the effective radiating surface of the magnets. The large magnets are respectively the lighting and extinguishing magnets. The function of the small magnet is to lock the armature of the lighting magnet whenever the red lamp at that end is lighted. This method prevents any car which might run under a lighting switch with the red lamp set against it from extinguishing the signal. The magnetic lock is instantaneous and requires no moving part to operate, as all it has to do is to hold its armature against its seat. The small magnet can do this because there is no air gap in its magnetic circuit, while there is a quarter air gap in the lighting magnet circuit at that time and the current is approximately the same in both.

Between the magnets is placed the switch lever, made of aluminum to decrease the inertia. As this switch does not break live circuits it can give no trouble. The circuit is broken in the box at three different points, according to the operation to be performed. The breaking is accomplished by a disc contact, is quick in operation and gives two breaks in series in its operation. The resistance plate is enameled and attached to insulated studs on the back of the movement. Care has been taken not only to insulate all current-carrying parts, but also to isolate them.

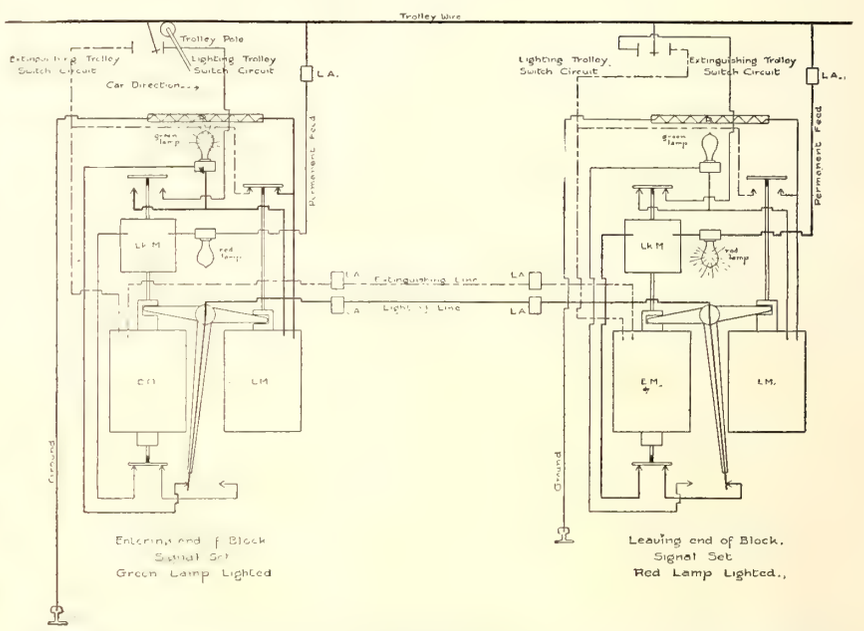


BOX CLOSED

The system, the wiring for which is shown below, operates as follows: When a car passes under a switch at the entrance to a block it causes current from the trolley wire to pass through the lighting magnet and resistance plate to the ground at that end. This causes the switch lever to be thrown over to the left-hand contact of the switch, which then causes current to be taken from the leaving end of block passing through the red lamp, locking magnet at that end, and then through the lighting signal line to the entering end, where it traverses the green lamp, lighting magnet and resistance plate to ground. To extinguish the signal, current is taken from the trolley at the extinguishing switch, through the extinguishing magnet at that end, and thence through the extinguishing line to the entering end where it passes through the extinguishing magnet and resistance plate to ground.



TROLLEY SWITCH



R.—Resistance plate.
Lk. M.—Locking magnet.
E. M.—Extinguishing magnet.
L. M.—Lighting Magnet.
L. A.—Lightning Arrester.

WIRING DIAGRAM

It would appear at first thought that there would be current through both magnets at the entering end, and, of course, under that condition the switch lever could not be restored to its normal condition. Observation, however, has shown that as soon as a current is established the gravity armatures in the extinguishing magnets are raised, the one in the leaving end of the block opens the lighting circuit and, therefore, cuts off the lighting magnet in the entering box, allowing its extinguishing magnet to operate. The wiring diagram shows that loss of current will not restore the signal nor will a cross between the signal lines.

The Uni Signal Company will have an interesting exhibit of its apparatus at the Saratoga Convention, and the representatives of the company will be pleased to give further details of the operation of this system.

ENLARGEMENT OF NEW YORK SUBWAY POWER HOUSE

The New York Rapid Transit Subway Commissioners have purchased an additional lot, 108 ft. x 200 ft., on which to build an addition to the power house now building between Fifty-Eighth Street and Fifty-Ninth Street and Eleventh Avenue to the Hudson River. The addition will make the plant the largest and most expensive in the world. It will cost altogether $7,000,000, and will be capable of generating 132,000 hp. In the boiler plant at first will be set up seventy-two boilers, each capable of producing 500 hp. The fuel of these boilers will amount to 1000 tons of coal a day. The coal will be carried by belt conveyors to a storehouse 80 ft. above the ground, with a capacity of 25,000 tons. The ashes from these 1000 tons a day will be carried by cars to scows lying in the river. The walls of the building will be of cut granite and terra cotta and pressed brick. The windows will be fitted with steel frames and the roof will be of terra cotta and glass. There are five brick chimneys to rise above the plant. They are unusual in their construction, in that their bases will rest on steel platforms about 40 ft. above the floor of the power house. Building the stacks from the ground up would have occupied a great deal of valuable space in the middle of the building. The chimneys will reach a height of 265 ft. Work on the main station, which has been delayed considerably through labor troubles, is now progressing satisfactorily, but it will be impossible to make up the time that was lost.

EXTENSIVE UNDERGROUND FEEDER CONDUIT CONSTRUCTION IN BROOKLYN

Some interesting underground feeder conduit construction is being carried out in Brooklyn by the Brooklyn Rapid Transit Company, as indicated by the accompanying cut. This illustration shows a 48-duct run, leading from the north side of the Third Avenue power house of the Brooklyn Rapid Transit Company, now under course of construlction, and was built by G. M. Gest, of New York and Cincinnati, who has made a specialty of this class of work. The conduit shown is for direct-current feeders. A smaller conduit system, built by the same contractor, leads from the south side of the building and carries the alternating wires.



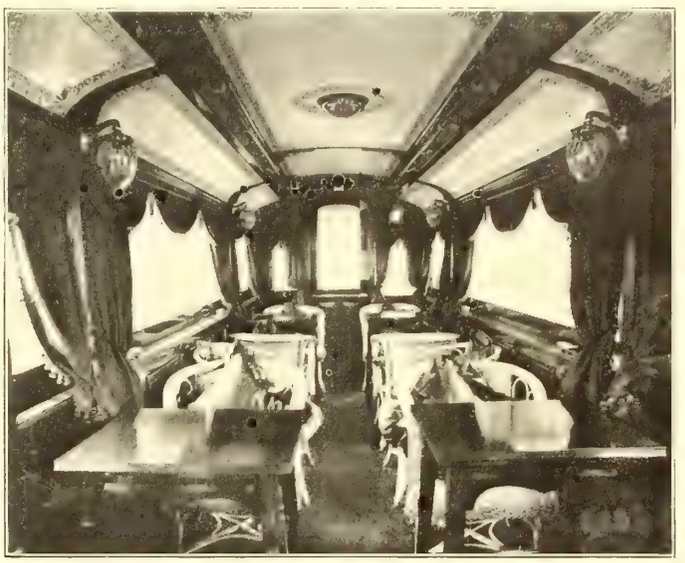
LAYING CONDUIT IN BROOKLYN

Extensive conduit construction is also going on in other parts of Brooklyn, notably East New York and the Twenty-Eighth Ward. The work is being carried on very quickly and neatly without causing disturbance to traffic.

LUXURIOUS RAILWAY TRAVELING

The accompanying illustration shows the interior of a car which has been constructed by the Brush Electrical Engineering Company, Limited, for use on ceremonial occasions on the Birmingham & Midland, Dudley & Stourbridge, and South Staffs lines, associated with the British Electric Traction Company.

It is of the single deck type, with a raised roof, is mounted on a



ENGLISH PRIVATE CAR

Brush standard four-wheel truck, and equipped with motors of the company's standard pattern.

The ornamental features are of special interest. The interior is finished in fumigated wainscot oak, with carvings over the doorways, and at the head of each side pillar. These carvings are continued over the roof, dividing it into three panels, which correspond in size to the width of the side windows.

The car comfortably contains ten chairs of white pulp cane, with loose down cushions covered with crimson silk to match the Axminster carpet. The green casement cloth curtains are fringed and festooned and looped back to the pillars with cords and tassels. Four small oak tables to match the woodwork of the car are placed between the chairs, with ash trays and electric bells within easy reach. The ceiling is of figured "Alhambrine" painted white, with an ornamental border picked out in gold. The whole of the metal work inside the car is nickel-plated. The interior is lighted by thirteen 8-cp lamps, arranged in two circuits.

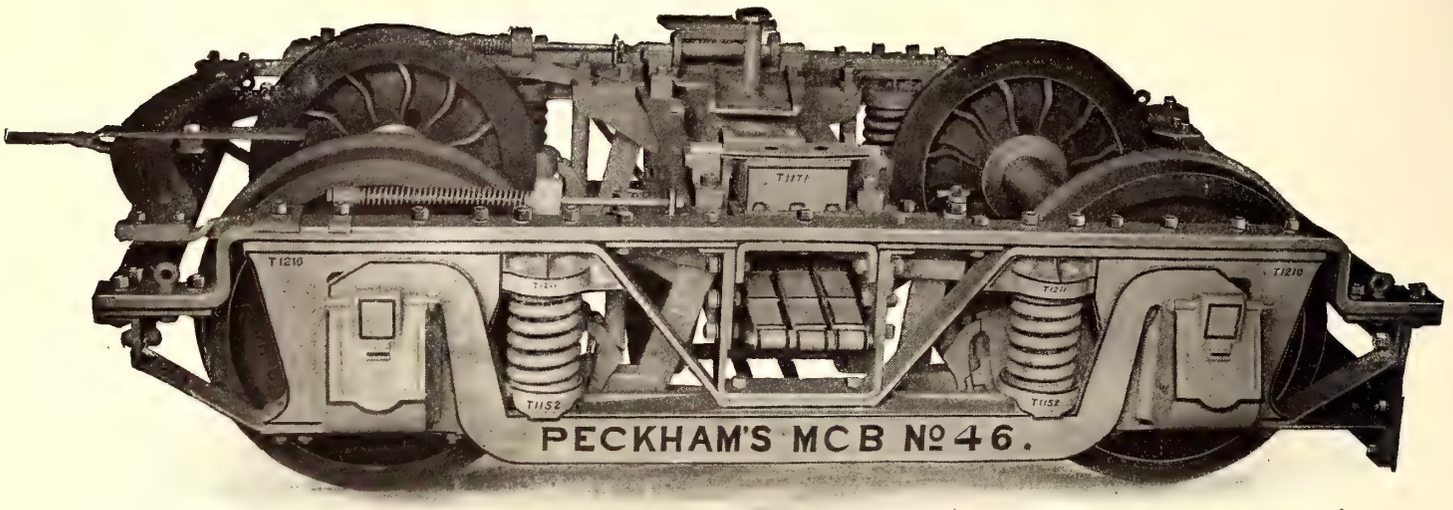
The exterior of the car is handsomely painted and decorated in keeping with its general character.

A commission, composed of representatives of the Imperial, Prussian, Bavarian, Saxon and Baden State railroads, recently observed a test of a new brake, known as the Steiner distance brake. This brake is claimed to be an improvement upon the air brake now in use. It is so connected with the air brakes of a train that when the front wheels of a locomotive pass over a danger or halt signal placed upon the tracks, it will automatically put on the brakes and open the whistle valve. The apparatus worked with perfect satisfaction, even at 83.75 miles an hour, but because of the extraordinary strain to which it was subjected an important part thereof was broken.

PECKHAM'S M. C. B. TRUCK NO. 46

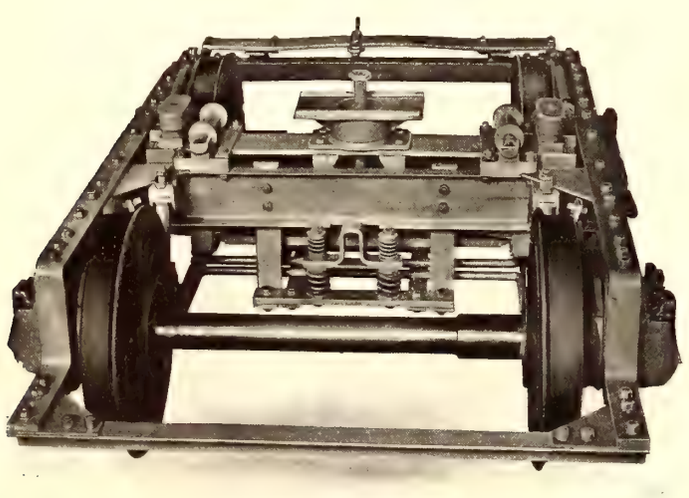
Several types of the M. C. B. form of truck, as built by the Peckham Manufacturing Company, have been illustrated in recent issues of this paper, and are interesting from the fact that they are constructed for high speed interurban service. The latest addition to this full line of trucks is the M. C. B. No. 46, which is designed expressly for steam railway service.

Peckham's patent combination side frames are used in the construction of this truck. They consist of a combination with two equalizing bars, of a center truss frame rigidly secured to the pedestals and top frames, forming an "extra strong" construction. This combination gives a double factor of safety, as the center frame alone is sufficiently strong to carry the weight of the car without the aid of double equalizing bars which are arranged on each side of the pedestals.



SIDE VIEW OF PECKHAM'S M. C. B. TRUCK NO. 46

The transom bars are 10-in. bulb angles secured rigidly to the top frames and to the center arch bars. The top frames and transom bars are rigidly secured to each other by a center steel plate gusset, which makes a rigid center brace that prevents the truck from getting out of square.



END VIEW OF PECKHAM'S M. C. B. TRUCK NO. 46

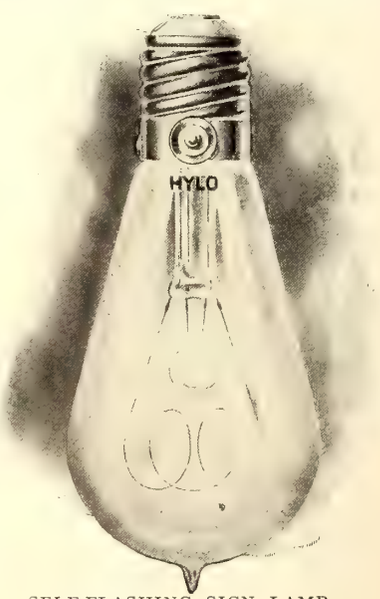
The top frames extend all around the truck. The end sections are of angle bar shape firmly secured to the side bars and corner plate gussets by machine turned bolts driven into machine reamed holes. The corner gussets prevent the truck frame from getting out of square. The bolsters are of forged steel, 10 ins. wide, and supported from the transom by forged links in one piece.

The motor suspension is from the transom bars and is provided with spiral springs. The arch-bar members are 4 ins. x 1½ ins. The journal boxes are of M. C. B. standard pattern with journals 5 ins. x 9 ins. The axles are hammered steel, 6½ ins. in diameter. The pedestals are semi-steel castings, machine fitted to the journal boxes and top frames. All bolts are machined to an exact size and driven into machine reamed holes. The brakes are of inside construction and provided with the Taylor non-chattering brake hanger.

The carrying capacity of the truck, with a factor of safety of six, is 60,000 lbs. per truck, or 120,000 lbs. per pair. With 6½-in. axles and 33-in. steel-tired wheels its weight is 10,500 lbs.

SELF-FLASHING SIGN LAMPS

One of the most remarkable incandescent lamps now on the market is the self-flashing sign lamp, manufactured by the Phelps Company, of Detroit, Mich., makers of the well-known Hylo lamps. This lamp, as shown in the accompanying cut, is of the regular Hylo type, with big and baby filament. Inside an ordinary Edison base there is a mechanism which turns the light up and down from the big to the baby filament at irregular intervals.



SELF-FLASHING SIGN LAMP

Each lamp is an independent unit and operates in any socket. There is an endless variety of movement, very different from the monotonous round of the old style flashers. When words are flashed on and out in the old style much of their attractiveness is lost because the sign is dark a large part of the time. The Hylo lamp sign is never dark, and the words on it can be read at a glance, because every lamp has either the large or small filament burning. A few lamps are winking up and down all the time, producing a shimmering appearance both beautiful and puzzling. It is evident that lamps of this kind may be used to great advantage for decorative purposes on special cars and in street railway parks. The Phelps Company states that its turn-down lamps are meeting with great favor, there being now over half a million users of them.

CONVERTIBLE CONSTRUCTION, BALLAST AND GONDOLA CAR

The Hart convertible construction, ballast and gondola car, illustrated herewith, which is manufactured by the Rodger Ballast Car Company, Chicago, Ill., has been in service during the past three seasons on some of the principal interurban electric railways with very satisfactory results. This car has the great advantage of combining three types in one, as it can readily be converted anywhere on the line without tools, expense or loss of time into a car suitable for three distinct classes of service.

As a center-dump construction or ballast car it will automatically dump its entire contents onto the center of the track, the flow of material being so regulated that small or large quantities can be deposited either for track raising, tamping in or top dressing.

It can be converted into a side-dump car for use with top plow for depositing material on one or both sides of the track, or it will automatically dump about two-thirds of its load on the sides without plowing.

The car can also be readily converted into a standard flat-bottom gondola, suitable for coal, ore or general freight service.

By using this car the material is deposited in the center of the track just where it is needed, saving extra handling in comparison with flat cars where the material is first thrown off onto the sides of the track and afterward shoveled onto the track. As the ballast is deposited in the center of the track it does not become intermixed with soil, thus assuring a safe and permanent roadway under all conditions. The waste of ballast incident to two handlings and its becoming intermingled with soil is eliminated. The car will handle all kinds of material, being provided with large openings in the bottom for use as an automatic center dump car and equally spacious openings for side-dump or top-plow work.

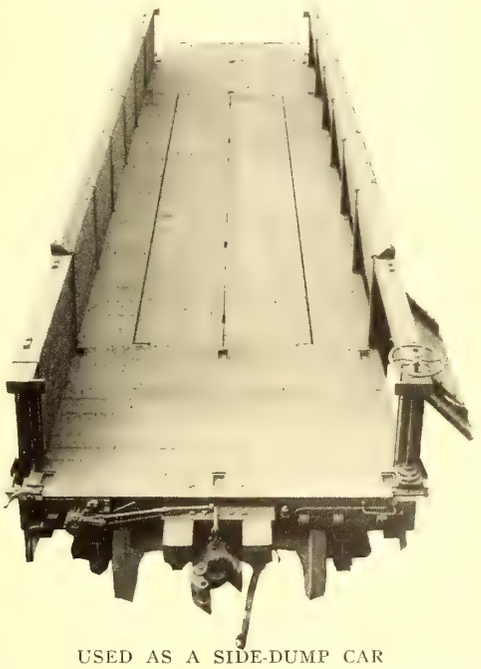
This car is built to carry as much material as four flat cars of the same length and width and as much as from six to ten small hopper cars, thus effecting a great saving in first cost, train service, trackage, switching and maintenance. In capacity the standard varies from 80,000 lbs. to 100,000 lbs., with cubic capacity up to 38 cu. yds.



FLAT-BOTTOM GONDOLA CAR



USED AS A CENTER-DUMP CAR

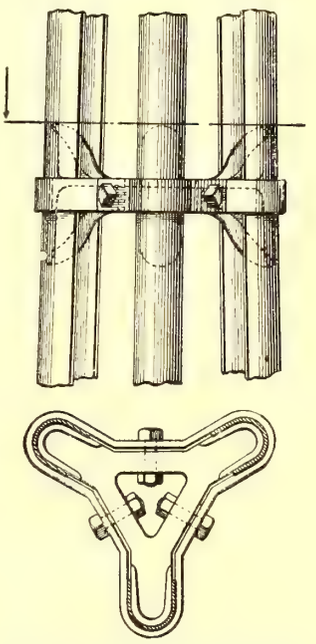


USED AS A SIDE-DUMP CAR

TRIPARTITE STEEL POLES

The accompanying cuts show a side elevation and section of the Tripartite steel pole made by the Franklin Rolling Mill & Foundry Company, Franklin, Pa. This pole differs from all others in being made up of three high-carbon rolled steel U's, formed like a tripod and constructed to make a tapered pole. In this pole there are no bolt or rivet holes. The three U's are held apart by spreaders and clamps, which reinforce the legs and hold them absolutely in rigid position.

It is claimed for this type that it is not only cheaper in first cost, but can also be installed for less money, as for positive anchorage only a 3-ft. set is required. Tests of this pole have shown that it does not take a set when an extra load is put on it by heavy winds, snow or ice. It can be transported in parts and assembled on the grounds along the line. It can also be painted internally as well as externally, thus insuring longer life.



SECTION AND SIDE ELEVATION OF TRIPARTITE POLE

Owing to its construction it is an entirely different pole than the structural steel poles, built up with rivets, which were used in the early days of electric railway work. It possesses all of the advantages of the structural pole, i. e., its lightness and strength, together with none of its disadvantages, such as multiplicity of parts. The poles have been used on a number of roads with satisfactory results.

Besides making this pole for electric railway and lighting companies the company is also prepared to contract according to customers' specifications for all overhead work, including Tripartite steel poles, span, trolley, feed-wire, all fixtures, bonds and bonding, set and lined up complete in working order.

A FINE PRIVATE CAR

The private car shown in the accompanying illustrations, lately built by the J. G. Brill Company for H. A. Everett, of Cleveland, Ohio, is unique in plan and appointments and one of the finest



FIG. 1.—EXTERIOR OF PRIVATE CAR

of its kind ever turned out by the builders. Provided with stateroom and kitchen, the car may be used for long inspection trips. The large windows at either end, with the bottom of the sashes but 12 ins. from the floor, make these portions of the car exceed-

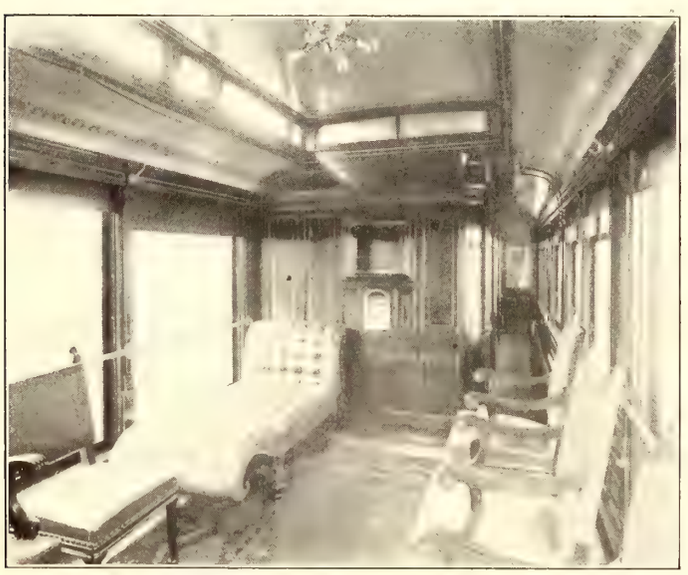


FIG. 2.—PARLOR OF PRIVATE CAR

ingly bright and attractive. A cab is furnished at both ends, as the car is intended to be run in either direction. The trap doors over the three entrance steps are utilized for cab flooring to save space. The partitions separating the cabs from the car are provided with curtains, which, when drawn down, add to the privacy of the compartment. One end of the car has six large leather-covered chairs and is intended for a smoking room. A swinging door closes this compartment off from the rest of the car. The other end, which may be called the parlor, is provided with five easy chairs and a lounge. Both compartments and passageway between have parquetry flooring of a tasteful design, and are covered with handsome rugs. The coloring throughout is green in varying harmonious shades. The exterior of the car is painted dark green and decorated with gold scroll work. The draperies, curtains and rugs are of the same color, and the ceilings are of a delicate tint of pale green decorated with gold. The finish is rich mahogany with marquetry inlaid work. Between the smoking room and parlor there are four compartments; an office with stenographer's desk and chair, and provided with a safe; next a kitchen with electric stove, conveniently located sink and folding lavatory; closets for provisions and utensils; a stateroom, 6 ft. x 7 ft. ⅜ ins., with three-quarter-size handsome brass bedstead, a closet in one corner with large mirror in the door, and a wash basin in the other corner with mirror at the side of it. The door of the toilet room opens into the smoking compartment. The toilet room is large enough to accommodate a hot-water heater of the latest type. An oval window admits light. In the corner of this room, opening into the smoking room, is a linen closet, below which is the coal box for the heater.

The flooring is double and the interspace of 5½ ins. is filled with mineral wool. Trap doors which give access to the motors are arranged to fit neatly, so that their presence is only apparent by close scrutiny. The length of car body is 48 ft. 6 ins.; measured over the bumpers, 49 ft. 6 ins.; height from rail to top of roof, 12 ft. 1⅜ ins. The side sills are 4¾-in. x 8½-in. long-leaf yellow pine, with ⅜-in x 12-in. plates on the inside. I-beams, placed 15 ins. apart, extend from crown piece to crown piece, enclosed in wooden stringers, each measuring over all 6 ft. 8 ins. The intermediate sills are 4½ ins. x 5¾ ins. and the crossings 4½ ins. x 7½ ins. From truck to under side of sill is 37⅜ ins., which height being greater than that of the regular rolling stock on the lines of which this car is to be operated, an angle iron bumper 14 ins. deep is placed at either end to prevent injury to the vestibules of other cars in case of collision. Substantial cow-catchers project 20 ins. beyond the bumpers. From track to top of lower step is 15⅞ ins. Risers are 10 ins. deep each.

Brill No. 27-E-2 trucks carry the car. The wheel base is 6 ft. 6 ins. and the wheels 33 ins. The wheels are steel tired. Each truck is equipped with two 75-hp motors. Total weight of car and trucks, with motors, 66,940 lbs.

OVERHEAD CONSTRUCTION ON OHIO INTERURBAN RAILWAY

The Cincinnati & Columbus Traction Company, of Cincinnati, Ohio, recently placed with the H. W. Johns-Manville Company, through its Cleveland branch, a contract for sufficient overhead

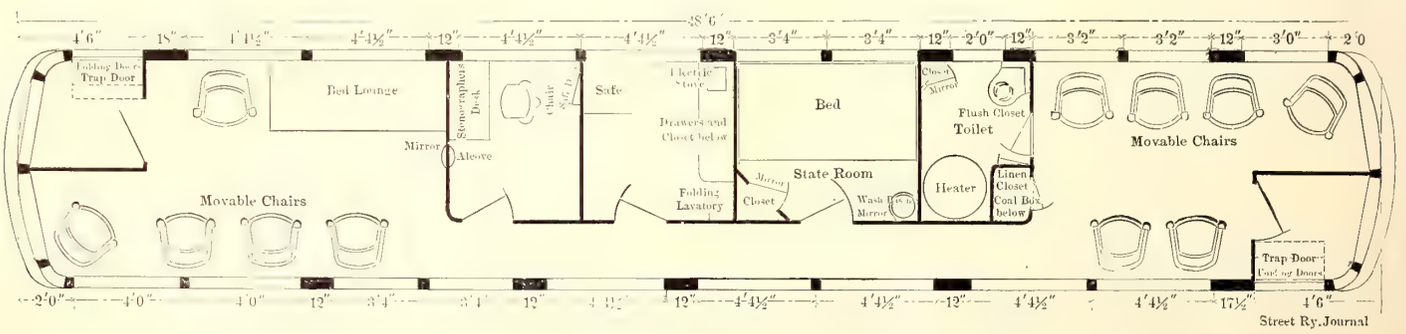


FIG. 3.—FLOOR PLAN OF PRIVATE CAR

line material to build 55 miles of new road. The construction will consist of parallel trolley wires of the 000 grooved-wire type. After careful comparisons of the designs of overhead material submitted, it was decided to adopt the well-known Johns-Manville extra heavy galvanized round top hangers with ¾-in. studs

provided with deep petticoats, insuring the best of surface insulation. These are attached to galvanized straight line yokes having a center dimension of 6 ins. between trolley wires.

The Combination mechanical and soldier clip, 15 ins. long, which is made of one piece only, and has proven so successful in the East on extra heavy construction, will also be used in conjunction with the extra heavy hangers and "Giant" type of pull-overs. "Giant" strains and "Philadelphia" section insulators will be used throughout.

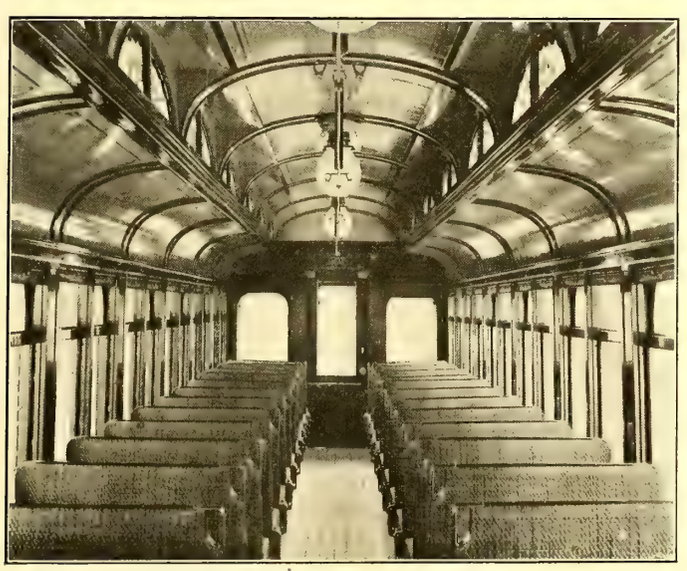
CARS FOR HEAVY SERVICE AT OAKLAND, CAL.

Heavy electric railroad construction is active around San Francisco just now. The electric cars for the North Shore Railroad, a converted steam road, have been illustrated in these columns. The present article is devoted to the rolling stock of a no less interesting undertaking which will give electric railway service approximating that given at present by steam roads, but in many respects superior. The transportation at Oakland, Cal., is peculiar. Oakland is to San Francisco as Brooklyn is to Manhattan in New York city. Many people in business in San Francisco live in Oakland. The journey from San Francisco to Oakland involves a half hour ride on the ferry. On the Oakland side of the bay the ferries cannot reach the shore because of shallow water, and piers or moles have been built out into the bay several miles for ferry landings. The Southern Pacific Railroad owns the only moles heretofore in existence, and has operated a suburban train service from the ferries to the heart of Oakland. From there passengers would take the street cars of the Oakland Transit Consolidated Company for various parts of the city. The arrangement was a cumbersome one from a traffic standpoint.

Interests identical with those behind the Oakland Transit Consolidated have constructed a new mole 17,000 feet long into the bay at Oakland, and will operate a line of ferries between there and San Francisco. The cars illustrated herewith for the San Francisco, Oakland & San Jose Railway are to take passengers as they come from the ferry and carry them to Oakland. As the crowds from a ferry boat are large the equipment was selected with a view to moving a large number of people at a time at intervals of 30 to 15 minutes, or whatever interval the ferries run at. The cars are 54 ft. 7 in. over bumpers, and 9 ft. wide. They are simple in construction, having but one unbroken compartment, and short platforms similar to those used on steam railroad coaches. Every bit of space is utilized for seating and the seating capacity is 64. One side of each platform is provided with folding doors which form a cab for the motorman when at the forward end, or are folded up against the dash when at the rear end, and not in use as a cab. The doors when folded up, as in the latter case, form a closet for the "Type-M." controller and air brake valve. The arrangement is very neat. The interior lighting is by arc lamps and arc headlights are used. The trucks are the St. Louis Car Company's No. 23 B. The car bodies, seats, arc lamps for interior and arc headlights were also the product of that company.



LONG DOUBLE TRUCK CAR FOR OAKLAND



INTERIOR OF OAKLAND CAR

MOMENTUM RAILWAY BRAKES

The Momentum Brake Company, Ltd., Toronto, Ont., announces that it intends to exhibit at the Saratoga Convention its momentum railway brake. This brake, which was fully described in the STREET RAILWAY JOURNAL for June 13, is said to be very economical, as the power required for its operation is derived from the momentum of the car. Its certainty and quickness of operation prevents serious and costly accidents.

The brake is constructed with a compensating spring in the controlling device, so as to make the skidding of wheels practically impossible. Motormen who have handled cars equipped with this brake state that very little sand is necessary to avoid skidding. Of the thirty odd cars of the Toronto Railway Company using this brake not one has reported flat-wheel trouble.

The connections between the brake mechanism and brake staff have been so arranged that by reversing the movement of the brake staff, back-roll will be prevented while on a grade.

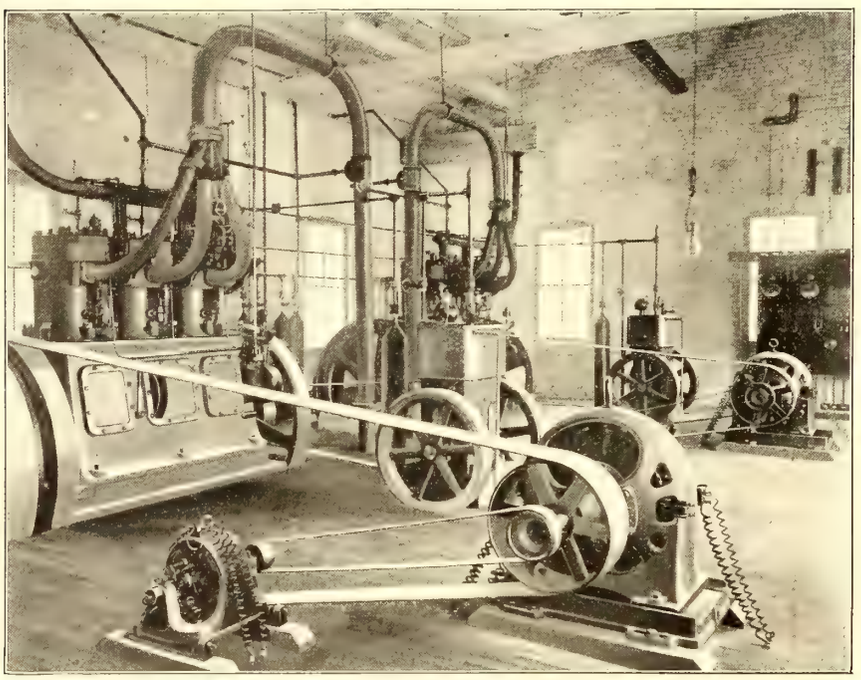
The weight of the complete equipment for either single or double trucks is about 300 lbs. Several of the Toronto equipments have been arranged so that both motor and trail cars are braked by the motorman.

After several weeks' test the South Chicago City Railway Company has ordered thirty momentum brakes and has adopted this type as its standard. Thirty-five equipments have also been ordered by the Toronto Railway Company, and three trial equipments are to be installed in Philadelphia.

AN OIL ENGINE POWER STATION

There have certainly been many developments in the power field during the last few years. The power user has not only now a wide choice in steam engines before him when selecting his equipment, but must also consider the possibilities of steam turbines and gas engines. In addition to these, if the advocates of the oil engine are to be believed, this machine will also be a factor in station construction before long. Considerable attention was attracted some years ago by the claims made for the Diesel engine, but it is only recently that this engine has been used in central power station work. The accompanying engraving shows a view of a new electric lighting plant at Jewett City, Conn., in which one of these engines has been in operation for a short time.

The oil supply for the engine is kept in two storage tanks set under ground. Their combined capacity is 6500 gallons. The oil, which is crude, costs 4.6 cents per gallon, delivered. From the main tanks it is pumped to a vertical tank holding forty gallons and from this tank it is supplied to the engines.



AN OIL ENGINE INSTALLATION

The latter were built for the American Diesel Engine Company, of New York, by the International Power Company, of Providence, R. I. They are operated on the well-known Otto cycle, but differ from the ordinary gas and oil engines in that there is no explosion in the cylinders but a steady combustion of the fuel at high-compression temperatures. The combustible is ignited at this temperature without the need of spark or other apparatus.

The oil is admitted to the cylinder by means of a valve operated by a shaft driven by the main shaft through an intermediate gear. It is forced into the cylinders by compressed air through a series of perforated brass washers, and enters in the form of a fine spray. The air which supports the combustion is drawn into the cylinder through an automatic mushroom valve, and is compressed on the up stroke to between 450 and 525 lbs. per sq. in., which corresponds to a temperature of about 1000 deg. F. The fuel valve remains open for about 1-10 of the working stroke and the fuel is let in and consumed during the whole or a part of this period, as determined by the action of the governor. When the supply of fuel stops the gases of combustion work expansively during the remainder of the stroke. The combustion is singularly complete on account of the large quantity of oxygen in the cylinder at the beginning of the working stroke. It is stated that the thermal efficiency of the engine is as high as 35 per cent.

In general outward appearance, the Diesel oil engine resembles the ordinary type of steam engine. The reciprocating parts are all enclosed within the engine housing which is fitted with detachable plates for easy access. The Jewett City station contains two engines of 75 hp each, and each drives a 60-kw Westinghouse single-phase 60-cycle alternator. The engines are guaranteed to operate on 0.47 lbs. of oil per brake horsepower-hour at full load, and on 0.5 lbs. of oil per brake horsepower-hour from friction load to full load. With oil at 4.6 cents per gallon this means about one cent per kilowatt-hour.

SAFETY CAR STRAP

The accompanying cut illustrates the Myers Y-formed safety car strap which has very recently been placed on the market. This strap, which marks a great advance upon the ordinary single style, is designed to prevent accidents to passengers when a car is going around curves or when it is suddenly stopped or started,



SAFETY CAR STRAP

as the strap does not slide along the strap rod like ordinary straps. With this form, the effect is the same as if the passenger were holding on to two straps.

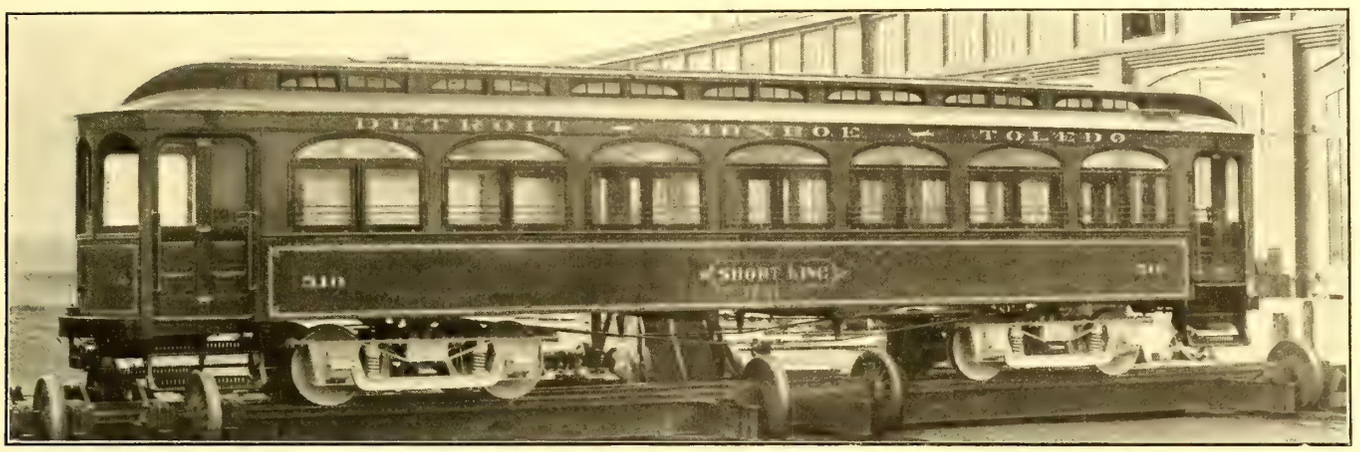
Straps of this type do not tend to accumulate at some one point on the rods on account of car vibration, and they are never near enough to each other to enable a passenger to hold two in one hand. Experience has shown that accidents are more likely to occur at the ends of a car rather than at the center, and it is therefore advisable to place a number of straps at the extreme ends, which can be done by attaching one end of each strap inside and the other outside the end rod supports. The strap branches are each 6 ins. long and are furnished with buckles and holes enabling each branch to be lengthened about 3 ins. The length of the middle piece is about 11½ ins. For the convenience of the passenger who is obliged to stand the handle is padded with fine, soft leather, and medicated to prevent the secretion of germs.

Owing to the Y-shape of these straps, they will give double the life and strength of ordinary straps, because the tension is divided among the branches. On the ordinary strap the weight of a man is concentrated at one point; the strain on the bar, therefore, is maximum at that one point. By using this car strap the strain on the bar is distributed over 6 ins., thereby reducing to a minimum the possibility of bar breakage.

A limited service has been put on the Rapid Railway System between Detroit and Port Huron, Mich. Two special limited cars run daily each way, stopping only at Detroit, Mount Clemens, New Baltimore, Anchorville, Marine City, the Oakland and Port Huron.

CARS FOR THE DETROIT, MONROE & TOLEDO SHORT LINE

For interurban service between Detroit and Toledo, 75 miles distant, and for local and suburban service, the Detroit, Monroe & Toledo Short Line Railway Company has adopted as its standard the type of passenger car illustrated herewith. These cars are now being built by the John Stephenson Company, and they embody several novel features. They are all of the standard steam railroad construction, so as to insure great strength, and in their appointments are in line with the standards set by the most recent examples in interurban cars in the West. They are divided into regular passenger and smoking compartments, with toilet rooms, ice coolers



HIGH SPEED CARS BETWEEN DETROIT AND TOLEDO

and other conveniences for interurban service. Only in the motor equipments do the cars vary, those intended for through interurban service being geared higher than the others.

The length of the car body over corner posts is 40 ft., while the extreme length over the buffers is 52 ft. The length of the vestibule is 4 ft. 6 ins., and the length of the rear platform is 5 ft. The extreme width of the car is 8 ft. 6 ins., and the height from the under side of the sills to the top of the roof is 9 ft. The interior finish and furnishings are attractive and comfortable throughout and were selected with the view of suiting the convenience of the passengers and best meeting the requirements of the service. Thus, the appointment of the regular passenger and smoking compartments differ somewhat. In the former the seats are of the Hale & Kilburn walk-over type, upholstered in crimson plush. They have high backs and head rolls. The cushions are 34 ins. long and 17 ins. wide. In the smoker the same type of seat is used, but the finish is in white woven rattan. Extending the entire length of the car are parcel racks, furnished by the Dayton Manufacturing Company. Hot-water heaters of the Peter Smith type are to be used. Stanwood sleet steps are provided, and the vestibule trap doors are of the Zimmerman type. When the vestibule is closed in and this door is in position, it rests upon two angle-irons fastened securely on each side of the door step, about 1½ ins. below the floor level, so that the door will be on a level with the vestibule floor, and in reality form a part of it, as it will extend out over the step to the vestibule door, thus making a continuous flooring for the entire inclosure. It is not hinged at the side, but when it is desired to get it out of the way so that the steps may be used for admitting passengers, it is raised like the leaf of a table and allowed to drop into a longitudinal pocket provided at the back of the step. It can be replaced by pulling it out of the pocket and letting it down upon the angle-iron rests. A pin at the rear of the step holds it securely in position and prevents the motion of the car from jarring it out of place.

The electrical equipments were furnished by the Westinghouse Company, and comprise Nos. 76-S and 86 motors. The cars equipped with the 76 motors are geared to run 65 m. p. h., and are to be used for local and suburban service, on a schedule calling for 45 m. p. h. to 50 m. p. h.; those with 86 motors are geared for 100 m. p. h. to 110 m. p. h., and will be used on through cars running at 50 m. p. h. to 60 m. p. h. Peckham trucks with 36-in. wheels will be used. Each car will have Christensen air brakes. One of these cars will be exhibited at Saratoga

MODERN SWEEPERS AND SPRINKLERS

The McGuire Manufacturing Company, of Chicago, Ill., has now under way at its works a combined sweeper and sprinkler of most unique design for Wellington, Australia. When completed the machine will have the appearance of an ordinary street car. Two tanks 14 ft. long by 6 ft. high, with a capacity of 1500 gallons each, form the body of the car. A passage of 2 ft. 6 in. wide separates the tanks and is covered like a common street car, with a provision made for the trolley-board. The sweepers are at each end, and, being of small diameter, are placed under the overhang. The sprinklers are so arranged that the street may be sprinkled ahead of the sweeper brooms or after, as may be desired. One of the particular advantages of such construction is that it can be knocked down and shipped in small packages, which are easily put together at destination.

The company shipped two sprinklers to South Africa early in the spring and another to Sao Paulo, Brazil, and has but lately shipped trucks to Bangkok, Siam, and North Sidney, Nova Scotia. The receipt of orders from such distant points by a company located so far inland as Chicago is certainly complimentary to the method of advertising, or perhaps to the product of this company.

There is now in the yards of the McGuire Manufacturing Company a 4500-gallon pneumatic sprinkler just about completed for the Rhode Island Company. This machine, or one similar to it, will be exhibited at the Street Railway Convention at Saratoga. It is claimed for this machine that it will sprinkle a street 100 ft. wide and six miles long with one charge. It is equipped with the company's latest type sprinkler head. The interesting features of the new head are that the quantity of water used can be regulated by the motorman to correspond with the speed at which the machine is run and a series of levers enables the operator to control the spray of water completely. It may be permitted to sprinkle 50 ft. from the side of the car or lessened to any desired distance, or the sprinkling may be confined to the track only.

The important feature of this machine is that the last gallon of water in the tank can be driven, through the aid of compressed air, the same distance as when the tank is full.

Inasmuch as many cities are agitating that street railway companies should sprinkle the streets, the operation of this sprinkler at the Saratoga Convention should prove interesting.

ALLFREE ENGINES

The distinctive feature of the engines built by the Ironton Engine Company, Ironton, Ohio, is the valve and valve-operating mechanism employed. The highest steam economy obtainable was sought in their design, and, as the cylinder clearance and cylinder condensation are two sources of excessive loss, an effort was made to reduce these. The valve shown in Fig. 1 was therefore determined upon, as by its use the cylinder clearance could be reduced to from 1½ per cent to 1¾ per cent of the piston displacement. The steam admission is from the "inside," the result being that all cylinders are jacketed with live steam a little over half their cir-

cumference tending to materially reduce the initial condensation. When desirable, cylinders can be steam-jacketed their entire circumference. A further advantage possessed by this valve is its very light construction, its perfect balance, and the facility with which all wear can be compensated for. The convex faces are fitted with packing strips which automatically take up the wear be-

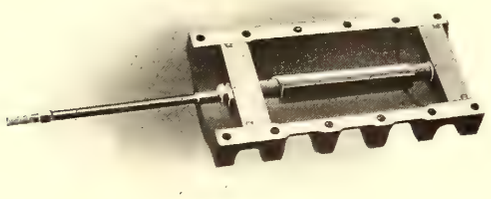


FIG. 1—VALVE

tween valve and pressure plate, and also obviate any tendency of the valve to stick upon starting.

The valve is operated through the medium of what the builder terms an "expansion gear." This gear is illustrated in Fig. 3, and two sectional elevations are shown in Figs. 4 and 5. The action of the gear is as follows: Eccentric rod *A* connects to the governing eccentric and operates the entire rocker arm as a whole, exactly similar to a high-speed automatic engine. Eccentric rod *B* connects to a fixed eccentric upon the shaft set opposite to the crank and connects to the sector *G* at the point of *F*. This sector is

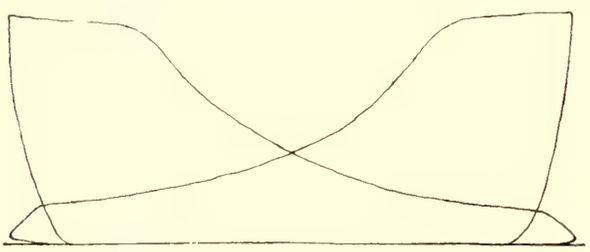


FIG. 2—INDICATOR CARDS

mounted in the rocker arm upon the shaft *E*, and its movement forward and backward rotates pinion *H* first in one direction then the other. Pinion *H* is finished at engine side with a 3⅛-in. crank, *J*, to which the valve knuckle is connected. The throw of the crank *J*, due to its rotation by travel of the sector *G*, will either increase or decrease the normal speed of the valve, which is imparted by the rocker arm as a whole. This accelerating and retarding effect upon the valve is so timed that the rapid movements take place at the opening and closing of ports, and the retarding effect occurs after closing of the admission, and before opening of exhaust. The result is a steam distribution exactly similar to that

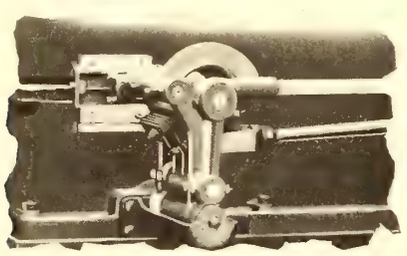


FIG. 3—EXPANSION GEAR

obtained from Corliss engines having double eccentrics, excepting that exhaust closure is not constant. The variation in the exhaust closure is, however, just sufficient to compensate for the difference in mean temperature of the cylinder for varying loads, so that the resulting pressure of compression is constant. A graduated load card shows compression lines all merging into one at admission.

Fig. 2 is a reproduction of a characteristic indicator card which accurately illustrates the advantages derived from the valve.

By using this gear the maker claims that the weight of valve and valve-operating mechanism are greatly reduced as compared with four-valve machines, the clearance is materially reduced, and the working parts are comparatively few in number, and are easier to maintain in adjustment. The action of the valve being positive, and no releasing gear or dash pots being present, the speed of rotation may be materially increased as compared with Corliss engines, resulting in a reduction in the size of the machine, cost of foundation, and very materially reducing the cost of direct-connected generators. The gear is much more quiet in operation and requires fewer repairs and adjustments than are necessary for the four-valve machines.

Another distinctive feature of this engine is the governor shown

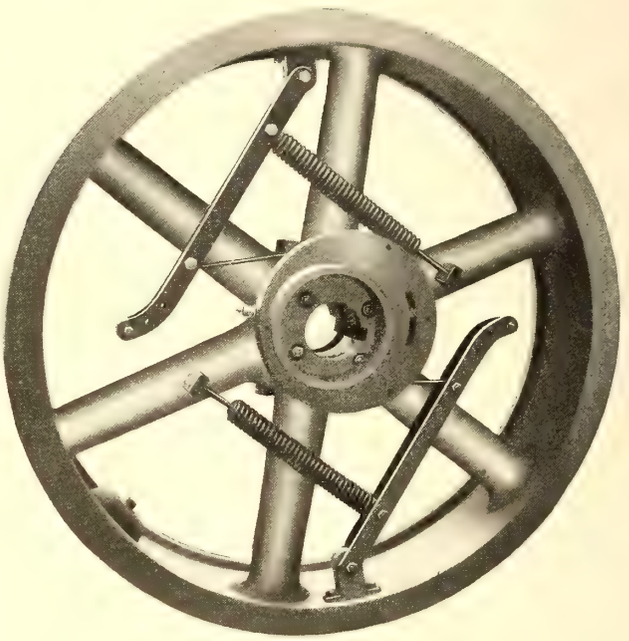
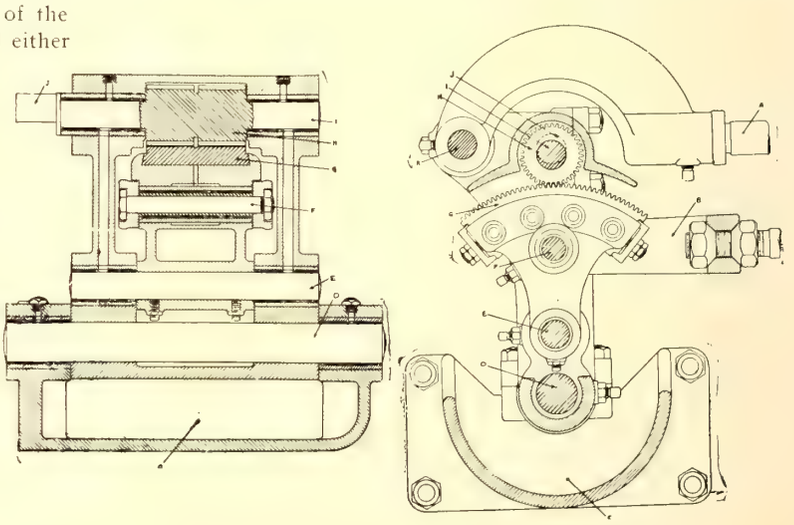


FIG. 6—GOVERNOR

in Fig. 6. This governor is of the inertia centrifugal type, but differs from others of this type in being absolutely symmetrical, and the center of gravity is maintained coincident with center of rotation for all points of cut-off. The method of suspension results in a more desirable port opening and steam distribution than is



FIGS. 4 AND 5—SECTIONAL VIEWS OF EXPANSION GEAR

obtained from other types of inertia governor. Any desired degree of refinement of regulation is obtainable from this governor, the adjustments being made in each instance to meet the conditions of service to be performed.

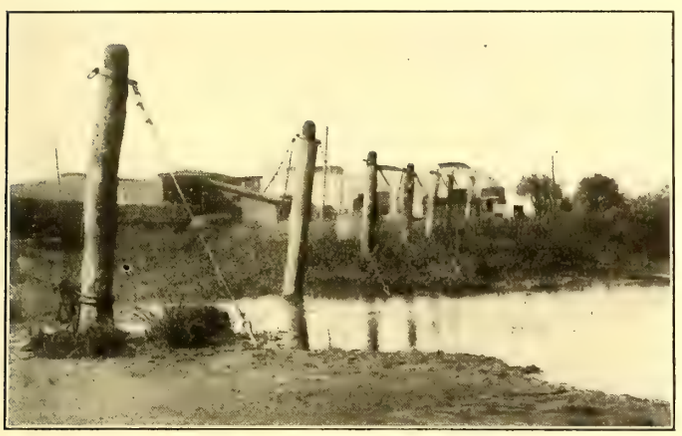
Engines direct connected to alternating-current generators operating in parallel have the governors equipped with a device by which the speed may be increased or decreased from 5 per cent to 10 per cent above or below normal, while the engines are in operation. This device is operated through a worm gear and affects the speed by varying the point of suspension of spring and increasing or decreasing the tension thereof. It is possible to secure

the most delicate adjustment by this device and impossible to injure the governor or produce racing of the engine.

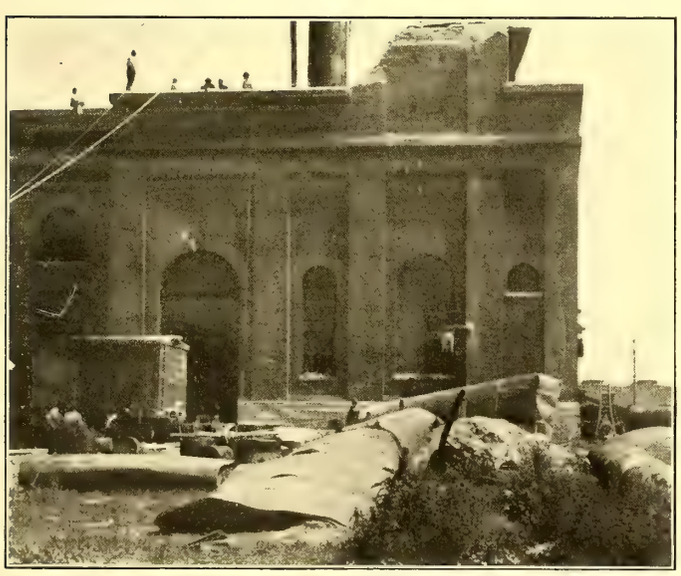
A 175-hp engine of this type, operated at 185 r. p. m. under initial steam pressure of 100 lbs. and exhausting to the atmosphere, showed an actual water rate at full load of 23.1 lbs. per indicated horse-power per hour. No allowances whatever were made for entrained moisture, steam having been considered dry after having passed through one of our centrifugal separators.

EFFECTS OF A SEVERE STORM

The accompanying illustrations were made from two photographs taken the day after the storm which wrecked the stacks of the large power house of the East St. Louis & Suburban Railway Company, East St. Louis, Ill. These stacks were 6 ft. in diameter, and 160 ft. high. They were guyed with ¾-in. steel cables to twenty-four 12-in. Stombaugh guy anchors, bored in to their full lengths. It is interesting to note that although the ¾-in. cable was snapped like thread the guy anchors were not moved an inch by this severe test. The East St. Louis & Suburban Railway Company are now using these guy anchors for all of their pole guying.



GUY ANCHORS FOR SUPPORTING STACK

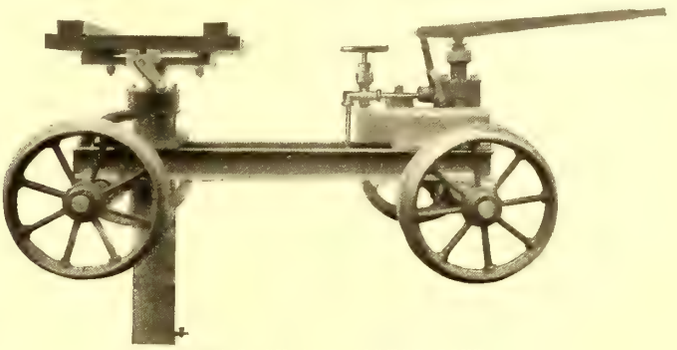


VIEW OF POWER HOUSE, SHOWING DESTRUCTION CAUSED BY STORM

Reports made by the Cincinnati Traction Company to the City Auditor indicate that the company has received during the past four months $19,455 under its traffic arrangements with the four interurban roads now entering the city. This is on a basis of 3 cents for each passenger carried within the city limits. Of this amount the city will, under the provision of an old franchise with the Cincinnati Street Railway, receive 5 per cent of the gross earnings. The City Auditor claims that the 5 per cent should be figured on the entire amount earned by interurban cars.

PIT JACK AND MOTOR LIFT

The City Machine Company, of Cleveland, Ohio, is manufacturing the pit jack and motor lift shown in the accompanying cut. It is of the hydraulic type, using either oil or water, and one filling is sufficient for a year or more. By simply turning a valve and operating the lever the table may be raised to any required height. The table may be revolved, making it very convenient for changing motors. There is also a side adjustment of several inches, operating by a screw, which renders it possible to readily locate screw holes in the motor casing. The device is very strong and durable.



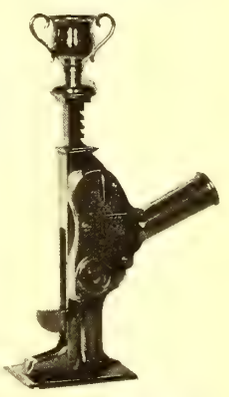
PIT JACK AND MOTOR LIFT

Within the past few months the company has shipped equipments to the following railways: Detroit United Railway, Detroit, Mich.; Cleveland Electric Railway, Cleveland, Ohio; Cleveland, Painesville & Eastern Railway, Willoughby, Ohio; Cleveland & Southwestern Traction Company, Cleveland, Ohio; Eastern Ohio Traction Company, Cleveland, Ohio; United Traction Company, Albany, N. Y.; Rockford, Beloit & Janesville, Beloit, Wis.; Utica & Mohawk Valley Railway Company, Utica, N. Y.; St. Johns Railway Company, St. Johns, N. B. The device is not a new one, as it has been on the market in a small way for nearly fifteen years. The company states that it has never heard of a machine being broken or wearing out during that time.

AN APPROPRIATE PRESENT FOR SIR THOMAS LIPTON

The accompanying cut illustrates a novel "cup lifter," which was presented to Sir Thomas Lipton, on Aug. 19, with the compliments of the Duff Manufacturing Company, Pittsburg, Pa.

This "cup lifter" is a miniature lifting jack made of silver, and is in the form of a small working model of the "Barrett" lifting jacks, bearing a handsome cup on the top of the lifting bar. The small jack itself stands 5 ins. high, and can be raised or lowered at will. This gift presents a very unique appearance, and as the jack and cup are handsomely finished, makes a very attractive ornament. Sir Thomas was highly pleased with it, and fully appreciated the "cup lifting" idea. The presentation was made by J. R. McGinley, president of the Duff Manufacturing Company, and J. W. Duntley, president of the Chicago Pneumatic Tool Company. Sir Thomas in response said that the America's cup was now in danger, as he had at last found a successful "cup lifter."



A SUCCESSFUL CUP LIFTER

Owing to the action of the Eastern Ohio Traction Company in raising the price for carrying milk from 1½ cents to 2 cents per gallon, dealers along the route have thrown their supplies to creameries and cheese factories to force the railway to return to the old scale. The company claims that 2 cents a gallon is a fair price, as it delivers the milk at its freight station in the center of the city, whereas all the other electric roads operated into Cleveland oblige dealers to haul milk from the city limits. Heretofore this company has handled about 2000 gals. of milk daily.

THE FENDER QUESTION

BY DR. CHAUNCEY B. FORWARD

It has been my fortune in the past two or three years to have visited almost every large city in the United States, and I have often noticed differences in the operation and equipment of electric street railways, especially the many freak devices used on the front end of the cars ostensibly for protecting the unfortunate pedestrian who fails to get off the track in time. That the majority of fenders in use are ineffective, or at least unsatisfactory to the railway company using them, is plain to everyone who knows anything of the street railway business or has had occasion to talk with any of the officials on the subject. While the subject is one that some street railway companies appear to avoid, the people are clamoring for better protection and more safety, particularly in crowded cities. This is not at all remarkable, in view of the development of street railways in the past few years from "dinky bob-tailed" horse cars to the large heavy double-truck cars that carry 80 to 100 passengers comfortably, and more often nearly twice as many uncomfortably, at speeds of from 8 to 20 miles and more per hour.

With the larger and heavier cars has come increased speed, and as a result many lives have been sacrificed and limbs lost. I am told that the amount of damages paid on account of accidents constitutes one of the very large items in the operation of all electric railways, particularly in large and crowded cities. It has always seemed queer to me that the subject of fenders should cause most managers to throw a fit in anger. However, after giving the matter further consideration and investigation, I am not surprised that it is so. I find that there are almost as many patent fenders as there are car lines, and yet there are hardly a half-dozen worthy the name. I dare say there is not a railway official in the country who has not been pestered to death with fender men, claiming to have a device that will save them more each year than half their gross profits, more or less. The railways have tried and found wanting fender after fender, until at last they are all sick and tired of the subject, and the word fender is to the railway manager what a red rag is to a mad bull.

It seems strange that fender improvements have not kept pace with other advances in street railway equipment. The American inventor, however, does not allow such opportunities to go very long unimproved. In the past five months there has been brought to the attention of the railway managers a fender, or rather life guard, that will actually do all that is claimed for it, and a great deal is claimed for it. It is not my purpose in this article to advertise this particular fender any more than to say that I have seen it in actual operation pick up a living man at speeds from 1 mile to 20 miles an hour, yet the man was apparently unhurt. It might be said that this was a case of good luck on the part of the individual at that particular time, but I am told that he has tested the fender in this way many dozens of times, and that a hundred or more have done the same thing, and in no instance has any one ever been injured in the slightest. In addition to these trial tests it is said that this fender has saved a score of lives in accident cases in the past few months for the railways who have them in use on their lines. If these statements are true it seems to me that all the electric lines in the country would want to equip their cars at once. I do not mean to insinuate that the railway managers throughout the country would suddenly turn philanthropists for the benefit of humanity, as I have found the average manager a pretty keen man to look after the five-cent pieces for his company, but if in 90 per cent of the front-end accidents the victim can be picked up uninjured the dividends of the company would certainly be materially increased on account of the saving in damage claims.

My attention was attracted to this subject while in a certain newspaper office. The paper in question had been saying a good many things about the need of better fenders, and as a result of these articles it had received a number of communications from different inventors of fenders, complaining of their inability to get an audience with the railroad managers, or have their fenders given a trial.

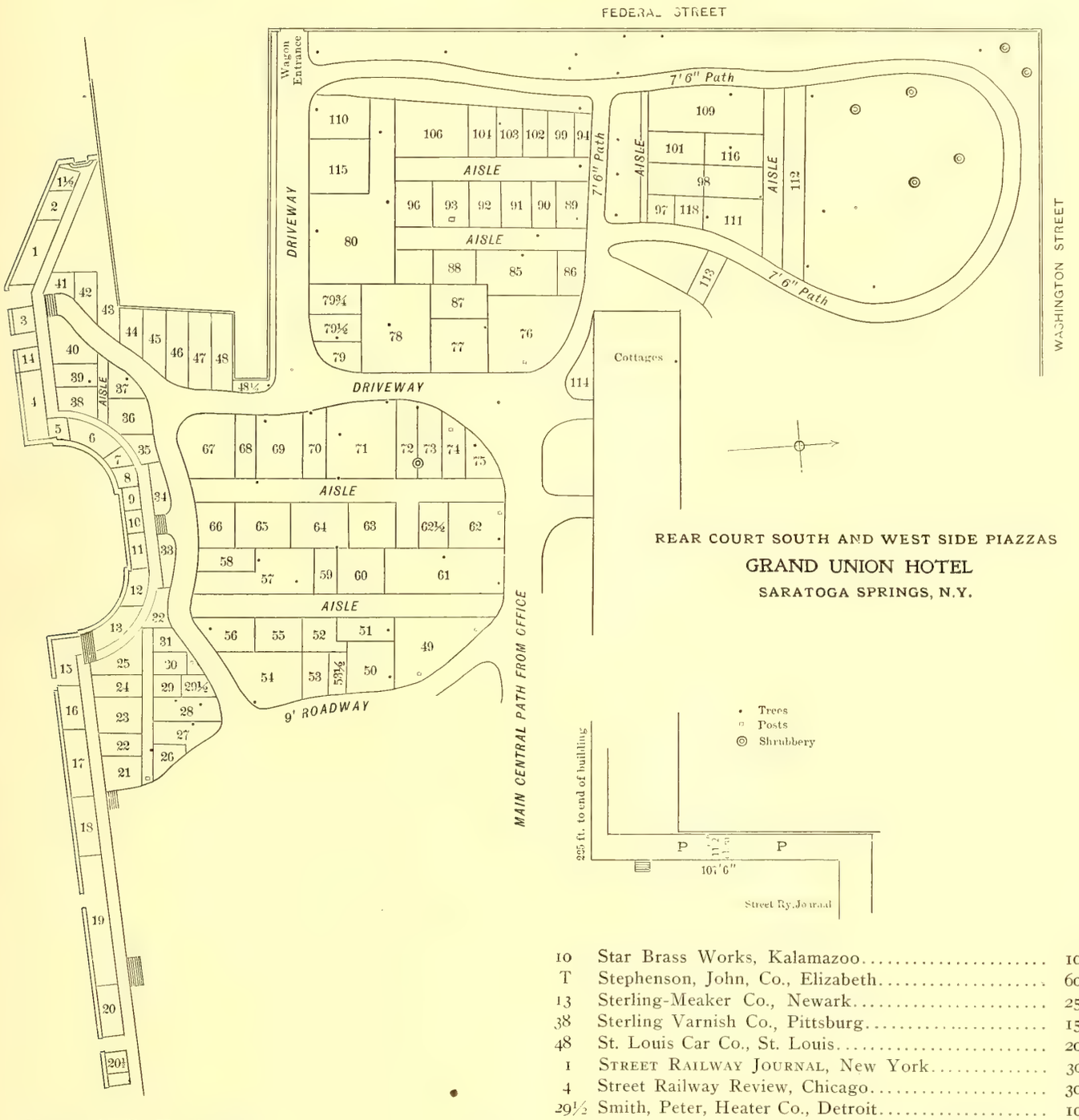
The way to reach most corporations is not by appealing to the humane aspect of the fender question, but to demonstrate to them in dollars and cents that it is to their advantage to adopt a real fender. If I were operating a street railway I would certainly give such an one a hearing and think it over.

EXHIBITORS AT THE SARATOGA CONVENTION

The following is a corrected list of exhibitors at the American Street Railway Association Convention at Saratoga, supplied by the chairman of the local committee on exhibits:

Location.	Name.	Space Sq. Ft.
16	Adams & Westlake Co., Chicago	200
30	American Automatic Switch Co., New York	100
36	American Brake Shoe & Foundry Co., Mahwah, N. J.	200
68	American Car Seat Co., Brooklyn	250
40	Atlas Railway Supply Co., Chicago	200
88	American Car & Fo ndry Co., Chicago	150
79¾	American Automatic Switch & Signal Co., Chicago	100
103	Anderson, Albert & J. M. M'f'g Co., Boston	200
113	Archbold-Brady Co., Syracuse	500
86	Baldwin Locomotive Works, Philadelphia	250
84	Bemis Car Truck Co., New York	850
92	Benjamin Electric M'f'g Co., New York	100
70	Berry Brothers, Detroit	200
11	Bliss, E. W., Co., Brooklyn	150
27	Brady Brass Co., New York	100
77	Brill, J. G. Co., Philadelphia	300
60	Brown, Harold P., New York	600
44	Bruck Solidified Oil Co., Boston	100
96	Bullock Electric M'f'g Co., Cincinnati	180
62½	Chase, L. C. & Co., Boston	200
69	Christensen Engineering Co., New York	400
32	Cook, Adam, & Sons, New York	100
3	Conant, R. W., Cambridge	100
61	Consolidated Car Fender Co., New York	1000
66	Consolidated Car Heating Co., Albany	300
73	Continuous Rail Joint Co., Chicago	200
17	Curtain Supply Co., Chicago	300
93	Climax Stock Guard Co., Chicago	150
—	Celluloid Co., New York	200
48½	Columbus Steel Rolling Shutter, Columbus	100
110	Chicago Pneumatic Tool Co., New York	600
53½	Chicago Mica Co., Valparaiso, Ind	100
114	Cheatham Electric Switching Device Co., Louisville	150
6	Dearborn Drug & Chemical Works, Chicago	200
39	Detroit Trolley & M'f'g Co., Detroit	200
—	Diamond State Steel Co., Wilmington	100
41	Duff M'f'g Co., Allegheny	100
63	Electric Storage Battery Co., Philadelphia	400
82	Electric Railway Equipment Co. (E. P. Morris), Cincinnati	1000
20¾	Edwards, O. M., Co., Syracuse	100
9	Field, C. J., New York	100
—	Federal M'f'g Co., Cleveland	100
53	Fabrikoid Co., Newburgh	100
50	General Electric Co., Schenectady	500
14	Globe Ticket Co., Philadelphia	100
57	Gold Car Heating & Lighting Co., New York	500
104	Gould Storage Battery Co., New York	200
18	Hale & Kilburn M'f'g Co., New York	250
12	Harrington, C. J., New York	200
42	Heywood Bros. & Wakefield Co., Philadelphia	100
79	Howe M'f'g Co., Scranton	100
90	Hipwood-Barrett Car Fender Co., Boston	300
—	Homestead Valve Co., Homestead, Pa	100
20	International Register Co., Chicago	200
91	Imperial Machine Co., Pittsburg	300
106	Ingersoll Construction Co., Pittsburg	600
67	Johns-Manville, H. W., Co., New York	600
94	Johnson Wrecking Frog Co., Cleveland	100
47	Kinnear M'f'g Co., Columbus	100
58	Knowles, C. S., Boston	225
74	Keefer Car Switch Co., Albany	100
25	Le Valley Vitæ Carbon Brush Co., New York	200
64	Lorain Steel Co., Lorain	500
59	Ludlow Supply Co., Cleveland	200

31	Lumen Bearing Co., Buffalo	100
27½	McLeod, Walter, Co., Cincinnati	100
76	Magann, G. P., Air Brake Co., Detroit	1000
102	Mayer & Englund Co., Philadelphia	200
105	Merritt & Co., Philadelphia	100
109	McGuire M'f'g Co., Chicago	600
55	National Carbon Co., Cleveland	300
69	National Electric Co., Milwaukee	400
7	National Ticket Co., Cleveland	100
56	National Lock Washer Co., Newark	250
51	Root Track Scraper Co., Kalamazoo	200
85	Rossiter, MacGovern & Co., New York	700
29	Railway Sander Co., Toronto, Can	100
113	Robins Conveying Belt Co., New York	200
—	Rogers Improved Journal Packing, Chicago	100
99	Railway Steel Spring Co., New York	200
97	Recording Fare Register Co., New Haven	100
20½	Sherwin-Williams Co., Cleveland	200
62	Standard Paint Co., New York	400
24	Standard Vitrified Conduit Co., New York	200



5	Newcomb, F. H., Brooklyn	100
49	Ohio Brass Co., Mansfield	875
19	Ohmer Fare Register Co., Dayton	500
—	Pantasote Co., New York	150
111	Parmenter Fender & Wheel Guard Co., Boston	150
78	Peckham M'f'g Co., New York	1000
71	Pennsylvania Steel Co., Philadelphia	1000
21	Pierce, T. Raymond, Boston	200
54	Pittsburg Reduction Co., Chicago	600
35	Pittsburg Switch & Signal Co., Pittsburg	100
112	Pneumatic Signal Co., New York	750
26	Railway Appliance Co., Albany	100
28	Railway Appliances Co., Chicago	200
10	Star Brass Works, Kalamazoo	100
T	Stephenson, John, Co., Elizabeth	600
13	Sterling-Meaker Co., Newark	250
38	Sterling Varnish Co., Pittsburg	150
48	St. Louis Car Co., St. Louis	200
1	STREET RAILWAY JOURNAL, New York	300
4	Street Railway Review, Chicago	300
29½	Smith, Peter, Heater Co., Detroit	100
—	Standard Automatic Lubricator Co., Philadelphia	100
23	Symington, F. H., Co., Baltimore	200
98	Stanley Electric M'f'g Co., Pittsfield	450
—	Speer Carbon Co., St. Marys, Pa	100
1½	Security Register Co., St. Louis, Mo	100
80	Taylor Electric Truck Co., Troy	1500
46	Traction Equipment Co., Brooklyn	150
101	Templeton, Kenly & Co., Chicago	100
43	Uni Signal Co., Cambridge	100
118	Universal Brake Co., Lancaster	100
8	U. S. Curtain Co., Newark	100
116	United States Steel Co., West Everett	300
—	U. S. Electric Signal Co., West Newton	100

22	Van Dorn & Dutton Co., Cleveland	200
37	Van Dorn, W. T., Co., Chicago	100
75	Watson, W. T., Newark	180
72	Weber Railway Joint M'f'g Co., New York	200
2	Western Electrician, Chicago	100
P	Westinghouse Electric & M'f'g Co., Pittsburg	600
65	Wharton, Wm., Jr., & Co., Philadelphia	500
34	Wheel Truing Brake Co., Detroit	100

RECEPTION BY MR. VREELAND

President H. H. Vreeland, of the Interurban Street Railway Company, instituted five years ago the plan of inviting to his country residence at Brewster, N. Y., all of the staff of that company for a day's outing. The entertainment was so popular with all that Mr. Vreeland has followed the practice each year since that time, and each trip has been, if possible, more enjoyable than the preceding. The annual reception this year occurred on Aug. 22 and a cordial invitation was extended to all of the officers and heads of departments and divisions of the company, as well as to a few outsiders, to take the 9:08 train to Brewster. The party consisted of about sixty, and upon their arrival at Brewster they were met by brakes, which quickly conveyed them to the Tonetta Outing Club, of which Mr. Vreeland is a member, and where the clam bake, which is a feature of these annual outings, was being prepared. While awaiting this part of the entertainment Mr. Vreeeland's guests found much to interest and occupy them on the grounds of the club, which is very picturesquely situated, and the time passed quickly until the chef announced that he was ready to demonstrate how well they understood the preparation of clams at the Tonetta Club. It must not be inferred from this that this bivalve was the only viand which graced the tables, for there was a wide provision of other delicacies, all of which taste better at Brewster than anywhere else. After the tables had been cleared the guests repaired, by invitation, to Mr. Vreeland's residence, "Rest-a-While," where they were received by Mrs. Vreeland, assisted by a number of other ladies who live in Brewster. Mr. Vreeland's home is a large one and the grounds are very spacious, so that the evening passed quickly away, and it came in the nature of a surprise when the time for leaving was announced. The party returned to New York on a special train on the Harlem Railroad.

MR. BAKER LEAVES LONDON

The London County Council is about to lose the services of Mr. Alfred Baker, who has been the general manager of the southern system for some years. Mr. Baker is not a London man, having originally come from the Midlands, and as he has recently been offered the position of general manager of the Birmingham Tramways, he has decided to accept the position and will leave London as soon as his successor has been appointed. Mr. Baker will also receive a very handsomely increased salary which will commence at £1,300 per year and will rise by two yearly installments to £1,500, while the salary for the general manager of the London County Council is only £1,000 per annum. Tramway committees have not yet apparently fully realized the importance of such positions, and the fact that a tramway manager in London is only drawing a salary of £1,000 a year partakes of the ludicrous. Mr. Baker is therefore to be congratulated upon receiving the appointment from Birmingham, especially as it will afford a splendid opportunity for those talents which he possesses so fully, since Birmingham may almost be said to be a virgin field so far as electric traction is concerned. It will be Mr. Baker's work to get rid of the filthy, noisy steam tramways which have been so long a part of Birmingham's streets. Mr. Baker received his early training with the Nottingham & District Tramways Company and was general manager of that company from 1890 to 1897, when the Corporation of Nottingham purchased the tramways and took Mr. Baker over as their general manager. Mr. Baker came to London in 1899 and has, as stated above, had to advise the London County Council generally upon the whole system of its tramways in London.

STREET RAILWAYS IN VERACRUZ AND TABASCO, MEXICO

The following is a list prepared by Wm. W. Canada, United States Consul, of the railways operating in the consular district of Veracruz, Mex., including the State of Tabasco:

Ferrocarril Urbano de Alvarado, of Alvarado, operates only in the streets of that town. It has 3½ miles of 36-in. gage track; two cars; animal traction. Miguel Vives, proprietor and manager, Alvarado, Veracruz.

Ferrocarril Urbano de Jalapa operates a street railway in Jalapa. It has 1¼ miles of standard gage track; four passenger and five freight cars; animal traction. Felipe de Mazarraza, president, Tacubaya; Felipe de Mazarraza, Jr., general manager, Jalapa, Veracruz. P. O. box No. 6. There are no electric railways operating in Jalapa.

Ferrocarril Urbano de Cordoba operates about 5 miles of standard gage track in Cardoba. It has twelve passenger and twenty freight cars and one funeral car; animal traction. Jose A. Marquezhoyos, president; Adalberto Casas Rodriguez, manager, both of Cordoba, Veracruz.

Ferrocarril Urbano de Orizaba connects Orizaba, Rio Blanco, Nogales and Santa Rosa. Has 18½ miles of standard gage track, thirty-one passenger and nineteen freight cars; animal traction. Angel Jimenez Arguelles, proprietor; Eduardo Arroyo, manager, both of Orizaba, at Avenida de la Libertad No. 7.

Ferrocarril Urbano de Veracruz. This railway is operated by the "Veracruz Railways, Limited." Has tracks in nearly all streets in the city for freight and passenger service. Length of tracks, 11 miles; standard gage; twenty passenger, forty freight and several funeral cars; animal traction. Sir W. D. Pearson, president, London, Eng.; G. H. Beeston, manager; Edgar Heymans, superintendent. Address, Veracruz.

Tlacotalpam and Coatzacoalcos, Veracruz, have no street cars.

Frontera, Tabasco, has no street cars.

San Juan Bautista, Tabasco, has three lines of street cars, but further information is not available at present.

STREET RAILWAYS IN LEIPZIG

In a very complete report to the Department of Commerce and Labor, made by B. H. Warner, Jr., consul at Leipzig, some interesting facts are given concerning the street railways in operation in that city.

The first car line operated by horses was opened to the public in the spring of 1872. This road continued to operate until 1895, when two companies were given franchises to build electric railways. The concessions, almost identical in their restrictions, are for a period of forty years from the completion of the lines. According to the terms of the concessions, all the property of the companies is to revert to the city after the expiration of the grants, with the exception of property acquired within the last five years of the grants. Provision is made, however, for the acquisition of even this new property, and, further, provision is made for the acquisition of the latter property by the city at the expiration of twenty, twenty-five, thirty or thirty-five years.

After the first three full years the lines are in operation, they must pay the city for the use of the streets 2 per cent of the gross receipts, which amount will be increased 1 per cent after the lapse of every five years, until it reaches 5 per cent. The companies must pay for paving and repairing the streets where new tracks are put down and where the running of the cars is responsible for the rapid deterioration.

The Grosse Leipziger Strassenbahn Gesellschaft, the larger company, known as the "Blue Line," is capitalized at $2,380,000, which is divided into 10,000 shares of $238 each. It has a bonded indebtedness of $2,380,000, bearing 4 per cent interest per annum, which is divided into 6500 bonds of $238 each and 7000 bonds of $119 each. The company has paid regular dividends to its stockholders since 1896, when it began operations, as follows: For the years 1896, 1897, 1898, 1899, 1900, 1901 and 1902, 6, 8, 8, 8, 7, 5½ and 5½ per cent, respectively.

The Leipziger Elektrische Strassenbahn Gesellschaft, the smaller company, known as the "Red Line," is capitalized at $1,487,500, which is divided into 6500 shares of $238 each. It has a bonded indebtedness of $952,000, bearing 4 per cent interest per annum, which is divided into 2000 bonds of $238 each and 4000 bonds of $119 each. Regular dividends have been paid the stockholders

since its organization, as follows: 1895 to 1899, 4 per cent per annum; 1900, 3 per cent; 1901, 2 per cent, and 1902, 2 per cent.

There are 131.17 miles of tracks, including those in the various car sheds, 77.2 miles of which belong to the larger company and 53.97 miles to the smaller. The former has had, for several years past, its own car shops. It has 275 motor cars and 112 closed and 30 open trailers—in all 417 cars in use. The smaller company has 130 motor cars and 20 closed and 30 open trailers—in all 180 cars in use. The smaller company's cars are fitted with the ordinary hand brakes, while those of the other (the Blue Line) have the latest Westinghouse air brakes attached, in addition to the hand brakes. The overhead trolley system is used by both companies.

Cars are run from 5:17 o'clock in the morning until midnight, upon schedules varying from 4 to 15 minutes apart. Municipal ordinances prescribe that street cars shall not run at a higher rate of speed than nine miles an hour in the business sections; with trailers, 7.2 miles; and in the suburbs, 15 miles, or 12 miles with trailers. Cars are not to be stopped at every corner to let passengers on or off, but at places perhaps 250 yards or less apart, marked for the guidance of the public by iron signposts placed a foot or two in from the curbstone. There are a certain number of standing-room places on the front and rear platforms of the car—perhaps 15 on an average. When these are taken and the inside is full, the conductor hangs out at the rear end of the car by the entrance a sign "Occupied," and no more stops are made to take on passengers until some are let off.

The fare for a single trip is 10 pfennigs (2.38 cents), which entitles one to a free transfer. Passengers carrying large baskets, bundles, etc., must pay a full fare for such. All employees of the city, as well as those connected with the police department, when in uniform, are entitled to ride upon the front platform free of charge, but never more than two at a time. In addition thereto, a large number of city officials—at the present time 560—are given "annual passes." To school children under 15 years of age are issued special cards, which are good only upon the lines running between their respective homes and the schools they attend and between certain hours of the day.

The wages of a conductor are $20 per month for the first year's service; the same amount is paid a motorman for the first six weeks he works. After their respective apprentice terms have expired they are paid from $21.42 to $28.52 per month, the amount being fixed by the length of time they have been employed. The men are given one day off in every six, seven or eight, depending upon the number of hours each one is compelled to work daily. A working day is usually from ten to twelve hours.

The streets are cleaned and sprinkled by the city government, and the cost of this work is charged to the railway companies.

In winter the companies keep their respective tracks clear with snow plows. The snow is piled on either side of the tracks and carted away by the city, which charges the companies 43 cents to 65 cents per wagonload containing about 71 cubic feet, the price depending upon the length of the haul.

For the benefit of those employees whose wages do not exceed $476 per annum, sick, accident, life insurance and assurety funds are established. These are also charged to the expense accounts, as is also the cost of the employees' uniforms, each man being provided with at least one uniform, two caps, an overcoat, etc., per annum, except, however, those who are working for the first year, from whose wages 10 pfennigs per day are deducted to pay for the uniforms.

The condition of the companies at the end of the calendar year 1902 is shown in the following statement:

Salaries	$278,335	$107,710
Expenses	296,370	136,566
Taxes	35,917	14,995
Interest account	98,175	45,431
Gross profits	309,391	94,834
Total debit	1,018,190	399,538
Credit (total income)	1,018,190	399,538

An extensive electric railway system is to be constructed in the city of Rosario by the Anglo-Argentine Company, an English syndicate. Several horse lines will be electrically converted. The scheme, according to South American advices, is a very comprehensive one, involving every quarter of the city.

AMONG THE MANUFACTURERS

THE CROUSE-HINDS ELECTRIC COMPANY, Syracuse, N. Y., has just added to its extensive line of railway specialties the manufacture of arc headlights and guy anchors for electric railways.

THE PITTSBURG RAILWAY SUPPLY COMPANY, of Pittsburg, Pa., which recently organized with $1,000,000 capital, has not yet located its plant, although several very flattering offers of free sites and good bonuses have been made to it.

THE ALLIANCE ASBESTOS MANUFACTURING COMPANY has been organized to manufacture asbestos products of all kinds. The company will erect a large factory in Alliance, Ohio. Dr. W. J. Snyder is president, and H. M. Kayler is general manager of the company.

THE CURTAIN SUPPLY COMPANY, of Chicago, Ill., has engaged B. S. McClellan, who will come to it Sept. 1, as salesman. Mr. McClellan will have his headquarters in Chicago, and will cover Western territory. He has had a large experience among railroad men, having been with the Illinois Central and New York Central in important positions for some twenty-two years, and is well-known to the trade.

THE SPRAGUE ELECTRIC COMPANY has recently issued a third edition of Bulletin No. 206, relative to its direct current motors. The publication contains a list of standard sizes, weights, dimensions, etc., of round type, M. S. type six-pole, S. S. type six-pole single-field coil, and F. M. type motors. These motors are made in all sizes, from 1-20 to 1000-hp., are wound for a wide range of speeds and voltages, and can be shunt, series or compound wound, as may be desired.

THE IRONTON ENGINE COMPANY, of Ironton, Ohio, has given to Fairbanks, Morse & Company, of St. Louis, Mo., the agency for Allfree engines, which it manufactures, for the St. Louis district and the Mexican trade. Harron, Rickard & McCone, successors to the old Park & Lacey Company, of San Francisco, Cal., have secured the agency for California, Nevada and Arizona. Both agents are in receipt of a very complete line of catalogues, illustrations, etc., and expect to secure a very creditable portion of the orders placed in their territories.

A VERY FINE CATALOGUE has just been published by the Allis-Chalmers Company, Chicago, Ill. The book is replete with many excellent illustrations of the company's products, particularly Reynolds-Corliss engines, air compressors, Reynolds air pump and condenser, blowing engines, combined vertical and horizontal direct-coupled engines, Reynolds feed-water heater, girder-frame engines and numerous types of hoisting engines. The illustrations also include views of prominent power plants using this company's apparatus and of the West Allis and E. P. Allis works.

THE R. D. NUTTALL COMPANY, of Pittsburg, Pa., announces that it has in preparation, and will place on the market at the proper time, a practical and perfect sleet cutting device, which is light, strong and compact, can be carried by the motorman without inconvenience, quickly adjusted without removing the wheel, and without using tools of any description. This device is the invention of an experienced street railway man, and has been thoroughly tested. The company will carry a large stock of both standard and high-speed sizes, and will fill all orders from stock.

THE STANDARD ENGINEERING COMPANY, of Cleveland, has taken the contract for building the first section of the Cincinnati, Hamilton & Indiana Electric Railway, of which J. C. Hooven, of Hamilton, is chief promoter. The Standard Company will do the grading, bridge building and track laying for the section between Hamilton and Richmond, Ind. The line will enter Cincinnati over the tracks of the Cincinnati, Dayton & Toledo Traction Company from Hamilton. Work will start in the very near future. A. W. Jones, at present chief engineer for the Scioto Valley Traction Company, of Columbus, will be chief engineer of the new road.

THE UNI SIGNAL COMPANY, of Cambridge, Mass., has just published its Bulletin No. 1. This publication gives a very complete explanation of the Uni signal system, including wiring diagrams and illustrations of the parts used. This is a standard, automatic, non-interfering, two-line wire block signal system, applicable to all electric railway systems, and is especially adapted for all single track trolley electric railways where it is desirable to protect any section of track from both a head or rear-end collision. The Uni Signal Company believes that the adoption of this system will insure safety and obviate delays in traffic necessitated by cars always meeting at a predetermined turnout.

THE OHMER FARE REGISTER COMPANY, besides exhibiting at Saratoga its No. 3 register with safety locks and conductors' identification keys, which are printed with each register record, will exhibit its No. 4 register, which, in addition to all the good features of the No. 3 register, will register and indicate twelve different classifications of fares, print the number of each kind which has been registered at the end of each half-trip, and give to the railway company a complete record of each and every transaction. The company will also exhibit its "Latest Register," specially adapted for city lines for two, three or four classes of fares. This register is so constructed that it can be operated from the rod in the car used with any ordinary register, and with this register the cord is dispensed with. The company expects to be represented at the Saratoga Convention by the following: John F. Ohmer, vice-president and general manager; J. H. Stedman, secretary; Walter E. Hinmon, M. Macdonald, H. A. Eckert and C. W. Ketteman.

THE KNUTSON TROLLEY RETRIEVER, manufactured by the Trolley Supply Company, Canton, Ohio, is meeting with gratifying success, although it has been on the market only a few months. Street railway managers are quick to appreciate the value of any device resulting in improved service, and the success of this retriever is ample evidence of its efficiency. This device is made to instantly, automatically and unfailingly catch the trolley as it leaves the wire, pull it 4 to 6 ft. down and hold it there, out of harm's way. It works unerringly at any speed, however great, in spite of rain, snow or sleet, with trolley rope frozen or not, and without any attention from any one. It is easily and quickly reset and there is no need of

touching it. Among the many railways which have recently adopted the retriever are the following: Canton-Akron Railway Company, Akron, Ohio; Stark Electric Railway Company, Alliance, Ohio; York Street Railway Company, York, Po.; Columbus, London & Springfield Railway Company, Columbus, Ohio; Union Traction Company, Anderson, Ind.; Indianapolis, Shelbyville Railway Company, Indianapolis, Ind.; Lehigh Traction Company, Hazleton, Pa.; Columbus, Buckeye Lake & Newark Traction Company, Newark, Ohio; Youngstown & Sharon Railway Company, Youngstown, Ohio; Detroit United Railway, Detroit, Mich.; Rockford, Beloit & Janesville Railway Company, Beloit, Wis.; Grand Rapids, Holland & Lake Michigan Rapid Railway, Holland, Mich.; Western Ohio Railway Company, Lima, Ohio. Shipments have also been made lately to France, Germany and South America. The company has issued a handsome booklet, describing the retriever, which it will gladly send to readers of the STREET RAILWAY JOURNAL on request.

A RECENT TESTIMONY to the value of flexible metallic conduit was made by Vice-President and General Manager Bryan, of the Interborough Rapid Transit Company, New York, in an interview published in the New York Sun August 12. Speaking of the fireproof construction of the new cars for the subway, and the impossibility of the Paris accident being repeated in New York, he says, according to the N. Y. Sun: "The wiring for lighting the cars is one roof away from the passengers. Two small wires are insulated with asbestos and carried in conduits of flexible metal." The flexible metallic conduit which he refers to is that manufactured by the Sprague Electric Company, who received the order for this type of conduit for the interborough car-wiring for lights. This type of conduit is said to be unequalled for car-wiring as well as the wiring of buildings where thorough protection to wires and insulation is essential. Its flexibility is such that it can be bent around corners and over obstructions with ease, the energy required to bend it being no more than is required to bend a manilla rope of the same diameter. No elbows, therefore, are required and the installation is reduced to absolute simplicity. It is self-evident that this type of conduit is well fitted to car wiring.

THE CONSTANTLY INCREASING DEVELOPMENT of electric railways, with the corresponding increase in the use of heavy, high-speed cars, is reflected in the remarkable growth of the National Electric Company's air brake business. During the first half of the present year this company's shipments of Christensen air brakes equalled the entire business of 1902, which was the largest year in the company's history. Among the recent orders for air brake equipments received are the following: Birmingham Railway Light & Power Company, Birmingham, Ala., 37; Little Rock Railway & Electric Company, Little Rock, Ark., 25; United Railway of San Francisco, San Francisco, Cal., 58; Pacific Electric Railway Company, Los Angeles, Cal., 90; Denver City Railway, Denver, Col., 25; Connecticut Railway & Lighting Company, Bridgeport, Conn., 36; Chicago City Railway Company, Chicago, Ill., 20; Lake Street Elevated Railway, Chicago, Ill., 40; Northwestern Elevated Railroad Company, Chicago, Ill., 35; Indianapolis Traction & Terminal Company, Indianapolis, Ind., 25; Tri-City Railway Company, Davenport, Ia., 16; Middleton & Danvers Street Railway Company, Danvers, Mass., 16; Boston & Worcester Electric Company, Boston, Mass., 27; Twin City Rapid Transit Company, Minneapolis, Minn., 177; Metropolitan Street Railway Company, Kansas City, Mo., 60; New Jersey & Sea Shore Railway Company, Atlantic City, N. J., 50; New Jersey & Hudson River Railway & Ferry Company, Edgewater, N. J., 18; Public Service Corporation, Jersey City, N. J., 150; International Traction Company, Buffalo, N. Y., 41; Brooklyn Rapid Transit Company, Brooklyn, N. Y., 52; Interborough Rapid Transit Company, New York, N. Y., 350; Cincinnati Traction Company, Cincinnati, Ohio, 70; Northern Ohio Traction Company, Akron, Ohio, 18; Philadelphia Rapid Transit Company, Philadelphia, Pa., 175; The Rhode Island Company, Providence, R. I., 233; Nashville Railway Company, Nashville, Tenn., 16; Chesapeake Transit Company, Norfolk, Va., 18; Seattle Electric Company, Seattle, Wash., 16; Tacoma Railway & Power Company, Tacoma, Wash., 26.

THE FOLLOWING IS A PARTIAL LIST OF ENGINE SALES for July, 1903, by the Allis-Chalmers Company, Chicago, Ill.: Chicago Beach Hotel, Chicago, Ill., one 16-in. x 36-in. heavy-duty direct-connected Reynolds Corliss engine; Knox Construction Company, Chicago, Ill., two 20-in. and 40-in. x 48-in. heavy-duty cross-compound direct-connected Reynolds Corliss engine; Richmond Cedar Works, Richmond, Va., one 24-in. and 36-in. x 48-in. heavy-duty cross-compound Reynolds Corliss engine; Barrett Manufacturing Company, Beloit, Wis., one 20-in. and 40-in. x 48-in. heavy-duty cross-compound Reynolds Corliss engine; American Aristotype Company, Jamestown, N. Y., one 18-in. x 36-in. girder frame Reyonlds Corliss engine; Stilwell-Bierce & Smith-Vaile Company, Dayton, Ohio, one 16-in. x 42-in. girder frame Reynolds Corliss engine; Fourche River Lumber Company, Chicago, Ill., one 24-in. x 48-in. heavy-duty Reynolds Corliss engine, one 20-in. x 42-in. heavy-duty Reynolds Corliss engine; J. I. Case Plow Works, Racine, Wis., one Reynolds air pump and jet condenser; Consumers' Heat & Electric Company, Bloomington, Ill., one 20-in. and 32-in. x 36-in. heavy-duty cross-compound Corliss engine; Union Sugar Company, San Francisco, Cal., one 18-in. x 36-in. girder frame Reynolds Corliss engine; Canton Oil Mill Company, Canton, Miss., one 16-in. x 42-in. girder frame Reynolds Corliss engine; Henry Du Pont, Wilmington, Del., one 20-in. x 42-in. girder frame Reynolds Corliss engine; Olds Motor Works, Lansing, Mich., one 16-in. x 42-in. girder frame Reynolds Corliss engine; The Clayton Oil Mills, Clayton, N. C., one 18-in. x 42-in. girder frame Reynolds Corliss engine; The Home stake Mining Company, Lead, S. D., one 18-32-34-in. x 42-in. combined horizontal-vertical triple expansion engine, three 320-hp Sederholm boilers; Lacey-Buek Iron Company, Birmingham, Ala., one 44-in. and 84-in. x 60-in. vertical standard furnace-blowing engine; C. A. Macdonald, Chicago, Ill., one 16-in. x 36-in. girder frame Reynolds Corliss engine, without crank, crank-shaft, wheel, etc.; Arkansas City Milling Company, Arkansas City, Kan., one 22-in. x 42-in. heavy-duty Reynolds Corliss engine; Manhattan Rubber Manufacturing Company, Passaic, N. J., one 24-in. and 40-in. x 42-in heavy-duty tandem-compound Reynolds Corliss engine; Charles B. Pride, Appleton, Wis., one 18-in. x 36-in. heavy-duty Reynolds Corliss engine, substituted for 14-in. x 36-in., sold May 25, 1903; Columbus, Buckeye Lake & Newark Traction Company, Columbus Ohio, one 34-in. and 68-in. x 48-in. vertical cross-compound condensing heavy-duty Reynolds Corliss engine; Lock, Moore & Company, Limited, Westlake, La., one 24-in. x 48-in. heavy-duty Reynolds Corliss engine; Georgia Cordage Mills, Decatur, Ga., one 16-in. x 42-in. heavy-duty Reynolds Corliss engine; Marquette Cement Manufacturing Company, La Salle, Ill., one 20-in. x 42-in. heavy-duty Reynolds Corliss engine; Coe Brass Manufacturing Company, Torrington, Conn., one 22-44-in. x 42-in. and one 19-38-in. x 42-in. combined horizontal and vertical compound Reynolds Corliss engine, two air pumps and two jet condensers.

THE FRANKLIN ROLLING MILL & FOUNDRY COMPANY now has in operation at Franklin, Venango County, Pa., a perfectly equipped and up-to-date plant in every respect. The plant is divided into five departments, comprising the steel pole department, rolling mill, malleable-iron foundry, gray iron foundry, steel and iron rivet department. The tripartite steel pole department has been established by the company as a specialty to fill a long-felt want, as wooden poles are becoming scarcer and dearer from year to year. As this company is the owner of the basic patents covering this pole, and is the only manufacturer of the same, it has been able to produce and sell these excellent poles at a price very little above that of wooden poles. These tripartite poles are specially designed to meet particular strain conditions, so that the purchaser is not obliged to pay for more metal than is actually required. This type is well fitted for electric railways, power transmission lines, telephone and telegraph lines, etc., because it is simple in construction and possesses great strength and elasticity. It can also be quickly and economically installed and, being made of high carbon steel, will not deteriorate. The company is prepared to guarantee the pole in every way, and will also contract for all the overhead construction with any railway company wishing to do so. The rolling mill department is used for the production of high-grade rolled steel for light structural work. A "U" section shape is a specialty of this department. This section is rolled from old steel rails and is high carbon, running from 30 to 40 points, which gives it strength and elasticity. This section is used in the construction of the tripartite steel pole for all overhead construction. The daily capacity of this department is about 80 tons. The malleable-iron department is equipped with the latest and most improved refined air furnaces, which produce the finest high-grade iron. The annealing ovens are arranged to insure perfect annealing. The gray iron department is furnished with one of the best cupolas known, and has a daily capacity of 50 tons. It is furnished with very heavy traveling cranes for handling any size castings. The steel and iron rivet department is equipped with the most improved furnaces and automatic machines for making soft rivets from Bessemer steel of structural sizes and any shaped heads. The capacity of this department is about 50 tons per day.

BRITISH INDUSTRIAL NOTES

J. G. White & Company, Limited, of London, have secured the tender for the supply and erection of the overhead line equipment of the Rochdale tramways, the amount being £21,619 13s. 10d. The same firm has also received the contract for the construction of the Colchester Tramways, including permanent way and overhead construction, amounting to £35,035.

G. D. Peters & Company, of Moorfields, London, who are the exclusive agents for Hale & Kilburn, of Philadelphia, have just issued a very interesting pamphlet showing a number of internal views of tramcars and railway cars fitted with their special seats, one of the views showing the interior of one of the cars recently built by the Brush Electrical Engineering Company for the Metropolitan District Railway, and which was furnished with Hale & Kilburn seats by G. D. Peters & Company. Another interesting view shows a sectional view of the rattan seating, which shows also the construction of the rattan. This rattan seating will undoubtedly become more and more popular in this country, as it is cool and cleanly and can readily be washed and kept clean.

The Elswick Coal Company, of Newcastle-on-Tyne, has placed a contract with Ernest Scott & Mountain, Limited, of the Close Works, Newcastle-on-Tyne, for a complete electric pumping plant for its North Elswick colliery. A feature of interest in connection with this plant is the fact that the colliery company is proposing to take the current for driving the pumps from the town supply mains. The plant consists of a Scott & Mountain horizontal slow-speed three-throw ram pump, delivering 400 gallons per minute against a vertical head of 800 ft., the pumps being driven by a Scott & Mountain multipolar continuous-current electric motor of 130 hp, the pump and motor being placed at the shaft bottom and delivering to the rising main to bank. The current will be taken from the supply company's mains to the shaft top, then down the shaft to the pumps in-bye, these cables being of sufficient capacity to transmit 150 hp at 500 volts, the cables being insulated and heavily armored for protection in the shaft. Another installation recently secured by the same firm, is for an electric conveyor of the Brothers type for conveying railway material from one side of the Victoria Falls on the Zambesi to the other, and also to be used in connection with the erection of a bridge which the Cleveland Bridge & Engineering Bridge Company is supplying. The electric conveyor consists of a hoisting and traveling gear, which runs upon a wire rope, suspended from one side of the falls to the other, the distance being 830 ft., and the weight of the rope and the load is supported at each end by balanced cantilevers. The wire rope is being supplied by T. & W. Smith, of Newcastle, and the cantilevers and other work by the Cleveland Bridge Company. The current for driving this plant is generated by a portable steam engine and dynamo on one side of the falls, the current being conveyed across the falls by a hard-drawn copper conductor, and collected by rollers. The firm is now very busy with mining work, having contracts in hand for Walbottle Colliery, Consett Iron Company, Limited, both these collieries being in the Newcastle district; also for the Wigan Coal & Iron Company, Limited, North Manchester, the Llay Hall Colliery, North Wales, and a number of other important contracts.

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The Saratoga Conventions

This year's gathering of street railway men at Saratoga was exceptional not only because of the large number in attendance and the interest displayed in the proceedings, but because of the fact that three conventions were conducted at practically the same time. Saratoga possesses many attractions as a convention city, and the Hudson and Mohawk Valleys are especially interesting to electrical railway men. The parent organization was, of course, the principal factor, but the newer associations, comprising the Accountants' and the Mechanical and Electrical organizations, came in for their share of attention.

The list of papers prepared for the American Street Railway Association proved to be one of the most attractive that was ever presented to that organization, and the work of the several committees, as reported to the Association, showed exceptional care, and a very large amount of work and earnest thought on the part of the individual members. Vice-President Ely, who presided, owing to the unavoidable absence of President Hutchins, commended the committees for their earnest work and the excellent results shown by their reports. This recognition was well deserved.

In the meeting of the Accountants' Association the reports of the president, secretary and several committees showed that the organization has made considerable progress, and is now in a very flourishing condition. The secretary's report, however, emphasized the necessity for increasing the membership, and pointed out that representation in this Association was of vital importance to every operating company in the country, and that it was for the best interests of the industry as a whole that the companies should support and encourage the work in which the accountants were engaged. Vice-President Ely, of the American Street Railway Association, also referred to this feature in his opening address, and commended the results brought about through the persistent agitation of the accountants, which resulted in securing uniformity. The fact that financial interests throughout the country favored the methods advocated by the accountants, and the governmental recognition that had been extended to its work were subjects of much favorable comment.

Taken altogether, the meetings of each organization were thoroughly satisfactory in every respect, and the proceedings were conducted in a business-like manner, in keeping with the magnitude and character of the interests involved.

The Next Convention

There is undoubtedly a very strong sentiment in favor of selecting St. Louis for holding the convention in 1904. The principal argument in favor of going to St. Louis is, of course, that this will give all of the delegates an opportunity of visiting the Louisiana Purchase Exposition. It is needless to say that every member of the Association would like to make this trip next year, but it would be difficult for many of the active members to absent themselves from business for a week or more twice during the summer or fall, once to visit the Exposition and once to attend the annual meeting of the American Street Railway Association. There are other reasons, however, urging the selection of St. Louis as the convention city in 1904. Among them are the advantages to the entire railway industry of combining the meeting of the American Street Railway Association with that of the International Electrical Congress, as is proposed by the managers of the Exposition; while still a third argument is that St. Louis itself is an attractive city in which to hold a street railway convention, and those who attended the convention held in that city in 1896 will not soon forget the hospitality extended on that occasion.

There are, of course, arguments against the selection of St. Louis as the convention city in 1904; one is the crowded condition of the city at that time, another the possible difficulty of so arranging the programme of the Association as to combine the usual two or three-day sessions of the Association with the union meeting proposed by the International Electrical Congress; another that the exhibits at the Fair will be somewhat scattered, being divided between the electrical and transportation buildings of the Exhibition. We believe, however, that these difficulties are all of minor importance and that they can be so adjusted as to insure a satisfactory meeting in every

respect if St. Louis is selected. The subject will be thoroughly discussed before any decision is reached, and the advocates for St. Louis will undoubtedly have an opportunity of presenting the claims of that city. The sentiment so far expressed is in favor of its selection.

The Right of Way

Mr. Vreeland's paper before the American Street Railway Association, though short, points out clearly a phase in the relations between railway companies and the public which is often forgotten by both. The reason for the existence of the railway company is that it serves the public, and any obstacle placed in the way of its performing this mission is an injury to the public. Nevertheless, there often seems to be an idea in the minds of the authorities and the public in general that when an individual becomes a passenger on a street railway his interest as a member of the community ceases, or at least is subordinate to that of the portion of the public which is outside of the car. Statistics show that the street railways of the country serve a very much larger number of people than any other public utility in which electric power is used. This fact can be graphically illustrated by the statement that where the average number of times each person in this country uses the telegraph is twice a year and the telephone from forty to fifty times a year, the average man will ride sixty-three times on a street car; and where he spends $1 on electric lighting from central stations he spends $3.20 for transportation by electric cars. In the discussions which sometimes arise in regard to the service given and required of street railway companies, the position taken by the authorities and daily press often seems to be that any request made by the companies for additional terminal facilities, extensions or higher speeds should be regarded in the light of an attempt of the company to benefit at the expense of the city. The abutting property owner, the team driver and the needs of the city treasurer always figure conspicuously in discussions of this kind. The wishes and requirements of the public as regards satisfactory transportation service seem not worth considering. As Professor Sumner would say, the street railway passenger is the "forgotten man." Nevertheless, every inhabitant of each moderately sized city rides on the street cars on an average of from 100 to 200 times during the year, and as Mr. Vreeland clearly points out, from this standpoint alone a crowded car full of people should, by mere preponderance of the number of individuals which it contains, have a superior right of passsage to a vehicle with a single individual in it or to a van containing merchandise.

Type-M Control

The title of Mr. Mundy's paper, perhaps, sounded at first a little too much like an advertisement of one particular company's controlling apparatus to be in place on the programme of a national association, but the opening paragraphs abundantly explain why such a title was justified and also throw considerable light on the present status of train-controlling systems. As pointed out by Mr. Mundy, there has been a most complete abandonment by the manufacturing companies of the cylinder-type controller for multiple unit work, and the only train-control system about which particulars were available, which was being pushed on the market at the time the author prepared his paper, was the one mentioned in its title. Mr. Mundy points out the general defects of any system of control for handling heavy currents where the contacts and arc-extinguishing devices are crowded too close together, and where the movement of the contacts is dependent upon the speed with which the motorman turns his controller, as in a cylinder, hand-operated controller. Attention is called to the fact that since the train-control systems have come into use they have also been adopted on locomotives and single-car equipments as well as for train control, although the train control feature will never be used in the new applications. They have been adopted in such places solely because of their ability to handle safely the large current necessary for electric locomotives and for heavy high-speed interurban cars. A number of interurban and elevated motor cars have been equipped with type-M control recently, simply for the reason that this form offers freedom from excessive trouble with controllers and places the bulk of the controlling apparatus under the car rather than on the platform.

Transferring Trucks in the Repair Shop

In the paper by Alfred Green on "Shop Practice" mention is made of one point in regard to the equipment and arrangement of new repair shops that is sometimes forgotten. This is the matter of providing facilities for removing the trucks of double-truck cars from under the car bodies for repairs. It is frequently desirable to take the truck from under the car body and substitute another in its place immediately. Mr. Green refers to the use of the transfer table for this purpose, which makes it possible to take the truck out sideways. In this way it is only necessary to raise the car body about 6 ins. in order to take a truck from under, which is considerably less time than would be required to run the truck out from under the end. If the road has a traveling crane the trucks can be picked up bodily and set down in any part of the shop desired, but very few roads, as yet, have traveling cranes spanning their shops. Another plan is to run the car over a truck elevator, which will lower the truck away from the car body. The old truck can then be taken off the elevator, and the new lifted into its place by the same apparatus. On a road which is constantly using the greater part of its equipment, so that there is only a small reserve, ability to change trucks quickly cannot be over-estimated. By always keeping a truck in good running order, ready to slip under any car upon which one of the motors may have become defective, it is necessary to detain the car but a very short time if there are good facilities for changing trucks.

Another matter of detail mentioned by Mr. Green which greatly adds to the neatness of the shops, to say nothing of saving time, is that of putting all loose parts away when the car is being repaired, rather than letting them lie around the shop floor during that time.

Improvements in Street Car Motors

Mr. Olds' paper on this subject puts in concrete form a number of the advanced ideas the author has advocated in street railway motor design for several years. As the double-truck car as a standard for city service was early adopted in Milwaukee, Mr. Olds probably felt the desirability of doing away with pit work sooner than a great many master mechanics, and he has been an earnest advocate of the type of motor which would be accessible from above for inspection and repairs. He does not believe that the quality of work done in the pit can ever equal that done on the open floor. Therefore, one of the principal features incorporated in the new motors which were designed especially to meet the ideas of the Milwaukee management, was a motor case which could be opened from above without disturbing the motor frame in the truck. The other improvements outlined by Mr. Olds and incorporated in these motors are, in general, a larger bearing surface for all wearing

parts, and oil lubrication, as a substitute for grease lubrication, used till recently on all smaller sizes of motors. These are all substantial improvements and will no doubt soon come into general use. We are enabled to present a complete description of these improvements in this issue, and we are sure that this article will be read with special interest at this time.

Care and Maintenance of Car Bodies

One of the strongest impressions gathered from reading the paper of C. F. Baker on this subject, is the thoroughness with which details are looked after in the assembling of car bodies in order that there may be no looseness in the joints or opportunities for moisture to creep in. "The painter should work hand-in-hand with the builder from the beginning to the finish of the car," says Mr. Baker. "The painter shall have one paramount idea in view, viz., durability." The highest degree of finish is not recommended, but rather that attention to the various coats which will give the longest life. The effect of moisture, when allowed to enter the frame work of a car, is said to be equalled only by fire and dampness. It is impossible to discuss in detail at this time the numerous points taken up by Mr. Baker, but his paper goes to show the great care given to all details, both in the construction and maintenance of car bodies on the great system at Boston.

A Good Begining

Beyond a doubt one of the most successful, useful and profitable gatherings of street railway men that has yet been held is the meeting this week at Saratoga of the American Railway Mechanical and Electrical Association. The proceedings of this infant association at its first convention have demonstrated beyond all doubt that the "Master Mechanics' Association," as it is familiarly known, is a great success, and that it will henceforth play the important part that such an association should in the development of the street railway industry.

Previous to the convention the fact that the American Railway Mechanical and Electrical Association was organized and prepared to do business, was perhaps not as well known among the street railway companies of the country as it should have been. Considering this, the excellent attendance at the very first session and the extended discussions, full of points of practical value to every company, were all the more encouraging. But after all it is not strange that the practical mechanical and electrical heads of departments of a road should be able to discuss matters pertaining to their departments better than the presidents and other higher officers of the companies who of necessity get much of their knowledge of these things second hand. It has been a matter of common remark for several years that the discussions on mechanical and electrical subjects in the American Street Railway Association meetings have been, with a few notable exceptions, woefully lacking in the exchange of experiences on practical details and methods of overcoming difficulties. Now that the mechanical men have gotten into a convention of their own, there is a free and profitable form of discussion which is productive of lasting benefit. This was amply demonstrated at Saratoga.

And now a word to non-member companies. This in an association that no live company which is looking out for its own interests can afford to stay out of. Neither can any master mechanic or electrical engineer of a road afford to remain off the association or personal membership roll, nor stay away from its conventions. To be sure, we are reporting the proceedings as fully as practicable in our columns, and those who cannot attend conventions and are not members can read them; but reading the proceedings cannot take the place of actual attendance at the convention. The "heart-to-heart talks," as they were jokingly called, where experiences and results obtained with particular kinds of goods were exchanged, were worth many dollars to those taking part in them, but for obvious reasons will never be seen in print.

Another commendable thing was the disposition of this new association to get down to business and stick to it. The junketing feature of conventions has to the knowledge of many kept down the attendance of those street railway men who believe that conventions should be for business purposes, and who do not care to spend the money and time involved unless results of practical value are discernable. We happen to know from certain plain talking at the sessions of the executive committee, as well as from conversation with many prominent men in the new organization, that it is to be conducted on the principle of "business first." That most of those in attendance were there with that idea in mind, the proceedings and the interest displayed amply demonstrate.

The new organization has made a good beginning and is entitled to respect, support and co-operation, and we believe that the railway interests of the country will respond in a way that will meet the expectations of those who have worked so hard to bring about these results.

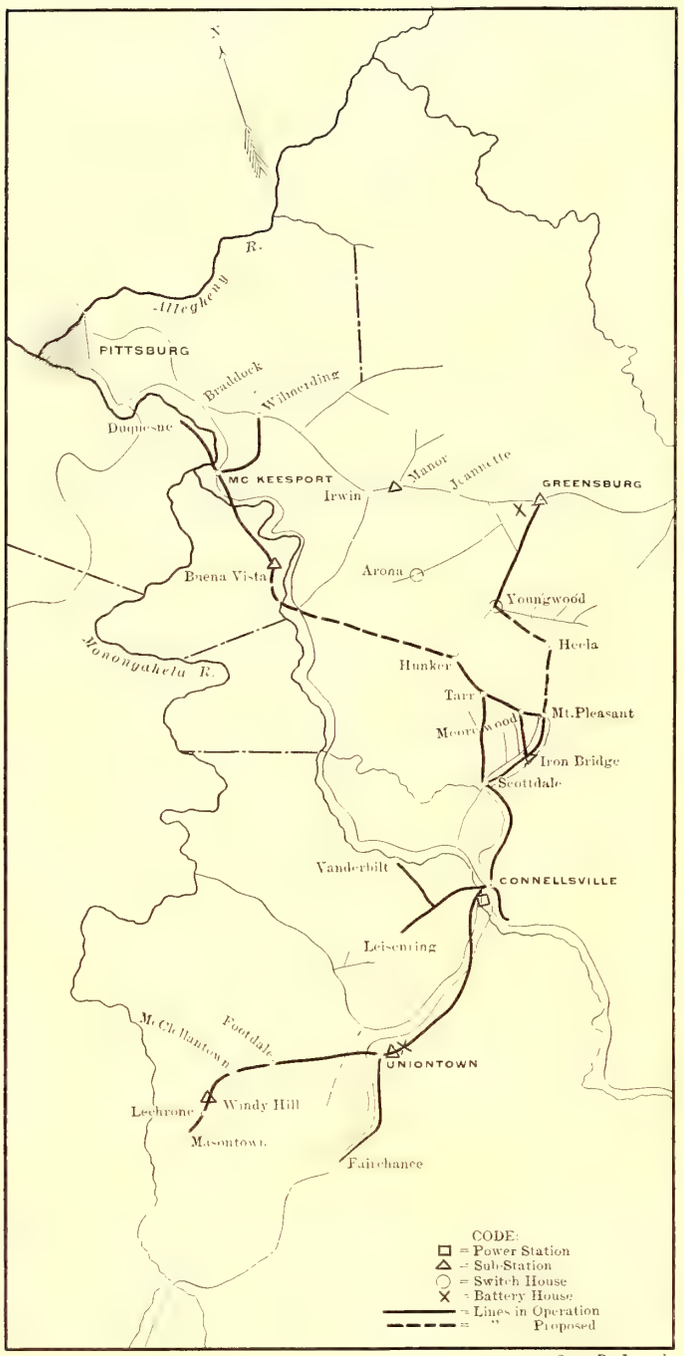
Shop Kinks

Mr. Adams' paper on "Shop Kinks," read at the convention of the American Railway Mechanical and Electrical Association, described a number of methods of accomplishing certain work peculiar to the shops of which he has charge in Baltimore. Some of these methods we know personally to have been adopted immediately, and with profit, upon their becoming known by the master mechanic of another large street railway company, which illustrates their practical value and the value of such papers. Experience has taught us, and we have tried to impress the lesson on others, that articles on shop kinks are always eagerly sought for and attentively read by progressive master mechanics. There is probably no class of street railway literature which is more appreciated or which leads to larger direct and immediate net returns in dollars and cents to those who make use of the suggestions. It is, of course, out of the question to expect any one man to give a large number of shop kinks in a convention paper, although Mr. Adams seems to have had a great wealth of material to draw from in his shops, but such a paper should cause others at the convention to "loosen up" in discussion, with the ultimate result of bringing out an immense fund of valuable knowledge on shop practice. It might not be a bad idea to follow the practice of the National Electric Light Association and start a question box, so that members can seek information during the year regarding the best way of accomplishing certain things, and also, in addition to answering the questions propounded by other members, give special ingenious methods used in their shops.

Among the features of Mr. Adams' notes to which especial attention should be called is the apparatus for revealing short-circuits in newly wound armatures. This apparatus makes use of an alternating field, and locates short-circuited coils easily and certainly. Mr. Adams' method of reinsulating fields, the wire of which is too heavy to be handled by the reinsulating machine, has been adopted with profit in other places. The other shop practices he describes are all well worth considering.

THE WEST PENN RAILWAYS AND LIGHTING SYSTEM

In many sections of the country there are mining and other industrial communities scattered over districts of 50 miles to 100 miles in extent, where the occupation and prevailing nationality of the inhabitants create a unification of interest both from a social and business standpoint. Especially is this true of the mining and coke regions of Middle and Western Pennsylvania. Numerous small towns, varying from 1000 to



MAP OF RAILWAY LINES OF WEST PENN SYSTEM.

10,000 inhabitants, constitute the nuclei of a larger distributed population, and in few cases have the more important towns failed to provide light and power, and, in some instances, railway plants for their exclusive service.

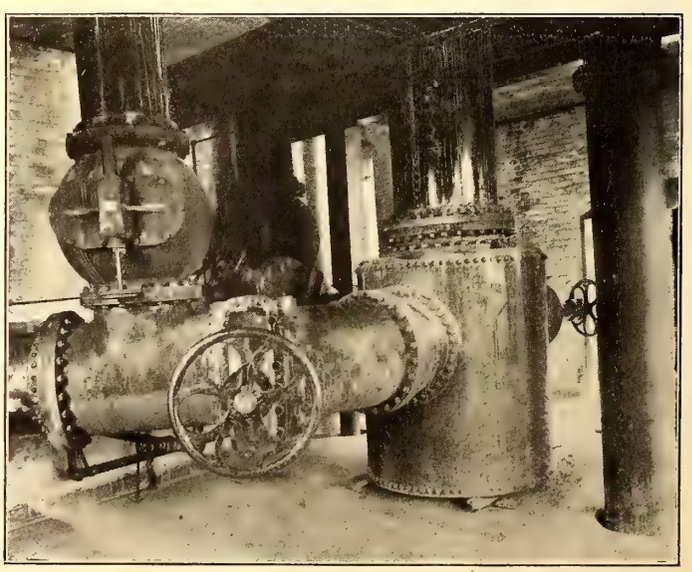
The system of the West Penn Railway & Lighting Company, in its scope and purpose, is a noteworthy example of modern practice in the rejuvenation of obsolete systems and the centralization of power stations. The forerunner of the present West Penn system was the Pittsburg, McKeesport & Connellsville Railway Company, the title under which the constituent railway companies now exist. It was originally intended to operate a line between the last two cities, and extend a line north to connect with that of the Pittsburg Railways. As the project grew, however, new opportunities arose, branches and extensions were decided upon, and, finally, local lighting was taken up in connection with the railway work, the company reorganizing for the purpose into the West Penn Railway &



MAIN POWER HOUSE, SHOWING TRANSFORMER HOUSE AND INTAKES

Lighting Company. The extent of the company's present operations may be judged from the fact that up to the present time four important railway power stations have been shut down, and at the completion of the lighting system and outlying substations three additional railway plants and eight lighting plants will have been discontinued, power for the entire system being supplied from one central power station.

The country in which the company operates is aptly termed the coke region, although many manufacturing interests are present. Important among these are the National Tube Works at McKeesport, and other large iron works, foundries, cast-iron pipe works and firebrick manufactories at several points in the



INTERIOR OF CONDENSER HOUSE

neighborhood of Uniontown, Scottdale, Greensburg and Connellsville. The towns in this territory are exceptionally prosperous, many of their citizens being men of large wealth and beautiful homes, derived from the sale of coal land to the Frick and other coke and coal companies operating in the district.

The road traverses the most populous district of Fayette and Westmoreland Counties, and the most important industrial section of Allegheny County, Westmoreland County being the fifth and Allegheny the second in population in the State. Six of the towns served aggregate, according to the census report, 65,000 inhabitants, ranging from 5000 to 35,000, and include two county seats, Greensburg and Uniontown. Twenty-four smaller towns, varying in population from 500 to 2000, are also served. The population tributary to the road is, however, much greater than is at first apparent from census reports, by reason of the large number of coke workers settled in the rural districts, and it is estimated that within a strip 2 miles in width on either side of the route there are fully 350,000 inhabitants who may be counted upon for patronage. In some districts an almost continuous community exists between towns, largely resulting from the topographical character of the country which confines the population within a narrow belt, through which the road runs.

RAILWAY LOCATION

The present railway property comprises three independent sections, which will be ultimately connected into one continuous or interconnecting system. Branches extend north of McKeesport and connect at Duquesne and Braddock, respectively, with Pittsburg Railways lines running into Pittsburg. This section and the former Greensburg and Southern Railway were operated independently until taken over by the syndicate. A short suburban line serving South Connellsville and outlying districts was also included in the system. The extensions now under way comprise a 15-mile line from Scott Haven to Hunker, completing the through line from Pittsburg to Connellsville; a branch from Mt. Pleasant through Hecla to Youngwood, thus connecting Greensburg with the main line, and a 2.9-mile extension from Lechrone, giving a southern terminus at Masontown.

The total length of single-track line at present in operation aggregates approximately 100 miles, half of which is through line. The extensions under way aggregate 25 miles, so that the completed road will consist of 75 miles of through line and 50 miles of city and suburban line. The greater portion of the route through rural districts is over private right of way, and in the present system but 31.6 miles operate on or along public highways.

The country traversed by the Pittsburg, McKeesport & Connellsville road is along natural water courses which are generally devious, and the location of suitable roadbed at times was found a difficult matter. Additional complications, arising from unavoidable intersection with present steam roads, including the Baltimore & Ohio, Pennsylvania and Pittsburg & Lake Erie, were met. For the greater part of its length the line parallels two, and sometimes all of these steam roads, which, in following the natural levels, have occasioned much difficult construction work for the electric line. Severe grades, in some cases as high as 10 per cent, have been encountered, especially in towns, and several curves of 50-ft. radius were occasioned by natural obstacles. The main section of the line, however, exclusive of towns, is well located, considering the geographical character of the country, which has proven serious, even to steam roads with their more favored locations.

THE ROADBED

The right of way averages about 26 ft. in width, sufficient to accommodate a single-track line. Rock ballast was used where the material was available, and slag and cinder for the balance. The track is laid with No. 70 A. S. C. E. rail, on 8-ft. oak ties, with the exception of sections through towns where 7½-in. grooved girder rail is generally used, thus limiting the depth of wheel flanges to ¾ in. A 5-ft. 2½-in. gage is necessitated by the State laws framed for the purpose of facilitating vehicular traffic over city streets. Elevation of the outer rail occurs at all curves and easements are provided on all except very long radius curves. Flange guards are also used, consisting partly of standard rolled section bolted to the rail web, and partly of old T-rail, with special cast-iron separators. Spring switches are generally employed in the country, and tongue and mate switches through towns with solid frogs throughout. Some of these are of the cast-joint pattern furnished by the Indianapolis Switch & Frog Company. Wharton and Lorain special hard center work is otherwise generally used. The rails are bonded with 0000 Crown protected web bonds, compressed into ⅞-in. drilled holes, and cross-bonds are applied at intervals of 500 ft. All special work is completely shunted by copper cable running underneath the track, so that renewals may be made without opening the track return circuit.

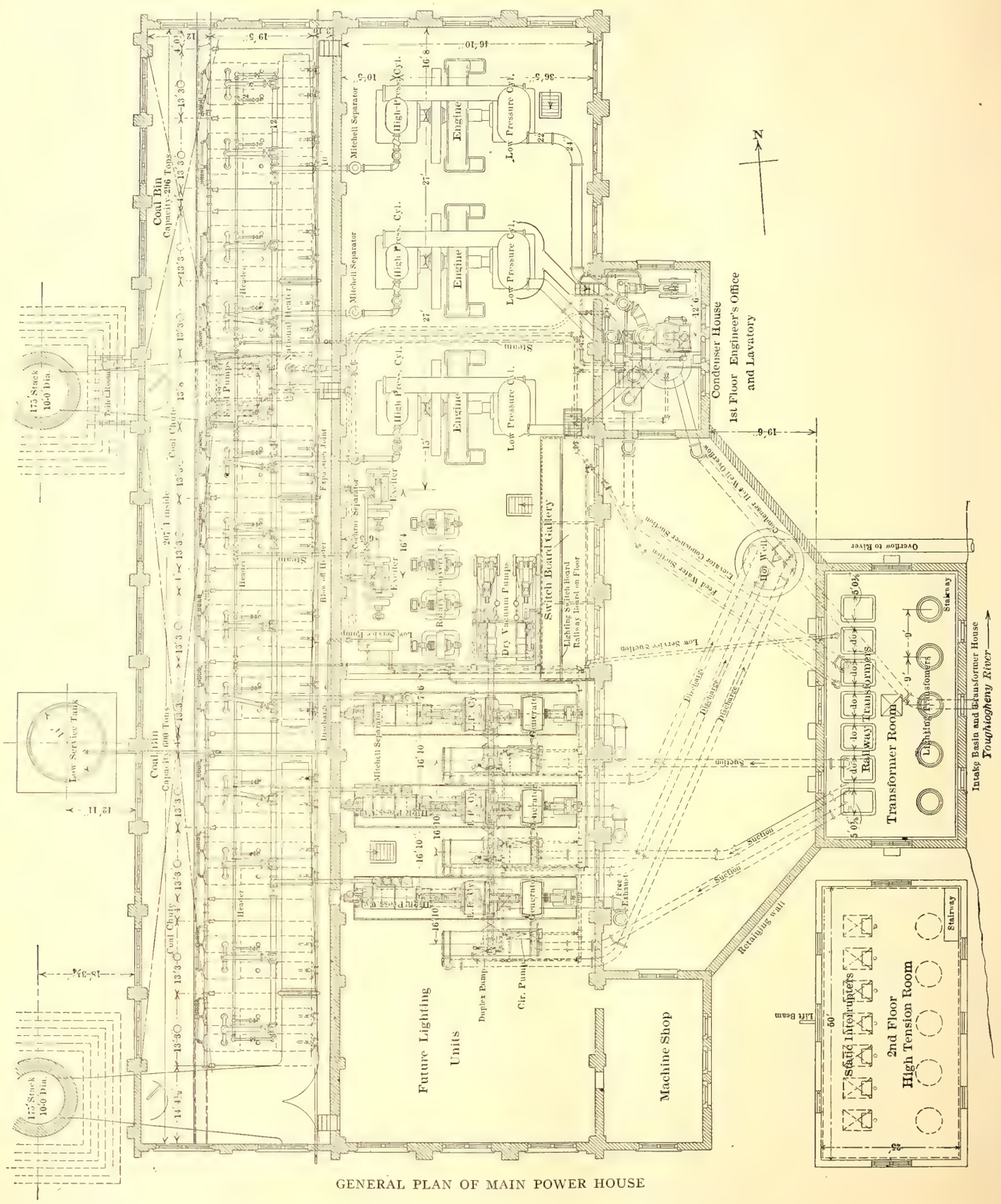


BOILER ROOM, SHOWING SETTINGS AND COAL BUNKER CONSTRUCTION

Considerable bridge work was encountered, perhaps the most difficult being a short distance south of Connellsville, where it was necessary to elevate crossings of the Baltimore & Ohio Railroad and Pennsylvania Railroad tracks, and to make an

abrupt 90-deg. turn at the end of the bridge to avoid crossing a third set of surface tracks. The bridges are all of steel, and of the deck girder pattern.

The line is provided with turnouts at frequent intervals, the exact location of a number of which will be largely determined by future development in traffic and running schedules.



GENERAL PLAN OF MAIN POWER HOUSE

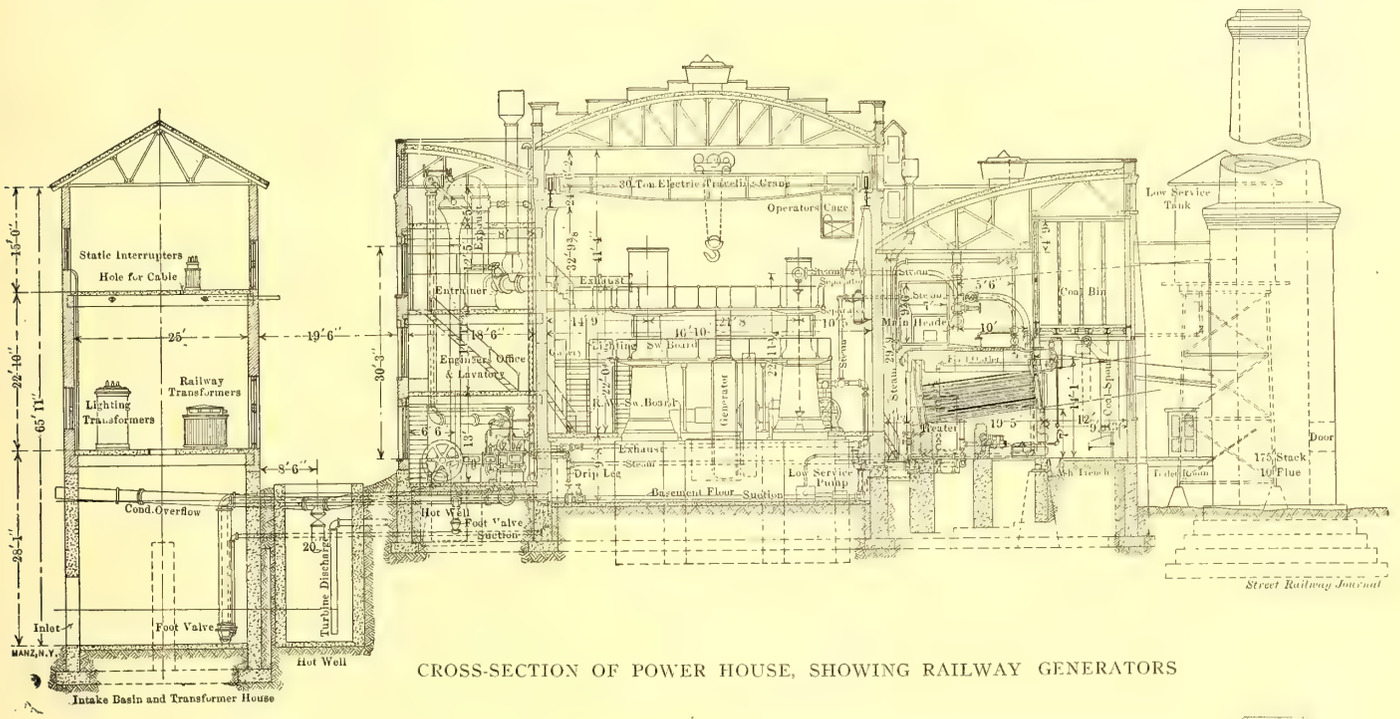
POWER EQUIPMENT

Previous to the incorporation of the West Penn system no less than a dozen plants were in operation within a 20-mile circle, centering at Connellsville. These furnished 550-volt current for railway operation and arc and incandescent lighting at numerous voltages and frequencies. The equipments were in many cases obsolete, although still serviceable, and flat rates for lighting prevailed.

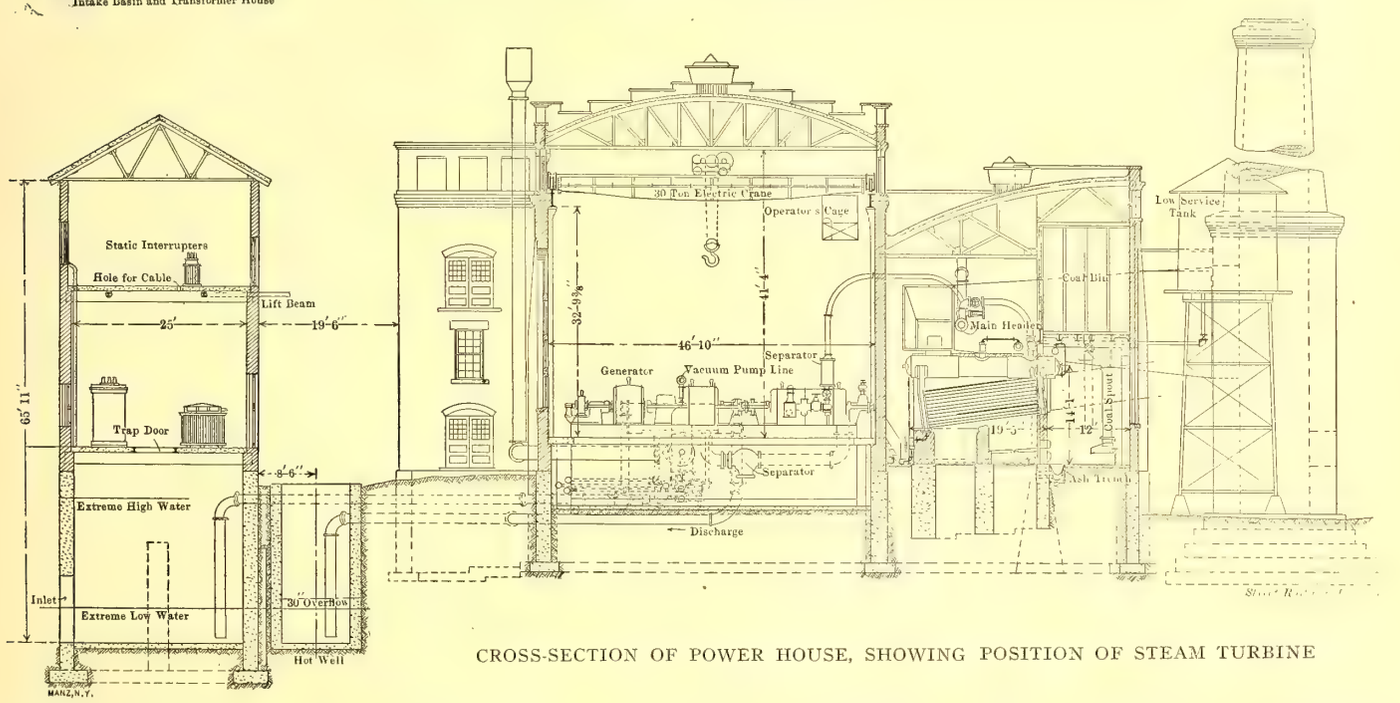
The entire electrical separation of railway and lighting systems has been effected, but common distributing points have been adopted, and all apparatus is housed in the same buildings.

The power generating station, serving the entire district, is located on the banks of the Youghiogheny River, about 1¾ miles south of Connellsville, on the New Haven bank. The site furnishes excellent coaling facilities and mountain water supply, and is the logical electrical center of the system. Low-

tension, alternating-current is generated at the station, and high-tension alternating-current transmission at 22,000 volts is employed for both systems. The power is transmitted by pole line over a private right of way to the sub-stations, where the current is transformed at these points to the proper distribution potential, 650-volt direct current for railway, and 2200 volts, two-phase alternating current for lighting work. One of the rotary converter equipments is stationed at the power house and receives current at 390 volts, directly from the main alter-



CROSS-SECTION OF POWER HOUSE, SHOWING RAILWAY GENERATORS



CROSS-SECTION OF POWER HOUSE, SHOWING POSITION OF STEAM TURBINE

nating-current bus, thus avoiding the cost of a transformer equipment and maintenance of a nearby sub-station to supply the immediate district. Similarly, local lighting is furnished directly from the power station, the generators being wound for 2200 volts for this purpose.

A feature of the lighting equipment is the employment of steam turbines in 1000-kw units. These were determined upon subsequent to the consolidation of railways and lighting interests, not only for their unique suitability for the lighting service, but particularly for the large saving in cost of power house extension.

Incandescent lighting is furnished entirely upon the 110-volt three-wire, alternating-current system, with ungrounded neutral and O. D.-type grouped transformers. Commercial lighting is also supplied from these mains through constant potential enclosed arc lamps. Constant current series enclosed arcs are employed for street lighting with 7½-amp. tub transformers, located in all cases in the sub-station. Primary distribution feeders are, in many cases, carried upon the railway pole line, where districts common to the two systems are served.

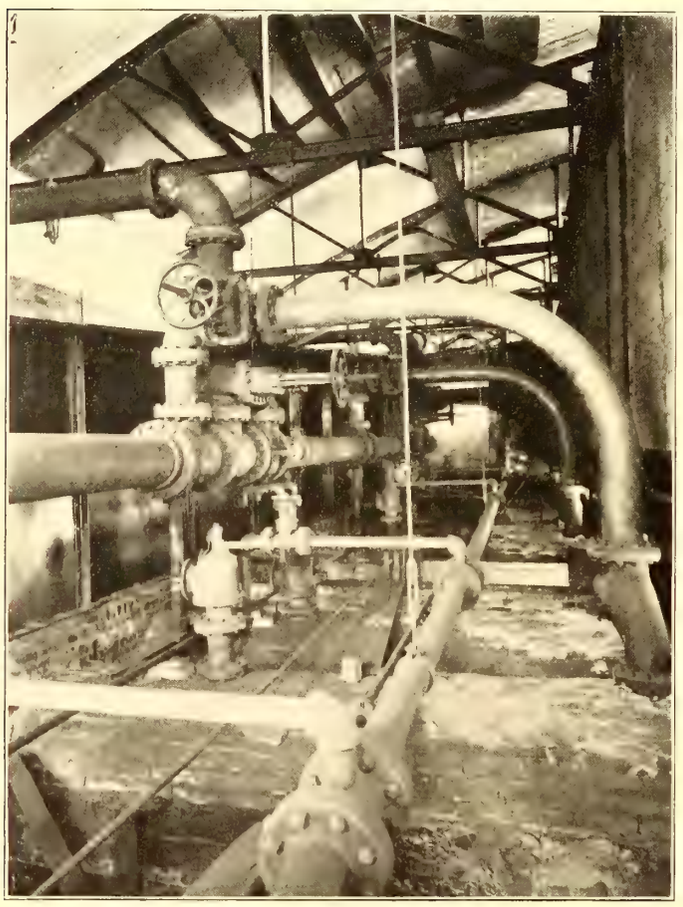
Power consumers are generally supplied with independent transformers, excepting in cases of small single-phase motors, of which a number are in service of both Wagner and General Electric type. Large motors are of the polyphase induction type, and one motor of 500 hp has recently been ordered to drive a mine air compressor. In such cases individual transformers and feeders will be used. In variable speed motor work, such as industrial haulage work, direct current will be supplied from the railway feeder system.

In addition to the sub-stations two high-tension switch houses are building upon the northern division through which the high-tension line will pass and the branches commence, thus permitting sectioning of the line in case of trouble. Two stor-

age battery stations are also in service. These were originally installed in connection with the former railway system, but are now highly effective in reducing the fluctuations of load at the two distant sub-stations at Greensburg and Uniontown. The stations are identical and are equipped with Gould type-S batteries, having a capacity of 320 amp.-hours at a 1-hour discharge rate.

THE POWER STATION

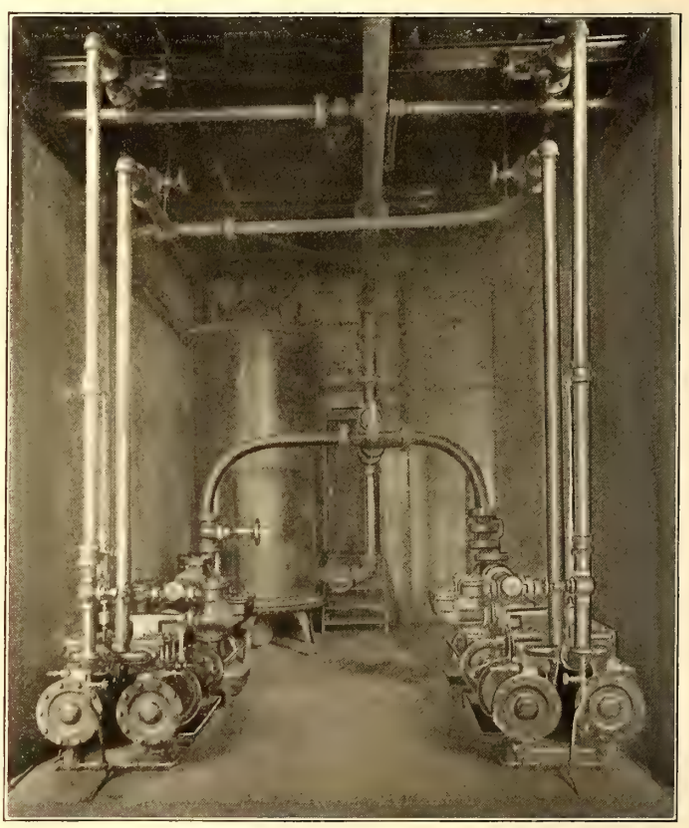
The power station in its present state has a rated capacity of 6000 kw, and an ultimate capacity of 8000 kw. The inside floor area is 165,000 sq. ft., or 15.4 sq. ft. per rated horsepower. It is fairly representative of advanced architectural and engineering practice, and, although erected and equipped at a cost of approximately $1,000,000, no unnecessary refinements have been indulged in, which in plants less favorably situated would have been considered indispensible.



HIGH-PRESSURE STEAM PIPING AND BIN CONSTRUCTION

The main part of the building is rectangular in shape, divided by an 18-in. brick wall into a boiler room 207 ft. in length by 35 ft. 3 ins. in width, and an engine room 207 ft. x 46 ft. 10 ins., the clear height to the lower chord of the roof trusses being 39 ft. and 41 ft., respectively. It is set back 65 ft. from the river bank, in order to make room for a high-tension transformer house, isolated from the main building. Upon the river side are two 18½-ft. x 30-ft. extensions; one containing the railway condenser equipment, engineer's office and lavatory, and the other a machine shop and tool room. The two chimneys are located outside and in the rear of the building. Fireproof construction has been employed throughout. The walls are of light brown brick, stiffened between windows with ornamented pilasters. Foundations are of concrete, resting upon hard gravel footings. Parapet walls are provided at each end, capped with sandstone flags and corbelled belt courses, cornices and blank windows to relieve the otherwise plain and monotonous exterior. The interiors are well lighted with large double-sash windows, with stone sills, the arch sash being operated from the floor through geared fixtures.

A row of smaller windows beneath the eaves facilitates the thorough ventilation of the building. Concrete and expanded metal construction is employed in roofs and floors, the basement floor being of plain concrete. The roofs are supported by latticed steel arched trusses and provided with Pancoast ventilators. A small extension to the boiler room beneath the stack flue serves as a lavatory and locker room for the firemen. An elevated coal bunker, 17 ft. in width and 14 ft. in depth, adjoins the rear wall of the boiler room above the top of the boiler settings. It is divided into two parts by the flue leading to the central chimney, providing a storage capacity of 300 tons and 600 tons for the railway and lighting plants, respectively. It is rectangular in section and constructed of concrete and expanded metal upon a steel framework. The engine room is spanned by a 30-ton 3-motor Cleveland plate girder crane. Both traverse and hoist are operated by electric power.



PUMPS AND HEATERS

The track is supported upon brick pilasters integral with those upon the outside of the building. Liberal future extension of the power station has been provided for, as is evident from the accompanying plan.

STEAM GENERATING PLANT.

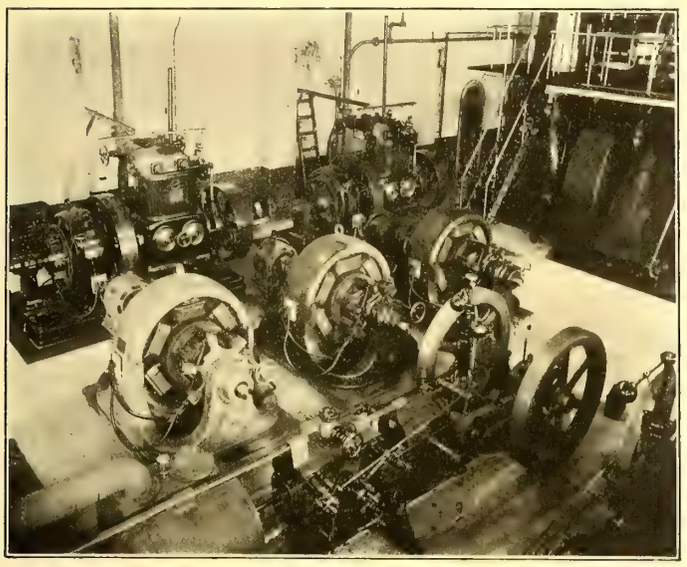
The boiler equipment aggregates 4800 hp, equally distributed between six independent batteries of two boilers each, all boilers being of the Geary water-tube type, rated at 400 hp, with 165 lbs. steam pressure. The boilers are supported independent of the brick setting, the front being hung from the steel bin structure and the rear resting upon a special footing in the rear foundation wall. The front of the settings are finished with white enamelled brick, thus improving the appearance of the room. All boilers will be equipped with mechanical stokers.

Coal is obtained from local mines over a Baltimore & Ohio spur track, and delivered at the power house at about 75 cents per ton. It is of the ordinary coking variety, used in the coke ovens, and averages about 13,500 B. T. U. per pound. A conveying system will be shortly installed, which will deliver directly into the bins. A spiral riveted chute, topped by a Hunt coal valve, will be installed in front of each boiler, delivering

coal to the floor in front of each boiler, as may be desired.

A concrete trough, covered by two iron gratings, runs in front of the ash pits, the full length of the building, sloping 5-16 in. to 1 ft. to a discharge opening at one end. When the trough is flushed with water ashes will be swept to the dump, where the water escapes to the river, and the ashes will be available for filling low ground or may be hauled away.

Draft is furnished by two stacks of Custodis radial brick construction, each 185 ft. in height, with a flue diameter of 10 ft



AUXILIARY APPARATUS IN ENGINE ROOM

Each stack is intended to serve eight boilers, and is connected to the settings by riveted sheet steel flues, a special expansion joint being inserted in each section. A Locke damper regulator operates the main flue dampers next to the stack.

The water supply for all purposes except drinking is obtained directly from the river, and contains no scale-forming impurities. Feed-water is pumped directly from the condenser hot wells of the railway power systems, from a point 6 ft. below the water level. Duplicate connection is also provided to the general supply line through a duplex pump in the basement pumping from the intake well to an elevated tank in the rear of the building. This pump is kept floating on the line, and is automatically controlled by a pressure regulator. In the event of breakdown to the condenser a relief valve in the feed suction operates to transfer the suction to the general supply

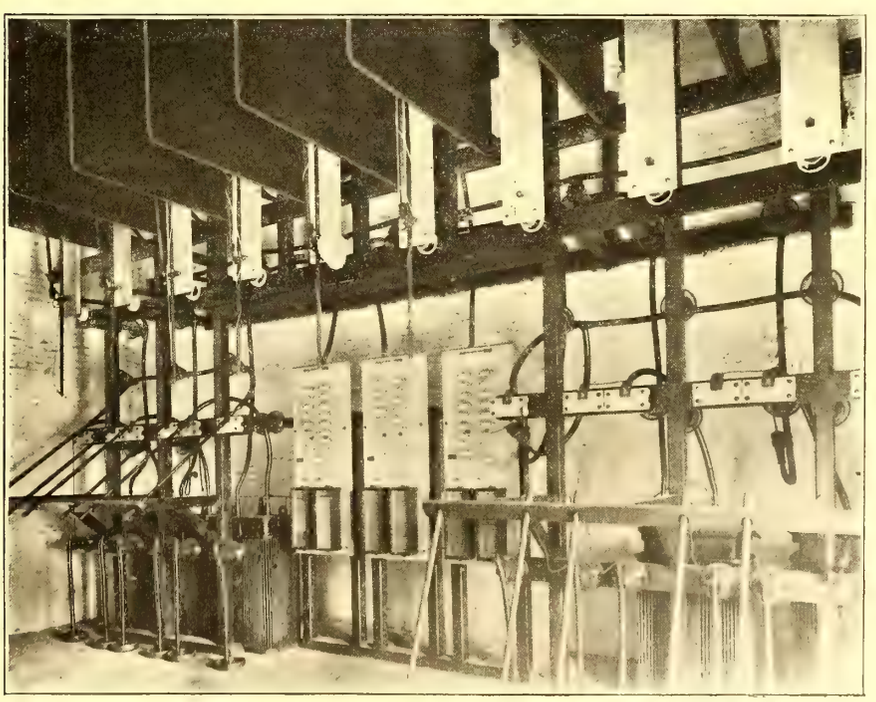


ONE OF THE 1000 KW. UNITS IN MAIN POWER STATION

system. The feed pumps are in duplicate and are of the 12-in. and 7½-in. x 10-in. Worthington duplex outside plunger type. Each suction is provided with a short standpipe at the pump, serving as an air cushion to prevent water hammer. The pumps discharge into a 2000-hp National closed induction



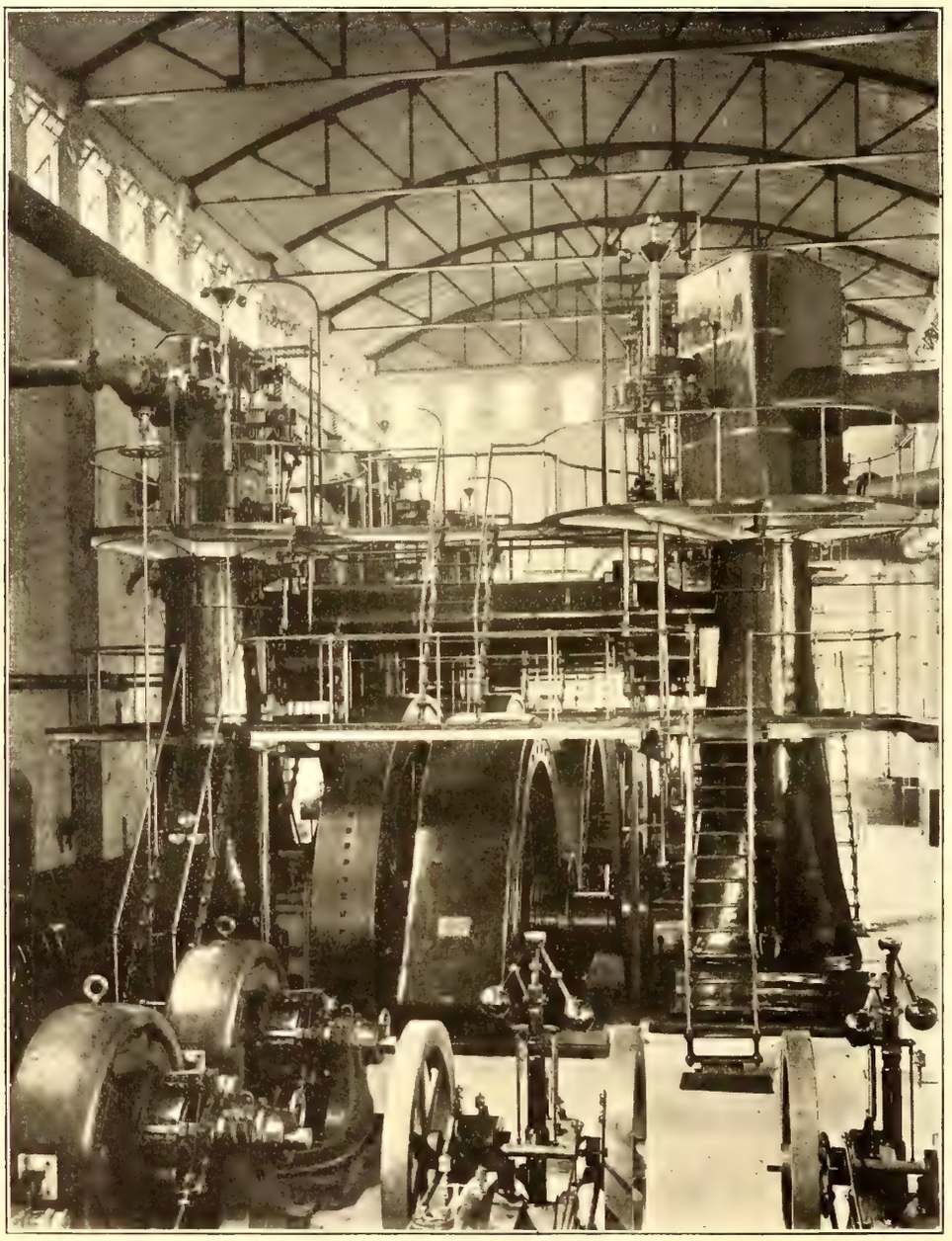
RAILWAY TRANSFORMERS IN UNIONTOWN SUB-STATION



HIGH TENSION APPARATUS IN TRANSFORMER HOUSE

heater, and thence into a 5-in. feed distributing main paralleling the boiler fronts. The heater is supplied with steam from the exciter engine and other auxiliaries, and may be by-passed if desired.

The high-pressure piping arrangement is well shown in the plan and sections of the power house. A 12-in. main and 4-in. auxiliary header, interconnected at both ends, run the length of the boiler room. The main header is sectional at each battery to provide for the isolation of a defective portion. It is suspended from the roof trusses and anchored at the middle point of the main sections, expansion being absorbed



ENGINE ROOM IN MAIN POWER HOUSE

by long radius bends to boilers and engines. The auxiliary main is tapped into each boiler drum beneath the safety valve, so that a continuous steam supply to all auxiliaries is reasonably certain. The entire high-pressure piping, together with valves and separators, is drained by a steam loop and Holly gravity return system, which returns the condensation to a main in the rear of the boilers tapped into each manifold. The piping was installed by W. K. Mitchell & Company, and is of standard full-weight pipe, with extra heavy flanged fittings screwed and peaned over 4 ins. in diameter. Chapman bronze seated valves are used throughout, all above 4 ins. being of the outside screw and yoke pattern, and all 12-in. valves by-passed. All joints are made steam tight, with corrugated copper gaskets and piping insulated with 85 per cent magnesia covering molded on pipes under 4 ins., and applied in strips wired in place and covered with a canvas jacket on pipes over 4 ins. in diameter. The entire piping system is sectioned so that the two sections supplying the railway and lighting units, respectively, may be isolated for purposes of conducting performance tests.

ELECTRIC GENERATING PLANT

The railway equipment comprises three units, and occupies the entire north end of the engine room, and consists of three 28-in. and 56-in. x 48-in. 1550-ihp Allis-Corliss vertical cross-compound engines, direct-connected to 1000-kw Westinghouse 390-volt, 25-cycle, three-phase generators of the revolving field type. The units operate at 94 r. p. m., and run in parallel, with common bus-bars. They are synchronized by means of a motor actuated sliding weight gear upon the governor lay-shaft, controlled by a double-throw switch upon the switchboard. An automatic speed limit device, controlled by an auxiliary governor, operates at a predetermined speed a quick-closing butterfly valve in the steam line. The engines are each provided with reheating receivers between the high-pressure and low-pressure cylinders, supplied with live steam from the throttle. The generators are excited by a duplicate set of Westinghouse exciter units, each consisting of a 62½-kw, 125-volt generator, direct-connected to an 11-in. and 19-in. x 11-in. compound engine, either unit being able to furnish the necessary exciting current for the railway plant.

The condensing plant consists of a 30-in. Worthington barometric jet condenser, with auxiliary vapor cooler, exhausted by an independent rotative dry vacuum pump. The condenser will handle 20,000 lbs. of steam at 27-in. vacuum, with injection water at 70. It is supplied by a 16-in. and 25-in. and 26-in. x 18-in. duplex compound pump.

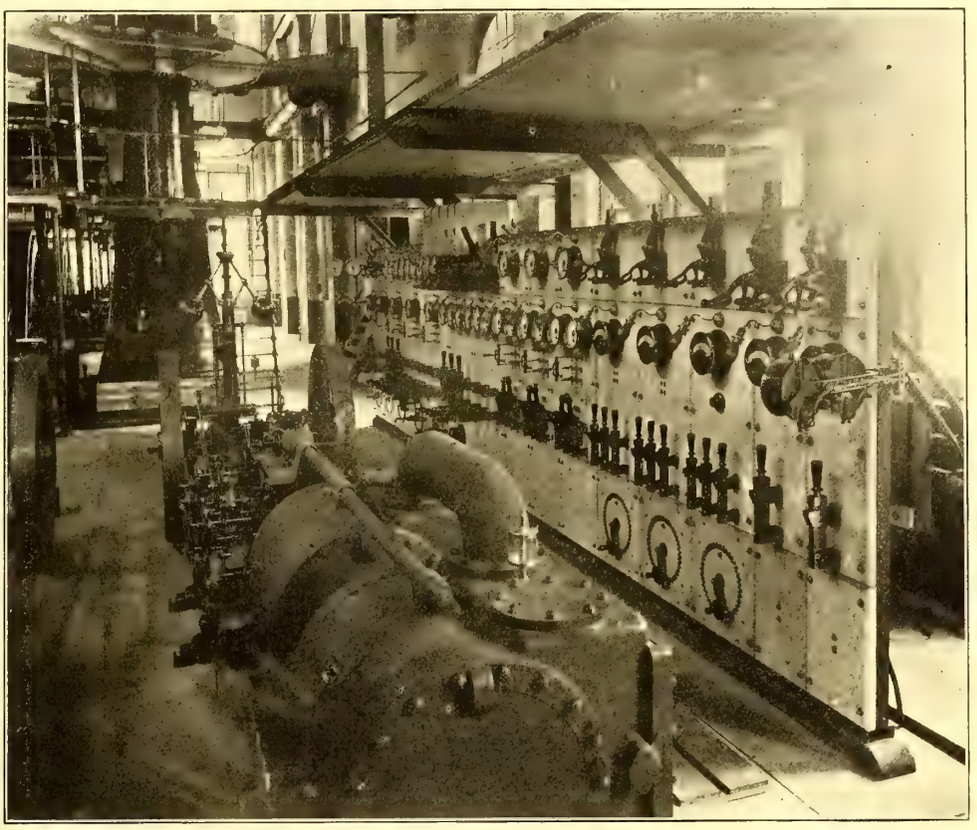
The condenser operates upon all three railway units, the three 24-in. exhaust lines from the latter converging to a central entrainer, piped to the condenser cone. A 25-in. Blake relief valve and gate valve are inserted in each engine exhaust line. The condenser tail pipe is sealed in a 6-ft. x 9-ft. elliptical hot well, divided by a central brick partition, which serves to preserve the seal in the event of loss of water in the main compartment. Provision has been made in the exhaust piping system for operating any or all auxiliaries upon the jet condenser, if found desirable. This feature has proved very satisfactory in the care of turbine-driven circulating pumps.

THE STEAM TURBINE EQUIPMENT

The lighting equipment comprises three 1000-kw Westinghouse turbo-generating units, each provided with an independent surface condenser outfit, arranged for high vacuum. With this arrangement the returning of hot condensation to the boilers thus becomes feasible and the condenser discharges are consequently piped directly to the feed-water suction.

The turbines are of the so-called compound, or tandem cylinder type, which at present is adapted by the builders for

machines above 400-kw capacity. Three units will be installed, one of which is now in place. The turbine operates at 1200 r. p. m., and is direct-connected to a 1000-kw, 6-pole, 2200-volt generator of the revolving field type. The unit is mounted upon a continuous bed-plate, sectioned at the center, the two parts being tongued and grooved and secured by interior bolts. As no vibration or jar is incident to the operation of the turbine, a comparatively light foundation is required, and holding-down bolts are entirely dispensed with. The foundation consists of two battered concrete walls, carried from the basement to the engine room floor level. These walls vary in thickness from 24 ins. at the top to 36 ins. at the bottom, and the space inclosed is utilized for the pipe connection between cylinders, and for the exhaust leading through the building wall to the roof level. In order to provide for linear expansion of the turbine casings, each cylinder is anchored to the bed-plate at one end only, the supporting pedestal at the other end being arranged to slide upon surfaced ways. This end motion as transmitted to the shaft is absorbed by flexible couplings inserted between cylinders, and between the low-pressure cylinder and the generator, respectively. The use of these couplings also prevents shaft stresses, due to possible misalignment and facilitates shipping by dividing the unit into three sections.

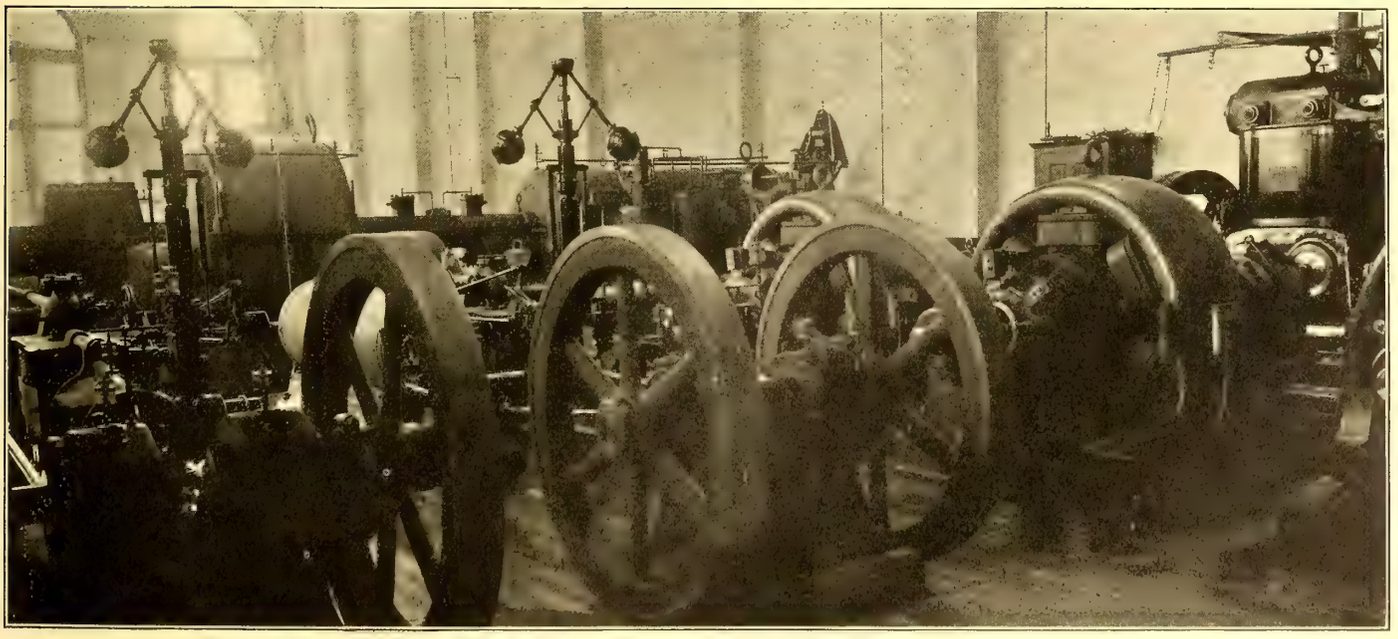


RAILWAY SWITCHBOARD IN MAIN POWER HOUSE

The turbine receives steam through a long radius 7-in. pipe bend from the main steam line, initial condensation being abstracted at the turbine by a special superheater fired by natural gas. Steam then passes successively through a quick-opening throttle, hand throttle, strainer and poppet admission valve into the first expansion stage of the turbine. The strainer has a removable perforated sheet steel pocket which serves to eliminate foreign matter from which turbine blades might receive injury. The admission valve, being nearly 1 sq. ft. in area, is not actuated directly by the valve gear, but by a small auxiliary cylinder, connected through a relay valve to the high-pressure steam. The relay is controlled through simple link work by the sensitive centrifugal governor mounted at the end of the high-pressure cylinder and driven from a worm gear on the end of the turbine shaft. This valve gear is directly actuated by a reciprocating lever and admits to the turbine short puffs of steam under maximum boiler pressure at a frequency of about 150 strokes per minute.

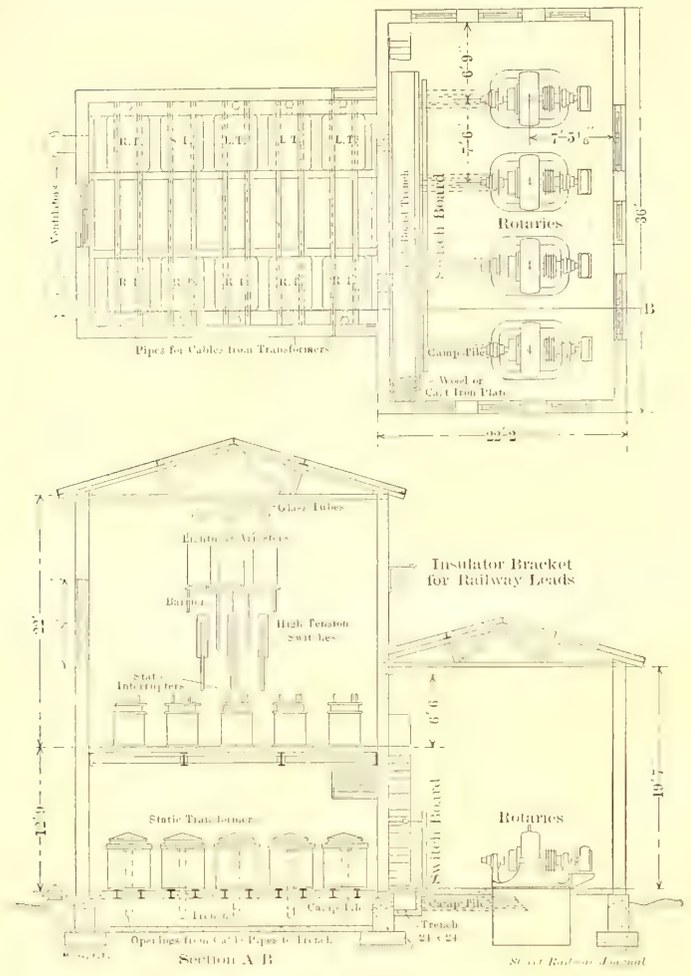
The method of governing involves a variation of the period of admission as determined by the position of the governor weights, this governing motion being superposed upon that of the reciprocating gear. A speed limit attachment is also used.

In anticipation of the accidental breaking of the vacuum or of fluctuating loads momentarily exceeding the normal capacity



ENGINE ROOM, WITH TURBINE IN BACKGROUND

of the machine, an automatic by-pass between two adjacent stages of the high-pressure cylinder has been provided. This device is actuated by the internal pressures of steam at the second stage in question, and serves to admit high-pressure steam



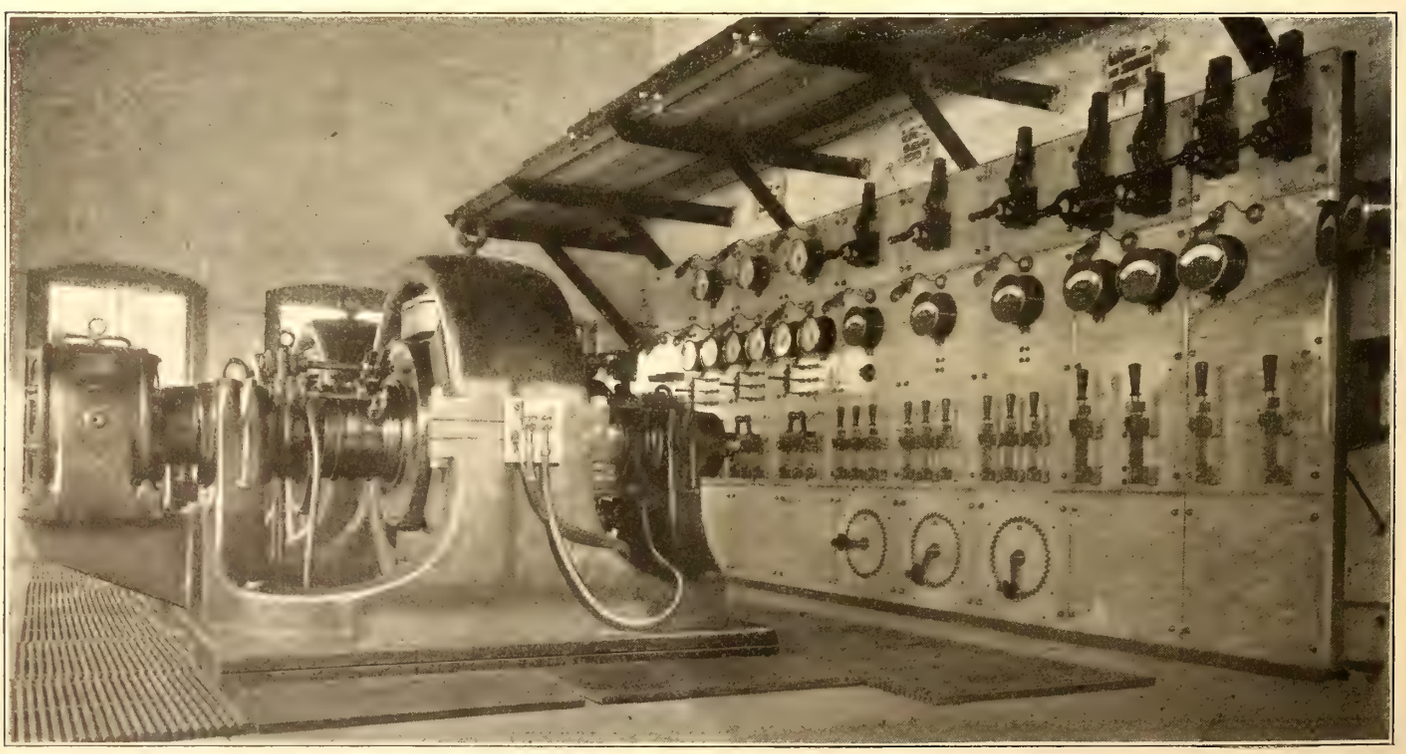
TYPICAL SUB-STATION

to the secondary stage, thus increasing the capacity sufficiently to sustain the overload. A visual index upon the side of the cylinder serves to indicate the position of the by-pass piston at all times.

All journals are of the concentric type, and have been designed with sufficient bearing surface to obviate the necessity of forced lubrication. An oil pump is employed to elevate the lubricant to a small storage tank, surmounting the end journal cap, and the resulting static head is employed for flushing the journal shells. The oil upon its return passes through a copper coil cooler, and thence into a reservoir, both located in the bed-plate of the turbine. It is then pumped to the elevated tank and the cycle of operation is repeated. The permanent adjustment of axial clearances between moving and stationary parts is maintained by thrust bearings, each constructed in two parts independently set up by set screws. The final adjustment is made during motion by means of sound transmitted through the casing to the ear. Both cylinders are heavily lagged with asbestos covering, retained by sheet-steel casings and polished steel retaining bands.

The turbo-generators are constructed particularly for direct connection at high speed, and are consequently of considerable length, but small diameter. The field is of steel, of high tensile strength, in which the copper bar winding is embedded. The armature winding is of the multi-coil or subdivided type, retained in position by the projecting teeth of the laminated core punchings. Thorough ventilation is provided by the fanning action of the field, the heated air escaping through radial ducts between punchings and frame. Exciting current is furnished by a 37½-kw compound-wound machine, driven by a turbine, as previously mentioned.

The condenser consists of three 4000-sq. ft. Alberger counter-current surface condensers, served in common by a duplicate set of two-stage rotative dry vacuum pumps. These are 10-in. and 24-in. x 24-in. machines, fitted with Corliss valve gear. Circulating water for each condenser is furnished by a centrifugal pump, driven by a De Laval steam turbine, exhausting into the auxiliary line leading to the heater. Sixteen-inch suction and delivery pipes lead, respectively, to common intake and hot wells, and as each pipe is sealed below water level, only sufficient power is required from the auxiliary turbines to overcome fluid and mechanical friction. The condensed steam in each condenser gravitates into a cast-iron hot well, and is controlled by a float. It is served by a small duplex pump, which returns the condensation to the boiler feed line. Each equipment occupies the space between adjacent turbine foundations, part of the condenser shells rising above the floor level of the



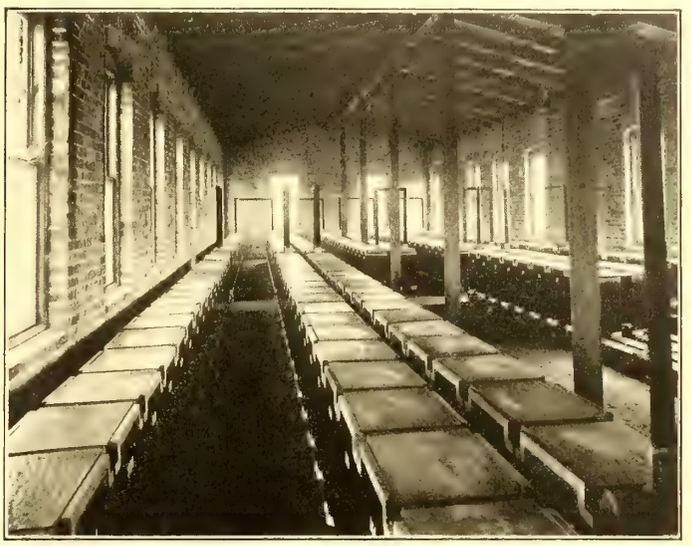
ROTARY CONVERTERS AND SWITCHBOARD IN UNIONTOWN SUB-STATION

engine room. Under full load and similar water temperatures, 27½-in. vacuum will be readily obtainable and 28 ins. or over with cold circulating water.

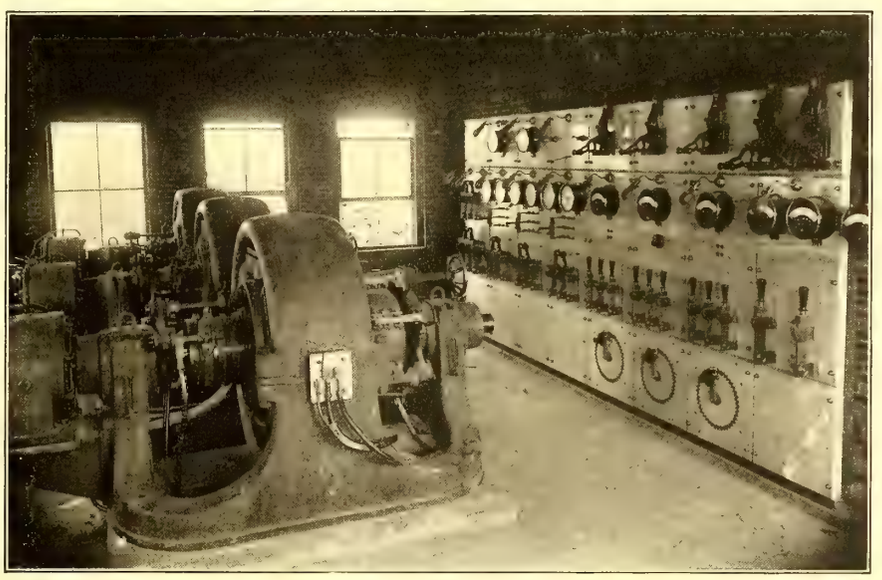
An interesting and significant aspect of the turbo-generating equipment is the opportunity for comparison with reciprocating engine standards. The two sections of the plant have at present the same capacity, the ultimate capacity, however, without building extensions, will favor the turbine equipment in the ratio of 5 to 3. The actual space required for the turbine unit is 314 sq. ft., or 23.4 sq. ft. per horse-power, 59 per cent of that required for the engine unit. In the present layout, turbine condensers included, the total floor space for each turbine is 792 sq. ft., as compared to 1265 sq. ft. for each engine. The difference in head room required for the two prime movers is fully 20 ft., and the cost of foundations shows a considerable difference in favor of the turbine.



SUB-STATION AT UNIONTOWN.



STORAGE BATTERY INSTALLATION



INTERIOR OF SUB-STATION

OILING SYSTEM

The handling and distribution of both machine and cylinder oil is accomplished by a simple and effective system employing compressed air. The oil in barrels is delivered to the power house basement, and an air-tight two-pipe nozzle inserted in the vent. Compressed air is then turned on and the oil rises to a steel tank located in the condenser addition, the elevation being such as to create a static head of at least 8 ft. in the pipe lines leading to the machinery. The cylinder oil system serves only the sight feed power pumps upon the engine cylinders; the other system the remaining parts of the power units, including main journals, which, by this means, are kept continually flushed with lubricant. Machine oil drips are piped to a central filter, located in the basement, where foreign matter is removed. Cheese cloth screens are furnished for this purpose, and the oil is then washed during its progress around a number of vertical baffles into a riveted steel storage reservoir, also piped to the compressed air supply.



CAR HOUSE, BATTERY HOUSE AND SUB-STATION AT UNIONTOWN

COMPRESSED AIR

A piping system extending to all parts of the power house supplies air at 50 lbs. to 100 lbs. pressure, for cleaning electrical machinery and switchboards, operating oil lifts and for cleansing pipe lines. The air is furnished by a Westinghouse steam compressor, mounted upon the engine-room wall and pumping into a storage tank in the basement. Oil return and drip pipe lines are fitted with air connections at effective points, and are regularly blown out by air blast to prevent clogging.

ELECTRICAL EQUIPMENT

The sub-station equipment in the main power house consists of three 250-kw Westinghouse rotaries, operating directly from the three-phase, 390-volt alternating-current bus.

Individual reactive coils are permanently connected to each machine for purposes of voltage regulation. These coils are contained in standard oil-cooled transformer cases, and are provided with extra taps to enable an accurate adjustment of

reactance to be made to suit operating conditions. The rotaries are started by means of direct-connected type-C motors, controlled from the switchboard, where two voltages are available from the bus and from separate taps upon the transformer.

At present only the railway switchboard is in place. It consists of fifteen panels of blue Vermont marble mounted upon a 2-in. x 3-in. angle-iron framework, anchored at the top to the wall through hardwood insulators. The panels are sectional at one-third their height, the lower section being generally blank. An entire panel is devoted to each piece of apparatus, such as generator, exciter, transformer bank and feeder, and one to each side of the rotary converters. Automatic leaf contact carbon break circuit breakers are installed in machine transformer and feeder circuits. Series transformers in main bus and heavy alternating-current leads, and calibrated shunts in the direct-current leads permit the use of low-tension current in the ammeters. Small shunt transformers are similarly used on the alternating-current potential circuits. All alternating-current meters are of the Westinghouse round dial type, with calibrated scale, embracing nearly 360 degs. of its circumference. Bus and machine voltmeters are mounted upon swinging arms at the end of the board, the direct-current meter at the right, and alternating-current at the left. Rheostat contacts are mounted directly upon the front of the lower panels, connecting wires being bunched and carried through the floor to ventilated grid rheostats in the basement built up of standard-sized units. The entire output is measured upon the alternating-current side by a Westinghouse three-phase recording wattmeter, round dial indicating wattmeters being also used on each generator panel in order to show when a proper distribution of the load between machines has been secured. The generators are synchronized by the usual lamps in connection with the special device before mentioned. Transformer delta connections are made up at the switchboard. Each transformer circuit contains a switch and circuit breaker, so that in case of damage the disabled transformer may be instantly disconnected from the bus, and the system continued in operation upon the remaining two between which the load will be equally divided. The cable leads from the switchboard are entirely of lead-encased, rubber-insulated copper strand, carried through a rectangular opening in the floor and strung upon wood-insulated iron hangers clamped to the floor beams.

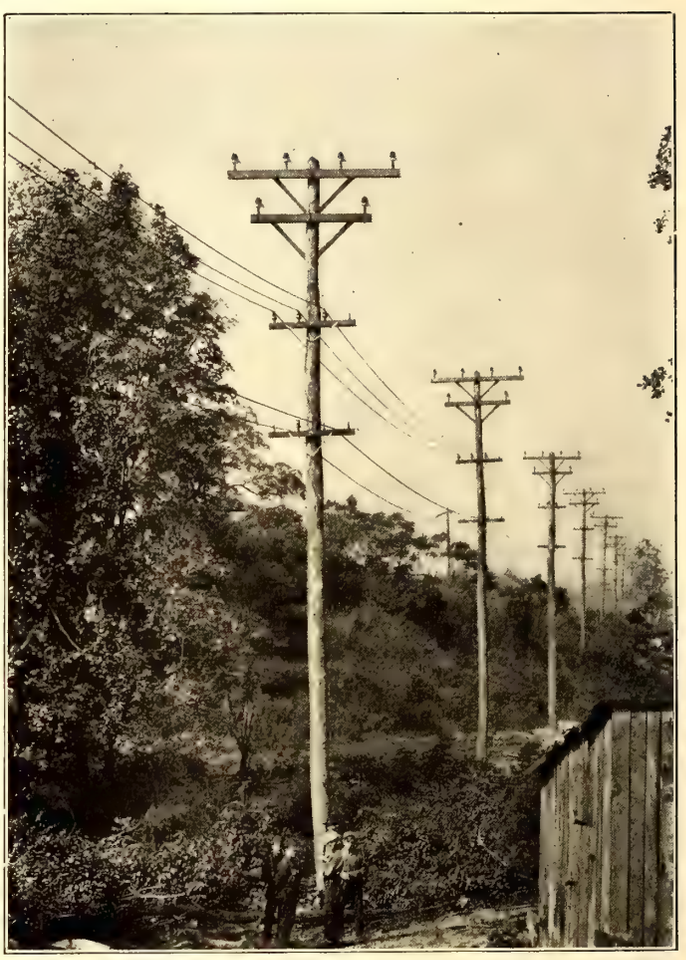
The lighting switchboard is designed for handling 2200-volt current, and will be equipped with oil-break switches, low-voltage meters and voltage regulators in each feeder circuit, compensators being also employed for indicating at the station the exact potential of each distributing center.

TRANSFORMER HOUSE

All high-tension apparatus is located in a separate building constructed as before mentioned with a view to isolating fires resulting from high-tension disturbances, or possible ignition of transformer oil. The entire ground floor is used for transformers, those for the railway system being ranged along one wall and for the lighting along the other. The railway system is served by duplicate banks of oil-insulated transformers, each bank containing three 500-kw units, connected in delta and raising the bus voltage to 22,000. Cables from the power house enter from beneath the floor through 6-in. tile, and the high-tension leads rise to the floor above through similar openings. In all cases of entrance and exit through walls or floors liberal air insulation is depended upon in place of glass or porcelain.

High-tension switching apparatus is arranged upon the third floor in independent systems. The apparatus is mounted upon a 4-in. x 4-in. wood framework, thoroughly filled with asphaltum after erection. Connections are made with No. 4 wire, covered with 5/8-in. rubber and jute braid insulation. The wires are carried upon standard glass line insulators and wooden pins. High-tension transformer leads terminate in two banks of selector switches, which provide means for instantly cutting out the high-tension winding of a defective transformer, also furnishing the high-tension delta connections. Should it be found desirable to install a spare unit the high-tension leads may be brought to the selector board and a separate pair of connections provided so that a disabled transformer may be replaced by the spare circuits issuing from the selector switches, first passing through the impedance coils of Westinghouse static interrupters and thence through pole-fuse switches to the 22,000-volt bus. The high-tension transmission line is connected through an auxiliary bank of pole-fuse switches. Lightning protection is afforded by two banks of low-equivalent arresters, with adjustable spark gap operating in connection with the static interrupters.

The lighting system will comprise five 750-kw oil-insulated, water-cooled transformers, connected two-phase three-phase



HIGH TENSION POLE LINE

in two banks with one spare. These will raise the bus-voltage of 2200 two-phase to 22,000 three-phase for transmission. A complete equipment of switches and arresters will be provided so as to separate absolutely the two power systems and secure independent control.

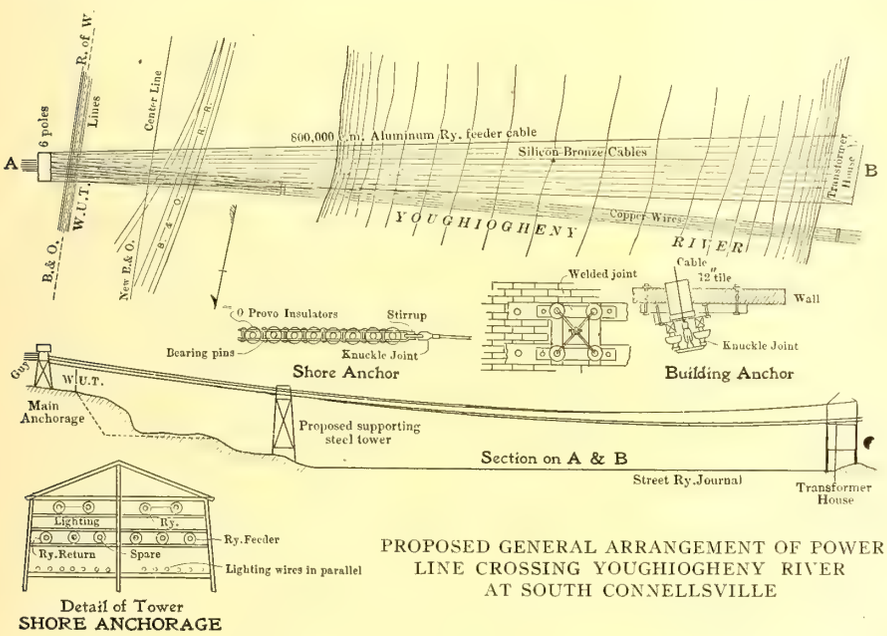
The high-tension line circuits leave the building through 8-in. and 12-in. glazed tile, sloped outward to shed rain. A single cross-arm anchorage upon the inside wall is used for the southern pole circuits. A long river span, however, occurs at the beginning of the northern line, for which special anchorages have been erected.

TRANSMISSION SYSTEM

Both northern and southern transmission lines traverse private right of way for the entire distance. The system was originally designed according to the common practice of carrying the high-tension line upon extra long poles, which also sup-

ported the trolley spans, but, with the acquirement of the lighting systems this plan was abandoned. Some difficulty was also anticipated in the coke districts from the breaking down of line insulation, due to smoke deposits upon the insulators. The present location of the pole lines avoids the coke ovens as much as possible and obviates this trouble. Both lighting and railway lines are carried upon the same poles, transposition being resorted to in order to prevent induction. Cross-arms are of 4-in. x 6-in. yellow pine, dipped in asphalt and through-bolted to the pole, double arms being employed on all curves, together with side, back and head guying. Wooden braces are used to facilitate insulation. The line insulators are Hemingray No. 0 Provo type. They are provided with 8-in. and 4-in. petticoats and support the cable 6 ins. above the lower rim and 12 ins. above the cross-arm. A 13-in. standard locust pin with 2-in. shank is used without protecting sleeve. The poles are of chestnut, 8-in. tops, spaced 100 ft. apart, and graded in height from 35 ft. to 60 ft. in order to compensate as much as possible for the irregular profile of the right of way.

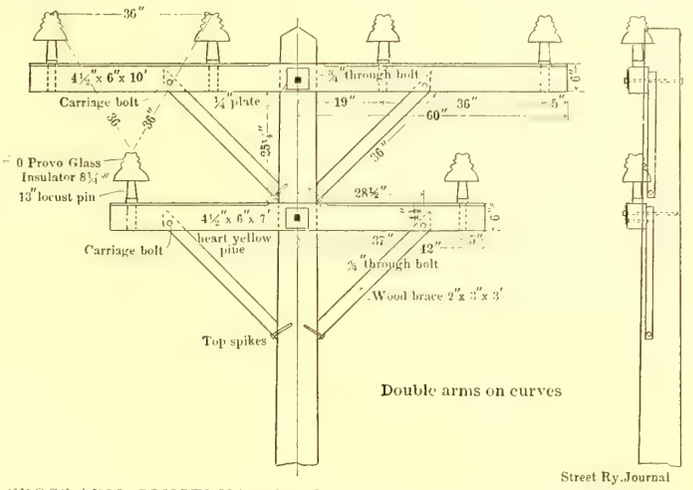
The line wire is partly of No. 4 solid copper and partly of stranded aluminum cable strung with screw couplings at joints. Transpositions are executed with a simple 120-deg. spiral between poles 25 ft. apart, double arms being used for safety. One line is carried straight through from station to station, and the other has two spirals. The river span at the



PROPOSED GENERAL ARRANGEMENT OF POWER LINE CROSSING YOUGHIOGHENY RIVER AT SOUTH CONNELLSVILLE

power house is composed of eight ½-in. silicon bronze cables, strung with a center dip one-thirtieth of the span. The two center cables are held in reserve and may be cut in upon either line in a short time in case of necessity. All cables leave the transformer house at the same level, and are spaced 5 ft. apart, but assume their triangular arrangement at the opposite anchorage. Outside of the transmission cables are strung two 800,000-circ. mil stranded aluminum cables, one serving as a local railway feeder, and the other as a metallic return. Lighting circuits will be strung below the transmission lines, and will require no special anchorage at the power house end. In order to provide greater security to passing trains a steel tower will be erected upon the river bank, which will considerably shorten the clear river span.

The shore anchorage is constructed of 40-ft. poles, set in concrete and laterally braced and back-guyed to withstand the strain of about 15,000 lbs. due to the river spans. The tops are framed together with standard cross-arm material and roofed over. The cable strain is transmitted equally to eight standard insulators by an iron stirrup, ending in a cable socket. All insulators are mounted upon standard pins in an upright position in order to shed rain. The transformer-house anchorage is similar in character, with the exception that the insulators and pins are placed under compression instead of side strain, this being possible on account of being housed. The



CROSS-ARM CONSTRUCTION ON HIGH TENSION TRANSMISSION LINES

cable socket is bolted to the center of an iron crow-foot, which distributes the thrust among four insulators, the bearing being adjusted by imbedding the pin thread in plaster. A heavy oak framework extending along the river wall of the switch room serves further to distribute the cable strain.

SUB-STATIONS

The sub-stations are of similar design, that at Uniontown being typical in all respects of the others. It is shown in plan and section herewith. Conforming with the arrangement of the main station all high-tension apparatus is isolated in the high-tension tower, including transformers on the main floor, and selector switches, pole and fuse switches, arresters and static interrupters upon the upper floor, the equipment being identical with that of the main station, except in point of size. Railway and lighting apparatus occupy opposite sides of the tower. The main room contains three 250-kw Westinghouse rotary converters without reactance control. The size of unit has been adopted as standard throughout the system. An eight-panel switchboard controls the low-tension system and embodies the same features as the main station board, with the exception of a double alternating-current bus, enabling either bank of transformers to be operated singly or in parallel. Massive copper choke coils, with tank arresters in addition to Wurts railway arresters on the board are used upon the direct-current system. Two transformer banks, delta-connected at the boards, reduce the line voltage to 390 for the rotaries. They consist of 200-kw and 100-kw units, respectively, each of the oil-cooled type. The two banks are arranged to operate either singly or in parallel.

OVERHEAD DISTRIBUTION

Throughout its length the road is supplied with current through an overhead trolley with span-wire construction. A single round 0000 hard-drawn wire is used, sectioned between stations for facilitating the localization of faults. Bare stranded copper cable with feed-in taps at every ten poles convey current from distributing stations. The pole line consists of 30-ft. and 40-ft. poles, set with a backward rake of about 3 ft. at the span. A 100-ft. spacing is usual on straight runs, reduced on curves where the poles are reinforced by back guys strung nearly vertically by reason of the rake and limited width of roadway.

Through towns iron poles are largely used. The trolley is suspended from 5-16-in. galvanized steel strand, with soldered ears, and cap and cone straight-line hangers, pullovers being substituted on curves. The span wire is permanently looped through insulated eye-bolts, passing through the poles with extra thread for taking up sag. The trolley curves are sprung



CAR HOUSE AND SHOPS AT NEW HAVEN

in by guys, and the wire is anchored at intervals by back and head guys. The feeders are carried upon a four-pin arm, through-bolted and braced to the 40-ft. poles just above the span wire. Upon all curves greater than 4 degs. double arms are employed for greater safety.

CAR HOUSES AND REPAIR SHOPS

The main storage and repair buildings of the road are at present located at New Haven, about 500 ft. back of the main line to Uniontown, with which the yard tracks are connected. Twenty-four car storage houses are also located at Uniontown and Iron Bridge for accommodating the cars on the Uniontown and Mount Pleasant divisions, respectively. Minor repairs are made at these car houses, but all heavy work upon car bodies, trucks or motors is done at New Haven. Car storage and repairs on the Greensburg and the McKeesport divisions are provided for in buildings erected by the former companies.

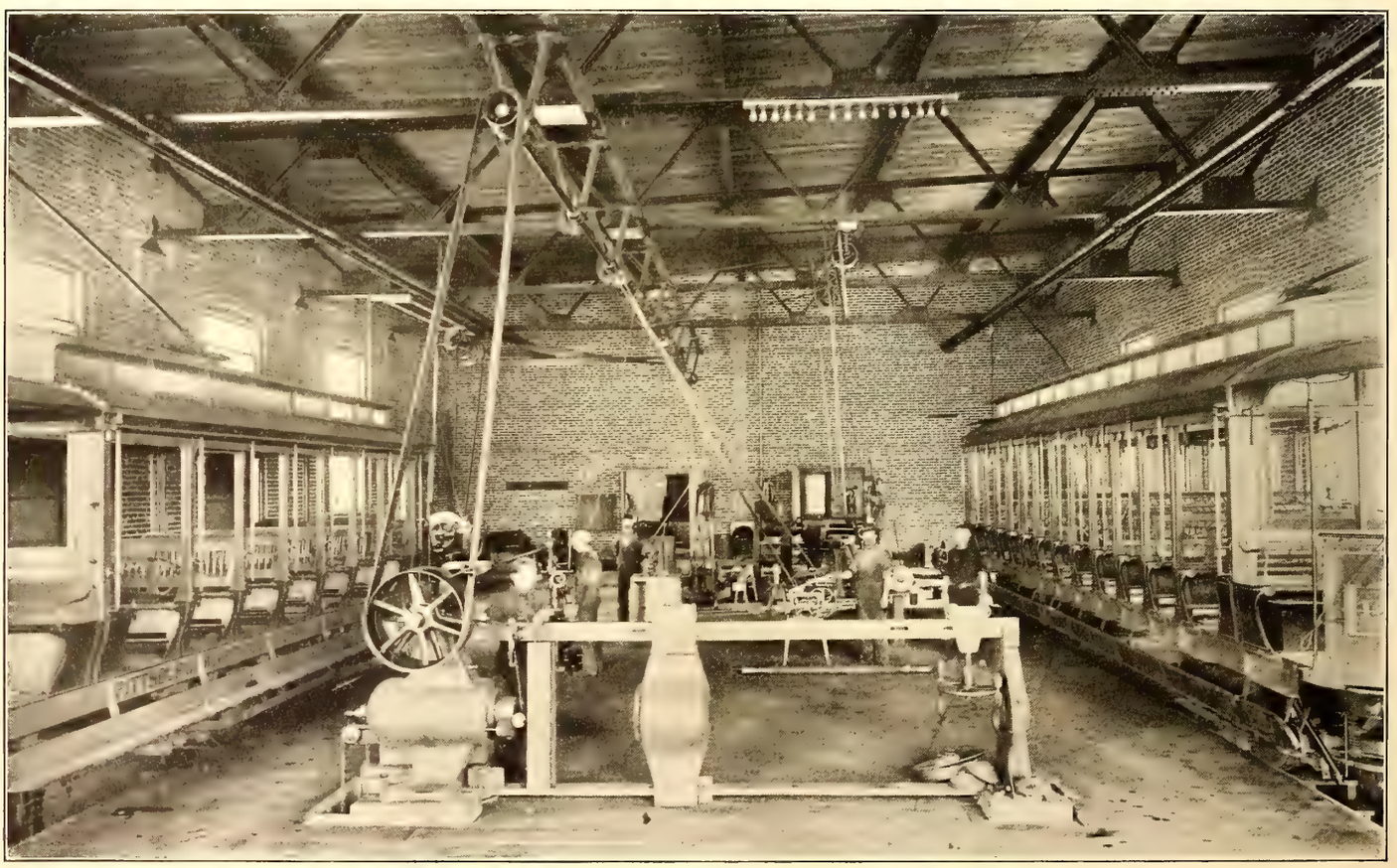
The New Haven shops comprise three independent buildings of approximately the same size, viz., the car house repair shop and woodworking and paint shop, all of the same general construction, to which the Uniontown and Iron Bridge car houses and brick firewalls between storage compartments. The roofs are of 2-in. matched pine sheathing, laid on 4-in. x 6-in. wood purlins, and covered by tarred paper and gravel. Double sash windows with stone sills, spaced at frequent intervals, furnish plenty of light to the interior. The building fronts or parapet walls are supported by steel columns set between tracks, and the openings are fitted with Kinnear rolling steel doors, each having a short section of dummy trolley wire to span the break between the two live sections upon either side of the door, and form a continuous tread for the trolley wheel. The house trolley wires are suspended from cross-spans, eye-bolted to the building walls. They are fed through a switch located near the doorway, so as to be cut out of the service if necessary.

STORAGE HOUSE

This building is 226 ft. x 52 ft. 6 ins., and contains four tracks with a capacity of four 50-ft. cars each. Inspection pits are located in each track of sufficient length to accommodate one car. Water and compressed air are available at frequent hydrants for cleaning purposes.

MACHINE SHOP

The front section only is devoted to repairs, the rear serving as the general store room for the road. Between these two compartments are located the blacksmith shop and armature winding room, each occupying one-half of the building width. The machine shop has two tracks next to the two side walls, the central space constituting the machine floor. Each track has an inspection pit accommodating one car. The machine tool equipment includes the following apparatus: 3-in. engine lathe, 20-in. engine lathe, 24-in. shaper, Mueller radial drill, taking work up to 6 ft. in diameter by 7½ ft. high, two smaller drill presses, one of which has a variable speed friction attachment, a 150-ton Schaffer wheel press, with a 9-in. ram, and



MACHINE SHOP

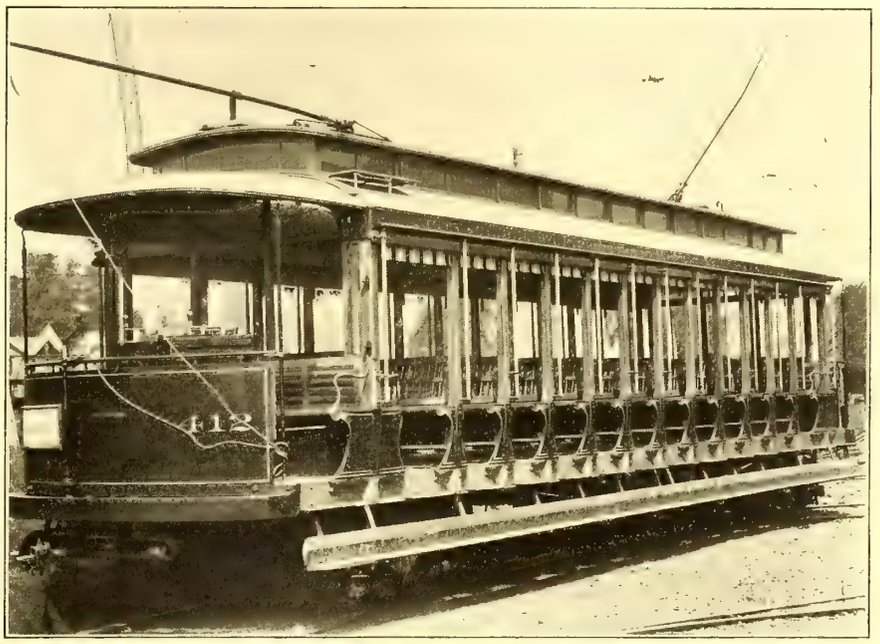
grindstone and emery wheel, power hack saw, drill grinder, air compressor, pneumatic drills, etc. The armature room contains racks for reserve armatures, is supplied with natural gas, compressed air, and the usual repair equipment. A Franklin portable crane, with a capacity of 2000 lbs., is used for shifting motor and truck parts about the shop. The blacksmith shop contains a Dupont power hammer, anvil blocks, vises, power forge and sand dryer. The shop machinery is operated by line shafting, belted to a 20-hp direct-current motor supplied from the trolley. The shop is also supplied with a 20-hp motor driving a line shaft from which is operated a single surfacer, band saw, hand jointer, combined cross and up-saw, self-feed timber saw and boring machine.

WOODWORKING AND PAINT SHOP

All car body repairs and redecoration of old cars are conducted in this building. The front section is devoted to a two-track paint shop, and a third track outside parallels the building wall, extending into the carpenter shop in the rear, which is about 12 ft. wider for this purpose. Disabled cars can then be run into the carpenter shop without disturbing work in the paint shop. A freight service track also runs between the two buildings to the storeroom in the rear.

ROLLING STOCK

A number of types of cars are in service upon different parts of the line, resulting from the absorption of independent lines and local requirements upon the several sections of the present system. All cars are double-ended with reversible seats and duplicate controller and brake equipments. The longer cars are fitted with two trolley poles, and the shorter with a single pole. Electric heaters are used throughout.



OPEN CAR FOR SUMMER TRAFFIC



INTERURBAN CAR

Two types of closed cars are in service, a 44-ft. double truck, 220-hp car for interurban winter service upon the main line, and a 30-ft. single-truck, 110-hp car for city and suburban winter service. The interurban equipment consists of twenty-five cars, all of Stephenson make, fitted with 27-F Brill trucks, and four Westinghouse No. 56 motors, with K-14 controllers. Three of these cars have Westinghouse magnetic traction brakes, and the remainder Christensen air brakes in addition to the usual hand brake. These cars were originally divided into two compartments, the forward end being reserved for smokers. The partition, however, has been removed and smoking prohibited, with a view to preserving a clean interior, which was found to be impossible with the former arrangement. The cars have a seating capacity of fifty. The interior is finished in mahogany and cherry, and the exterior in olive green and gold, which are the official colors. The city and suburban cars were built by the St. Louis Car Company. They have 20-ft. bodies and 5-ft. platforms, and are fitted with Peckham single trucks and two No. 56 motors. They are finished similarly to the interurban cars and have fourteen cross-seats for twenty-eight people.

For summer interurban service the company has recently added to its equipment fifteen "Narragansett" open cars, built by the J. G. Brill Company. The length of the cars over crown pieces is 41 ft. 4⅜ ins.; the width over sills and post brackets, 8 ft. 2 ins., and over posts at belt 8 ft. 7 ins.; other dimensions are: From center of corner post over crown pieces, 4 ft. 6 ins.; from corner post to first side post, 3 ft. 5 ins.; from center to center of side posts, 2 ft. 6 ins.; thickness of corner post, 3⅝ ins.; thickness of side post, 2¾ ins. The crown pieces are 2¾ ins. x 12½ ins.; from rail head to top of floor, 3 ft. 2 ins. Step heights are as follows: Sixteen and one-half inches from rail to top of folding step; 13½ ins. to sill step, and 8 ins. from sill step to car floor. The load distribution is arranged as follows: One-third of the load is carried at each end, supported directly on the bolster. Through the combined strength of the side sills and center stringers the central section between the ends of the stringers, constituting one-third of the car length, carries its quota of the load, supported entirely upon the Z-bar side sills.

Fifteen reversible benches, together with the twin end benches furnish seating accommodation for ninety passengers. The exterior is finished in green with yellow sills and canopy and gold letters. The interior of the cars are finished in cherry

and ash, natural colors, with ceilings of decorated birch. "Dumpit" sand boxes, angle-iron bumpers, radial draw-bars, ratchet brake handles and "Dedenda" gongs find place in this equipment. The trucks are Brill 27-G-E-1, with solid forge side frames and spring-link suspended semi-elliptic equalizers. The wheel base is 4 ft., the wheels 33 ins. in diameter, and the axles 5 ins. Each truck is equipped with four Westinghouse No. 56 motors, with K-14 controllers and magnetic brakes. Though the motors are outside hung the cars may be run at a speed of 30 miles an hour with perfect safety, and without oscillation of the trucks.

The city and suburban equipment for summer comprises forty cars of standard construction, fitted with Peckham trucks, two No. 56 motors and handbrakes. All cars, the latter type excepted, are geared to approximately 45 m. p. h. on level track, the ratio employed being 18 to 64. Thirty-three-inch spoked wheels with 2½-in. tread and ¾-in. flange are used on regular cars. The standard trolley wheel is 4 ins. in diameter, with graphite bushing, and all cars are equipped with 12-ft. poles and United States trolley bases.

OPERATION

Until recently a 40-minute headway upon main and branch lines was in force. This, however, has been reduced to 30 minutes upon the main line better to accommodate increasing traffic. The interurban cars make an average schedule speed of approximately 14 miles, including runs through city streets, and frequent stops. The cars are despatched by telephone from a central station located at Connellsville. Booths are stationed at all switches and sidings, and all instruments are bridged across a main line, comprising a cable which consists of twisted pairs of telephone conductors. This cable is strung along the pole line beneath the railway feeders.

The passenger traffic of the road is undergoing marked development as a result of increased facilities incident to the starting of the transmission system and sub-stations, and additional converting machinery has even now become an immediate necessity. The average passenger rate over the company's lines is approximately 1.5 cents per mile. Neither express nor freight is carried.

MANAGEMENT AND ENGINEERING

The West Penn Railway & Light Company is financed by a syndicate of New York and Pittsburg capitalists. The permanent officers of the company will be: President, E. C. Converse, president of the Liberty National Bank, of New York, and the Bankers' Trust Company, of New York; vice-president, J. S. Kuhn, president of the Pittsburg Bank for Savings; secretary and treasurer, J. B. Van Wagoner; general manager, Thomas Elliott; superintendent of construction, W. E. Moore. The official headquarters are in the Title & Trust Building, at Connellsville, Pa.

The reconstruction of the railway and lighting properties has been largely the result of co-operative effort on the part of manager and engineer. The designs for the power station were executed by Westinghouse, Church, Kerr & Company, consulting engineers for the Pittsburg, McKeesport & Connellsville Railway, who also prepared preliminary designs for sub-stations, car houses and overhead distribution system. The construction of the power station, with such extensions and modifications as were occasioned by the addition of the lighting feature, together with the sub-station and car house, was carried out under the direction of Thomas Elliott and R. W. Hunt & Company, Pittsburg, inspecting engineers of buildings and equipment. The corporation now maintains a thoroughly organized engineering department, equipped for executing the general construction work of all departments. The entire electrical railway and lighting equipment was furnished by the Westinghouse Electric & Manufacturing Company, Pittsburg, Pa.

IMPROVEMENTS IN INTERURBAN CARS AND MOTORS BY THE MILWAUKEE ELECTRIC RAILWAY & LIGHT COMPANY

The Milwaukee Electric Railway & Light Company has the past summer put into operation twenty-five interurban cars which are notable innovations in several respects. The design of the car body introduces several radically new and desirable features, and the motors are also of a new design, brought out especially to meet the specifications of the company.

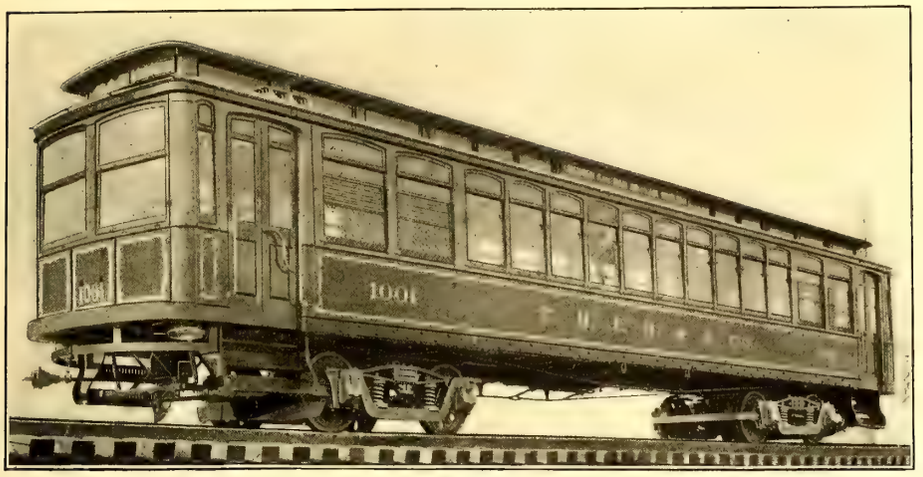
When the fact is stated that the car bodies are 51 ft. 6 ins. over all and seat comfortably sixty-four passengers, enough



MOTORMAN'S CAB AND END COMPARTMENT

has been said to arouse at once the interest of the practical electric railway man, who is accustomed to figuring the seating capacity of an interurban car at about one passenger per foot of length over all. Not only is the car notable on account of its great seating capacity but because it is arranged to be practically an observation car. The accompanying plans and engravings from photographs give some idea of the design of the car, although it is difficult to appreciate all of its good qualities until a personal inspection has been made. Looking at the plan of the car body, it is seen that each end of the car has a compartment of peculiar design. The main body of the car presents no unusual features, most of the study having been given to the proper arrangement of the end compartments. The arrangement, as shown, permits the motorman's compartment to be turned at once into the rear entrance of the car as soon as the motorman changes ends at the end of the route. The motorman's cab is partitioned off from the rest of the car by means of two sliding doors, which meet at an angle of about 100 degs. When these sliding doors are open there is no obstruction whatever to the entrance and exit of passengers. These doors are amply provided with glass, and the side of the car not occupied by the motorman also has a large window, so that an almost unobstructed view to the front or rear is offered. The end compartments have side seats, arranged as seen in

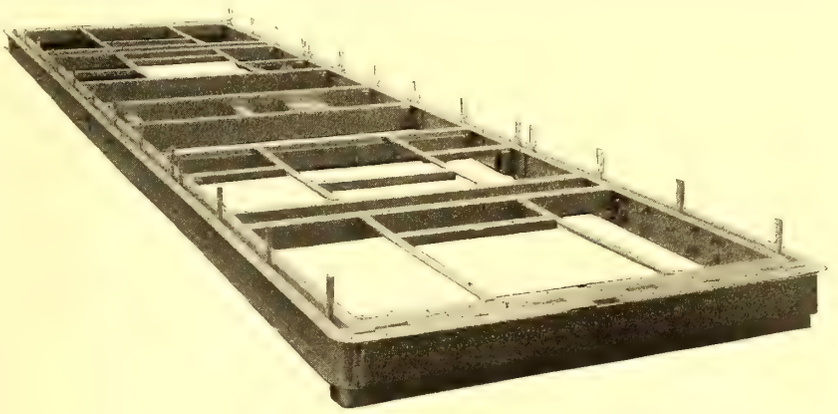
the plan. The folding seat is raised when the car is in the city and taking on passengers, as it occupies the space over the front steps on the right-hand side. This seat is shut down when the car is in the country, so that the view to the front is unobstructed. The rear compartment only is used for smoking, because of the draft which would carry smoke into the main compartment if there was smoking in the front compartment. Type-M control is used on these cars, so that very little room is taken in the motorman's cab by the controlling apparatus. The motorman's stool is placed on a hinged support, which is swung back against the side of the compartment when the compartment is at the rear of the car. The seat is removable from this support, and is changed from end to end along with the controlling handles. Both end compartments are on the same level as the main compartment. The sliding doors of the motorman's compartment can also serve a useful purpose in closing this compartment in the winter when at the rear of the car and in use as an entrance. Passengers can mount the steps before coming to the sliding doors. A view is shown looking forward through the front compartment, and it can be seen how unobstructed the view ahead is to the passengers. The toilet room occupies one corner of the main compartment, and the hot-water heater a corresponding corner diagonally opposite.



MILWAUKEE INTERURBAN CAR

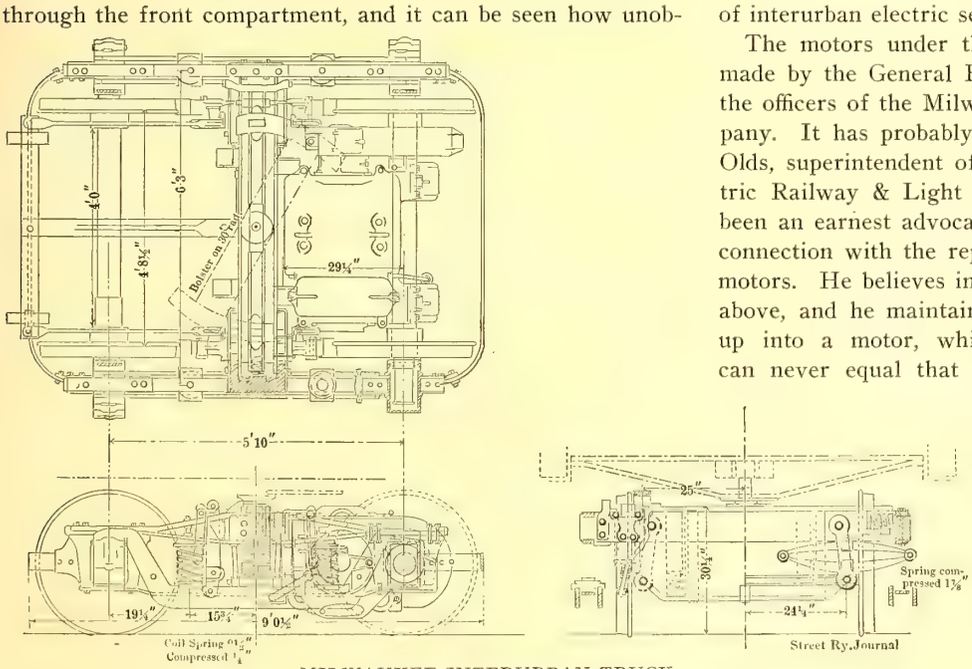
In these cars considerable pride is taken, both by President John I. Beggs, of the railway company, and the St. Louis Car Company, which built them. This pride is certainly justified, for it would be hard to find an interurban car in which all the details have been more carefully worked out, and in which so many passengers can be comfortably seated and afforded such observation privileges.

The trucks put under these cars were designed especially for the Milwaukee Electric Railway & Light Company by the St. Louis Car Company. They are somewhat similar to the No. 23 trucks which the St. Louis Car Company has built in large numbers for the Milwaukee city cars. The new truck is designated as No. 23-E. It is an M. C. B. type of truck, and differs from previous trucks of this type built by this company in having the end frames lowered so as to present a neater appearance and interferes less with the under rigging of the car. The side frames of this truck are arranged as a truss. This type of truck has practically all the flexibility of the M. C. B. steam road passenger trucks, while at the same time giving strength and compactness for the peculiar requirements of interurban electric service.



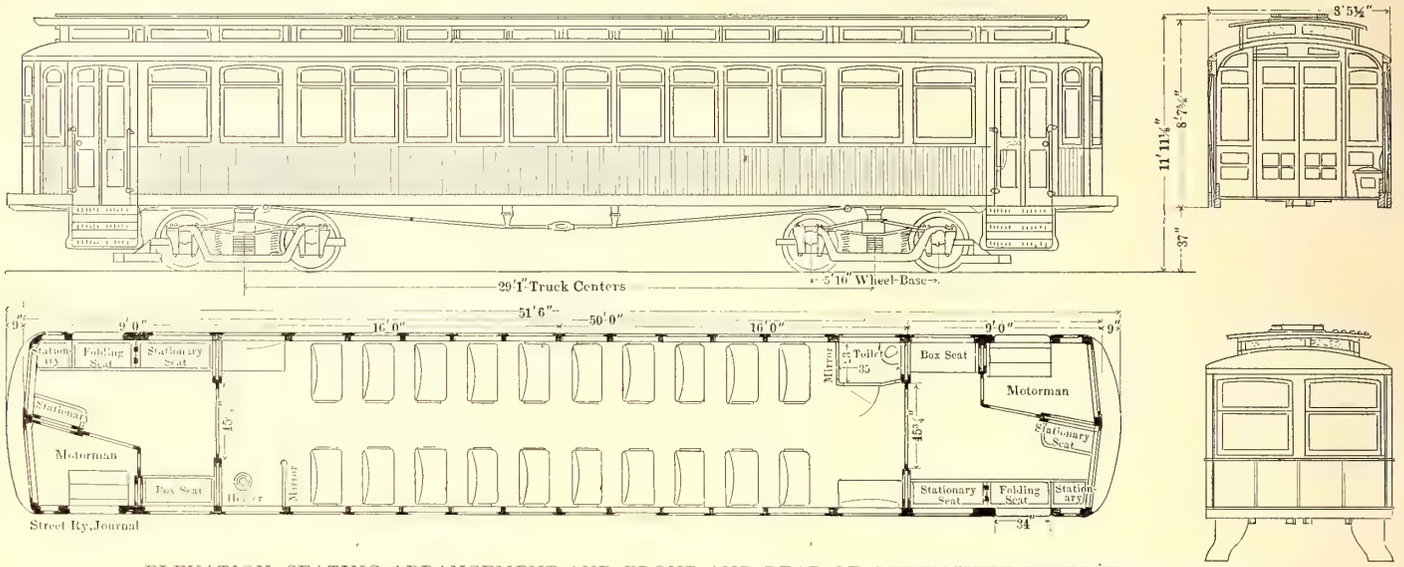
FLOOR FRAMING

The motors under these cars are of entirely new design, made by the General Electric Company to meet the ideas of the officers of the Milwaukee Electric Railway & Light Company. It has probably been known to the friends of E. W. Olds, superintendent of rolling stock of the Milwaukee Electric Railway & Light Company, that he has for some time been an earnest advocate of doing away with all pit work in connection with the repair and inspection of electric railway motors. He believes in doing as much work as possible from above, and he maintains that work done from a pit looking up into a motor, which necessarily has some dirt in it, can never equal that done out on an open floor, working from above. He has, therefore, favored a motor which is adapted to go on a modern swivel truck, which can be opened from above for casual inspection, and which can be lifted out of the trucks from above for further overhauling if necessary. This idea is incorporated in the design of the new motors. President Beggs believed so thoroughly in the correctness of these ideas and others mentioned later that the new General Electric 74-motor, with a capacity of 60 hp for interurban work, and the General Electric 70-motor, with a capacity of 40 hp for city work, were designed especially by the engineers of the General Electric



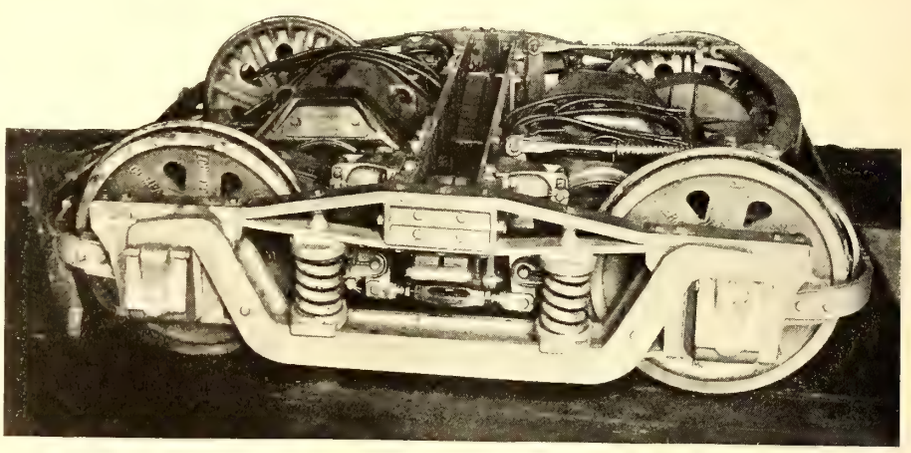
MILWAUKEE INTERURBAN TRUCK

Company at his request. The motor is supported on the truck by means of a suspension bar, which bolts to two lugs cast on the lower frame, instead of to one lug, as is common. This relieves some of the twisting of the motor in the bearings and consequent throwing out of parallel

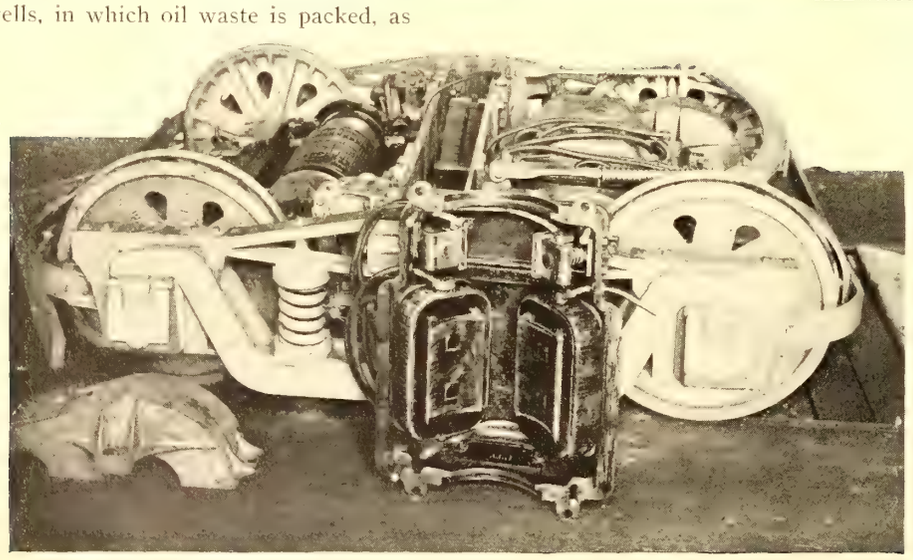


ELEVATION, SEATING ARRANGEMENT AND FRONT AND REAR OF MILWAUKEE INTERURBAN CAR

of gear and pinion which is so common on motors suspended with a single lug. The frame of this motor is octagonal in shape, and is divided in a horizontal plane considerably above the center into a large upper frame and a large lower frame, which are bolted together. The lower frame has two large openings on the sides, into which frame heads carrying the armature bearings are bolted in bored seats, these frame heads being somewhat similar to those used on the well-known box type of General Electric motors, in which the armatures are removed endwise. These frame heads are cored for liberal oil wells, in which oil waste is packed, as



MILWAUKEE TRUCK



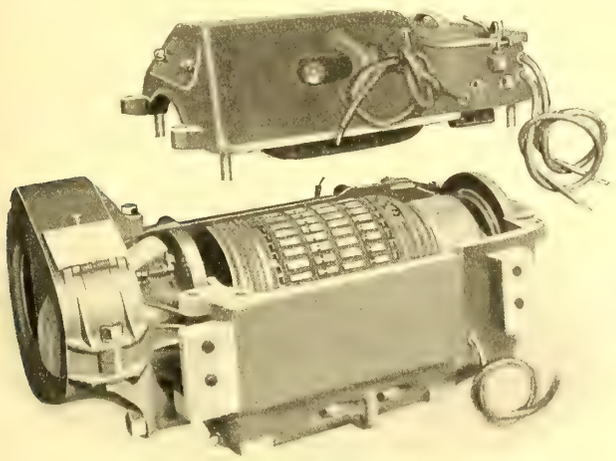
MILWAUKEE TRUCK, WITH UPPER FIELD OF ONE MOTOR REMOVED

in the box type of motors. The upper frame of the motor is not hinged, but lifts directly off, and has two of the field coils upon it. To protect the field coils from injury, pins set in the four corners of the upper frame form legs upon which the upper frame is set when removed.

When the upper frame is removed, together with the upper half of the gear cover, the armature, together with the frame heads, may be lifted out, leaving other parts of the motor still intact as assembled on the trucks. Once the upper frame is removed the motor and armature can be thoroughly inspected without disturbing the motor frame in the truck. The gear case is suspended in a way which will tend to prevent it from dropping off. It is suspended at three points. Three lugs are cast on the lower frame and the gear case is bolted to these. This furnishes a more rigid support than when lugs are placed on separate halves of the frame. With this arrangement the gear case is not affected by loose bolts on other parts of the motor, and excessive vibration of gear covers in service is largely prevented, so that the liability of breakage is reduced. This feature has been used on the General Electric box motors, and the peculiar design of this new split motor makes it possible to use it here. Hitherto many of the excellent features which have characterized the construction of the box type of General Electric motors, like the General Electric 66, of 125 hp, and the General Electric 69, of 200 hp, such as construction of bearings for oil lubrication, ventilation and gear case suspension, have been chiefly confined to motors of large capacity, but in the General Electric 74-motor these advantages are embodied in the split frame construction and in the smaller sizes. The axle-bearing linings are supported within axle caps, bolted to vertical planed sur-

faces in the lower frame. The axle caps are also cored for large oil wells and oil waste lubrication.

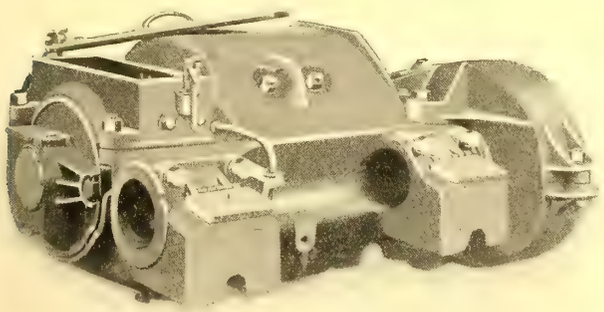
The provisions for ventilation and the easy inspection of the interior of the motor are quite complete. Besides the opening over the commutator the frame is provided with liberal openings at the top and bottom of each end of the motor. These openings are closed by malleable iron covers, which may be removed to secure perfect ventilation and circulation of air within the motor whenever the service conditions will permit. To reduce to a minimum the tendency to flash all short-

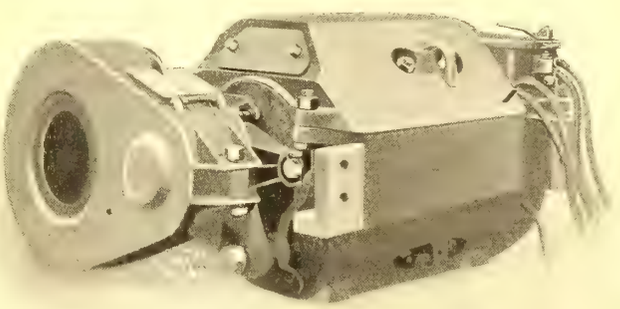


MOTOR, OPEN

circuiting devices around the pole pieces have been carefully avoided.

In general, the details of electrical and mechanical construction follow the well-known practices of the General Electric Company, but with some added improvements which have been thought desirable. Among these improvements is the more liberal surface given the armature bearings and the gears. In comparison with the General Electric 57, which is slightly smaller, the General Electric 74 has a pinion-end armature bearing 3⅝ ins. in diameter by 8¾ ins. long, as against 3¼ ins. x 8¾ ins. The commutator-end bearing is 3⅛ ins. in





END VIEWS OF GENERAL ELECTRIC 74-MOTOR, AS USED IN MILWAUKEE

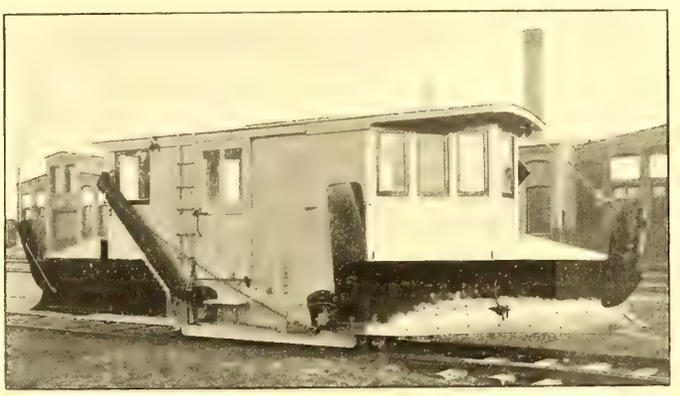
diameter by 6¾ ins. long, as against 2⅞ ins. x 6⅜ ins. The width of the gear face is 5½ ins., as against 5 ins. in the General Electric 57. The weight of the General Electric 74-motor complete with gear and cover is approximately 3320 lbs. The General Electric 70 is a lighter motor, which the Milwaukee Electric Railway & Light Company has ordered for city service, and which has the same ideas embodied in its design. There have been 100 four-motor equipments ordered for this city service.

Orders have been received from Washington designating the Worcester & Southbridge Street Railway, operating between Worcester and Southbridge, Mass., as a mail route, beginning Sept. 14.

WASON SNOW-PLOWS

The accompanying engraving shows the latest type of single-truck Wason snow-plow, which has been handled very successfully during the last five years by Thomas F. Carey, of Boston. The popularity of these plows makes some particulars of the latest type of single and double-truck plows of interest.

The four-wheel plows are made compact and simple, are easy of operation and not liable to get out of order. The shares are raised by a large, strong worm and worm gear, and are so connected that they balance one another, making it easy to



WASON SNOW-PLOW

raise and lower. This connection can be cut out at any time so that the shares may be worked independently, all by a hand-wheel staff at either end of the plow.

The shares are so hung that they may be adjusted and are free to conform to the unevenness of the rail at all times. The bottom edge of the share is fully protected by a heavy steel plate, ¾ in. thick, so shaped as to conform to the crown of the road bed between and just outside the rails; heavy steel shoes bear on the rail, insuring a clean rail, saving much loss of power; for ice heavy tool steel pointed diggers are provided forward of the wheels, making a clean rail doubly sure.

Each share is provided with an indicator, showing plainly the exact height of share from rail, a device of much value for properly clearing switches, frogs, guard rails, etc. The share can be raised 10 ins. above the rail.

The nose or working point of the share is a strong malleable casting to which the plates and irons are securely bolted. A cast-steel point or cover is fitted to this and can be easily replaced when worn out. The wings, both rear and front, are powerful, and can be worked easily at any height from the inside of the plow.

The share plate is curved, giving a rolling motion to the snow, throwing it far to the side of the track. This method requires much less power than to push the snow sideways.

The force of the blow on the share is conveyed to the body and truck frame by heavy angle-irons and forgings.

Powerful brakes control the plow. All parts beneath the body are protected from the flying snow by a side covering. The working parts inside the body are so arranged as to give a large amount of room for salt, sand, tools, etc. All plows can be fitted with a long leveling wing, on either side or both sides, which can be raised or lowered from inside of the plow. All plows are so constructed that air brakes may be applied at small additional expense.

The double-truck plows, while having all the advantages of the smaller ones, contain many new and valuable additions. The shares are well counterbalanced, making the operation by hand very easy, considering their weight, but when fitted with the air lift they are as easily controlled and operated as air brakes.

These shares, like those of the smaller plows, are provided with the same steel shoes and points, also powerful diggers on the truck frame, steel pointed, guarantee a clean rail.

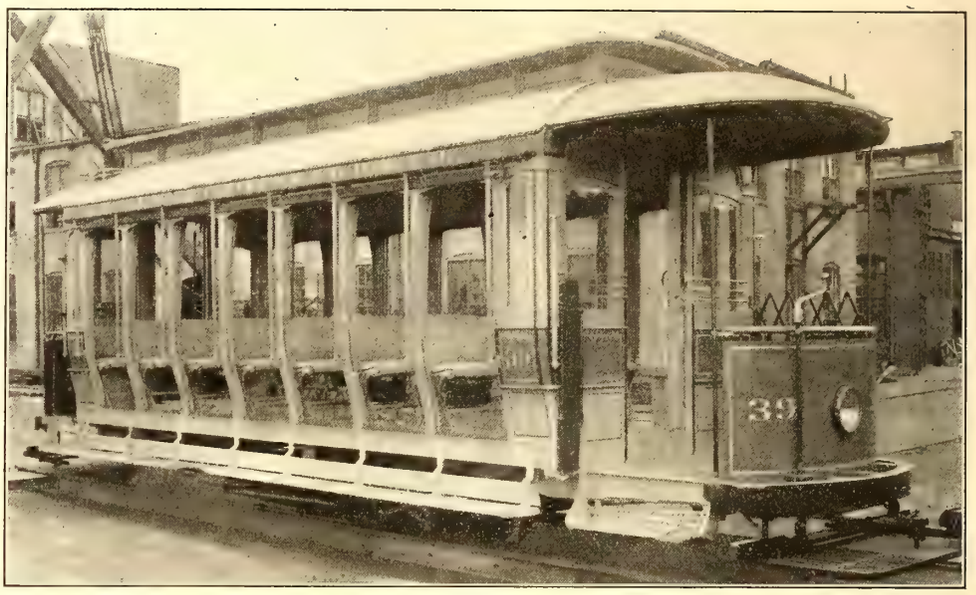
The double-truck plows are so ample in their arrangements that many railways are using them for other work than plowing. The large amount of clear space inside renders them a most practical part of the railway equipment for hauling, transportation and repairs. Some plows have been fitted with towers which raise above or lower to the level of the roof. When used in this way the shares are removed. A draw-bar head can be provided, which, with a link and pin, couples directly with any M. C. B. coupler.

The Boston Elevated Railway Company, of Boston, Mass., and the Rhode Island Company, of Providence, R. I., have recently placed contracts for Wason plows.

CONVERTIBLE CARS FOR VINCENNES, IND.

The American Car Company, of St. Louis, has recently finished an order for cars of the Brill patented convertible type for the Vincennes Citizens' Railway Company. This railway is distinctively a city system, operating about 7½ miles of lines, with more under construction. The several parks in the vicinity of Vincennes furnish considerable traffic during the summer months. The city is on the southwestern border of the State, and is one of the most important railway centers in that locality.

The new cars present a very attractive appearance, as the accompanying cut shows, and furnish seating capacity for twenty-eight passengers, with standing room considerably larger than the ordinary type of summer car. The cars are mounted on Brill 21-E trucks, which carry them low and make ingress and egress at the sides rapid and safe. The interiors are finished in ash with birch ceilings, making them bright and attractive. The corner posts are 3¾ ins. thick and are substantially connected with the first side posts with solid panels. The side posts are 3⅜ ins. thick, and are 2 ft. 7 ins. from center to center. The panels and sashes are stored in roof pockets in warm weather. The runways which guide the window trunnions are of metal, to prevent any possibility of sticking. Round-corner-seat-end panels strengthen the lower portions of posts, together with substantial connection with the seats, thus entirely compensating for the small addition of weight in the side roofs when the panels and sashes are stored in the pockets. Sweep of the posts is 5 ins. The lower sashes are 23 ins. x 28⅝ ins., and the upper sashes 16 3-16 ins. x 28⅝ ins. The side sills, of long-leaf yellow pine, are 5¼ ins. x 6 ins., plated on the outside with ⅝-in. x 6-in. steel. The end sills, of white oak, are 4¼ ins. x 6 ins. From rail to platform step 14¼ ins., from step to platform 12 ins. Length of cars over end panels is 20 ft. 7 ins., over crown pieces 29 ft. 7 ins., from panel over crown piece 4 ft. 6 ins. Width over sills 6 ft. 10 ins., width over posts, at belt, 7 ft. 9 ins. Under corner seats are located sand boxes of the American Car Company's make. The wheel base of the truck is 6 ft. 6 ins., and diameter of wheels 33 ins. Trucks are equipped with two 25-hp motors. Weight without motors about 17,500 lbs.



CONVERTIBLE CAR FOR VINCENNES, IND.

PENNY SALES MACHINE

The penny-in-the-slot machine as an auxiliary source of revenue is not new to the street railway manager, but hitherto no devices of that kind have succeeded because they were not designed to meet the conditions peculiar to street car service. Realizing the need for an efficient and durable machine for street cars, the New York Penny Sales Company, of New York, has recently devised the machine illustrated herewith.



The size of this machine, 2¾ ins. x 2¾ ins. x 30 ins. high, makes it very suitable for putting it in places where it will not interfere with the movements of passengers. It is made entirely of steel in any desired finish. By bolting to a car angle-iron it can be fastened so securely that nothing but a crowbar can dislodge it. Experiments with this device have proved conclusively that it cannot be operated by the insertion of counterfeit coins, metal discs or anything else except one cent. The machine is designed for the sale of matches, chocolate, chewing gum, confectionery and other articles which can be profitably sold in small packages.

The manufacturer of this device is prepared to make contracts based either upon space, rental or division of gross receipts, and is confident that it will prove a source of large revenue to all railways installing it.

As the latest models of this machine will be exhibited at the Saratoga Convention, street railway men will have an excellent opportunity to investigate the claims made for it by the manufacturer.

PROCEEDINGS OF THE SARATOGA CONVENTIONS

AMERICAN RAILWAY MECHANICAL AND ELECTRICAL ASSOCIATION

The Convention of the American Railway Mechanical and Electrical Association was held at Saratoga Springs, N. Y., Sept. 1, 2, 3 and 4.

President Thomas Farmer called the convention to order at 10:45 a. m. on Sept. 1, and introduced Joseph P. Brennan, the village attorney of Saratoga Springs, who delivered an address of welcome, to which the president responded.

COMMUNICATIONS

Secretary Walter Mower read the following letter:

THE UNITED RAILWAYS & ELECTRIC COMPANY, OF BALTIMORE

BALTIMORE, August 27, 1903.

MR. WALTER MOWER, Secretary and Treasurer, Detroit, Mich.

Dear Sir—I have to advise you that I shall be unable to attend the convention of our Association at Saratoga Springs. Our general manager is going away for a few weeks' trip, starting Monday, Aug. 31, and it is his desire that the heads of departments should not be away at the same time. I regret this exceedingly, as I shall be unable to present my paper on "Shop Kinks" in person.

There was one suggestion that I desire to present at the meeting of the executive committee, and it was that an open discussion be held upon the points suggested in the last issue of the STREET RAILWAY JOURNAL (Aug. 22, 1903), namely, on the method used in determining when equipments should be overhauled. I feel that a discussion of this kind would be beneficial to all of us.

Kindly explain my situation to the officers of the Association, and say that it is with regret that I am unable to be present to assist them in this work.

Trusting that you may have a successful meeting, believe me,

Very truly yours,

H. H. ADAMS,
Superintendent of Shops.

The secretary also read a letter from E. F. Peck, general manager of the Schenectady Railway Company, inviting officers and delegates of the Association to make use of its lines in Schenectady, Albany and Troy during the convention, for which privilege the badge of the Association would be recognized on all divisions on Sept. 1, 2, 3 and 4.

PRESIDENT'S ADDRESS

The president read his annual address, which is presented herewith:

Gentlemen of the Association:—It gives me great pleasure to meet with you here at this the first annual meeting of the American Railway Mechanical and Electrical Association. As all present may not be familiar with the conception of this organization, I will briefly state that the matter had been talked over between a few of the master mechanics during the summer of 1902, and that during the convention of the American Street Railway Association, held at Detroit, in October of that year, a number of the mechanical and electrical men who were present came together and effected a temporary organization. It was then decided to meet at Cleveland, Ohio, on January 12, 1903, to perfect a permanent organization. The date was later changed to February 16th.

The meeting at Cleveland was attended by representatives of a number of roads from all sections of the country, and a spirit was manifested at this meeting that at once spoke for its future success. Since that time, owing in a great measure to the personal efforts of the executive committee, ably seconded by our worthy secretary, the membership has now reached a total of 85.

I earnestly hope that while we are here in Saratoga, with the opportunities we will have to meet the different companies and their representatives who are not our members, that each and every one of you will use all possible endeavors to increase our membership to at least 150. We should all make an extra effort in this direction, and there is no doubt but what this result may be accomplished.

The objects of this association are clearly set forth in our Constitution, Article 2, which says: "The object of this association shall be the acquisition of experimental, statistical, scientific and practical knowledge relating to the construction, equipment and operation of street and interurban railways." Added to this are the advantages to be derived by all of us in the opportunities it affords for the interchange of ideas and the hearing of the members' papers, and to be able to freely discuss the same. The subjects of the papers which we will have the pleasure of hearing are as follows:

"Care and Maintenance of Car Bodies," C. F. Baker, superintendent of motive power and machinery, Boston Elevated Railway, Boston.

"Improvements in Street Car Motors," E. W. Olds, superintendent of rolling stock, Milwaukee Electric Railway and Light Co., Milwaukee.

"The 'M' Type of Control," W. O. Mundy, master mechanic, St. Louis Transit Company, St. Louis, Mo.

"Use and Abuse of Controlling Mechanism," D. F. Carver, chief engineer, Public Service Corporation of New Jersey, Jersey City, N. J.

"Shop Kinks," H. H. Adams, superintendent of shops, The United Railways & Electric Company, Baltimore, Md.

"Car Shop Practice," Alfred Green, master mechanic, Rochester Railway Company, Rochester, N. Y.

We should all take part in the discussions, as one of their principal objects is to provoke discussion, and from the many intelligent faces which I see before me there is no doubt but what they will be most ably handled. It should be the duty of each member of this association to freely impart to his fellows any information that he is possessed of regarding details, not only of matters relating to the electric car and regular shop practice, but of any special knowledge that he may have regarding same, for by so doing it will brighten us all up and make us, one and all, of more value to the companies we have the honor to represent. The representatives of the smaller roads can be of especial value in this respect, as, their facilities being more limited than those of the larger roads, the tendency of these men is always to be thinking of and working out new ideas which can be elaborated if necessary to meet the requirements of any sized road. We should all lend a helping hand if we wish to accomplish results laid out by our association. The American Street Railway Association has a committee on standards, appointed for the purpose of investigating and suggesting better methods and devices than are now current practice, and to secure uniformity in all matters relating to the electric railway equipment. The work of this committee has been very ably handled, and the results obtained, while not as far reaching as they should be, can be seen in many ways. It should be the earnest effort of every member of this association to give this committee every possible assistance to bring about the results hoped for in this direction. The fact of there being at present virtually no acceptance by the manufacturers of street railway material of any such standards leads to an enormous multiplicity of repair parts, not only electrical, but mechanical. The stock rooms of some of the larger roads have the appearance of a wholesale hardware store, and the amount of money invested in these stocks could be very materially reduced, as well as stock room attendance, by weeding out unnecessary parts and sizes. Too much stress cannot be laid upon this question of standardization. The steam roads are very far in advance of the electric roads in this respect, and it is up to us, as the mechanical representatives, to try and get order out of existing chaos. It will not only be better for the companies, but will lessen our own labors to a very appreciable extent.

Thanking you, gentlemen, for the honor you conferred upon me by electing me to the highest office within your gift, and again thanking you, one and all, for your co-operation in making this association the success that it is, I will not trespass further on your time, but commend the business of the association to your hands with the fullest confidence that the results will be most satisfactory and beneficial to every one present. We will now proceed to the regular order of business.

EXECUTIVE COMMITTEE REPORT

The secretary read the report of the executive committee, as follows:

"Rather than read the minutes of all preceding meetings, in order to save time, I will state briefly the substance of the business transacted.

"The first steps toward organizing this Association were taken during the American Street Railway Convention, held in Detroit, in October, 1902, seventeen different companies

being represented. A committee or six, with Thomas Farmer as chairman, was selected to proceed with the organization. In response to a circular letter issued by this committee a meeting was held in Cleveland in February of this year, and a permanent organization effected. Fourteen companies were represented and officers elected, details with which you are all familiar. Immediately after this meeting adjourned the executive committee went into session, selecting a committee on membership, fixing the salary of the secretary-treasurer at $500 per annum, placing his bond at $2,000, and electing the Street Railway Review, Street Railway Journal and Western Electrician honorary members.

"A special meeting of the executive committee was held Monday, Aug. 31, at the Grand Union Hotel. The minutes of the last meeting were read and approved; the reports of the secretary-treasurer were read, and after being audited by a committee of three and found to be correct, were approved. Mr. Farmer presented the secretary-treasurer's bond for $2,000.

"A letter from the Schenectady Railway Company, inviting members of the Association to make use of its lines upon presentation of badges, was received, and a vote of thanks given for the kindness."

On motion of C. F. Baker the report of the executive committee was adopted.

SECRETARY-TREASURER'S REPORT

The secretary-treasurer then presented his report, showing the following list of members: Active members, 21; honorary, 3; associate, 27; junior, 34. Total, 85.

Dues from active members to Sept. 1, $420; from associate members, $135; from junior members, $102. Total, $657.

Disbursements to Sept. 1, $176.77. Balance on hand, $480.23.

The report was adopted.

MEMBERSHIP

The President—I think it would be well to have a discussion on the best way to increase our membership. We have done fairly well so far, but we must do better than we have.

E. W. Olds—Nearly all of the members have joined the Association through the instrumentality of the letters and circulars that have been sent out by our secretary, and it is now up to us to see what can be done further to increase our membership. Our expenses have been considerable, and to get out our reports and bear the other expenses which will fall upon us at this meeting, and also to be ready for our next year's meeting, will require quite a good deal of money, and I think the only way for us to get at it is for each member to be a committee of one and get all others who are eligible to membership in the Association interested in its work so that they will become members.

We all know that the smallest shop, the smallest road, will give us ideas that are of great value. We do not always adopt exactly what we see, but we get ideas which we apply to our conditions and are greatly benefited by them. If we do not do this we are liable to keep following the old beaten path, and the first thing we know we are side-tracked. Let us bring out our ideas. Another thing, as we pass around let us become better acquainted with each other.

W. O. Mundy—The object of our Association is for the betterment of the railroads, and incidentally anything for the betterment of the road is for the betterment of the individual. It is only a few years since the engineer was considered to be the man who turned the throttle, and the master mechanic the fellow who shoved a file or scraped a bar. We must establish our work as a profession and not a trade, and we must make ourselves felt. I believe that this Association will help us more than anything else in reaching that end. It gives us a prestige we have never had before. It is necessary for this Association to be a financial success as well as a success from the engineering standpoint. That means we must have an income which will keep the Association in good financial condition. I want to urge that instead of considering that because the road is a member of the Association there is no necessity for you being an associate or junior member, we get over that idea. The yearly dues for associate members are $5, and junior members $3, a very small amount in either case. That class of membership includes the receipt of copies of the reports and all discussion that go on at the meeting. A number of the roads around the country have said that they can get the transactions from the technical press. Suppose they can? If all the roads and all master mechanics did not care to become active, associate or junior members there could be no Association. If we want success we must, as individuals and companies, become members and help along from the financial standpoint. Each must consider the necessity of becoming an associate or junior member, and not a hanger-on, and going around to hear what the other fellows say and get the results without helping to pay for them.

Alfred Green—This is one of the most important times in the history of the profession of master mechanics and electricians. We are now starting out to make a beginning that is either going to raise us in the estimation of all men or we are going to go below the level that we now hold; for there is no man, no set of men, no men in any profession, that can stand still. There is not, in my opinion, any set of men that have any more brains, any more ability, or any more power to adapt themselves to circumstances than have the master mechanics and chief electricians of this country. There is no reason why we should not have and hold the honor that our position gives us; but we must earn it, we must earn it honestly, we must earn it by hard work, careful thought, plenty of discussion and heart-to-heart talks. We have a nice start, but it is nothing to what it must be. We are now a branch of the American Street Railway Association. There is no reason why we should not be the ones that they will come to hear discuss the papers that are the most important, or take care of the most important details of any street railway system. There is, of course, in the general manager's office the financial part of the business, with which we have nothing to do, and there is the department of the superintendent of transportation. But neither one of them can be a success unless the master mechanic and the chief electrician succeed in their departments; unless the latter are taken care of and brought to the point of success in careful business management which will give the best results with the least expenditure. Now, there is no reason why we should not attain the standing that belongs to us, and, as I have said before, what we want is hard work, and plenty of it.

DISCUSSION OF PAPER ON "THE CARE AND MAINTENANCE OF CAR BODIES"

The president then introduced Mr. Baker, of Boston, who read his paper on "The Care and Maintenance of Car Bodies," which is presented elsewhere.

Mr. Green—Mr. Baker says after a newly painted car has been placed in service for six months it is taken off and given one coat of body varnish. I would like to ask how many coats of finishing varnish that car gets before it goes out, and when he gives it the extra coat after six months does he add that as an extra coat, or what does he do before the car goes out?

Mr. Baker—I referred there to a new car. I would say, gentlemen, that we have Mr. Libby with us, who was formerly our master painter, now superintendent of our car shops, who could give you the details of all this much better than I, and he will answer any questions in that connection.

Mr. Libby—Mr. Baker referred to the new cars on which two coats had been applied. We deem it advisable to have a new car in service at least six months before we give it a third coat. Some builders advocate putting on three coats when the car is built. We think it better to have six months elapse between the

second and third coats. That applies to either a new car or a car burned off.

Mr. Mundy—In applying that varnish in two coats do you put on two coats of rubbing, or one coat of rubbing and one coat of finishing varnish?

Mr. Libby—We use no rubbing varnish on the exterior except on the sashes and doors.

Mr. Mundy—If you put the third coat on after six months do you give it one coat of varnish every year when you renovate?

Mr. Libby—One coat.

Mr. Green—How about the interior?

Mr. Libby—Our repair work on interiors is simply a question of touching up the heel board, the toe board, and, possibly, the window sills. Other than that we expect to get ten or twelve years out of a new car with a rubbing up. We have not tried patented processes as yet. We mix our own preparation.

Mr. Green—It is a nice thing, if it can be done, to bring your car in after it has run for six months, because the first two coats had a chance to harden. Then, when you bring it in before the weather has had any effect on the varnish and give it an extra coat, you have something there which is a great help to the body, but I do not know how many roads there are that could afford to do that.

Mr. Mullin—What is the object in omitting the rubbing varnish? It has been my understanding that it was of special benefit to the body varnish as a binder. It is in use on our road and on several others that I know of.

Mr. Libby—We believe a rubbing varnish makes a brittle finish, and it is our purpose from the beginning to make the surface of the car as elastic as possible. It will stand more vibration, and we believe that we get better results. Rubbing varnish is used very largely to facilitate getting a good, smooth surface, and must necessarily dry hard and brittle in order to be rubbed with pumice stone and curled hair. We do not make any attempt to produce such a fine surface, but we do get a softer and more elastic finish if we omit the use of rubbing varnish.

Mr. Olds—That has been our experience regarding the painting of cars, whether new or old. Leave the rubbing varnish in the manufacturer's cellar. We have no use for it. We use two coats of finishing varnish.

It is very pleasing to note in Mr. Baker's paper the method they pursue in painting their cars. As nearly all of you know, the rough stuffs and primers that are brought to our attention are a curse as a whole. There may be some of them that are good, but I have yet to find them. The lead surface will produce an elastic coat that will give years of service. I can show you cars that have been painted for about eight years, and the body is not cracked; it is solid and sound. The car has been varnished quite a good many times, and a few times the varnish has been taken off—it got too old and became yellow. There are a number of varnish removers, but we have had as good results from using ammonia. If it is used properly and with reasonable care it will not injure the paint. If the ammonia is removed thoroughly and the car cleaned off, the car can be brought up then with small expense, not to the fine finish that we used to get upon a coach, but a good, durable and elastic finish.

Ten years ago we were getting out some cars that were needed for a special summer service. The car builder said that it was impossible for him to finish the cars for us. We went through very nearly the same process that Mr. Baker has described, but instead of using the knife coat we simply leaded, and did not wait for the knife coat. In fact, the cars were finished in four days and put into service—and they were not repainted for four years, being simply touched up and varnished. There was very little body on the cars, but it was good.

As to the finishing of the inside of the car we have many mechanics who are not as clean as they should be, who injure the inside of our cars, causing the wearing off of the varnish at the doors, window sills and various other points. We find we have to clean them and quite often refinish them. Then, as Mr. Libby has stated, the principal part of the work is the rubbing of the inside with some varnish renovator or some preparation of oil to bring out its life.

Mr. Green—In washing the cars, Mr. Baker, what do you use? What help have you? I understand there are some roads that employ women for washing cars.

Mr. Baker—We employ men in our car house and pay them $1.50 a day for ten hours' work. I believe they work 63 hours a week. John Lindall, foreman of the elevated shops, is here, and will give us his experience on that point.

Mr. Lindall—We pay our car cleaners $1.50 a day, and they work seven days a week, one car cleaner taking care of seven cars. Our method is to wash the cars every day in wet weather, or keep washing them until they are cleaned up after a storm, and then clean the inside of the cars.

There is something which interests me very much just now on account of the recent disaster in the Paris tunnel, and that is the fireproofing of cars. We try to make the elevated cars fireproof, and have the motor end of the car flooring covered with asbestos and galvanized iron. On account of some trouble we have had on account of fire ignited through the light switches, etc., we have put asbestos mats under the switches and stripped the insulation of the wire back 6 ins. or 8 ins., and put on asbestos stockings. We are also contemplating extending this practice to the light sockets on new equipment. I believe there has been some discussion among the underwriters in regard to putting the wiring in the cars in conduits.

Mr. Green—When we used the old-style rheostat, and when we had the old contact boards, we tried asbestos and found it one of the most dangerous things we ever used. We fastened asbestos board to the floor of the car, covered it with sheet-iron and fastened the rheostat to that. We found the asbestos would not only take up and hold moisture, but it got hot and the iron got hot; the asbestos held the heat long enough to set fire to the car on several occasions.

It is certainly to the interest of the railway companies to improve the method of wiring, especially where the climate is such as we have in Rochester. We have for six months in the year slush and mud, and where we use salt in the switches it cannot be kept away from the wires. The moisture seems to work through every crevice in the car where you have the cables. In that case it is necessary that the car wires eventually shall be put into a conduit, not for the benefit of the underwriters as much as for the benefit of the railway companies themselves. We are now getting away from the use of the old-style rheostat so that we have something from which the heat can radiate. I do not think we will ever be able to prevent motormen from running on any part of the rheostat. They will run on it and get it so hot that they will simply burn it up. You ask the motorman why he did it, and he will tell you that the car was in that condition when he took it out.

The President—We had trouble in Detroit with snow-plow cables. We use salt on the tracks, and after every storm we had five or six out of the eight ordinary snow-plows come in with the cables burned out. We took some 1½-in., inside diameter, lead pipe and made junction points at the proper place with small lead pipe leading into the larger lead pipe, and put all the cables into those pipes. This overcomes the trouble. It is expensive, but it is an absolute protection.

All the cars in Detroit are heated by stoves, set in a box, which is lined with asbestos inside and iron outside. We have had a great many fires in the interior of cars because of the non-protection of asbestos. Lately we have used merely sheet-iron with a good big air space, both top and bottom; a good circulation of air through the box is better than any insulating material.

I would like to know if Mr. Libby has tried wiping the outside of cars with linseed oil to brighten up the varnish?

Mr. Libby—We never did that. If we should attempt that it would have to be done in the car house. We are now using a very weak solution of linseed oil soap. On white work, the lower panels around windows and under the bonnets, etc., we have to give them a very hard rubbing sometimes to get them clean, but our main dependence is upon the use of clean water.

The President—Do you have trouble with the soap getting in the corners and accumulating dust?

Mr. Libby—We have the soap thoroughly diluted and give it to the men in diluted form, so that it will easily rinse out of all crevices.

The President—We had trouble in Detroit with the soap lodging in corners and crevices. We are using it yet, but in much less quantities.

The President—How often do you paint your floors?

Mr. Libby—Only when we shop the cars, once a year.

The President—Do you not have trouble with the car floors rotting from the excessive amount of washing which you give them?

Mr. Libby—No; we have not experienced any great trouble with that. We paint them once a year, when the car is shopped.

The President—On one suburban line in Detroit the car floors are all rotting out, and it is because of the excessive amount of water they used and the fact that they did not dry it out at all after they washed the cars. The result was that we had eight cars on one line there on which the floors had to be replaced. You can stick a knife right through the floor, it is all brown wood.

Mr. Libby—Do you hose them out inside?

The President—Yes, take a hose and wash it all around.

Mr. Libby—We do not use that amount of water on the interior.

The President—Do you ever use any ochre in your paint on the roofs?

Mr. Libby—No, sir.

The President—Have you any reason for not using it?

Mr. Libby—The management wants white paint.

The President—Are your car roofs painted white?

Mr. Libby—Well, they are supposed to be white, but we have gradually been introducing lamp-black, a little at a time.

The President—If the management did not prefer a white roof do you not think ochre better than lead?

Mr. Libby—I should most decidedly change the tint. I should prefer the base to be white lead.

The President—Mr. Baker said on open cars the seat backs and arms should have attention, and that the half-round iron on the steps and running boards should not be allowed to project above the edge. What do you do when that iron does project above the edge, as it does in a whole lot of places. Do you put on a new running board?

Mr. Baker—Yes. Otherwise it would be a very slippery and dangerous thing.

The President—Do you use the same old iron?

Mr. Baker—Yes.

Mr. Olds—In a number of cases we have lowered the iron about ⅛ in., and have been quite successful in that way. The running board originally was 1¼ ins., so that we were able to lower it and get the same result.

The President—I was going to make a suggestion after hearing what Mr. Baker had to say about putting on the new running board—why wouldn't it be a good plan to make an oval hole when you put that on? Then you have got it right on the start, so that when it does wear you can slack up on your screws and drop it down at no expense whatever.

Mr. Olds—I am afraid we would have trouble at times. The iron will get a hard blow. That will drop it down. It will then wear off the board and we will be unable to drop it again.

The President—You could bring it back?

Mr. Olds—Yes, but as it comes out of the car house, my experience is, that some of those things are overlooked. We have to issue orders calling that car in. Our company is very short of cars, and to get the car in for the necessary painting and overhauling is like pulling teeth. During the last winter we have been obliged to neglect our cars for that reason. In Boston they use a double equipment, as a great many others do. With us our equipment runs the whole year round, practically, and in that way we are obliged to bring them in from service.

The President—Mr. Baker spoke about the trap-door lift being kept in proper shape. What is the best form of trap-door lift?

Mr. Baker—I think we have had the best success with the T-lift. The only thing is to keep them down, keep the dirt out from under them. They will get rusty anyway and want to be renewed at times and kept clean and in workable condition.

The President—In building up on your first painting you use less oil in each coat, do you not?

Mr. Libby—Yes, that is the idea exactly. It is our object to fill the grain or pores of the wood only to a level surface; in other words, to apply as little on the car as possible. It is our object to get as much off as possible and press into the grain and pores of the wood. After having sand-papered that coat we then give it just one coat of ground color, which depends upon what the body color of the car is going to be, and then two coats of color and two coats of varnish.

We ornament practically on the flat color and give two coats of body varnish, about 48 hours between the coats, rubbing the first coat slightly.

The President—Mr. Lindall said he allowed one man to seven cars. Do you mean that one man can wash seven cars in a day?

Mr. Lindall—Yes, wash and clean them.

The President—That beats the record out in our country.

Mr. Baker—I might say that we have in our car houses seven cars to the man, for sweeping and maintenance. We have tried eight cars to the man, but we did not get our work done satisfactorily. Possibly we do too much work, and clean our cars too often. As I stated, we wash the cars once a week, except in wet weather; and, as Mr. Lindall went on to say, in bad weather we wash them every day, or keep at them until we get through. It is a question, really, of doing all the work we can with our men. If we cannot wash them every day they have to go two days or three days. In our inspection and other work, as I said before, we have tried to do that every third day. Some roads have criticised us, I believe, because we had too many men in our car houses for that work, but if we find other roads that can keep their equipment in good shape with less inspection and less work, we would like to know how they do it. We are anxious to get down our cost as low as we can, and keep our equipment in proper shape.

Mr. Green—I would like to ask Mr. Baker what percentage of rolling stock he operates per day.

Mr. Baker—At this time of the year, or practically all times of the year, our equipment is operated up to probably 85 per cent or 90 per cent. We might have 10 per cent at times in the shops. At the present time we have almost that, on maintenance and revestibuling our cars. But we can at this time of the year operate all of our open cars except a few that might be damaged, and also a large portion, 80 per cent or 90 per cent, of our box-cars. We run them out in wet weather or bad weather, even in the summer time.

Mr. Green—Yes; but you have a double equipment then?

Mr. Baker—We have, practically, in the summer time.

Mr. Green—Of course that makes a great deal of difference in handling the system.

Mr. Baker—Yes; makes extra work to keep up in one sense of the word; we have the two equipments to keep up, and it is pretty hard for our men in the summer time to keep up the open car and the box equipment; makes more inspection.

Mr. Green—I think you would find it harder if you ran about 80 per cent of your entire equipment every day in the year.

Mr. Lake—This matter of car cleaning has been a great bone of contention between myself and the management. I would like to inquire about the size of the cars. Of course, the city cars vary a great deal from our interurban cars. I suppose that the seven cars that Mr. Baker turns over to one man to clean are small city cars, are they not, and perhaps open cars at that?

Mr. Lindall—Twenty-five foot.

Mr. Lake—My management is very particular about car cleaning; wants them very clean inside and out. I perhaps have a different combination to contend with than the majority of you in the territory that we go through, which is composed of oil and gas country. The oil and gas, of course, comes from the ground, but I find a great deal of it circulating about through the air, and the cars accumulate a great deal of it when they are passing through; and about the best I can do on a 40-ft. car is to allow one man to a car per day. I change my cars off. I only run cars every other day, a run of a little better than 20 hours, making from 350 miles to 390 miles a day. In order to keep these cars up in any kind of presentable condition I have to clean them every day, windows and all. When they come in they are coated with a kind of yellow sediment that looks very much like brick dust, mixed with water. Just what it is we have not been able to find out, but we think it is a sediment that comes from the oil, and that is also very greasy.

We use what is known as linseed oil soap. There are two or three different makes. We have a very hard water and we have to use some kind of soap with it in order to get this grease off the cars. Another trouble we have is that we take our water from a river which is lined with paper mills, I guess from one end to the other, and those paper mills dump their refuse into the river.

Mr. Lewis—We clean six cars a day with one man, on an average. Our equipment is a mixture of interurban and urban, ranging from 25-ft. bodies up to 52 ft. Probably our interurban cars have to be cleaned more frequently on account of the higher speed and greater accumulation of dust upon the body and the windows of the car, but our average is six cars a day.

Mr. Mundy—We are using a soap very similar to that Mr. Libby speaks of, and do not find any serious results on varnish. If Mr. Lake got some other kind of water he might get better results with the soap. I think that has a great deal to do with it.

Mr. Lake—Our cars have been in operation now more than six months. We received four new cars less than two months ago that have not been in operation yet, and you can see very little difference in the paint. I would say that much, that I have preserved my varnish and paint to very nearly a new luster, but I have been very careful.

Mr. Mundy—Referring again to the paint question, I am hardly in a position to say very much on that, because at the present time the St. Louis Transit Company cannot pride itself on its cars. We are practically a combination of a lot of roads that left the cars in about the most inartistic shape in which you could possibly find them. We have been short of cars, and for that reason unable to get around and cover them to the best advantage, but we have been doing the best we could, and have been following out some lines in painting slightly different from those commonly used. We have got down to the point where we put the color on the car and then do nothing but stripe it. We have not the name of the St. Louis Transit Company on it; in one corner we have the initials, "St. L. T. Co.," and the number appears in the middle of the panel, on the side and on each dash, but the car is free from decoration of any kind. We are getting quite a number of new cars for the World's Fair, and in doing that we have even gone further; we have made the inside woodwork absolutely plain. We have not put a line of beading in the whole car surface. For instance, the pilaster on the window is simply a plain face with a corner taken off, about ¼-in. radius. The cars are finished that way all through, so that when it comes to cleaning in the future we will have it right down to a minimum, with no place for dust that we can possibly avoid, and no decoration to maintain and rub up.

W. D. Wright—We do not use very much soap; we believe in plenty of good water, no paper-mill water. I do not know that I can give you any statement as to the number of cars assigned to each cleaner. Many of our car cleaners have other duties, shifting cars, etc. We keep our equipment looking pretty well. We have the idea, just mentioned, of eliminating much of the decoration and fancy work on the cars. I believe that idea will gain strength—it is good common sense.

Speaking of the trouble from fires through electric circuits we have had some trouble in that line. We had one quite serious fire that I am satisfied was started by a heater wire on a side-seat car. The car was in the repair house not many minutes before the fire started. I think it was started by a small rubber-covered wire connected with the heater becoming moist to the breaking point, and, finally, from some little jar, it gave way and the heater circuit happened to be on. One of the first things we did to guard against fire was to stop the use of a solid conductor, especially in the smaller sizes, and for our lighting and heater circuits we use nothing but a stranded wire, which will not become nicked and break off inside the insulation. Inside, under the seats, we go still further, and in our heater wiring use a slow-burning cover, the same as is used in houses, and get the rubber out of the way. We use nothing but stranded wire. In order to avoid trouble from the cables, due to water under the car, we adopted a plan of putting our cables as much as possible above board, even in the cross-seat cars, having a conduit for them along the side and making all taps to the cables above the floor. That seems to be the weak point of the car cables, underneath the floor. Now we make all taps above the floor and bring the wires from the floor through porcelain or clay tubes, not cleated, to the inside of the car body. We use a porcelain knob that will hold two wires, designed to take different sized wires. We put two wires on one knob. The idea was to give an air space around the wire which would be better than any tube you could put on. The wheels can throw water on these knobs, but they will dry off sooner, and they also prevent the lodging of mud which holds the moisture, and which affects the woodwork all the time. Eliminate all these points if possible. Sometimes, for resistance, we bring a whole bunch of resistance wires, six or seven, in a separate cable. These are in the center of the car and not subject to the water from the wheels, and you can protect them better. When we come to the center line of the car motor leads, the resistance leads are in position where they can be cleated safely in carrying the wire around resistance boxes. In the first place we lower the leads and get them down over the car floor, and in carrying lead wires to the resistance box we never carry a wire with a rubber covering on it from one box to another or between boxes. We cut off the insulation and leave a part of the wire bare, leave it so that it can have an air space. If it is necessary to insulate it we put on a piece of porcelain or clay tube. Of course, the trouble is that we have got to go out of the car body somewhere. In the case of a box-car, which gives the most trouble from water, we have adopted a 2-in. pipe where we go out at the corner of the car, using a 45 deg. L, and use that pipe to go from above the floor down to a point where you would branch off and run under the platform to the controller.

H. E. Farrington—The matter of car cleaning on our road is in the hands of the superintendent of the transportation department, and, therefore, I have nothing to do with it. I do not believe in using a strong alkali, or a very strong solution

of soap upon the outside of the car. My experience has been that if the cleaning is handled by men who understand how to do it properly, no bad results will follow; but if it is handled by the ordinary run of car cleaners, unless they are watched very carefully, we are apt to have bad results.

We are governed in our car building by the same conditions that govern the Boston Elevated Road, as we run into Boston and our cars are practically the same as theirs, except some few which we have on the long lines out of town, where we have some larger cars, using the same straight side car with cross seats. Our methods of painting differ from those described by Mr. Libby. For some years we followed the same method as the Boston Elevated; but our people thought we should have a little better lustre and higher polish, and we went back to the old method of carriage painting. We gave up the knifing, but filled and rubbed down. The only object of the filling is to put it there for the purpose of producing a good finish, and, I believe, as the committee does, that better results can be obtained by using an oil lead primer, using your second coat, than knifing. Better results can be obtained in this way than is possible by a coat of any rough stuff that may be used. It insures long life and more durability. I have never followed the practice of putting varnish into a flat color. I tried that several years ago, but had more or less chipping or flaking off of the color. Then, after the color was reduced to a consistency for use, my men applied a very small amount of raw linseed oil, not enough to produce what we call an egg-shell gloss, or keep it from drying, but you can make the color more elastic than would be possible to get by using the varnish. I have seen cars painted with the knifing process that have been out in service from eight to ten years before coming back into the shop with any apparent cracks. I do not believe rubbing varnish is intended to do any more than rough stuff for producing a fine finish and getting down to a surface. It is heavily freighted with drying qualities not elastic, and if there comes a hot day it will not expand and contract with the outside varnish. The result is you get cracks. If you carry the same elastic coating through from foundation to finish, you will find that the ground work will stand for a number of years without showing any cracking or peeling, and stand up and do good work. I think for car work that method is the best of any I have ever seen.

As to the method of inside varnishing—the finishing of the inside of the car—I believe if we use inside lead color, not a rubbing varnish wholly, but mixing it possibly with one-half rubbing, or two-thirds rubbing and one-third finishing, it will dry sufficiently hard to give better results. With an occasional cleaning and rubbing with oil it will stand for several years and make a good appearance without any expense to the company. I follow that method, and the only varnish we have on the inside of the car is on the doors and windows and similar places.

William Pestell—I am interested in the matter of fireproof car wiring. Has any one else had any experience in putting cables or wiring in conduits on car work?

Mr. Ballard—On the Boston Elevated we have experimented a little with lead cable; we have only four cars running with that cable. We took our motor leads and encased them with 1¼-in. lead pipe, the pipe coming up under the seat and carrying it directly over the motors. The cables are not encased in lead—only the leads. The cables are encased in linen hose, and fastened up under the seat. The taps are made in the cable. For a great many years we had much trouble with the leads parting at the brush holder or other points, and taking fire and setting fire to the car underneath the seat. There is a fireproof wire which we use entirely on our field leads, bumper leads and the taps that run to the resistance boxes. We never had a case where the fire would run more than 3 ins. on this wire. It is impossible to burn it with a torch. There is a coating outside which is practically waterproof, it is impossible to set it on fire, and we have not had a case where a fire was carried under the seat of the car or for any distance whatever.

The President—Where we take the taps off we wipe the joints the same as a plumber would, so as to make them smooth. We never have had a cable down since they have been put up according to these plans. These cables are on the snow-plows only.

Mr. Olds—Our method of car construction is a little different from some others. We have two sills running through the full length of our cars that are placed 6 ins. apart, and the space between these sills is separated by a small cast-iron box, which gives a space between the sills. Our cables are run in between them. As you come to four motor equipment the leads are taken out from that hose, through the sill, dropped directly to the motor, which is inside hung, on the other side of the body bolster. By so doing they are absolutely protected from the water, and the lead being very short is not injured by the swinging of the trucks. We have been using this method for about seven years, and have found it very successful. In fact, the only short circuits we have had in any of our cables have been caused by very hot resistances, or in a few cases at the trap-door, where the cleaners have allowed the mud and dirt to accumulate, and in very wet weather this causes a short circuit of the wiring in the hose. At the ends of the car we used two center platform leads, coming up directly under the sill, the cables being passed in between them in the same way.

In regard to car cleaning I have found that no matter what soap you use you need to take extra care and caution with the car cleaners to keep them from using too much. It does not really matter much what the soap is, in my opinion, if you use a small quantity. We must have a little alkali in the soap in order to clean the dirt off.

Mr. Ballard—In car wiring have any of the members used any method of keeping the wires separated where they go into the controller underneath the car platform, whether they put them in one post or two posts? We have had a great deal of trouble with moisture getting in from the platform and getting into the cables, and the cables being short-circuited a foot or two from the controller on either platform. In our last lot of cars we have taken the wires out of the holes entirely and run them separately, and they do not arc if the water gets near them.

Mr. Pestell—When we get the water guard on we are pretty careful to get it tight, and underneath the car, at the right-hand of the bumper sill, we put a canvas around the cable where it comes out, nailing it on and keeping it painted. That takes the washing of the water away from the cable. The place we find they burn is where the bend comes in the cable underneath the sill. We protect that so as to keep the dust out of the controller and keep the water from getting on the cables at that point.

Mr. Mundy—We have had some trouble in the grounding of cables, but most of it occurred in summer cars on which the car company put the cable in. We were using at that time rubber-lined hose. They cut the hose level with the top of the floor, so that the water got into the hose and ran down it. We found if we ripped the hose open for about 3 ft., retapped it, providing an opening so that the water could get out after it got in, the wires dried themselves off, and we eliminated short circuits. On our ordinary work we run the hose 3 ins. above the floor and set the controller on a wooden block so that the hose keeps the water from getting in. We find it better to split the hose and retape it so that any water which gets in will work out of the hose, owing to the split.

On motion the meeting then adjourned until 2:30 p. m.

TUESDAY AFTERNOON SESSION

President Farmer called the meeting to order at 2:45 p. m.

Mr. Green called up the question of the time of the meeting

of the next convention, and suggested that it would be wise to hold the mechanical convention two days in advance of the National Association's meeting, on the ground that a great many more master mechanics would attend the meetings, because it would give them an opportunity to attend the convention and get the full benefit of the papers and discussions of both associations.

Mr. Baker—I would offer the further suggestion that we have three sessions a day, morning, afternoon and evening. We do not come here on a junket.

The president put the question on the motion to have the meeting of the Association two days in advance of the meeting of the American Street Railway Association, at the same place, and that there be three sessions a day instead of two. It was determined in the affirmative.

The president called upon E. W. Olds, who read his paper on "Improvements in Street Car Motors," which is presented on another page.

DISCUSSION OF PAPER ON "IMPROVEMENTS IN STREET CAR MOTORS"

The President—The paper by Mr. Olds is now open for discussion.

Mr. Green—Do you use split boxes?

Mr. Olds—We did use them until about a year ago exclusively. We now use some of the solid boxes.

Mr. Green—Why do you use a solid box?

Mr. Olds—The general construction of the bearing and of the oil-well is such, on account of getting the long bearing, we are obliged to let the bar extend, so to speak, somewhat into the end of the armature so that the bearing is all lifted out together, and as all pinions are now put on with a taper fit we have not the same objection to the solid bearing that we had years ago.

Mr. Pestell—How much larger are the bolts and gears?

Mr. Olds—About one-eighth of an inch.

Mr. Pestell—Do you use outside or inside hung motors principally?

Mr. Olds—Inside.

Mr. Pestell—Have you any outside hung motors?

Mr. Olds—Yes.

Mr. Pestell—Have you made any changes in regard to bringing the leads out on either side, so as to bring the leads into the center of the truck?

Mr. Olds—When we ordered the motors for the cars we had the leads changed and brought out on the axle side. We have but twenty cars with the outside hung motors, and these have the leads coming out on the axle side. They are General Electric 1000-motors and were built in that way for us.

Mr. Pestell—We have many trucks with the motors hung outside, and the lead troubles have been reduced 50 per cent by bringing the leads on the opposite side. It occurred to me, in ordering new motors, it would be well to have holes drilled, and then plugged, so that you could use the motors either way.

Mr. Mundy—We have gone into the motor proposition and are having some new motors built. I talked this matter over with Mr. Olds, and we placed an order. We went perhaps a little further than he has done. Our motors are all outside hung and the leads are brought out on the axle side. We have motors arranged so that we can use solid gear for small motors down to 40 hp. As far as bringing the leads out is concerned, the company decided it would put in bushings on both sides and plug the side which was not to be used. These motors are Westinghouse. We have had some motors from the General Electric Company with the leads coming out on the axle side, and in that case we simply drill one side.

Mr. Wright—In our double-truck cars we bring the leads from the top of the motor. That leaves the car bolster as it should be. The lead goes into the motor on the outside, and we bring it into a piece of canvas which lies on the top of the motor. It makes no difference in the life of the lead.

Mr. Olds—In that type of truck, with outside hung motor, how do you get the brake rigging on?

Mr. Wright—We lay it down right on top of the lid of the motor. Our types of motor have a lug on the side for side-bearing suspension, and we bring them around through there. I believe that is the place to support the lead to the bolster.

Mr. Mundy—Just a word on the subject of lids. Our cars are set low, and they barely clear the wheels, and the brake-rod, inside hung and straight rod, rubs sometimes on top of the motor. It sometimes carries off the motor lids and leaves them on the street. I have been hunting for something in the way of an improved motor lid and have not found it yet.

Mr. Green—We had the same trouble, and we made a long stirrup and fastened it on the cross sill so as to give the brake-rod plenty of room to adjust itself to the swing of the car. It travels in the stirrup. Otherwise it would take the lid off the motor.

Mr. Olds—Regarding the twenty cars equipped with the outside hung motors, we made a little stirrup or guard that carried the rod so that it was always above the motor—just clears it. We have no trouble with the leads, as they come out on the axle side of the motor. This is the General Electric 1000-motor, and it is no trouble to make the change.

Mr. Wright—You can make a little sling to be attached to the motor, which is set over the top of the grease-cup.

Mr. Mundy—I had reference to the cam type.

Mr. Lake—I had some experience with the fastenings of the motor lids on work cars; we were losing them frequently. Our passenger equipment does not trouble us. I made a hinge hasp, sort of loose staple, drilled through the lid so that the hasp came down on the side of the casing, a thumb button turned through the loop in the hasp, and dropped it down. It answers better than the gear rigging.

The President—Mr. Mundy, do I understand that you are using solid gears down to 40 hp?

Mr. Mundy—We have just gone into them.

Mr. Annable—We have used solid gears at Grand Rapids for eight years, on all sizes of motors, from 25 hp up. The only split gears in use are those on new equipment.

The President—We get all gears bored to a standard size. Take a gear and press it onto an axle, about 25 tons to 30 tons pressure. That gear goes onto the gear fit. After the gear is worn out, and is pressed off the axle, it occurred to me that the next one that went on, bored to the same size as the first one, would not be as tight a fit. That thing could continue indefinitely. Suppose you wore out a half dozen? Each one would be looser than its predecessor. Is it your practice to turn the gear fit very smooth, or do you leave it rough?

Mr. Annable—All the axles we have used it on have been cold-rolled finished axles. All we did was to cut the keyway and reduce the journal, and the manufacturer bored it. The only dimensions given the manufacturer was the size of axles.

The President—Have you experienced trouble in having the gears become looser after pressing on one or two on the same axle?

Mr. Annable—We have not, for the reason that the first axles the gears were used on were on cars of lighter equipment and lighter trucks. The result was there are new axles placed under them to take care of other equipment. We put on new axles. Where we ran along on that type of axle we have not had any trouble in that direction. We put them on with a hydrostatic press instead of clamping them. This has reference to the split gears. We get much better fit than by bolting. While these split gears will become loosened from the stretching of the bolts, of course, we would not meet with that trouble in the solid gear. After one gear has been removed the next one would be a stronger fit, put on with a hydrostatic press, than

if we put on a split gear. We have close enough fit so that in increasing our key we hold them, and in increasing the fit we do not throw the gear out of center any more than in the other case.

The President—I have only had a year's experience with solid gears, but it has been in my mind that as you keep on pressing on new gears you will get a loose slim fit. In the use of the solid gear on some of our axles the hub goes right against the hub of the wheel. Most of us have 100-ton presses, and we have found that we do not dare to press them off, the gear and wheel together, with a 100-ton press. We have had to split the gear—drill holes into it and split it—before we dared to shove them off together; otherwise we would break the press. For this reason a short time ago I advised the purchase of a 200-ton press, so as to be able to shove them both at once. There is no way of getting presses in between them.

Mr. Mundy—I do it with a split gear—shove out the split gears. I have not anticipated any trouble with the solid gear, because I have large holes in the web of the gear and run columns through there and shove the wheel off.

The President—We could not get anything that would stand the strain. Our wheel has very heavy arms, which makes the distance between the arms small and we cannot use that method.

Mr. Mundy—We use a piece of iron shaped like a horseshoe for slipping between the wheel and the gear. The columns go into little pockets and make a bird-cage through the gear, and shoved the gear off and left the wheel on. That is a system which we use with split gears.

The President—The trouble with split gears is this—we put on a nut which does not fit. They ought to make a nut wrench fit the whole length of the bolt, but they do not do that.

Mr. Wright—We use crown nuts altogether. We have no trouble with the nuts working loose or the bolt breaking off.

Mr. Mundy—We have been using 7/8-in. bolts on all of the small gears and using crown nuts. The bolts seem to become crystallized and break off, and get in between the gear and the pinion, and you know what happens. That is one thing we prevented by using the solid gear. I may be mistaken with regard to the fit of the gear, but I do not expect any great amount of trouble, because for a number of years we have been following the practice of placing our wheels on axles in a manner slightly different from the general custom. I do not let my wheel fitter fit a wheel to the axle. The axle is turned to a gage and the wheel turned to a gage, and he does not know what axle the wheel is going on. We carry that standard right through. We will press on and off eight or ten wheels before the fit is loose enough to give any trouble.

Mr. Baker—We can do that also. We can get the same fit eight or ten times.

The President—Speaking of the heads of the bolts crystallizing I have used a rod with nuts on both ends.

Mr. Mundy—It crystallizes in the thread just under the nut and breaks off there.

Mr. Baker—I think we should try to get a better quality of iron. Two years ago we used Norway iron for almost everything about the truck. We have given that up, and we find that a 3/4-in. rod running over a wooden block will crystallize and break off like a piece of chalk. We have tried to get a fibrous iron, but the trouble with us seems to be to get the right quality. The purchasing agent naturally wants to make the best showing he can on the price paid for supplies, and as a result he does not always get us the kind of material that would really be the cheapest in the end.

Mr. Ballard—I would ask Mr. Mundy, speaking about putting the wheels on the axles, whether it was a taper or straight fit?

Mr. Mundy—A straight fit, with a small taper at the end of the axle, about 3-16 in. The bore in the wheel is tapered for about the same length, so that in starting you get a chance to enter the heel on the axle a little easier.

Mr. Ballard—I have tried fitting wheels on old axles, and I find I cannot get as good fit by boring as fitting the axle to the bore of the wheel. In our solid gears I cannot see how it is possible to get the wheel to fit, where you have to renew the wheel, without removing the gear.

Mr. Mundy—The gears which we have are supplied with four holes about 3 ins. in diameter, all carried through the web. I figure on pushing it off by using a double horseshoe arrangement, one of which has columns in it 18 ins. long; the other arrangement shoves in between the gear and wheel and has little recesses for little pockets, and the other end of the columns will fit in these recesses without passing through the gear.

In St. Louis we are using a web-spoke wheel; the plate is almost solid except a little bit of a hole taken out to get rid of the sound.

Mr. Pestell—In regard to the insulation for fields, Mr Wright sent me some time ago samples of insulated wire, and he may give us some information about that matter.

Mr. Wright—About seven years ago an effort was made in Providence to get up an insulation which should not have any cotton in it. It is pure asbestos. They spin the yarn and wind it on the wire, just a little spiral. There is some compound put on the copper to help the asbestos cling to it. I have some fields which have been in use two or three years. I am following this method myself and I believe it is going to make a field that is indestructible. The field is wound on a metal form, and there is brushed on each layer a compound of shellac and whiting, made about the consistency of mud. When we take the field spool onto the form, the outside layers are held together with a little tape, and then we bolt the field spool between some iron plates, so that when we put it in the oven to bake it it cannot swell and get out of shape. In that way we get a field which is of the proper size, and after it is cooked you can take it and throw it for 5 ft. or 6 ft. on the floor, and you will not start a wire. It is like a rock. I think it will make a good field. If we can get the field trouble eliminated from weak fields we will cure half the trouble with the motors.

Mr. Green—I think one thing which will help insulation is to get motors big enough to do our work.

Mr. Mundy—How will you get the general manager to pay the extra price for the extra motors?

Mr. Green—He has to pay it, and pay heavily right now.

Mr. Mundy—What is the outside insulation?

Mr. Wright—The field is afterwards wound with cotton tape, and this tape is dipped into an insulating compound. I should have said that for the first layer of tape we put around the field, after we wind it, we brush on some of the compound referred to, shellac and whiting, not getting it too wet to be handled conveniently, and then we wind a 1-in. web around a field and draw it tightly, and the compound oozes through the webbing to a certain extent and makes a cement. Outside of that we take 8-oz. tape and roll it, and make a heavy tape in that manner. For the last coating we use lampblack and oil and try to get it waterproof. I will say that the insulation is put on small wire, as a rule, but we have some armature coils in service with that asbestos insulation.

Mr. Mullin—I understand you use this compound on the bare wire?

Mr. Wright—No, sir; the wire is covered with an asbestos cover, and we use the compound as a sort of cement.

Mr. Mullin—Over the asbestos cover?

Mr. Wright—Yes. It is supposed to be fully as good a conductor of heat as is the air around your wire.

Mr. Baker—Do I understand that that is the commercial asbestos, or do you use a special asbestos?

Mr. Wright—We use a special make, just about ready to go on the market. We have had to work pretty hard to get what we wanted. It has been a great trouble to get an asbestos that would be fine enough and still be strong enough to work.

Mr. Mundy—I really was very much disappointed last night to find that Mr. Adams, of Baltimore, was not going to be here, because I, for one, wanted to express to him my great appreciation for some little schemes that he has gotten up, and to tell him that he actually got me out of trouble this year. We were getting ready for the dedication of the World's Fair, and owing to the trouble with circuit facilities it was almost impossible to get field wire for the motors. Mr. Adams, as is shown in his paper, has a way of putting on tape by hand that saves lots of money. I was able not only to get out of the trouble, because I was able to put my motors into service by using the old fields over, a thing I had not been able to do before, but found it an excellent insulation scheme.

Mr. Baker—Regarding the axle bearings, armature bearings, I take it for granted that Mr. Olds used babbitt. In specifying our motors we have the shells made of cast-iron and the lining about one-quarter inch thick of composition. We have our own brass foundry and make those linings, and we find that on the average they wear something over a year, and in some cases on test they run much longer. We do not have the trouble about bands that we had where we have tried the babbitt recommended by the motor builder.

Mr. Mundy—Mr. Baker, what is your experience, as far as cutting the axle is concerned, with the use of a composition bearing? Do you not find that the axle does become moist?

Mr. Baker—No; I think we have less trouble with our axle bearings. The babbitt is apt to be cut if it gets burnt. If you burn babbitt, it is about as apt to cut as anything you can find except cast-iron with cast-iron. Mr. Ballard is here. He can tell us more about it. He has the armature bearings to look after, that is, the armature shafts.

Mr. Ballard—We have very few cut bearings. We have one occasionally, but they do not cut badly. The cut is just in little grooves, instead of cutting the same as if they were babbitt. When they do cut with babbitt, they cut the whole width of the bearing, but with metal we find it only cuts in grooves.

Mr. Mundy—What method do you have of getting those bearings into shape afterward? Do you turn them down and shrink a sleeve on, or put a new shaft in, or what do you do?

Mr. Ballard—With the W. P. we put a new sleeve on when it is necessary. When they get worn to a certain size, if they are too small, say 1-64 in., we turn the shaft down and we have a special bearing for it. On our old motors we have three sizes of bearings on our shafts, 1-32 of an inch decrease in each size. When they get below that we renew the shaft.

Mr. Mundy—I know there are a number of roads using the shells with shrinking sleeves on. Is there anybody here that has experience in that line?

Mr. Pestell—We have adopted the practice of shrinking on sleeves when the shafts were below a certain size, using a sleeve rough-turned on the outside and true on the inside; simply a matter of turning the armature shaft to a proper fit, cleaning up the sleeve, putting it on and turning it off. It is an inexpensive process.

Mr. Mundy—Do they give them with a finished interior that way?

Mr. Pestell—Yes, sir.

The President—How thick are they, Mr. Pestell?

Mr. Pestell—We figure to use a sleeve on the start about ¼ inch thick, turned down at the bottom about 1-16 inch.

The President—Where your taper leaves your armature bearing?

Mr. Pestell—We only turn a fit to that part, and not beyond the taper.

The President—There are a whole lot of armature shafts up in Detroit that have no shoulder left at all on the old steel motors. The taper runs right straight out to the armature, the bearing side.

Mr. Pestell—Even if they were so and you cut your sleeve right up so that it left a shoulder, you wouldn't lose enough of the fit of the pinion to do any harm. I should not consider that anything. As I remember it, there would not be more than about 3-16 in. of your fit gone.

The President—When you press these sleeves on do you increase the size of the armature shaft over the original size?

Mr. Pestell—No, bring it back to the original size.

The President—Then, under that condition, if it is ¼ in. thick I should think that you would turn away down into that taper.

Mr. Pestell—On our motors it does not affect it much.

Mr. Mundy—Do you find it necessary to either pin or key that shell at all?

Mr. Pestell—No, sir; the shrinking is sufficient. You have to do it pretty quick or you lose your fit.

Mr. Green—We have put on a great many sleeves to bring our armatures back to size, but our greatest trouble comes on the commutator end. What are they doing in Boston in regard to lubrication? Are they using oil or grease? We are using oil entirely in Rochester. I do not know what results we are going to have when we come to cold spells—it may tell a different story—but we find that with the oil lubrication we are getting most excellent results. We oil with a feed-cup. We are experimenting with a cup of our own and another form. We are getting good results. In greasing your outside bearings, your grease gets to the back part of the box and collects dirt and dust from the street, and it hangs to that grease and forms a perfect emery wheel on the axle, cuts it, and the dirt keeps working back into the grease if you do not watch it very closely. With the oil we find our brasses are giving us better results, and on our busiest days, where we run the 80-mile round trip to Sodus and back, we never have a hot journal or hot brasses of any description. Our axle bearings are all babbitt.

Mr. Mundy—Do you use oil on the outside bearings too?

Mr. Green—No, but we lubricate with oil.

Mr. Pestell—What is the comparative cost of lubrication as between oil and grease?

Mr. Green—Up to date we have not been able to go into it deep enough to be able to tell; but I can say to the present time that the improvement in the shafts and bearings all around and the cutting down of the number of boxes that we have had to babbitt, from the time we have started in with oil, is considerable. The babbitting alone has dropped down more than one-half. On our busiest days, with long trips to Charlotte and Summerville, and the cars going out in the morning with no inspectors to take care of those things, you can save enough to pay the increased cost of the oil, if there be any, without taking into consideration the benefit you get to your bearings.

Mr. Mundy—Is it necessary for a man to turn on these oil cups when he goes out or is it self-lubricating?

Mr. Green—There is the principal trouble. Your grease cup always feeds. We are experimenting now with a double cup, one feeding down into a lower cup, with a ball set over the opening, which vibrates with the action of the brake or the car, allowing the oil to feed, and the moment the car comes to a standstill the ball drops over the hole and stops the flow of oil.

Mr. Mullen—We have been using the cup that Mr. Green refers to for about a year and a half, and are very much pleased with it. We save about one-third in the cost of our lubricants besides prolonging the life of our bearings 50 per cent.

Mr. Baker—Mr. Green asked me if we used oil or grease. We use both. We use oil on car journals almost exclusively. On some of our motors we are using grease or solidified oil, and we are having very good success with that. On our elevated lines, Mr. Lindall, who is here, tried that device that has been spoken of, and in some places he had some trouble with it. I

think he is using oil altogether. I think oil is better in a great many cases.

Mr. Wright—In regard to oil versus grease I will say we have not used grease for six years for lubrication. I believe in oil as a lubricant.

Mr. Mundy—On the question of gear casing we have had a great deal of trouble with gear casings breaking, also the supporting bolts that hold those casings breaking and dropping in the street. I guess everybody here has had that experience, and the difficulty of getting a gear casing out from under a car when it was broken. It means a tie-up of anywhere from 45 minutes to an hour; and in trying to overcome that we have been getting our new motors according to a design which is somewhat radical. They are going on double trucks, and we expect to do all repair work by running the truck out from underneath the car and working from overhead. The trucks that we are using are known as the Dupont double trucks, in which the truck goes underneath the axle; the axle lifts up. So we have had this motor designed so that the gear case is supported on top of the motor, and you cannot take the bottom half of the gear case off without lifting the pair of wheels out, so we are not depending on a bolt in any manner for holding it up. The lugs are underneath. Whether that is going to prove a remedy for this dropping of gear cases in the street I do not know. We have tried on other motors everything we could think of, tried all kinds of bolts, all kinds of nuts, and still the bolts will break and the gear cases drop down in the street. I would like to know whether anybody else has had any experience in this line?

Mr. Annabel—That works out very nicely when we are going after new machines and can have them built to receive those improvements, but what are we going to do when we have a lot of them giving us that trouble, and still have to use them? I will tell you what I have been doing since 1894 on the old type of machines. On General Electric 800-motors we are using a wood gear case, of 7/8 in. hard maple (though I prefer sycamore), with a 12-in. gage steel top screwed on. I use an 18¾-in. screw for holding the 12-in. gage, and use the same support or anchor that was originally designed for the machine. That means we have reduced the weight to a point where there is not any self-destruction, and as for the life of the gear case, to say nothing about its breaking loose from the motor, it has doubled the life of the gear case, we have found, five or six times.

The President—I have just designed a gear case, and we have some of them in use in Detroit. It is just four angles, curved in the form of a case. Then for the sides I use 5-16-in. thick wood, and for the outside, the periphery, of the case I use wood 1/8 in. thick. The reason I made it so thin was that if a bolt breaks instead of getting in there and springing your armature shaft it will go through the gear case and not hurt anything.

Mr. Mundy—How do you hold that bolt?

The President—I put the thin pieces in first, in between the two ends, and then I put the side pieces in next, and the side pieces hold the outside pieces in. You see, it cannot get out. Then in between these angles I put in distance pieces and rivet the whole thing up together. The outside angle pieces, the large pieces, are cast with lugs on to hold onto the motor case. I have patterns out now for a 12-A, a 38-B, a Steel-34, and a Westinghouse-76. I think the patterns are nearly out for all the different motors we have, and it looks pretty good. It looked so good to me that I started to get a patent out on it, and I found some other fellow had patented it away back in 1893.

Mr. Mullen—We have designed a gear case something after the pattern described by Mr. Annabel, made of 7/8-in. maple, and covered with No. 14 galvanized iron covering, but we have a little different method of anchoring the gear case than formerly. We use an angle on the side of the gear case and fasten it onto the lower bolts on the axle cap, which gives the strain right in the heavy part of the gear case, or in the widest portion, almost directly under the axle, and it takes practically all of the strain off of the gear case; and then on the front end we anchor it in the old place provided for the purpose on that style of motor, and I can safely say we have decreased the cost of our gear case expense for the last two years at least 30 per cent.

The President—In making it out of wood you get rid of the excessive weight. The gear case on a 12-A weighs 126 lbs. This gear case I got up weighs 58 lbs.

Mr. Mullen—You do not have that jumping effect to loosen bolts that you do with a heavy gear case.

The President—This structure is elastic.

Mr. Anabel—You just about take off 100 lbs. with this class of gear case that I make. They weigh about 32 lbs.

Mr. Olds—I would like to describe a method we have been using now for about two years. We made up our mind that most of our gear cases were broken by coming in contact with something on the street. It breaks the top half. The lower half very often is not injured at all. We cut off the lower half, about 3½ ins. to 4 ins., and got out a new set of patterns, cast in malleable iron, for the upper part, and then made a sheet-iron bottom of No. 20 iron. The lower edge of this lower half of the gear case had a flange cast on it and bolt holes. Now, this little sheet-iron bottom has an edge turned something like this (indicating), then in just the ordinary folding machine we make a folded joint. There is another ring made out of 3-16 in. x 1 in. That slips over; then there are bolts through. I have yet the first case to renew after I have put that on, which is about two years ago. We have to renew the bottom parts very often.

Mr. Pestell—We have adopted a little scheme in Worcester to prevent the gear case from falling when a bolt does break. We put a little angle right under the bolt, right on the end of the gear case, and let the bolt go right down through it. The bolt breaks off usually right down near the nut, near the thread, and this angle is still retained on there, and holds the gear case up. It has saved us a great deal of trouble on the street. We put one of these on both ends of the gear case.

Mr. Green—We have a condition to go up against at Rochester that I think is different from what any one else here has. We have 38 miles of track between the curb and the sidewalk, so that we have to chop out the side of the trees to get the cars through. We start to plow snow every year about the middle of November, and we will plow snow up until the latter part of March. On this side-track we have to use a nose plow, and they will not let us throw any more than they can possibly help in between the trees and the walk, and they will not let us throw it out into the street any more than they can possibly help. The consequence is, using the nose plow, the plow keeps climbing, and leaves a certain amount in the center, and then the frost heaves all the cross-walks that are in that track, and the consequence is that if we do not watch it we have to take up a great many cross-walks and relay them again in the spring. They take out gear cases right square off, so that we cannot get anything strong enough in the form of a gear case just on account of that piece of track—38 miles of it.

The President—As you all know, Mr. Adams is not here, and it has been suggested that we read his paper this afternoon.

(The president read the paper referred to, which appears elsewhere.)

DISCUSSION OF PAPER ON "SHOP KINKS"

The President—With regard to the glass question, I would like to ask if it is necessary to have the glass ground to make the glue do its work. In our case, at home, we take plain glass

and put the glue on, and it will lift it every time if the glue is good.

Mr. Bigelow—A friend of mine, connected with the Boston & Maine, described to me a simple arrangement they had in which they had a box, the top covered with plush, and about a 2-in. hole through it, and a sandpipe discharging directly underneath this hole, a lead pipe about 1½ ins. in diameter, and they moved the glass around on top of this plush as the writer describes. If they wanted it to come up to the edge of the glass they would put another piece of glass or cloth against it. They had no trouble with dust blowing. There was a reservoir for the sand at the side of this box, and the sand dropped into the pipe from that, the same as the writer describes, with a 45-deg. fitting, and then the sand dropped to the bottom of the box. The box was beveled.

The President—On that question, as to the reinsulating of fields, if any of you have had any experience I should like to hear from you.

Mr. Mundy—About reinsulating, although we did not get started at it until April, and have not had a chance yet to determine how long it will last, we see no reason why it should not last just as long as the cotton insulation, because if anything the tape is better than the cotton for holding, and I find that unless the difference between the price of scrap copper and insulated copper is more than eight cents and a half it pays me to reinsulate. In the majority of cases the copper we have been getting makes a difference of about five cents, so that we are just that much to the good. You would naturally think the field would occupy considerably more space than it does with copper, but after the men get a little used to it they can get it into almost exactly the same space. The wire goes back right into the former positions and gives a very solid field indeed.

Mr. Wright—You use about ¾ in. tape?

Mr. Mundy—Use a ¾-in. tape, and have the tape cut into lengths to take one side of the loop; go around the loop, starting from the top and going down to the bottom. We work it to have two men to clean. The first thing is to spread it out, then go over it with a knife and clean up the insulation. After it is cleaned either those same two men or another two take it out and wind the two sides right along together. Then it takes two men to put it on. The actual labor of reinsulating and putting on is probably twice that of winding with cotton.

Mr. Green—We have reinsulated wire now for seven years, and we have reinsulated wire which we use on a Westinghouse 3 and all other sizes for the different fields. We have one of the Detroit machines that we use and an old lathe that was bought second-hand, rigged up with a head to wind fields. We have a boy for that whom we pay $1.38 a day for nine hours' work. All our men get free transportation. In regard to cost, I am very sorry that I have not the exact figures with me, as I could give it to you in detail, since every field is wound under a job order number. I will not make any guess at it, but if any one wishes to get the full data in regard to the cost of reinsulating fields I will give it to him. Every field is numbered as it goes out and the day and date recorded. The copper hardens after a time. If there were no way of softening that copper, of course you would not be able to reinsulate that field more than twice before it would be perfectly worthless. We take the field right out into the yard, build a fire and burn the insulation off and let it stay there, of course, until it is cold. That softens the copper. We do not put any tension on when we rewind, only the tension of the machine. We use insulated tape with gum on one side; it is a thin tape. On every layer we also use the St. Louis compound. We have tried everything. And of course you cannot use that St. Louis compound only just where it is going to stay just where you put it, because if you bend it you will break the body.

The President—When you form a field, after it is wound have you had any trouble with the insulation being destroyed when you form it in the wheel press?

Mr. Green—We do not form a field.

The President—In forming fields we wind with new wire, but do not use insulated wire.

Mr. Mundy—That is the reason we have not heretofore been able to reinsulate No. 56 fields.

The President—We used new wire, as we found in forming them up it would destroy the tape.

Mr. Olds—Mr. Mundy gave his method of reinsulating the field, which is practically the same as Mr. Adams'. I have seen the work done in Mr. Adams' shop, so that I simply got his method, which is practically the same at the start as that of Mr. Mundy, except that the cleaning of the old insulation from the wire and the winding of the tape is all done by girls and women. He told me he found them better workers and that they did the work neater, and after they were broken into the work they would stay by it, whereas a man would wish to advance himself to something higher. I saw some fields that he had when I was at the works last fall, that had been put in shape that certainly looked as neat as anything I had ever seen in that line.

Mr. Mundy—By using six men we can get eight fields per day on the basis on which we work. To overcome the possibility of a man being careless in getting the tape on (of course we have to press them somewhat in the press to bring them down tight) I transform all fields, and if the man has been careless the transformer breaks it down. If it does, I then open the field and reinsulate the place that gives the trouble. I agree with Mr. Adams that this matter of transforming to get at defects in the armature room is a big money-saver. The least carelessness of any kind on the part of the coil makers or the armature winders is detected at once and saves the expense of putting an imperfect armature into the motor. I will not state the name of the company I got them from, but not long ago we found some difficulty in getting cotton-covered wire of the right size for one of our motors. We ordered by telegraph from a manufacturing concern 25 sets of armature coils. I got them and started to place them in service, but I found six or seven coils in which the wires had been crossed and put in the press so hard you could not tell the difference between them. I do not know whether they put this kind of coil into their own armatures, or send them out to people who buy repair parts. We adopted a transformer test. We have a home-made machine, made up of an old Sprague motor by simply taking the commutator off, replacing it by a couple of copper rings and bringing out the leads at opposite sides. It runs 1300 revolutions and gives me 25 cycles alternating current. For a really satisfactory test it is claimed the current should be of a high frequency, up to 125, if possible. I find the 25 cycle transformer gives me everything we want, and it is not an expensive apparatus to fix up. Any road that has not taken it up, if they will look into this matter it will pay them.

Mr. Pestell—We use a method for testing all windings of the armatures, etc. We use a milli-voltmeter, and a current from a lamp circuit through the armature. It is handy and does not require moving around and can be used at any armature stand. If it is a repair job and the armature comes in, it is simply a matter of putting the current through the armature with a wooden yoke (putting the current through the same points as the brushes), and then running the connections of the milli-voltmeter to the commutator. Many short circuits in the armature can be located quickly and the bad coil taken out and replaced, and also new work can be checked up in that way in a short time and at very little expense. We use no shunt; but enough current from the armature to get a suffi-

cient deflection, 75 or 150 milli-volts, through a normal coil. If there is a short circuit we do not get as much deflection.

Mr. Baker—In addition to the test mentioned, we put our armatures into a frame and run from 20 to 30 minutes with a load on the armatures before they go out. We have a report of every armature that comes in that has not been out thirty days in actual service. There is no doubt that some of them are damaged between the time they leave the armature room and the time they are placed on the cars.

Mr. Ballard—We take two motor frames and put them together end for end. We have them mounted on old pieces of railroad iron and move them forward and back. We use one motor as a generator and the other as a motor, and run the current to 40 amp. to get them to the highest point they will run at. We run them from 20 to 30 minutes, first as a motor and then as a generator. In testing for short circuits we use a step-up transformer.

Mr. Mundy—May I ask what voltage you use for testing a newly-wound armature, and also what voltage you use for testing an armature brought in for repairs?

Mr. Ballard—On new work we run up to 2000; as high as they can step up. On old work we calculate to run from 800 to 1000. If the armature will stand 800 volts we let it go out.

Mr. Baker—Mr. Lindall can give us a few shop kinks in regard to steel-tired wheels. We have had to take our wheels out and grind them about every two weeks.

Mr. Lindall—Owing to our severe conditions, curves, etc., in Boston, we wear out the steel-tired wheels very rapidly. The road has been running now about two years and we have replaced over 200 pairs of tires in that time. We have a gas heater. After the wheel is taken out we heat up the old tire until it drops off. Then with a large lathe we bore out a new tire to a shrinkage fit, allowing about 31-1000 of an inch in a 33-in. tire. The heater is arranged so we can drop the wheel into it, and we can take off a tire in 6 minutes with the heater. It takes 10 minutes to heat a new tire so that we can drop the wheel in it. In this way it costs us about $2 a wheel for changing the tires.

Mr. Ballard—In repairing heater coils it is necessary to wind long coils of wire, and in place of winding them on a mandrel the wire is fed through a fine hole into the interior of a die containing several screw threads, which is revolved in a lathe, and the coil of wire is fed out as long as desired.

Mr. Lindall—There is a way which has come to my notice of moving motor trucks. There is a large lift which takes the truck from underneath the car on the upper floor and carries it to the machine shops. We have to move the trucks from the lift or elevator 25 ft. or 30 ft. At one time we had ropes and tackle and pulled the trucks around the shops in that manner, but one day of the men said, "Why don't you make the trucks run themselves?" We took one of the car rheostats and put it on the wall and connected a line to it and ran a flexible lead out to the truck. In moving the truck we simply take the lead to the truck and make the connections. We have saved a great deal by doing away with the pushing and pulling of the trucks.

Mr. Pestell—We are using a little scheme for regrinding air-brake valves that may be of some interest, using a small motor with a little fine wheel on it, mounted to the post of a lathe, and mounting the valve seat in the lathe, revolving the valve seat and then running this motor right across the face of it and finishing it up in 2 or 3 minutes. We have a hardened steel head for grinding the disc, a small hole to take the stud on the face of the disc, and put in ground glass and oil between the two faces, after which it is simply a matter of grinding.

Mr. Bigelow—An arrangement which we adopted in one of our stations may be of interest. We wished to make some columns to support a heavy weight. We took some 9-in. girder rails and riveted to each side of the web a 5-in. T-rail to make a strong column. In this way we can use up some of the old iron. It makes a solid and substantial column, riveting the flat part of a T-rail against the web of a 9-in. girder rail.

The president then appointed the following gentlemen as a committee on nomination, the election of officers to occur at the last session of the convention: Messrs, Olds, Green, Baker, Mundy and Mullen.

TUESDAY EVENING SESSION

At the session on Tuesday evening the constitution and by-laws were carefully gone over and revised in some particulars. The most important changes were in regard to membership. Active members, according to the new constitution, will consist of the heads of the electrical and mechanical departments of railways. All active members will be entitled to a vote and must pay dues of $5 per year. Associate members will consist of railway companies, and will be entitled to one vote through a properly accredited delegate. Associate memberships will cost $20 a year in dues. Junior members, as before, will be employees in electrical and mechanical departments who are not eligible to active membership.

WEDNESDAY SESSION

The Wednesday morning session was opened by the reading of the paper by Alfred Green on "Car Shop Practice," which is published elsewhere.

President Farmer—The paper is open for discussion, gentlemen. I see that there are quite a number of gentlemen here to-day who were not here yesterday.

DISCUSSION OF PAPER ON "CAR SHOP PRACTICE"

William Pestell, of Worcester—I should like to ask Mr. Green what his experience has been with the air hoist, whether he has any trouble with it slipping when he gets the load on it?

Mr. Green, of Rochester—For putting armatures in the lathe we don't use the straight hoist. We use the Chisolm & Moore air lift, one of the finest little tools ever put in a shop, and you can put your load anywhere and have your load there as long as you want it. With the straight hoist we cannot use it to put an armature in the lathe or anything of that description. It will drop its load.

Mr. Mundy, of St. Louis—Have you had any experience with the balance hoist, using air on both sides? I am using that for handling armatures and I find you can place it just about as carefully as you can with chain and block.

Mr. Green—No; I haven't had any experience with that.

Mr. Lake, of Muncie—I will say I am using the same thing with satisfactory results.

Mr. Pestell—Do you find that holds the load in any position? For the information of the members I will say that in our shops we have handled over 30,000 trucks with these hoists. We have arranged a little runway to near where those trucks are placed, and it is probably 500 ft. from where we start to where we drop it. We hoist our truck and can push it along on this little trolley until it comes to the cross-track. We have no trouble in carrying it that distance. We do not have the one long hose. We have a short hose at each end and pass it along that way.

Mr. Lindall, of Boston—We use in our shops at Boston a straight-lift pneumatic hoist of from 3000 lbs. to 6000 lbs. capacity, and we have no trouble in putting the wheels on the lathe centers with a straight-lift hoist. We also have a pneumatic gear hoist.

Mr. Olds, of Milwaukee—In Milwaukee we also use the straight lift in putting the armature in the lathe, and in hoisting we have no trouble to speak of. Once in a while in the handling of trucks or wheels or holding motors suspended for some time it will give down a little, but generally speaking there is no trouble in that respect. The hoist that we

use for putting armatures in the lathe has a small valve on it so that the air goes into it very slowly, and you don't get the jerk that you would otherwise.

Mr. Pestell—I would like to ask if anyone else has had experience with the cross transfer table in taking trucks out of double-truck cars?

Mr. Green—I would like to say we are building a 300-ft. car house on one of our divisions and we are putting a transfer table in that car house for that purpose alone.

Mr. Bigelow, of Boston—In our shipping department equipment shop we have a straight air hoist that works very satisfactorily in loading the cars with the material we wish to ship.

Mr. Olds—I note by Mr. Green's paper that he does all of the work in the pit. I presume that refers more particularly to the single-truck cars. With us our double-truck work is all done after the truck is removed from under the car. We have found it more satisfactory than doing it in the pit.

Mr. Mundy—We are doing a good deal of the repairing from overhead and intend to do it all; but this brings us into a situation which has been quite a puzzle to me, and if there is anybody else who has had any experience in that line it would be a great deal of help. I have installed a motor-driven mechanical hoist with which from the time the car enters the shop until it is in the air ready to allow the truck to run out, there is less than 1 minute. With a four-motor car we have at least sixteen leads to disconnect. With the ordinary method of connecting those leads it takes a pretty good man at least 2 minutes; in other words, it will take longer to disconnect the motors than it will to hoist the car. I am looking for and trying to get up some very rapid method of connecting the motor leads which will be thoroughly efficient. At the present time I will acknowledge I have not struck it. I have asked the General Electric Company and the Westinghouse Company to solve this problem, but they both say they have had no experience in this particular field, and they don't appear to be very enthusiastic in being able to hit it. Now, if anybody anywhere around the country has had any experience along that line and can give me any information it will help me considerable, because I will surely need it. It means dollars and cents to me.

Mr. Green—I would like to say in answer to Mr. Olds that we do not jack a body of any description or lift a body off the trucks under any consideration unless the car is going through the shops for general repairs.

Mr. Lake—I would like to ask Mr. Mundy what kind of motor connections he uses—what kind of a joint?

Mr. Mundy—At the present time I am using a 2-A connector with screws.

Mr. Lake—The General Electric connection?

Mr. Mundy—Yes.

Mr. Lake—The Westinghouse broken connection is much more convenient to handle, and quicker to operate. By using a piece of hose instead of tape, on the joint, I find they can be connected and disconnected very quickly, and the hose slips on and off readily.

Mr. Mundy—The Westinghouse connector, if I remember correctly, is better proportioned for a large size wire. You are probably using that on your interurban cars. When you get on motors of 20 hp and even up to forty, the connector is a small piece of apparatus. To be thoroughly satisfactory it must be so that you can put it onto the motor cable and pull it through the insulation bushing in the motor. We don't want to have to solder or do any other connection of that kind after the lead is in the motor. Especially is this true of the brush-holder leads, and before adopting anything at all I am still hunting around with the hopes of striking something that will be small enough to go through the opening in the motor, and yet can be thoroughly insulated. The use of hose or tape either, I think, is objectionable, if it can be overcome. At the present time I don't know how it is going to be done, so I don't know how it can be.

Mr. Lindall—On our elevated motors we use the Westinghouse double-joint connector and we appreciate the value of having some easy way of disconnecting them on account of having to take the trucks out every two weeks. We use over the connectors a piece of rubber hose, and each side of the connector we have a little cleat that takes the four leads so that the leads and the insulation for the connector are held in place by these cleats; the cleats are held by one bolt in each. It takes a man about two minutes to disconnect the motor, that is, including the work of taking up the traps and so forth.

Mr. Morgan, of Youngstown—I would like to ask Mr. Green if he has any figures. I notice he made the statement that he never removes the car body from the trucks unless it is for general repairs. I would like to know if he has any figures or general statement which shows the economy of taking the truck out to remove the armatures, or of removing the armatures from below, which he would have to do if he didn't take the truck out?

Mr. Green—I couldn't give the exact figures now.

Mr. Morgan—There seems to be some doubt as to the easiest way to handle trucks, and whether to take them out. Personally I should imagine that the thorough inspection of a truck after being taken out from under a car is of such value as an economic proposition that it would be better to take the trucks out. That is our custom. We take the trucks out and get an examination, and we run a high-speed road—not a phenomenal speed—about 45 miles to 50 miles an hour in parts of our road, and we think that the taking out of the trucks, and the mechanical department being able to give them a very thorough examination, materially decreases our liability of loose bolts and other things which cause annoyance and accidents.

Mr. Baker, of Boston—How often do you take those trucks out?

Mr. Morgan—When the armature gets low on the bearings we take them out.

Mr. Baker—How do you find that out?

Mr. Morgan—From below, by inspection done from below, and we have gages. I guess it is an almost universal custom for testing the armature; and if we find the armature low we take it out and replace the bearings and then examine the truck. We can do that easily with jacks, although we are at present equipping our shops with a large motor-driven hoist which is being manufactured especially for us, which will take the entire car, trucks and all, up in the air if we want to do it.

Mr. Baker—Do you make any other inspection under the car?

Mr. Morgan—All our general inspection is made under the car.

Mr. Baker—General inspection?

Mr. Morgan—Yes, the entire general inspection is made under the car.

Mr. Baker—Is that a daily inspection?

Mr. Morgan—Daily, yes.

Mr. Lake—This matter of car inspection I would like to inquire about for information more than anything else; how often or what method the most of you use in this general overhauling. My method has always been to give a car a general overhauling and general inspection after it has made, say, 20,000 miles. Taking a number of cars that will vary, say, from 20,000 miles to 30,000 miles before you can get around. I have my cars inspected from underneath thoroughly every day, or every other day. They don't get an inspection every day, because, as a general thing, during the week-

days they only run every other day, that is, in cool weather. If the days are warm I change them off in the middle of the day when we change crews. The car makes from 375 miles to 390 miles a day if it runs the full day. Saturdays and Sundays our cars are all in service. Of course these two days the cars are not inspected any more than the regular running inspection that every car gets as it goes by the car house. That running inspection is a matter that quite a number have brought up to me as to why I do it. My car inspector says it takes a good deal of time to run out and inspect a car every time it goes through. He says: "We never find anything wrong." I said: "You do once in a while." He said: "Oh, yes, once in a great while." I said: "You found a fault one day," and he said: "Yes," and I said, "That will pay all it will cost for a number of days' inspection." So I think the traveling inspection is a good idea.

Mr. Ballard—I should like to ask in the inspection of these cars, or any cars, what experience you have had with the Conant testing machine or any other device for determining weak fields when your armatures are giving trouble, to locate whether it is a weak field or what the trouble is. We are using a device made by Mr. Conant called the Conant testing device for testing weak fields, and we have had great success with it.

Mr. Lake—My experience with that device has been very satisfactory, although with the new equipment that we have I have not been troubled very much in that respect with weak fields, thus far.

Mr. Mundy—Referring first to the inspection of the car by mileage, I think that undoubtedly this is the only way that we will eventually get thorough success, for, in my own case, during the rush hours we are operating about from 875 cars to 900 cars, but during the middle of the day that number is dropped to about 425 cars to 450 cars, meaning that in the morning and evening we run out a number of trippers, that in a great many cases don't make more than one trip; hence a single car in a month may make from 6000 miles to 7000 miles, and its mate may not make over 1000 miles. If we try to go by the time basis, the one car might destroy its apparatus, while the other one has hardly commenced to show any signs of wear. Taking this into consideration, I considered that the mileage basis was the only one on which I could work, and I have since the first of the year been keeping the individual mileage of every car. But when you get into that, especially in city service, you find a great many difficulties that you had no anticipation of. I find that on our different lines—and we have some thirty-two or thirty-three—that the same motor will run a different mileage on the different line. Another thing, the same motor will run a different mileage when mounted on different trucks. The method of mounting, the vibration which the truck has, make just as much difference on the wear that the bearings will stand as the inspection and care the men give them. Taking these things into consideration, I have had armatures that will not stay out 3000 miles. Another armature on a similar car will run 10,000 miles to 12,000 miles. When I say 3000 miles, it is very low. I am almost ashamed to acknowledge it, but it is a condition that we have to meet. We have dirt of the worst kind, and some of the trucks are shaped so that they do shake the motor up the worst in the world, and all give you the mean conditions to meet. Now, if we can get the basis down correctly and work on the mileage basis I think it is undoubtedly the only one which will give thorough satisfaction.

Referring again to the testing of fields, it is a subject in which I have had a great deal of trouble, because we have small motors that are doing more work than they were ever intended to do. As you all know, that means baking out the insulation and weakening the fields in a short time. I have experimented with different methods of testing these fields. I have the Conant coil testing machine; I can go out and work it myself, but when I give it to the shop man I find I might just as well give him a stick of wood to play with. He doesn't know anything about it. As far as checking fields up by resistance there is a difference between summer and winter weather of 15 per cent to 16 per cent, and the temperature of the motor will make that much. When you drop the resistance of a field off that amount it commences to show too, and so the resistance method is a poor thing. The only method that I know of at the present time that really gives any accurate results is the transformer test; but with that you have to have two conditions. You cannot have a coil in a brass form; you have to have a mummy field. Another thing, you have to have it out of the motor because the frame of the motor will become red-hot before you can tell anything in measuring the field. I have checked up a great many fields taken out of the motors with the transformer, but we don't meet the conditions that we want to meet. The field may be all right when it is put on a transformer test and may be all wrong when it is put in the motor, because, in the motor, after it is heated up, naturally the copper swells in size and occupies more space, and then again it is under pressure from the pole tips. You want that coil held tightly so it will not shake around, so you must have a certain amount of pressure there. You may have layers in the coils which, if the coils are left without pressure, putting them in the motor and pulling down the pole piece will pull them together and short-circuit your turns. We have spent probably two or three months trying to devise a scheme of measuring the fields in the motor. I thought at one time I had it but at the present time I am going back to the woods. It is a serious point. The weakening of a field necessarily affects your apparatus all the way back, burning out the armature and that in turn the rheostats, thus blowing up the controller; and when a controller blows up with us we have a few passengers perhaps jumping off the car while it is running at full speed and have a few damages suits on our hands. So these motor fields cause as much trouble as anything. But how to measure, where we ought to measure, is a question I have not as yet solved.

Mr. Pestell—Mr. Mundy says he can work the Conant test himself, and I cannot see any reason why he cannot educate somebody else to do it. I don't expect every car house employee to work the Conant test, but it seems to me the St. Louis Transit Company can afford to have a man educated to use that machine and keep him going around and finding the measurements of all motor fields. A motor field doesn't usually get short-circuited in one day. It is usually a question of some little run, and if those cars were gone over periodically it seems the trouble would be reduced. I really believe we could afford to have a man do little else but test fields. We could surely find some one man there to work the coil-testing device.

Mr. Baker—We have a similar road in Boston, and we have some eight, ten or twelve-coil testing machines, and we have had no trouble to educate our men to use them.

Mr. Mundy—I have always heard that the Boston Elevated could be heard a few miles around in Boston, and under the circumstances I am quite surprised to hear Mr. Baker state that the instrument is satisfactory, because when I want to work that instrument myself I want to get out in the woods, clear away.

Mr. Green—We use the bridge—Wheatstone bridge. All of our men, that is our leaders, what we call our leaders in the pit, are held responsible for testing the fields of the equipment as the cars pull in. Of course, if the cars are going through general repairs the entire fields of all motors are read up by that time. In rewinding or reinsulating your fields you find it is actually necessary to keep tab on every field that is rewound, because if you are not careful and give them an opportunity to

stretch that wire in winding you have trouble. So we read every field before it goes into stock and it is marked.

Now, getting away from that, I would like to take up the question of car inspection. That is one of the most important things that a road has to contend with to-day on a system of any size. Our conditions are such that we cannot do in Rochester what Mr. Baker would do in Boston, and probably Mr. Mundy in St. Louis would have it entirely different from what Mr. Green would in Rochester, and thereabouts all the way around. We have taken into consideration the idea of having inspectors out on the lines, giving so many lines to each one to take care of and inspect and report on each day. We have tried that. If you could hire a foreman to stand with each inspector you might get a better report. It runs all right for a little while and then you are in trouble. You cannot find your inspector or he is not getting out his reports as they ought to be. We operate 80 per cent of our rolling stock every day, which gives the master mechanic an opportunity to put two cars in shape a week. It is important to us, because we have to do our inspection at night. If you can possibly get away from night inspection it will be a good thing, because it is one of the poorest things ever thought of. In the first place, you get your men out in the early part of the evening, and there are very few cars in the car houses, and the consequence is you are losing time. Your cars go out early in the morning, and you have your men there, and paying them for so many hours' work, and the consequence is you are losing time again, so you are not getting results out of money expended for car inspection, and if there is anyone here operating a road under the same conditions I would like to have him tell me what he does to get results.

Mr. Olds—Regarding the operating of cars, I would say this: In Milwaukee we are practically a double-track, four-motor system. All our regular cars are of that class. When our lines are all full with double trucks we have three extra cars to keep the system up. Our extras are single trucks, which the boys have all called "dinkies," and as a matter of course they turn in their double-truck car and get a dinkie, and there is at once a kick, not only from the motorman, but from the transportation department. For the past year we have been unable to give our cars the attention that they should have. Our rule and practice has been that a car shall not be in regular service to exceed four months before it shall come to the shop for a general overhauling. We have been obliged to leave them out as high as eight months before they have come in. It is not good practice. I think the cars should come in on a certain mileage. As we use all of our cars all the time the monthly proposition works out practically the same. We hope sometimes to have enough cars that we can hold in and use them as extras, about one-third of our equipment. By so doing, they can receive a daily inspection, and then the night inspection will be but very little. Our night inspection is very unsatisfactory, as our friend Mr. Green states—there is but very little done. The men cannot work at night, and get the results that they do in daytime. So, as I said before, we hope to see the time that our cars will get a day inspection at least every third day. By so doing I believe we shall reduce our expenses very greatly.

Mr. Bigelow—Showing the necessity of a rigid inspection, and also the power lost in tight brakes, a case that came under my observation recently might be interesting. We were making tests on some cars. We had a 25-ft. box car loaded so as to weigh about 36,000 pounds, equipped with four motors, and it had hand brakes. We had run the car through the early evening slowly, making numerous stops, and everything had worked all right. The brakes appeared to be loose, if anything. We started on a speed run and the brakes appeared to be tight. At the end of the run we examined and found the brake-shoes and wheels were warm. On further examination we found the trouble to be the large link at the end of the brake chain had become jammed into the hook at the end of the brake rod in such a manner as to shorten the chain and jammed in so tight it took several blows of the hammer to loosen it. On making the second trip, made under the same conditions and same direction, the results were quite interesting. The length of the run was 5 miles, and we made the first trip with tight shoes, making fifteen stops of about 10 seconds duration in 23 minutes and 45 seconds. The second trip, same conditions and same direction, was made in 21 minutes and 3 seconds, a difference of 12 per cent in running time. One less stop was made, and the correction has been made for this stop. But the difference in power consumption is still more interesting. We took 10-second readings of amperes and voltage. The power consumption of the first trip was 216 watt-hours per ton-mile, and the second run, 140 watt-hours, a difference of 54 per cent in power consumption, this difference being caused simply from tight brake-shoes. I think that will show we have an unsuspected loss in power consumption, being caused by tight brake-shoes, and also I believe one of the papers speaks of controlling the speed of cars by not shutting off the power but by using the brake. I believe that would give a very high loss.

Mr. Hile, of Boston—It has been my business to look after the overhead line. Perhaps you will not see the connection between car inspection and what I am going to say, but I would like to inquire if any of you have any method in regard to inspection of overhead poles, trolley bases and trolley harps and sills. We are having a good many lines coming in over our lines, and I can see poles bent in every direction, and that necessarily leads to considerable trouble on the overhead line, and it strikes me that there are a great many that don't give much attention to that, and so many things can occur about a trolley post or harp that will lead to the pulling down of the wire, making stopping of traffic and, perhaps, accident. I have not heard anything bearing on that matter. It may be too small from your point of view to deserve consideration, but it strikes me that it is nevertheless deserving of some thought as to whether you have a method of keeping a certain tension on the wire, and what attention is paid to a motorman or conductor reporting that his trolley is coming off. You may say it is the fault of the overhead line, and he goes out again and pretty nearly every corner his trolley is flying off, and it may mean an accident, and does mean inconvenience. When you take a wheel off or run along until a wheel splits and then run along on the bearing, that means they are liable to pull down the trolley. And the same with a pole that is badly bent. A car has a trolley pole bent and it leaves the wire. It is blamed on the overhead wire, and the linemen come and cannot see anything wrong, and they watch car after car go over, and nothing happen. But this car comes along and goes off, and every time it goes over the line somebody reports it, and then things are vitally interesting.

Mr. Baker—I will say a word in answer to Mr. Hile. I don't think he told quite all the story. Mr. Hile don't tell us sometimes he goes out and finds a crossing worn out so that it pulls our trolley pole off the car.

Mr. Mundy—Replying to Mr. Hile, we try to maintain a uniform pressure on our trolleys. I tried to have my own inspectors inspect these trolley bases, but I don't listen much to the other fellow. A little story to illustrate: Some years ago I was connected with the Louisville Railway, and I got the idea I could get up a better trolley base than any other on the market. We built fourteen. Almost immediately we started a new line, which required fifteen cars, and as we had these new bases in stock, we put fourteen of them on these cars, and one of the old T. H. bases for the old original type of long body. It had been a mule-car line, and we used the old drivers for new motormen. As you can imagine they didn't handle the

cars in the most artistic way, especially at crossings, and we had all sorts of trouble with trolley bases and trolley poles. One night I was going home from the shop and we stopped at a transfer point by which this line ran. There had been a block on the line for half an hour when we got there. We asked the transfer agent what was the trouble. "Oh, one of those new trolley bases pulled off and came down through the hood, and came near killing a man." "What number is that car," said I. He said "224." No. 224 was the only car out of the fifteen that had the T. H. base.

Mr. Bigelow—I would like to ask if any one has had experience in running four General Electric 800 motors? I understand Mr. Mundy has been running four General Electric 800 motors.

Mr. Mundy—I have four General Electric 800 motors running under cars, but they are too heavy for them. The repair account is a little high, but outside of that they are giving thorough satisfaction, and they run thoroughly well provided they are not used on our country lines. There where our voltages are a little high the bands don't stay on, and they come in and we get a bird cage. Outside of that they are all right. We don't use any shunt whatever. We use the motor with the full field.

Mr. Green—What is the weight of the body?

Mr. Mundy—The cars on which we have had them installed are 36,000 lbs., 18 tons. That is too heavy a car for these motors, and we are figuring on putting them on cars that will weigh 26,000 lbs. or 27,000 lbs. That, of course, means the total car body, trucks, motors and all.

President Farmer—I think you are getting a little off the subject of the discussion of Mr. Green's paper. There is nothing in his paper about some of the things that have been discussed, and it will only lengthen the session to a point where we will get tired. I would suggest that if the discussions are confined to the subject in hand it will be a great deal better, and we will make better progress. After we get through all the discussion on the paper then we can take up what was termed a heart-to-heart talk at the last meeting.

Mr. Hile—I would like to inquire from some of those here as to the best shop practice in the use of shafting and belt gear and of motor-driven machinery. By this time, it appears to me, there ought to be some experience to show which method is the most desirable.

Mr. Pestell—We have just finished a small shop—our shops are not very large—and we have subdivided the equipment to some extent by using separate motors for different departments. Thus, the machinery in the blacksmith shop, comprising the forges, power hammer and the belt cutter, is driven by one motor. The idea being that with the power-driven blower and power hammer one of the blacksmith's helpers would usually be more or less idle, and he could do all the bolt cutting that would be necessary. Then our machine shop is driven by another motor. In addition to that, in our winding shop, which is directly over the machine shop, we use a separate motor for driving coil tape machines. This plan seems to work out well in our case. Unless a road is very large the shops will not assume very great proportions, and I do not think that it is good policy to use individual drive for different tools. I believe that shops can be divided up into departments, which can be driven by separate motors with shafting and belting, although when a shop is very large the larger tools can profitably, perhaps, be driven by separate motors. I think Mr. Wright, of Providence, could give us a little information on that subject. He has a new shop.

Mr. Wright—We purchased the tools for our shop about two years and a half ago, and there was not as much motor-driven machinery on the market at that time as to-day. We have no tool in the shop or no machine that is direct motor-driven with the motor built on a part of the frame. In the carpenter shop most all of the machines are driven with individual motors, the motor resting right on the floor and being boxed up and the belt running to the machine. In the iron shop, of course, it is different. Iron-working machines operate different speeds, and unless you have a variable speed-motor you must necessarily use the cones. There we have a section of shafting for three or four machines, and perhaps a section of shafting for a dozen more somewhere else, so I think our practice is more to divide up the machinery into groups and handle the group with the motor except in the carpenter shop, where individual driving is the rule.

Mr. Bigelow, of Boston—There is no question in my mind but that for a large shop individual motors should be used for the larger machines, while the smaller tools should be driven in groups. We have one of our large shops, an old shop, driven by a motor, and the loss in driving the shafting is a very large per cent of the power used, taking readings of the power used by the motor in driving the shafting alone and then when the machines are in use. We have another shop, about which Mr. Lindall can tell you more than I, in which the large machines are driven by separate motors. There we have one group of smaller machines driven by a separate motor, and the results of power consumption there are much better than they would be in the shop if driven entirely by one motor, or any other source of power, as far as that is concerned.

Mr. O'Brien, of the Chicago City Railway—We have our machinery divided up in groups and driven from separate shafts. In the machine shop we have three motors. I have a line shaft divided up in three parts, driving each line shaft with separate motors, and the same plan is carried out throughout all the other shops. It is my opinion it is the most practicable way in street railway shop work. We tried to look into the matter very thoroughly when we were laying out the machines for the new shop and we came to that conclusion.

Mr. Green—If you will permit me, and excuse me for interrupting the discussion any further in regard to shop uses, I would like to have a little talk with our members here in regard to our Association. I see that we have a number of strange faces with us this morning, and I am very sorry that they were not with us yesterday, and could have taken a part in the discussions. We had three meetings yesterday, and what we are after now is to get all the roads possible interested in our society, and all the engineers and mechanics and heads of the departments to belong to our society as junior members. Mr. Ely, in making the opening address for the Street Railway Association, is going to call attention to our Master Mechanics' Association, and will do a little missionary work for us. But the thing for us to do is to exert ourselves and get all the new members possible. Our society is a success. I think we can honestly say this at this time, and what will help it along a great deal more is to get all the boys in. And what will help us along after that is that at the meetings the members relate their practice, and that is going to help us. It is surprising how many new ideas were suggested at the meetings yesterday.

President Farmer—The next in order is the paper by Mr. Mundy, on "Type-M Control."

DISCUSSION OF PAPER ON "TYPE-M CONTROL."

Mr. Mundy read the paper and said:

I called upon the Westinghouse Company on July 15 to get some information that I could embody in this paper. Mr. Westinghouse at that time was on the other side of the ocean and did not wish any information given out. They have their apparatus on exhibition here to-day. I haven't had the opportunity of looking into it as yet, as they had a padlock on it, but it is on exhibition now, and I think it would be a good thing for all the members to look into it.

Mr. Green—Mr. President, I would have liked to have had Mr. Mundy go into the question of the relative cost of

construction or maintenance and where to draw the line with type-M control. Where would hand control come in and what conditions would you have to operate under in order to use the type-M control; for instance, with single-truck cars, using other cars as travel increased and operating them as a train? There is a great deal that could be gone into on that subject.

Mr. Mundy—To be able to draw a line where you should start to use train control and stop hand control is, of course, a very much disputed point, and one which I don't believe anyone could reach. They are installing the apparatus on equipments as small as four 40-hp motors. They have also apparatus made, I believe, that is to handle two 40 hp. The difference in expense, of course, varies materially with the size of the apparatus. Roughly speaking, though, I should say that the difference between an equipment fitted with K-6 controllers, which you all probably know, and with the train control, is somewhere in the neighborhood of $800 to $900. This is an item. I may be mistaken in that, and I am only getting at it by guess work. Therefore, the question of a road equipping with the train control means materially greater cost. It is a very satisfactory apparatus in the sense that as far as the burnt tips are concerned the repairs are almost nothing. From quite a lot of experience with these contact tips that have run from nine months to twelve months, don't show much more wear with the use of current than they do if you simply make them all the same number of contacts without current. This is demonstrated more particularly in the factory, where we have run one idle and the other with current-breaking arcs, showing that the small arc I spoke of is not a destructive arc. The use of the apparatus on the single-truck cars is, of course, more a question of the operation of the road.

Mr. Olds—Regarding the use of the type-M control on single cars we now have it on twenty-five of our interurban cars. It has only been in use a short time and has proven very satisfactory. The motors with which they are used are each 60 hp, being a new machine gotten out by the General Electric Company, which is numbered 74, and which will also be on exhibition at the Schenectady works. I understand there has been some trouble by those who have operated it during the winter on account of the contactor sticking. We have had two stick thus far, but they didn't cause any trouble, as the circuit was open and the minute that it was again thrown in the effect was like putting the trolley on with the controller turned on full; the motorman knew it and got out and examined the apparatus. By simply touching the contactor it opened. The mechanism is more or less complicated, more so than I wish it was. There are a great many wires underneath the car, and the contactors are, of course, under the car, which is, I think, a very valuable feature. It takes the fireworks off the front platform. In Milwaukee passengers ride on the front platform as well as on the rear platform, and with hand control we get a display of fireworks once in a while on a four-motor equipment that we did not get on the single-truck two-motor equipment. This is caused by the larger amount of current fusing more metal in breaking. In this larger arc an arc of metal vapor is formed, which is very hard to break. As to the wearing of the contactors or burning of them I would like very much to hear from some that are using them, some who have had them in service for some time.

Mr. Lindall—Mr. Mundy states that undoubtedly the principal cause of our trouble is the necessarily heavy working parts of the controller having to move slowly. The arc is therefore longer in being broken, but I cannot say as I can see that principle clearly. For instance, we compare a platform controller operated by the motorman, and the Sprague controller, the current being broken by the reverser which is operated by a powerful spring. The break is much quicker with the Sprague than it is with the ordinary platform controller. It is an undisputed fact that the trouble in making and breaking contacts increases enormously with the current, but is it not a fact that the success of the contactor is due more to the individual blow-out than to the fact that they do not break heavy currents, on account of cutting in the resistance before the break is finally made. We have some few cars equipped with four G-73 motors, on which we use the Sprague controllers, and two reversers. With those reversers we have very little trouble. In fact some of them are in service for a year and a half without our being obliged to change any of the plates, showing very little burning, while on the reversers where we use 150-hp motors it is quite an expense for copper. I merely state this fact to show that the difference is rather in the amount of current that you are breaking, and as the current gets higher the destructiveness of the arc is very much more.

Mr. Olds—I see that we have with us this morning, Mr. John A. Beeler, vice-president and general manager of the Denver Consolidated Tramway Company. I understand they also have some of the M-control in service. We should be pleased to hear from Mr. Beeler.

Mr. Beeler, of Denver—We have had for a short time, about thirty days, one or two of our freight cars equipped with type-M control. We have had no opportunity as yet to use them in trains, only in coal trailers, simply to trail behind type-M. As far as we have used them we have found that they gave very satisfactory service. We use General Electric 53, 50-hp, four motors to a car, and we have had for the past year or two a number of passenger cars equipped with the K-6 and four 37 Westinghouse motors. We have had no trouble, however, with these controllers burning, nor have they, after eighteen months' service, shown any excessive wear upon the controller. Our experience with the type-M control has not been sufficient to give an opinion as to their durability, or the amount of wear, but as far as we can ascertain we believe it is certainly a great improvement over the regular controller.

Mr. Mundy—In my reference to the slower movement, I did not necessarily mean that of a pilot motor or electro-pneumatic controller, but if you take a controller of the size of a K-14 and compare it with a K-10 or K-12, the cylinder on the K-14 must necessarily move more slowly than on K-10. If you have equally rapid movement, when you cut off, something is liable to shake loose. As far as the breaking capacity of the contactors is concerned, I will state that personally I have tested these contactors, breaking 700 volts as high as 2500 amps. apiece. I don't believe the drum controller is made which will do that. There may be, but I have never seen it.

Mr. Olds—That is just the position I take in regard to the matter of drum controllers upon our heavy four-motor equipment. The motorman will feed up quickly and very often get over into parallel before they have gone 10 ft. Then, if they get a quick bell to stop, they throw current instantly off. The current that is being used is then enormous, and the arc that will form sometimes burns out the controller. The Chicago City Railway people, as well as ourselves are using a good many of these in city service, and I would like to hear whether they have any trouble burning out controllers under those conditions.

Mr. O'Brien—We are operating now in the neighborhood of 205 large double-truck cars, K-6 controller. The most have been in operation now two years. We are not having any special trouble at all with K-6 controllers. The fact is there is no more wear on them than naturally should be.

Mr. Mundy—I want to modify my remarks. I don't mean to say that I think the drum controller is not a satisfactory controller, because I do. I bank a great deal on it. I think it is the best we can have for some service, and the idea of adopt-

ing any kind of control similar to type-M control for all cars would be unreasonable, and we could not think of doing it. I don't think we would give any better service to our passengers or any safer service to our passengers, but there are some conditions under which the train control on cars will be more satisfactory than that on the smaller controller.

The meeting then adjourned.

AMERICAN STREET RAILWAY ASSOCIATION

WEDNESDAY AFTERNOON

The first session of the twenty-second annual convention of the American Street Railway Association was held in the ball room of the Grand Union Hotel, Saratoga Springs, on the afternoon of Wednesday, Sept. 1.

In the absence of President J. C. Hutchins, of Detroit, First Vice-President W. Caryl Ely called the meeting to order at about 2:15 p. m.

Vice-President Ely—By reason of the absence in Europe of President Hutchins the pleasant duty now devolves upon me of calling to order the twenty-second annual convention of this Association. During a recent visit to Europe, from which I have but just returned, it was my pleasure on the outward voyage to be a fellow passenger of President Hutchins, whom I afterwards saw at several different points and on different occasions. I bear to you his personal greetings, coupled with the highest expressions of regard and of regret at his inability to be present at this meeting. I am glad to be able to confirm the statement concerning his health contained in his letter, which you will hear read, and to say that it has continued to improve, and that he now confidently expects to return within the month and resume the active duties of his business position. The duties thus devolving so unexpectedly upon me, pleasant and agreeable though they may be, are not without embarrassments, but I shall enter upon them confidently relying upon your forebearance and asking your assistance and co-operation at every stage of the proceedings. We assemble to-day at one of America's oldest, most famous and beautiful watering places, in the midst of the historic associations and beautiful scenery of the upper Hudson Valley. Concerning all that may be said of the locality and its surroundings, its people and their hospitality, and of the great State within whose borders it is situated, there is no one better qualified to speak than the able and distinguished lawyer who has been selected by the local committee to welcome you to the place. I have the pleasure in introducing to you one of the leaders of the Senate of the State of New York, the Honorable Edgar T. Brackett, of Saratoga Springs.

Senator Brackett—On behalf, and in the name, of the municipality in which you are assembled, I give you welcome to her borders. Saratoga, the greatest pleasure resort of the Western Continent, extends to you her most cordial greeting. As a layman I cannot forbear to extend to you, workers in one of the most important lines of the world's industries, congratulations on the progress you have made in the last decade. The problem of transportation, of the comfortable, speedy carrying of the crowds in our cities and villages, is second only to the problem of feeding the same crowds. Indeed, the problem of carrying is corelated with, and not a little involved in, the problem of feeding. How well you have worked out this problem, both in urban and country communities, will be recalled and appreciated by every one who compares the present lines and methods, with those of twenty years ago, when behind a sorry team you entered a little car, and reached through an opening in the front door to pay your fare to the driver, who furnished you change up to $2. The world moves, and with it our crowded populations move too, and with speed and comfort. It is,too, not only in the centers of population that your work has resulted in comfort and in satisfaction to the people; to my mind, if possible, a greater good has come to our rural communities from the extension and perfecting of your work. No one who has failed to have the experience of life on a remote farm can appreciate the monotony and loneliness there existing during the months where the highways are practically impassable. I do not forget that there are compensations, but the monotony and loneliness are there. I know of nothing that so relieves from these conditions as the coming of an electric line through a neighborhood. With its facility of boarding at any point it often means to a rural community, especially the women, all the difference between absolute isolation and a reasonably close touch with the rest of the world. And so I place your work, not simply as one that develops commercial propositions, but one that goes further and becomes one of the positive forces in the diffusion of education and in the development of our civilization, and as such workers I again bid you welcome to Saratoga Springs.

The Vice-President—We return our hearty thanks to Senator Brackett for his most gracious welcome to Saratoga Springs. The next order of business is the calling of the roll. If there is no objection the registration at the door will take the place of the roll-call and will be passed. The next order of business is the reading of the minutes of the last meeting, and unless objection is made the minutes will stand approved, as heretofore printed. The secretary has a resolution, which is offered by Mr. Vreeland.

Secretary Penington read the following resolution:

Whereas, The executive committee of this Association, at its meeting held in Saratoga Springs, Feb. 23, 1903, owing to its inability to secure hotel accommodations for the annual meeting of the Association at any other time, issued its call for the meeting of the Association to be held in Saratoga Springs Sept. 2, 3 and 4, 1903.

Resolved, That the action of the executive committee be, and the same is hereby approved, ratified and confirmed, and that this meeting is hereby declared to be the regular annual meeting of the Association for the year 1903.

Resolved, That all of the business of this Association be proceeded with at this meeting in accordance with the by-laws of the Association applicable to regular meetings called and held within the date provided by article vii. of said by-laws.

The Vice-President—Gentlemen, you have heard the resolution. Are there any remarks?

Mr. E. P. Shaw, Newburyport, Mass.—I move the acceptance of the resolution. (Motion seconded and carried.)

The Vice-President—If there are any persons present who are representatives of companies not members of the Association, and they desire that their companies shall become members of the Association, we shall be glad if they will make known their wish to the secretary at the close of this meeting.

The secretary has a letter from President Hutchins, and some other communications of interest, which he will now read:

Zurich, Aug. 3, 1903.

Mr. T. C. Penington, Secretary American Street Railway Association, Chicago.

My Dear Mr. Penington.—I have delayed writing you until now because my plans were not quite certain; but it is now finally settled that I shall not be able to return in time for the Saratoga Convention. I am much disappointed that this is the case. My health is very much improved—in fact I feel as well as I have ever been, but it is thought I should not risk a relapse by hastening back, and consequently I have concluded to remain in Europe until the middle of September.

I am sure, remembering our trip to Saratoga, that you have everything in good shape for the convention. Mr. Ely will, doubtless, be back in time to preside, and I am confident everything will pass off all right—better, in fact, under his skilled handling, than would be the case were I present. My duty, however, is there, and it pains me that I have to write that I cannot discharge it.

Hoping that I may make amends by such work as I may be able to do for the Association in the future, I remain,

Sincerely yours,

J. C. Hutchins.

The Vice-President—The very great sorrow I have felt at knowing it would be impossible for President Hutchins to come here, I know will be shared by all the members of this convention. His integrity, his ability, his stick-to-it-iveness in the transaction of his business and his work are well known to you all. It is also well known that his devotion to the duties of his position brought him well nigh to death's door, and that he left the country under the imperative orders of his physicians, as the only way to save his life. He is a better-feeling man, and is more hopeful now than he has been for a number of years, and I congratulate him upon it and I congratulate you all upon it, because we could ill afford to lose so useful a member of this Association. It is customary, gentlemen, to have an annual address presented by the president of the Association. Mr. Hutchins has been in such condition that he could not prepare one. I arrived in New York last Saturday, reached my home in Buffalo on Sunday, and got here on Monday, and have felt that something should be presented to you. I have prepared something in the nature of an address, rather hastily, but I could not affront you by offering anything to you which was not the result of careful thought. The following is what I have prepared for this occasion:

VICE-PRESIDENT ELY'S ADDRESS

In presenting to you under existing circumstances a few brief references to matters and things of importance affecting the interests of your Association, a proper sense of the importance of the occasion and the magnitude of the interests represented here impels me to ask your indulgent consideration of the statements, which, while representing the result of careful thought and reflection, have been somewhat hastily formulated and put together.

The present condition of your Association, as appears from the reports of the executive committee and secretary and treasurer about to be submitted, is most gratifying and calls for sincere congratulation.

Statistical information of any great length concerning the magnitude of the interests represented in this Association would be wearisome and perhaps confusing. It is sufficient to say that from the recent United States Census reports upon the street railway industry it appears that there were on June 30, 1902, in the United States 987 companies, owning and operating 22,589 miles of single track, upon which were transported in that year more than four and a half billion passengers, by the use of more than one and one-q arter million of horse-power. The aggregate mileage run by the cars used in these operations exceeded one billion miles. In these stupendous operations capital is employed as represented by capital stock and funded debt in the aggregate amount of two billion four hundred million dollars. These figures represent the investments of many thousands of people and relate to the intimate concerns and the daily life of millions of people. They are therefore the legitimate subject alike of popular and governmental interest and inquiry, and correct data and information concerning them are matters of the very highest importance.

I am glad to be able to state that the methods of keeping the records and accounts of this class of transportation companies are improving from year to year, and that it is rare to find an instance where the fullest and freest information is withheld from even the most casual inquiry. Service of great value has been rendered in this department of street railroad work by the Street Railway Accountants' Association of America. The classification of construction accounts and operating expense accounts which has finally been settled upon by this Association was adopted by the United States Census Bureau in gathering statistics for its census of electric railways, and a representative of the Census Bureau has prepared a paper on the subject which is to be read in the Accountants' Convention now being held here. This classification has been officially adopted by the State Railroad Commissions of New York, Massachusetts, Connecticut and Maine, and is about to be adopted by the Commission of the State of Pennsylvania. The Association's form of monthly and annual report has also been approved and adopted by the National Association of Railroad Commissioners. The standard classification and forms of report have also been approved by the leading bankers and financiers of the country. It is quite common, I am informed, at the present time, for a banking firm examining properties with a view of purchasing to require the accounts to be changed in accordance with the forms of the Accountants' Association. It has already been adopted by many of the most progressive electric railways and by a larger number of companies than any other one system of accounting. Exact and precise uniformity in forms of classification and report are highly desirable, and the sooner it is attained the better it will be for the stability and value of electric railway investments, and it would seem that the system which has been worked out by our Accountants' Association and adopted by such high governmental authorities, and which has received the approval of the financial and banking community, ought to be speedily adopted by all. The members of the Executive Committee of your Association join me in urging upon members the desirability of immediate affiliation with the Accountants' Association, and the speedy adoption of its forms of classification and report.

The work of the various State Railroad Commissions has come to be of the highest value, not only in this regard, but in its bearing upon the actual operations of railroads in States where such commissions exist. The annual reports required to be made to such commissions are full and complete, and present data and statistical information exhibiting in the clearest manner the actual results of the operations of all of such properties within their jurisdiction. Their investigation of accidents and their causes, and their directions and recommendations concerning construction of safety appliances; condition of roadbed and bridges; signal systems and various other matters bearing particularly upon the operation of cars are in the main in accordance with the highest state of the art of railroad operation. The railroad commissions have come to be regarded by all progressive managers as wise and safe tribunals for the settlement of vexed questions which are continually arising. It is a singular fact that these institutions, which at the beginning were so vigorously combatted by railroad managers, almost without exception have come to be regarded as almost indispensible and of the highest benefit and advantage to the very corporations which are subject to their control and regulation.

The rapid growth of interurban electric railways and their extension through long stretches of country have brought the street railroad fraternity face to face with the problems which for fifty years have been from time to time the subject of settlement at the hands of steam railroad managers, and the wisest and most progressive electric railway operators are now following more and more closely steam railroad methods. The safety of the passengers intrusted to your care is your first and highest duty. In a short time your business has been almost revolutionized; the light cars drawn slowly by horses have given place to heavy ones, swiftly propelled by the powerful agency of electricity; the dangers attendant upon the operation of cars have been multiplied, and have in many cases far outstripped the protective measures and appliances absolutely necessary for proper and safe operation. The frequent recurrence of accidents on electric railways has been the subject of criticism by the press of the country, and the public mind is thoroughly awakened upon the subject. The attempt is now being made in a sister State to hold directors criminally responsible for an alleged failure to install safeguards at the crossing of a steam railroad where a fatal accident occurred. Apart from considerations of humanity and law, the proper discharge of your business requires that money shall be expended wherever improvements of this kind are necessary. From every point of view money spent for the prevention of accidents is money well expended, and you should never fail to impress upon those in control of the finances of your companies these views, and never flinch in pressing your recommendations until favorable action has been secured.

The greatest activity displayed during the year has been in the development of the suburban and interurban properties as distinguished from the purely local service of city companies. This development has been notable not only in the increased mileage, equipment and volume of business transacted by the interurban and suburban properties, but also in the extent of the field occupied and the scope of the service given.

A discussion of the possibilities of interurban electric railroading cannot fail to be of interest to any gathering in the Hudson Valley, where some of the most notable pioneer work in this branch has been done. The operating companies of this section have not only set a good example in indicating the possibilities of this class of service, but have gone on developing it and have maintained their commanding position as leaders in this field. It is estimated that there are now nearly 100 companies throughout the country engaged in the handling of freight and express business, and there are possibly as many more who are contemplating engaging in this work. All of these will be interested in the methods employed by the interurban companies of the Hudson and Mohawk Valleys, and by the city systems of Albany, Schenectady, Troy and other large communities which serve as distributing points. The organization which has been perfected in these places and the experience gained by the man-

agement, will, of course, be placed at the disposal of the visiting managers, who will need no assurance of the value of this opportunity for the examination of the practice adopted.

At the present time the water-power development in this region is one of the largest and most important in the country, and the street railway properties are taking advantage of it in securing their current at a low rate and insuring reliable and constant service. The engineering features that have been developed in this connection appeal to those who are directly in touch with this branch of the service. Preparations are now being made for greatly increasing the available power from this source, and it is anticipated that within a few years the entire electrical service of this region will be operated by current produced by water-power.

Another striking development of the year has been the tendency displayed toward consolidation of the street railway properties in the smaller cities, together with the electric and gas-lighting service; in fact, this tendency has been so marked during the last year that in spite of the large number of new street railway corporations that have been formed in the last twelve months, the actual number of operating systems has been only slightly increased. The value of the properties, however, has been growing constantly, and the general average increase in gross receipts for 1902 over 1901 was 9 per cent. The largest individual consolidation was that of the properties of the North Jersey Street Railway Companies and allied lines in the Public Service Corporation of New Jersey. Other notable consolidations were those at Augusta, Mobile, New Orleans, Kingston, Oakland, Norfolk, and Newport News.

From a financial standpoint, probably the most important development of this character was the acquirement by the Interborough Rapid Transit Company, of New York, through lease, of the lines of the Manhattan Railway Company, thus assuring the operation of the elevated and subway properties of New York under a single management. The physical union of the two properties had already been recommended by the Rapid Transit Commission, and it had been suggested that the trains pass between the subway and the present elevated structure at several different points. This is hardly practicable at present, although it is within the possibilities that an exchange of traffic may be effected. The rolling stock of the elevated system would not be suitable for operation through the subway, and the great weight of the cars that are being built for the latter would prohibit their operation in long trains upon the present elevated structure. This feature of the change in methods of construction and equipment is, of course, suggestive of the general advancement that has been made in the rolling stock of all branches of the service with a view of increasing the comfort and convenience of passengers, as well as the safety and reliability of operation.

The growing importance of mechanical and engineering departments in electric railroad operation has resulted in the formulation of a new association, The American Railway Mechanical and Electrical Association, which is meeting for the first time this year in connection with this convention. It is the purpose of this new organization to discuss mechanical and electrical subjects, exchange ideas on construction and equipment, and raise the standard of operation wherever improvement is possible. The necessity for better shop methods, and the advantages of correct and comprehensive records in the mechanical department are now generally recognized, and it will be the duty of the men forming the new organization to determine the best practice to be followed and see that it is adopted. It will be recognized, therefore, that the new association has an important mission and is entitled to the support and co-operation of this, the parent organization.

A number of individual instances have been afforded during the year showing the progress that has been made in electric railway engineering. In Pennsylvania two very important interurban properties operated by third-rail systems have been opened. One of these employs a protected third-rail, and is the first attempt at commercial operation of such a system. The line extends from Hazleton to Wilkesbarre, through a district that is visited by severe sleet and snow storms, and this feature of the equipment will receive a severe practical test of its efficiency. The other third-rail system mentioned is that recently opened through the Wyoming Valley and intended for freight and express service, as well as the transportation of passengers, in competition with several well-established steam lines. This property is particularly noteworthy because of the terminal facilities that have been provided and the organization effected for the collection and distribution of freight and express, as well as its transportation over the electric lines. It is really the first instance of the organization and establishment of an electric property intended for this class of service in which provision was made for handling a large volume of business from the opening of the road.

In station equipment and distributing systems, as well as in the character of the rolling stock, appreciable advancement has been made. At the last annual meeting, it will be remembered, a very interesting paper was read upon the steam turbine. The investigation of this important subject has been continued during the last twelve months, and a further contribution is promised for this meeting, which it is hoped will embody the record of the advancement during the last year. Already plans have been prepared and actual work has been begun upon the installation of several large power stations in which this class of apparatus is to be installed. The most important of this character for street railway service thus far announced is that of the new station of the Union Traction Company, of Philadelphia, where an installation of ten 5000-kw engines is contemplated.

A year ago considerable interest was awakened among street railway men, particularly those interested in interurban electric railroading, in the possibility of developing a single-phase motor for railway service. It was, of course, understood that such a motor would not be adaptable for city service, but many promises were held out to those who were interested in the development of long interurban lines. During the last twelve months assurances have been given that progress was being made, but up to the present time no reliable information has been available, and the electric railway engineers are still dependent upon the direct-current motor for interurban as well as city work.

Vice-President Ely (speaking)—This brings us, in a somewhat crude manner, to the close of the year. If you will bear with me yet a few minutes, I wish to speak very briefly upon several points of the highest importance. As I have run out of manuscript, I feel that you will pardon me if I go ahead without any.

First, I wish to refer to the work that has been done by the committee on rules, and I ask and earnestly urge every member here present to read the report of that committee with great care between now and to-morrow morning.

I also wish to refer to the papers to be presented here. The subjects were chosen with great care at the meeting of your executive committee held in this place last February, which was very fully attended. A businesslike and intelligent method in the printing and distribution of the papers upon the subjects so chosen has been heretofore adopted, and it is earnestly to be hoped that the same method will hereafter be pursued.

I wish also to speak of the admirable exhibit which has been prepared and installed here by the supply men. I think that a good, fair share of each delegate's time should be given, not only to a careful examination of the exhibits, but to a pleasant greeting and extension of thanks to the representatives of the companies which have expended so much money and so much effort in getting these exhibits here and installing them in perhaps a somewhat difficult and expensive place.

Another most important subject is that of general standardization. We have now arrived at a point in electric railway practice where it would seem that it would be possible very shortly to reach a general standardization which should extend, not only to road construction, equipment, and other features of the system, but also to every branch of accounting, and every branch of the operating, mechanical and engineering departments.

All these things appeal to business men; all these things appeal to those who have dollars in their pockets. It is business, and the quicker we arrive at a similar situation in our affairs, the better it will be for the value of the stocks and bonds of our properties, and the better we will stand in the face and eyes of the world, because we are charged, first of all, and most important of all, with the safety of millions of people.

The present status of this Association seems, according to expressions which yesterday found vent in your executive committee, to be somewhat incompatible with the nature and extent of the work now before it. It represents at the present time an attempt to mix fun and business, and from the mixture to obtain valuable business results—oil and water will mix as easily. No one can deny that it is a source of genuine pleasure to meet each other annually, but that feature could

still be retained, though the plan of the Association were to be changed. If the Association shall serve its highest purpose there should be, perhaps, a permanent place of meeting, with a settled, business-like method of defraying expenses, and no reliance upon the good nature and generosity of local companies for free entertainment; but a payment for all amusement by the individual members enjoying or participating in it. In this way the expenses could be reduced to a small sum, which might be defrayed in a manner similar to that adopted by a leading steam railway association.

Your executive committee has devoted considerable time to the consideration of this matter, and some plan will undoubtedly be communicated by it to the members in due time. Meanwhile, it may be, perhaps, proper to state that as yet no invitation has been extended to the Association by any company for next year's meeting.

I do not intend to weary you with long remarks, but I cannot refrain, in closing, from saying a brief word concerning the nature of your business. There is no other business in the world to-day that more intimately concerns the private life, the private necessities, the private conveniences of the citizens than the street railroad and the electric railway business; and, as Senator Brackett observed so correctly, not only the people who dwell in cities, but those who live in the small communities and upon the farmlands and in the byways of the land.

Draw a line which shall fairly define what belongs to you from the property of the public; then toe the mark, do not run away, be aggressive, be well informed, be prudent, fair, and confident, and win every fight that you go into, because your cause is just.

E. G. Connette, Syracuse, N. Y.—I move that we tender the thanks of this Association to our presiding officer for the very able address which he has presented to this convention.

The secretary put the motion, which was unanimously carried.

The secretary announced that the Hudson Valley Railway, the United Railway, of Albany, and the Schenectady Railway extended the courtesy of their roads to the delegates and their friends. Free transportation to be given on the badges of the Association.

The secretary also announced that the American Telephone & Telegraph Company and the Hudson River Telephone Company extended the courtesies of their long-distance telephone system to the delegates; the service to be given between 5 p. m. and 8 a. m. on presentation of the badge of the Association.

The Vice-President—The next order of business is the presentation of the report of the executive committee, which the secretary will read.

The report of the executive committee described the business transacted at two meetings of the executive committee during the present year, at which arrangements for the convention were made, including the selection of topics for papers, the assignment of the topics to the writers of the papers, and the various details of the convention.

On motion of Mr. C. D. Wyman the report of the executive committee was adopted.

The following rules of order to govern debate, recommended by the executive committee, were then presented and adopted by the Association:

1. No member shall be recognized by the president unless he shall announce distinctly his name and address.
2. Speeches will be limited to ten minutes, unless the time shall be extended by the convention.
3. Members who desire to offer resolutions, or other matters, to be considered by the convention, are requested to submit them in writing over their own signature to the secretary.

The Vice-President—The next business will be the report of the secretary and treasurer.

Secretary Penington read the report, which showed that twenty companies had joined the Association since the last meeting; that five companies had withdrawn, mainly because of consolidation. The membership on August 24 was 206 companies.

The financial transactions during the year were as follows:

Balance in bank, Oct. 1, 1902, $9,948.03; receipts, $7,677.28; total, $17,625.31. Expenditures during the year, $7,286.62, leaving a balance on Aug. 22 of $10,338.69.

The Vice-President—The chair announces the following gentlemen as the members of the committee on nominations to nominate officers and select a place for the next meeting: Messrs. Laffin, of Worcester; Goodrich, of Hartford; Sloan, of Chicago; Stanley, of Detroit; Henry, of St. Louis. This completes the preliminary business laid out for this session, and unless there is some other business to come before the meeting, we will adjourn until 10 o'clock to-morrow morning, promptly.

Mr. Grant, of St. Louis—I will bring before this Association the question of mail car service in cities. Some time ago a representative of the government came to St. Louis and said to the officers of our company, when we had the subject of mail car service up with him, that if some concerted action was taken by this Association he thought it would be possible for us to get an increase in the compensation now paid. This payment, as every one knows who has to do with the operation of mail cars, is not adequate. I should like to state, at this time, that at this meeting I will offer a resolution that a committee be appointed to confer with the government officials on the subject of increasing the compensation paid to street railway companies for carrying the mails.

Mr. Beggs, of Milwaukee—I would ask what report was made by the special committee which was appointed by this Association some three or four years ago, and of which the present Postmaster-General was a member, on this particular question. I should like to know whether the committee ever made a report. If not, I ask whether it would not be well to address a communication to the Postmaster-General, as a member of that committee, for a report on that subject.

The Secretary—The committee never made any final report. I heard from one member of the committee, who said it was impossible to do anything. He said that some effort had been made to secure increased compensation, but nothing had come from it.

Mr. Grant—If any action is to be taken it must be taken right away, because we shall have to go to the Postmaster-General and before the committee on appropriations before Congress meets. Unless we do that we cannot get any more money. A certain amount of money is appropriated for this service, and unless the appropriation is increased there can be no increase in the compensation. The committee's work would have to be done before Congress meets, whether Congress meets in October in special session or not; but the business relating to the subject of appropriations for mail service will be taken up in December, and the committee work must be done between now and December. The only thing the committee can do is to appear before the proper authorities and seek to secure an increase in the compensation which is allowed per car-mile for the carrying of the mail for the government. The committee should be appointed and go ahead, and then it can report what has been done at the next session.

The Vice-President—The motion of Mr. Grant is that the chair appoint a committee of three to take up the subject of the compensation to be paid by the National Government to the street railway companies for carrying the mail, the committee to enter immediately upon the discharge of its duties and to report at the next annual meeting.

Mr. Beggs—Does Mr. Grant contemplate the compensation allowed for rural delivery or does his motion only contemplate the city service?

Mr. Grant—Only the city service.

Mr. Beggs—I would broaden it, because the government is seeking, almost importuning, the interurban and suburban lines to carry mails at a rate which is wholly inadequate, as they desire to broaden the service in all of the cities. I declined to accept a proposition to carry the mail for rural delivery within thirty days, because of the inadequate rate. I should like to have Mr. Grant broaden his motion.

Mr. Grant—I have no objection to that.

The Vice-President—Mr. Grant consents to broaden the scope of his resolution.

Mr. Myers—What is the use of appointing a committee now to report twelve months hence. It seems to me there is not a uniform service, or a uniform compensation, except for mail cars on city tracks. I have three different kinds of contracts on my road. I certainly do not want to wait thirteen months before being put in possession of the report of this committee.

The Vice-President—The chair suggests that the resolution be committed to writing, and so amended that it will provide that as soon as the committee has finished its work it shall file a report with the secretary of the Association, who shall forthwith communicate it to all the members of the Association for their guidance. The chair will request Mr. Grant to frame such a resolution and present it at his convenience.

The meeting then adjourned until 10 o'clock Thursday morning.

THURSDAY MORNING'S SESSION

The convention was late in assembling, and the only paper presented at the meeting was W. L. R. Emmett's contribution on "Steam Turbines."

STREET RAILWAY ACCOUNTANTS' ASSOCIATION OF AMERICA.

WEDNESDAY MORNING

The first meeting of the Street Railway Accountants' Association of America was held at the Grand Union Hotel, Saratoga Springs, on Wednesday morning. President H. J. Davies, of Cleveland, called the convention to order at 10:20 a. m.

The reading of the minutes of the previous meeting was, on motion, dispensed with, having been issued during the year in printed form. The President's address was then read and appears below:

PRESIDENT'S ADDRESS

As I was not present at last year's meeting I did not have an opportunity to express my appreciation of the honor you then conferred upon me in electing me to the highest office within the gift of the Association, and I wish, first of all to-day, to give you my heartfelt thanks for that evidence of your confidence. It was the more complimentary and the more appreciated because it came to me after an absence of several years from the street railroad business.

The Street Railway Accountants' Association has grown within the past year in membership, in wealth and in influence. Notwithstanding the numerous consolidations of street railway companies, there has been an increase of sixteen in our membership. The treasurer's report, to be presented this morning, shows a balance in the treasury of about $2,400. When we remember that in 1899 the Association called upon the members represented at the meeting in Chicago for voluntary contributions to wipe out a deficit the present condition of the treasury is very gratifying. It is due mainly to the unflagging interest, zeal and activity, in this as in all Association matters, of our able secretary and treasurer, Mr. Brockway. The increasing influence of the Association is shown in the adoption by the United States Census Bureau and by various State bodies having to do with street railway statistics, of its recommendations as to the classification of construction and expense accounts, and as to blanks and forms of reports. The Railroad Commissioners of several States have adopted our classification of accounts, and the National Association of Railroad Commissioners, at its annual meeting six or seven weeks ago, approved with slight changes the form of report recommended at our Detroit meeting. I think it safe to say that the work of this Association has been more widely adopted and applied, with fewer modifications or criticisms, than any work of any similar organization in any line of business anywhere.

The standard system of street railway accounting is so simple and logical, and the definitions and explanations which accompany the Association's classification of accounts and form of report are so clear and minute that a street railway accountant whose company uses a different system may, without difficulty, make a report for any period for his company in accordance with the standard system, and so obtain a valuable comparison of its business with that of any company using our system.

Valuable as the work of the Association has been, however, much useful work remains to be done. It is not necessary, nor, perhaps, very important, that a standard method of shop-cost-keeping, of storeroom accounting, or of time-keeping, or a standard form of conductors' report, for example, be adopted by the Association; but these subjects are of interest to all our members. We all want to find the surest and shortest ways to results. One of the most beneficial features of our annual meetings is the exchange of ideas in conversations among ourselves outside of the regular meetings. Improvements in methods of accounting come to us every year from constant study and effort on our own part and from the relation of the experience of fellow-workers in the same line. Other subjects for consideration at future meetings may be the use of the kilowatt-hour as a unit (although this may not extend beyond statistics regarding the operation of the power plant), the best form of inventory of buildings, fixtures, track machinery, cars, material and supplies, and a further discussion of a standard unit of measurement and comparison. The rapid development of the transportation business will bring new problems from year to year, and give the Association good reason for continued existence.

A topic that has been touched upon at nearly every meeting of the Association, but never discussed, and which has always seemed to me of vital importance to every company, is that of accounting for depreciation in the value of the company's property, or providing a reserve fund from which to pay for renewals and betterments of the property. I know it has been said, in our meetings and elsewhere, that it is not the province of a street railway auditor to say whether depreciation shall be included in his accounting, or, if included, the rate at which it shall be calculated; that that is the business of the board of directors or the managing officers of the company. Of course, it is the business of the directors. So is the question of whether more cars shall be purchased, of whether track shall be renewed, of whether wages shall be increased or decreased. But it is the duty of the manager to report to the board the need of additional cars, of renewal of track, and to recommend an increase or decrease, if occasion calls for a change, in rate of wages.

And so it is the duty of the accountant to keep the managing officers and the directors informed, not only as to the gross earnings, operating expenses and net earnings of the road, but as to its real financial condition, which involves a statement or account of the actual value—not merely the first cost, but the actual present value—of the company's property. His books should show, not alone the cost of things and the expense of their maintenance, but their value at all times, and their value cannot be stated without taking into consideration the effect upon them of constant use—of wear and tear and waste. Street railway companies in these days employ experts as accountants, and pay them the compensation of experts, and accountants do not perform their full duty to their employers unless they point out to them (if they lack knowledge on the subject) that the value of a thing after years of use is not its original cost; that the difference between gross receipts and the cost of operation is neither surplus nor net income; that as track, cars and machinery wear but if the company makes use of them, the wear should be accounted for from year to year or month to month as it occurs; that the payment of interest upon bonds is not a discharge of the principal, but that the obligation will mature in time, and that, to provide for it, a fund should be accumulated from year to year or month to month, out of earnings; that while growth of population may add to the value of franchises, and this added value may offset for a time depreciation in the value of the company's tangible property, yet, as franchises approach their expiration, they depreciate in value, notwithstanding continued increase in the population of the territory served, and that financial embarrassment, if not ruin, is likely to result from constant disregard for these considerations.

It may be said that these are matters of common knowledge, and that it is not necessary for an accountant to speak of them, but the accounting methods of street railway companies indicate that the knowledge has not been generally applied. Promoters

and directors of many street railway enterprises have been either ignorant of the first principles of accounting, or guilty of an attempt to deceive their stockholders and the investing public as to the dividend-earning possibilities of their properties, and it seems to me eminently proper for this Association, or some one for it, to point out the effect of such misleading practices in accounting. I have never been an advocate of the publishing of detailed statements of the business of street railway companies, but, if their accounts were properly kept, and had been so kept from the beginning of the street railway business in America, with a proper appreciation of depreciation, and of the obligation to return borrowed money, it would not be so hard to convince the people of our cities that they have not been robbed so extensively as they supposed, that franchises are not as valuable as the capital stocks of railroad companies indicate, and that it may not be profitable nor practicable for a municipality whose officers ought, of course, to provide for its citizens efficient street railway facilities at the lowest reasonable fare per ride, to itself construct and operate lines of street railway and furnish as good acommodations as are now furnished by private corporations, at a rate of fare lower than that now almost universally charged in American cities. Roads are built with borrowed money—from the proceeds of the sale of bonds at less than par, with a stock bonus. If well located they are operated, even in the first year of their existence, at an apparent profit, no account being taken of depreciation, and no provision made for the accumulation of a fund to pay the bonds or renew track and equipment. From the gross earnings, operating expenses and interest on bonds are deducted, and the remainder is called net income, or surplus applicable to the payment of dividends. If dividends are not actually paid representations are made that they have been earned. The promoters list their bonds and stock on the local stock exchange and dispose of part or all of their holdings to people unfamiliar with promotion accounting. Then things wear out and must be renewed; more money is borrowed for this purpose or the company is "reorganized;" the vision of dividends recedes; the troubles are charged to political agitation, rather than to false accounting, and the process begins again. This is an extreme case, perhaps, but, although the capital stocks of most companies represent an actual investment much in excess of the bonded debts of the companies, the practice has not been uncommon. All companies have been affected and injured by it. Whether this method has been practiced with a design to deceive or through ignorance of the principles of accounting, the effect has been to mislead the public as to the amount of profit in legitimate street railway business, and to create or confirm the impression that an unjust and unconscionable contract was made between the company and the people's representatives. Unreasonable contracts do, doubtless, exist. That is not the point. I am not arguing that all profits are reasonable or all contracts just; I am pleading for honest accounting. The effect of improper accounting in one notable case was most forcibly stated by T. S. Williams, of Brooklyn, in a paper read by him at our meeting two years ago.

Honest accounting—I am not blaming the accountants; put the responsibility on the directors—they say it is their business, and not ours—honest accounting from the beginning of the business might have prevented many of the efforts now making by municipalities to reduce fares and to increase the taxes of street railway companies. The profits to the promoters from the sale of their stocks would not have been so great, but the legitimate earnings of those investors who actually put their money into the property would not have been less, and their investments would be in better condition to withstand some of the unreasoning assaults now made upon them. Publicity in accounting will not be so injurious to street railway investors as the false methods of accounting heretofore prevalent. Past methods in many cases—in nearly all cases—have been deceptive to stockholders and to the public. If the deception has come from ignorance it is inexcusable; if from design, it is dishonest. Whether it is dishonest, or whether it only deceives, it is bad policy. Let us be honest.

Some of us in late years have been trying to offset the neglect of depreciation by charging the cost of renewal of track and equipment to operating expenses. There is precedent for this in steam railroad practice, and it was recently defended by the Wall Street Journal in an article on "Capitalization," in the following words: "In a general way capital accounts or capital assets represent permanent investment and are in antithesis to quick assets. When an item is capitalized it usually means that the money has been sunk once for all in some kind of property that it is not expected to sell or convert. If we could imagine a railroad completely finished and in perfect condition, its capital accounts would be finally closed and its expenditures would all be charged to operating account." But, however honestly meant, this is only another mode of deception. It is not the truthful method. To charge against earnings the cost of renewals is to make one month, or one year, bear an undue proportion of expense or depreciation. The effect will be clearly apparent if we imagine all franchises terminated and the business of a company at an end. Under such circumstances the property of the company would stand on the books at its original cost—a valuation which, unless the road had just been entirely renewed and re-equipped, would be fictitious.

These suggestions are not new; they have been made by former presidents and others who have addressed the Association. The subjects of depreciation and of sinking and reserve funds are treated in every book on accounting. The only justification for their repetition here is the fact that improper methods still prevail.

The relation between the accounting and managing departments of our street railway companies is much closer than it used to be, and the work of the accountant, which has come to be more and more appreciated by the manager, has become more useful to the company. All receipts and expenditures coming under his eye, he can be a most val able aid to the manager in the operation of the road, and his usefulness in this capacity is as great as in that of recording the company's transactions for the information of its directors and stockholders. Systematic and intelligent accounting saves more than it costs. The accounting department is not a direct producer of revenue; its province is to keep tab on all income and on every item of expenditure; to compare the results of one period of operation with those of another, the receipts or expenditures, per unit of measurement or comparison, of one route with those of another; the business of one company with that of another; to ascertain why receipts are lower or expenditures higher on one line or at one station than at another; to show clearly and concisely the true financial condition of the company and the value of its property at all times; to throw a calcium light upon all the details of management so that the experience of the past and present may be constantly before the eyes of the officers and directors of the company as a guide for the future. The value of figures is not mainly in their numbers. A single fact succinctly stated is usually more effective than a volume of figures. But the figures should be behind the statement to verify it if questioned. It is more effective, for instance, to say that the number of passengers or transfers on a given line increased in the past month more than upon any other line of the system to give the percentage of increase, and, if possible, to point out the probable reason for the change, than to give to the management a detailed statement of figures showing the number of cash fares, number of ticket fares, number of transfers, fares and transfers per trip or per car-mile, upon each of fifteen or twenty lines of railway, from which the manager must pick the facts that will enable him so to change his schedules as to produce a like increase in business on the other lines; first, because the manager has not time at command for the study of these statistics, and secondly, because he has not usually an accountant's love of the study of figures. Of course, the detailed statements should be prepared and should be within the manager's reach, but the accountant will be more valuable to his company if, when he makes up his figures, he selects and makes a brief and pointed report of the most striking and important facts.

Your executive committee met at Cleveland in April with eight of the nine members in attendance. Several matters were considered and discussed, as will appear in the secretary's report of the proceedings. The most important was an invitation from the Association of Tramway Managers of Great Britain to attend a meeting of that body in Glasgow on July 10, at which a paper on standardization of tramway accounting was to be read. The invitation came to us through correspondence between C. N. Duffy, the secretary and auditor of the Chicago City Railway Company, and James Dalrymple, chief accountant of the Glasgow Corporation Tramways, on the subject of the differences between the methods of accounting of our Association and those of the city of Glasgow. In view of Mr. Duffy's careful study of the Glasgow tramway accounts, his extensive correspondence with Mr. Dalrymple and his intimate familiarity with this Association's work, the committee requested him to attend the Glasgow convention as the representative of the Association and at its expense. Mr. Duffy expected until within a few days of the meeting to go to Scotland to represent us, but the franchise situation in Chicago made it impossible for him to leave. A copy of Mr. Dalrymple's paper has reached us, and Mr. Duffy will give us the benefit of his study of it and of the discussion which followed its presentation.

One other committee, the committee on standard form of report, has been active in the year. A majority of its members attended at Boston a conference of the committee of the National Association of Railroad Commissioners on the same subject, and

represented us at the annual meeting of that association at Portland, Maine, last July. W. F. Ham, of Washington, and E. M. White, of Hartford, will present a report for the committee.

The secretary's report was then read, but the report of the executive committee was deferred until a later session.

REPORT OF THE SECRETARY AND TREASURER

It is pleasant again to report to you that we have prospered, that we have more members and more money than last year, and that if we were a stock company we would declare a dividend without cramping the business. We have added since my last report the following companies:

Atlantic Coast Electric Railway, Asbury Park, N. J.
Northwestern Elevated Railroad, Chicago, Ill.
Lynchburg Traction & Light Company, Lynchburg, Va.
Rockford & Interurban Railway, Rockford, Ill.
Nashville Railway & Light Company, Nashville, Tenn.
Santa Barbara Consolidated Railway, Santa Barbara, Cal.
Cleveland & Southwestern Traction Company, Cleveland, Ohio.
Hoosac Valley Street Railway, North Adams, Mass.
Evansville Electric Railway, Evansville, Ind.
Geneva Electric Tramways Company, Geneva, Switzerland.
Ashville Electric Company, Ashville, N. C.
Beaumont Street Railway, Beaumont, Tex.
Monterey & Pacific Grove Railway, Monterey, Cal.
Metropolitan Railway Company, Oklahoma City, Okla.
Pittsburg, McKeesport & Connellsville Railway, Pittsburg, Pa.
Little Rock Railway & Electric Company, Little Rock, Ark.
Spokane Traction Company, Spokane, Wash.
Stark Electric Railroad, Alliance, Ohio.
Columbus, London & Springfield Railway, Columbus, Ohio.
Conneaut & Erie Traction Company, Girard, Pa.
Sheffield Company, Sheffield, Ohio.
Cedar Rapids & Iowa City Railway & Light Company, Cedar Rapids, Ia.
Northern Illinois Electric Railway, Dixon, Ill.
Sanford & Cape Porpoise Railway, Sanford, Maine.
DeKalb & Sycamore Electric Company, DeKalb, Ill.
Canton-Akron Railway Company, Canton, Ohio.
Fairmont & Clarksburg Traction Company, Fairmont, W. Va.
New Orleans Railways Company, New Orleans, La. (Consolidated.)
Worcester & Connecticut Eastern Railway, Worcester, Mass. (Consolidated.)
Virginia Passenger & Power Company, Richmond, Va. (Consolidated.)

Total, 30, of which 27 are new, and 3 consolidations.

There have been withdrawn from our lists for various causes the following named companies:

Tiffin, Fostoria & Eastern Railway, Tiffin, Ohio.
Merida Tramways Company, Merida, Mex.
Erie Transit Company, Erie, Pa., Resigned.
Indianapolis & Greenfield Rapid Transit Company, Greenfield, Ind.
St. Louis, Belleville & Suburban Railway, Belleville, Ill.
Natchez Electric Railway, Light & Power Company, Natchez, Miss.
Citizens' Electric Company, Eureka Springs, Ark.
Central Rapid Transit Company, Pittsburg, Pa.
Consolidated Traction Company, Pittsburg, Pa.
New Orleans City Railway, New Orleans, La.
New Orleans & Carrollton Railway, Light & Power Company, New Orleans, La.
People's Tramway Company, Putnam, Conn.
Richmond Traction Company, Richmond, Va. (Consolidated.)
Richmond Passenger & Power Company, Richmond, Va. (Consolidated.)

Total 14, making a net gain of 16 for the year.

The record of membership since the organization of the Association is:

Year	Admitted	Withdrawn	Balance
Organization	25		
1897	12	1	36
1898	32	0	68
1899	34	2	100
1900	21	25	96
1901	25	11	110
1902	19	7	122
1903	30	14	138
	198	60	138

The finances are summarized as follows:

Brought forward from Oct. 3, 1902		$1,640.93
Received this year from		
New members—27 at $20	$540.00	
1901 dues	20.00	
1902 dues	120.00	
1903 dues	2,120.00	
Interest on deposits	53.06	2,853.06
		$4,493.99
Payments have been made this year for		
Salaries Secretary's office	$600.00	
Expenses Secretary's office	118.61	
Traveling expenses Secretary	99.49	
Traveling expenses, committees	424.61	
Account of Detroit convention	51.26	
Stenographer Detroit convention	110.00	
Printing report of convention	300.55	
Printing and stationery	278.78	
Miscellaneous	111.20	$2,094.50
On deposit Home Savings Bank, Toledo, Ohio	$1,058.11	
On deposit Van Norden Trust Company, New York	1,341.38	$2,399.49
		$4,493.99

There is open on the books for unpaid dues, $140.00.

There are no unpaid rendered bills.

No blanks have been added to the collection exhibited this year for the reason that it is considered better to make a new set soon rather than to have it partially up to date. The collection is now four years old in its present form, but some parts of it are a year older. In some measure it has been added to each year, until now, but not to the extent its importance deserves; therefore, to stop adding to this set now and to begin upon another collection which will comprehend those great changes in practice that have been brought about by consolidations and by experience, seems to be the best step to take to keep it really useful.

Now and then in the secretary's report there has been mentioned the addition of something to the Association's library. This effort has now resulted in a rather substantial collection of magazines and railway commissions' reports, and some books. So far it has cost nothing, but I wish to advise that a certain sum be set aside for the purchase of works upon such subjects as enter into our needs. This accumulation will always be useful, and an early start is better than lots of afterthought.

I might consider my duty done by a mere report of the changes in finance and membership during the years as they go by, but I connot refrain from setting before you at this time a more comprehensive view of the way some of the Association's problems appear to one who is at all times very near to them, and who has no period of weeks or months, as you have, of inaction in Association matters, but is constantly within hailing distance of its aims and its works during and between the annual conventions. Another reason I would bring forward would be that it is the only time during the year that I can say anything to you verbally, and should I limit this report to the mere details I would, perhaps, miss an opportunity to gain something for the Association. When it is remembered that this office has come in contact with every company that is, or has been, a member since the Association was organized, it will be readily agreed that some lessons have been seen and learned in that time, and so far as I am able I want to have you as the representatives of the members see one or two things as I now see them. It would seem that an association the same as our business can grow only by effort, and that effort should be in a direction pointed out by self-examination.

An association can be organized from two standpoints, one being for entertainment, and one being for work, these two can only be combined by the most careful administration, and by the members keeping clearly before them where the one leaves off and the other begins.

This, I believe, this Association has done pretty well, if our reputation and our records can be taken for a guide.

There are four things an association must watch carefully if it would truly be a success, its personnel, its finances, its work and its reputation. Of these I want to speak of but one, its membership.

Since the organization a constant plea has been made from this office, and from the president's, for the increase of the membership to its widest possible extent. But it is only fair to you to remind you that outside of a few enthusiastic members this effort has resulted lamely. In other words, it has been left largely to the officers to put forth the energy for membership. It may not have occurred to all the members, yet one thought stands out clearly to me, and I want you to see it, too. It is this: This is an association for the mutual benefit of its members and American

street railways. What it does to benefit one is to benefit all. Therefore, it is a mutual association, and so it follows that all are responsible, and all should help toward its advancement. We have withstood the loss of about fifty members through consolidations in the last three years, besides others, and yet we have gained even under these circumstances. I see plainly that we will lose at least ten more the coming year from the same cause, and I want to urge you to take up this matter and help to overcome this natural loss.

We thought at first that the smaller companies would not freely join; that the larger ones would be in the majority, but we have seen by experience that it is the smaller ones that gain the most by membership; therefore, our efforts should be directed toward any company, be it ever so small. There is no small item in operating expenses that can bring so large a return if properly used, as a membership in the railway associations, which is an argument that should be used to every company not now a member with us. Our past is one to show with reasonable pride, and the future will be as bright and useful if the present membership keeps awake to its opportunities, which I think it will. The correspondence of this office is filled with queries relating to a great range of subjects in railway accounting, and when these are properly solved by the secretary or by reference to other members, can any one doubt the usefulness of the Association? I hope to see the time when our work will be so large and important that it cannot be handled as it is now, but will have its secretary a regularly salaried officer and devoting his whole time to the work. Those are not idle words, but come from more than seven years' intimate contact with the whole situation, and with its possibilities plainly understood. When that time comes it may be permissible to let your officers work for the membership, but until that time I cannot help but feel that it is as much the duty of the individual member to be on the lookout for members, as it is for your officers, and I think you agree with me. We need a large membership, not so much for the finances, although they are important, too, but for the broader effect our deliberations will have.

Very respectfully,
W. B. BROCKWAY,
Secretary and Treasurer.

NEW YORK, Aug. 31.

Secretary Brockway called attention to the fact that the accountants had a separate registration booth, and that it was desirable that all members register there and secure the badges of this Association as well as those of the American Street Railway Association, with a view to advertising in that way the Accountants' Association.

The secretary also read an invitation from the Schenectady Railway Company to make use of its lines in Schenectady, Albany and Troy, for which purpose the badges of the Association would be honored, together with a schedule furnished by the company of its different lines.

F. E. Smith, of Chicago, suggested the advisability of considering the question of admitting public certified accountants to membership in the Association, with such standing therein as might be decided to be practicable. Several members reported the existence of a demand for the information gotten out by the Association on the part of the general accountant. While some members expressed a willingness to enlarge the field of membership in the direction proposed, others doubted the wisdom of such a departure, preferring that the Association be continued exclusively in the interests to which it had been devoted in the past. In view of the fact that the change proposed would involve an amendment of the by-laws, the president was, on motion, authorized to appoint a committee of three to draft such amendments for submission at the next convention, and he appointed as such committee Messrs. Smith, Magilton and Brockway.

Irwin Fullerton, general auditor of the Detroit United Railway, then read a paper on "Freight and Express Accounts," which is published elsewhere in this issue. This paper was discussed at length by the members generally. The discussion brought out much valuable information on a variety of details, such as the time and opportunity under varying conditions for making out way bills, statements rendered as to tonnage, commissions paid at the smaller stations to agents, the methods of charging the expenses of the freight and express business and the desirability of establishing a standard on that subject, the rights of companies in the several States of the country under existing charters to engage in this branch of business, the liability to shippers for goods carried, and methods of determining the weight of shipments.

In connection with this general subject, Secretary Brockway read a paper prepared by Mr. Harmon, auditor of the Electric Package Company, of Cleveland, accompanied with a set of blanks, which it is intended to reproduce in the convention report. The latter paper developed some discussion of the methods adopted for checking the collections of agents and preventing thefts. Reverting to the question of separating the expenses of an express and freight department, Mr. Ham thought electric roads might follow the example of the steam roads, which had determined that such differentiation was impracticable, and made no effort whatever to keep a distinction between passenger and freight expenses, but that some unit like the car mile or the car hour would admit of determining whether or not a given department was profitable or otherwise. In reply to the president, Mr. Duffy stated that the committee on standard classification of accounts had not considered the question of freight and express accounting as yet, but he thought it was in line with the work of that committee, and that if the convention desired he had no doubt the committee would undertake the work.

The president appointed the following committees:

On nominations: Messrs, Ross, of Montreal; Pease, of Buffalo; Bartlett, of Boston; Simpson, of Birmingham, and Duffy, of New York.

On resolutions: Messrs. Mitchell, Rogers, Fullerton, McAssey and Yeatman.

The question box was then taken up, with a view of giving opportunity for eliciting information upon matters not covered by the formal programme.

Mr. Mackey inquired as to the issuing of stopovers on interurban roads, on trains where the tickets were issued by conductors.

Mr. Pease, of Buffalo, stated that his company did not give what were regularly termed stopovers, but they did have a coupon for each division, allowing the passenger, when he reached the end of a division, to stop over as long as he pleased and then continue his ride. These tickets are issued by the conductors and credit is allowed for the 5 cents paid on the original division; the through ticket is sold for that much less, and the conductor returns the coupon as 5 cents, and the station clerk in settling with the conductor at the close of the day allows the latter 5 cents on each one turned in. The interurban conductor selling the ticket receives from the city passenger either a coupon or a transfer.

The secretary read the following question which had been sent to the desk in writing:

"What is the customary way of putting up receipts for the banks? It is asked because the banks in my city desire all coin to be wrapped, and I want to do it otherwise, if I can?" (Laughter.)

Mr. Henry A. Ferrandou, auditor New Orleans Railways Company, said that they had established a system of receivers at their seven different stations in New Orleans, and with a view of saving in office force they attempted to deposit their earnings as they came in from the receivers direct into the bank. It so happened that his board of directors was composed of presidents of the leading banks of the city, and at the end of two weeks they directed a change in the system on the ground that otherwise the banks would be obliged to hire more help; so he was now putting up the nickels in $5 packages, dimes in $10 packages, and dollars in $500 packages. He did not have to roll the packages, however.

Mr. Fullerton said that in Detroit they received a great deal of Canadian money, and the banks further insisted that that must be sorted from the American, both silver and bills.

In reply to a question by Mr. Lynn as to what part of the

ticket sold on interurban roads, or city and interurban combined, was treated as earnings of the day on which it was sold, Mr. Mackay said that in the case of round trips they put it all as earnings, because it must all be used on that trip; in the case of return coupons, they were treated as earnings the day they were lifted.

Mr. Mackay added, in reply to Mr. Simpson, that where a general ticket was used it was taken up and credited not only to the line on which it was taken up, but to the divisions in that line, and that they carried a ticket acount; the going portion of the ticket must be used on the day it was purchased, and on the same train, because it was sold on the train only, and represented a passage; under this method they had no regular ticket offices.

In reply to a question by Mr. Swift as to the methods employed to get rid of canceled tickets, Mr. Ham said that after looking into the question of mutilating machines, they found that there were machines that worked fairly satisfactorily, but at the same time they had decided that if the burning of the tickets was surrounded by proper safeguards they felt it was preferable. He thought that a macerating machine such as is used in the Treasury Department for the destruction of paper money would be very expensive. There was another scheme for treating the material chemically, which took off all the ink, but it was a nasty method.

President Davies stated they chipped out triangular pieces from the ends of the tickets, and sent them to the furnace to be burned in the building in which their offices were located, but found that in the summer time it made too much heat.

Mr. Mackay inquired whether it was the general custom to charge injuries and damages to account 33 as paid, or to pass them through a reserve. In their own case they passed them into a reserve. He raised the point that the standard classification made no provision for that, and the question arose whether it was not to that extent misleading.

President Davies replied that his companies passed them into a reserve account, or an accident fund account, charging a per centage of gross receipts in that account, and charging to that account the damages as they were paid.

Mr. Brockway said it was customary in his companies to charge it into that reserve fund and a certain proportion of the account into operating expenses each month, but to wipe that account out absolutely at the end of each fiscal year. As to providing for accidents which had occurred during the year and must be paid for later, that offset itself in a measure by having taken into the expenses, and into the fund, liabilities which were created during a prior year.

Mr. Mackay stated that the amount which went into expense account with them, for accidents, was an arbitrary figure based upon past experience, a percentage of the gross receipts, and at the present time their injuries and damages reserve fund, instead of being balanced, stood about $125,000 to the good, to take care of injuries and damages that had occurred, and which would have to be paid in the future.

Mr. Duffy thought that damages were only one of many other similar propositions which had to be estimated and apportioned, and that it was not necessary that the classification should specify anything on the subject.

Mr. Ford thought that if he had $125,000 set aside from surplus as a damage fund he would stop there and attempt to close his damage account with each fiscal year, inasmuch as by increasing that fund the company was deprived of the use of that much of its surplus. He thought the experience of Mr. Mackay's company in having a credit balance was the exception; that most railroads had a debit balance.

After some further discussion of the question of a damage fund and the expression of somewhat conflicting opinions as to the best procedure, an adjournment was taken until Thursday morning at 10 o'clock.

THURSDAY MORNING'S SESSION

The programme for the second day's proceedings was followed closely. The first subject on the list was the paper by S. C. Stivers, of the New Jersey & Hudson River Railway, on "Car Maintenance Records." This paper will be found on another page of this issue. The report of the committee on a standard form of report for electric railways, of which William F. Ham, controller of the Washington Railway & Electric Company, is chairman, had been prepared in the following form:

REPORT OF COMMITTEE ON FORM OF REPORT FOR ELECTRIC RAILWAYS

To the President and Members of the Street Railway Accountants' Association of America:

At the last convention of this association your committee submitted a report which was thoroughly discussed and finally adopted. The form of report presented was primarily for use in submitting reports to the Railroad Commissions of the several States. The same subject was to be considered by a joint committee of the National Association of Railroad Commissioners and your Association, and a report presented by such joint committee to the Portland convention of the National Association of Railroad Commissioners, to be held in Portland in July, 1903. By action of your convention the committee was continued and authorized to agree to such corrections as the Railroad Commissioners might require.

Your committee conferred with the Hon. George W. Bishop, of the Massachusetts Board of Railroad Commissioners, at Boston in June last, and a form of report was prepared, embodying, without change, the form of report prepared by your committee. This report was presented at the convention of the National Association of Railroad Commissioners, held in Portland July 14, 15 and 16 last, and was unanimously adopted.

To show the latitude allowed the several States in the use of this report, the following excerpt from the report of that committee will suffice:

> We realize that it is no easy task to prepare a form of report acceptable to all, as what one State might demand, another State might consider entirely unnecessary. If the form submitted lacks information which in the opinion of any State should be furnished, provision may be made for it without interference with the balance of the report.
>
> If, on the other hand, more information is demanded than is thought necessary, it may be omitted without changing the substance of the report. In this connection we refer particularly to "Schedule C," "detailed statement of rental of leased lines and terminals;" "Schedule D," "construction and equipment," and "Schedule E," "construction and equipment of leased lines."

In presenting the report, the chairman, Hon. George W. Bishop, of Massachusetts, stated before the convention that he felt very much indebted to his associates on the committee representing the Street Railway Accountants' Association of America, stating that they had spent a great deal of time on this matter, and that practically what they had worked out had been adopted in the report; also stating that he thought that the convention should feel much indebted to them and their associates for the time they had devoted to this work. Your committee make mention of this simply to present to your attention the cordiality felt toward this association by the National Association of Railroad Commissioners.

At the Portland convention your delegates were treated with the greatest courtesy and consideration, and we feel that the work of this Association was impressed upon the minds of the Railroad Commissioners present.

Having fully completed our labor, we suggest that our committee be discharged. Respectfully,

W. F. Ham,
E. M. White,
C. N. Duffy.

It is wonderful what different opinions judges have of the ethics of behavior in public. At St. Paul, Minn., recently a justice remarked that a motorman, under certain conditions of service, was justified in not stopping to take on a passenger. In striking contrast with this is the vehement utterance of a St. Louis judge, who, in discharging a man who had held up a street car with a revolver, said that any street car motorman brought before him on a substantial charge of passing passengers at street corners would be fined the limit of the law." "It is small wonder," said the judge, "that anarchistic feeling prevails among people who support the street car lines, for every day they see their rights trampled upon."

THE FIRST THIRD-RAIL ROAD IN CALIFORNIA

The North Shore Railroad of California, which is being converted from a steam to a third-rail electric railway, has been placed in operation between Mill Valley and Sausalito, a point across the bay north of San Franciso, and which is connected with San Francisco by a line of fast ferryboats. The official opening took place on the evening of Aug. 19, when 200 persons made the trip over the line as the guests of General Manager W. M. Rank. To transport the party a train of five cars was made up, two of which were motor cars. Power to operate the line is secured from the Bay Counties Power Company, whose line voltage is 40,000. This current is stepped down at the Alto power station and converted into direct current at 550 volts, at which pressure it is fed to the third rail. At the Alto power house is an auxiliary steam plant, and there also is a storage battery of sufficient capacity to carry the load for one-half hour. Oil burners are used under the boilers in the auxiliary plant. The rolling stock was supplied by the St. Louis Car Company, which also furnished the track equipments. The trail cars are very similar to light steam railroad cars in construction. They are 50 ft. 6 ins. over all, and seat sixty-six passengers. The motor cars are combination baggage and passenger cars. They are 50 ft. over the bumpers and 40 ft. 8 ins. over the corner posts. Unlike the trail cars they have vestibules, so that the motorman can shut off the platform he is occupying to form a cab.

SHOP NOTES FROM THE AURORA, ELGIN & CHICAGO RAILWAY

Braking service on the Aurora, Elgin & Chicago Railway is very severe and causes a large number of flat wheels as compared with ordinary interurban service where stops are not so frequent and speeds are not so high. One peculiar wheel trouble noticed on this road is blistering-like effect on the thread of the chilled cast-iron wheels. At the present time 800-lb. standard steel tire wheels are being substituted in place of cast-iron wheels.

Brake-shoes last about 5000 miles. This shows the severity of the braking service on this road probably better than anything else could.

During the last winter all of the contactors used in the General Electric type-M controllers which were placed under the cars have been boxed in, to protect them from flying dirt and snow. This was found necessary because of the high speed and the force of the air currents around the car, which caused snow to pack in the contactor boxes.

Cars are now equipped with a new lubricating device which has just been put on the market by the Railway Journal-Lubricating Company. This has two ball-bearing wheels running in oil held by springs against the journal. They carry the oil from the bottom of the box to the journal.

NEW POWER HOUSE AT LITTLE ROCK, ARK.

Ford, Bacon & Davis, engineers of New York, have designed a new power house for the Little Rock Railway & Electric Company, the construction of which is now under way. The building is a brick and steel construction with concrete floor, consisting of engine and boiler rooms with a basement under the engine room. There is being installed in this new plant one 1000-kw 500-volt railway generator, made by the General Electric Company. This generator is direct-connected to an Allis-Chalmers cross-compound condensing engine. A second railway unit of 600-kw capacity, General Electric make, direct-connected to a Hamilton-Corliss cross-compound condensing engine, is also being installed. In addition to this two lighting units will be removed to the new station from the old one. These units are three-phase, 60-cycle machines, one of 350-kw capacity and the other of 650-kw. The 350-kw machine is direct-connected to a McIntosh & Seymour tandem-compound condensing engine, and the 650-kw machine is direct-connected to a Hamilton-Corliss tandem compound-condensing engine. Wheeler surface condensers will be installed. Two new batteries of two boilers each, Aultman & Taylor make, are also being installed, and in addition an Aultman & Taylor boiler will be removed from the old plant and reinstalled. The new boilers are 550-hp each, and are of the water-tube type. The Buffalo Forge Company's forced draft system will be used. The building has been designed to allow of considerable increase in capacity.

THE RESPONSIBILITY FOR ACCIDENTS

Worcester, Mass., Aug. 15, 1903.

EDITORS STREET RAILWAY JOURNAL:

Of the large number of recent criticisms of present methods of interurban railway operation a major part lay the chief blame of the accidents upon the car crew. This seems to cover only a part of the story. For is it not true that railway companies issue in their instruction books "rules" that are systematically and openly violated—rules that are not enforced, and the existence of which is not suspected by the outside public until some accident brings forth from the management the statement that the crew disobeyed orders? Are not rules, the open violation of which is permitted, worse than no rules? And should not the management see that its instructions are not allowed to lapse into a state of desuetude that becomes at times anything but innocuous?

The riding public, although violent in its denunciation of the "criminal negligence" on the part of the company in case of an accident, will shout "let her go" when all is well, and "No. 10 is motorman and he will make up for lost time." Such approbation on the part of the public is not rare. It seems to the writer that criticisms at the time of accidents should sometimes be directed toward the management and the public as well as the car crew.

Dr. Bell, in a recent article, states in effect that not one motorman in twenty appreciates the danger space in front of his car at difference speeds. This appears rather a small estimate of the intelligence of the ordinary motorman. It is certainly a lower estimate than could be made of motormen of some of the roads throughout the country. If this gentleman will attempt to run a car over some of the New England roads, keeping up to schedule day after day, he will find that, at times at least, he must take chances on the danger space around curves.

This is a broad question, one that cannot be settled by the vociferations of a few theorists; yet I may venture to suggest that a school for managers and superintendents may be a good institution as well as one for motormen.

In this letter I have endeavored to call to your attention an aspect of the subject that does not appear to me to receive its share of the discussion. If I have erred in the attempt I trust you will pardon the error. READER.

Recently there was introduced in the City Council of Toledo, Ohio, an ordinance to "destroy" what is known colloquially as the end-seat hog, and the Detroit "News" expresses the opinion editorially that the railway companies themselves, through the improper arrangement of the seats in their cars, are responsible for the hog. With the poor Councilman at Toledo it is easy for one to sympathize, for back of his effort there certainly is sincerity born of personal suffering. With the "News," however, one is inclined to become impatient, and say that its utterance on the "pig-philosophy" of the end-seat hog is "damphoolosophy."

SOME OF THE PAPERS AT THE SARATOGA CONVENTIONS

CARE AND MAINTENANCE OF CAR BODIES

BY C. F. BAKER, SUPERINTENDENT OF SHOPS AND MACHINERY, BOSTON ELEVATED RAILWAY COMPANY, BOSTON, MASS.

The writer, in giving his views regarding the care and maintenance of car bodies, expects to meet with criticism, although it should be borne in mind that on the various roads in different sections of the country the conditions may vary considerably. In Boston, referring to the surface lines, we have comparatively few severe grades, but our crossings are numerous, and many of the streets are so narrow and crooked that they form an important factor in governing the size of our cars; so really our first care is to see that we keep within certain prescribed dimensions in order that we may pass on curves, keep off the sidewalk corners and be able to pass teams that may be standing on the street. Occasionally we are obliged to wait for a team to get out of the way, for with one wheel next the curb the hub on the other side of the wagon will not clear our cars.

Our next care is the drawings and specifications. We furnish the car builders with both general and complete detail drawings, so that should we place an order for 100 or more cars, dividing same between two or more car builders, they would all look alike; and should the workmanship and material be equally good in all cases, the cars would be practically the same. By pursuing this method we believe the cost of maintenance is materially reduced, as we have less spare parts to keep in stock, and a workman can do more routine work in a day than he could if working on first one design of car and then another.

Referring to our specifications, I would say these cover some twenty odd pages, and while to some of you this may seem voluminous, we often find that something has been omitted which should have been included.

We not only specify that all material and workmanship shall be first-class in every respect, and that all lumber shall be cut from live timber, to be free from injurious checks, wanes, shakes or damaging knots, but we designate the kind of material for each part and how it shall be put together. For instance, all tenons must be coated with white lead thinned with varnish; the bottom framing shall have two coats of lead paint mixed with oil. As the vital parts inside the car are covered by ceiling, finish, etc., and the outside with paint and varnish, its strength and durability depend upon the fitness of the material used and the honesty of the builder. It is most difficult to judge from the appearance of a car whether or not it will be long or short lived, and whether it will spend most of its time on the rail or in the repair shop. Full painting instructions are also given. But the point I wish to make is, that care taken to protect all tenons, joints and bottom framing or foundation of the car, etc., will add to its life and help to keep down the cost of maintenance.

The next point I would call to your attention is the car body bolster, which, if not amply strong, especially where center bearing trucks are used, the car will go down at the sides, or apparently up in the middle; and where this is the case there is more or less liability of trouble with the doors.

Assuming that the car has been properly designed, is built of the best material, and the workmanship throughout is first-class, care for same should begin in mounting it on trucks that will give it the best possible support and relieve it as much as possible from twisting strains, jar or vibration. Care should also be exercised in attaching the trucks, electrical equipment and all other apparatus to the body of the car, as boring or cutting holes in the various parts not only tends to weaken them but it is liable to furnish a path for moisture, which, if allowed to reach any portion of the work, is only equalled by fire or dynamite.

We have now reached the point where the car goes into service and is put into the hands of the car house foreman for inspection and care. On our road we have what the men term a "pit list," which arranges for one-third of the cars in each house to go over the pits every day; or, in other words, each car is over the pits every third day for general inspection and care of the car body and its equipment. The car house foreman makes out a list of the cars to have attention each day, and hands it to the men who are responsible for the different parts of the work, and they, at the end of the day's work, return the slips with all defects they have found reported thereon, in the meantime reporting to the foreman anything found out of the ordinary line of repairs. A car coming in from the street and reported for any trouble has immediate attention and is not held up for the three-day inspection. We hold our foremen responsible, and insist that they give their personal attention and supervision to all defects or irregularities reported by their, or other, inspectors. A man selected to inspect the car bodies is one who has served through the various departments of pit work and is considered capable of doing any of the work required of the car house men. I would say, however, that we do no extensive repairing or painting in our car houses, the work consisting of inspection of motors, trucks, controllers, changing wheels and axles, armatures, brake-shoes and the renewal of all parts subject to wear. The car houses are, however, supplied with a forge and some minor tools, and we have quite an extensive stock room in each house for supplying the spare parts of the various equipment, so that the work falling upon the car house foreman and his assistant in connection with the care and maintenance of car bodies is limited largely to that of inspection and renewals; although it is their duty to inspect and adjust the tie-rods, bolts, trusses and struts, keeping the cars in perfect alignment; doors, windows, ventilators, hand straps, rods, brackets, bells, register and bell cords should have thorough inspection and attention. Doors, rolls, pins, etc., should be oiled, and if a little bayberry tallow were occasionally applied to the sashes and posts, it would save trouble and possibly broken glass. They are cautioned to pay particular attention to all parts that might cause accident to passengers; for instance, loose register backs, signal bells, ventilator sashes, which might become loosened and fall; grab handles, rails, trap-door lifts, or screws that may project. On open cars the seat backs and arms should have attention, also the half-round iron on the steps and running board should not be allowed to project above the edge. Floor slats, where used, should be thoroughly inspected and none allowed to project above the level; trap-door lifts should be kept in proper shape so they will be available for use when necessary; all dirt should be cleaned from under the trap doors, so they will fit down closely and not project. The dirt which collects in the crevices will hold moisture, which is very detrimental to both wood and iron.

Under the head of care of car bodies might be included the cleaning, which, in some cases, comes under the department of transportation. It is a very important question, and one on which a great deal has been written. In 1900 the subject was one for topical discussion at the meeting of the American Master Mechanics' Association, and the questions of washing at terminals, dry wiping and using various cleaning oils and compounds were considered, and the report was published in July, 1900.

On the New York Central the success met with in dry wiping was quite gratifying, and I understand that road has done away with washing cars at terminals, except during damp weather. They claim the varnish stands better and the equipment looks better. Mr. Pflager, of the Pullman Company, stated that they had cleaned cars by dry wiping, also by using water, and at the end of twelve months very little difference was noticeable in the appearance of the car as to which method was used. Mr. Morris, of the Chesapeake & Ohio, said that for light-colored cars they used a cleaner of evaporating oil combined with linseed oil to neutralize the alkali in the quantity of soap deemed necessary for the composition. This cleaner was used about once a week on light-colored cars, while on the darker cars the dry cleaning could be used longer without the introduction of liquid cleaner.

Regarding our method of washing cars, we attempt to wash them once a week in dry weather, and every day during wet or muddy weather. We use a little alkali or soft oil soap for cleaning the sinker panels or parts that are painted white. Our instructions are to use cold water and as little alkali or soap as possible, and only when necessary. The cars are swept and dusted once every day, and the glass cleaned with Bon Ami every third day.

The elevated cars we do not attempt to clean, more than the glass and the inside of the car, for in their constantly going through the subway they become covered with a coating of grime or oxide, caused from the iron dust arising from the excessive wear of the brake-shoes, etc., which is impossible to remove without taking the varnish.

The practice of cleaning cars with petroleum is in vogue in England, it is claimed, with very good results. I understand this is being done by some of our steam roads, and would like to learn if any here are following that practice.

As car cleaning is a subject of interest to us all in the discussions which I trust will follow, I hope to hear expressions from the other roads represented here.

When our cars go into the paint shop for the annual overhauling, touching up, or repainting, they are dismantled or stripped of all cushions, seat backs, doors, hand rails and all metal or composition parts are removed and sent to the various departments for refinishing, polishing and lacquering, and the cushions and backs are thoroughly cleaned. The mechanics then take hold and do all the wood and iron work necessary to put the cars in proper repair and ready for the painters. If the painting is properly done we may be sure of many years of service.

The painter should work hand in hand with the builder from the beginning to the finish of the car, to the effect that all parts of contact and all exposed parts are thoroughly coated with best lead and oil as the building progresses in order to insure against decay. The painter should have one paramount idea in view—that of durability—as I believe the time is past when it is wise, or even possible, to tie a car up in the shops long enough, or to expend that amount of money necessary to attain the perfection of surface called for on a private carriage or coach. It is not the object of modern street railways to maintain, at a considerable expense, a painting department for the exclusive purpose of embellishing its equipment to the highest degree, nor is it the intent that all the energy of the painting department should be concentrated in the development of extreme display; but it is expected that the company shall receive adequate returns for the money invested, by giving its rolling stock all the protection possible under the existing conditions. The important points to be obtained are durability, cleanliness and wholesome appearance at a minimum cost.

To obtain the above standard nothing but the best material should be selected. The painter who specifies and insists upon having nothing else is the most economical man. With the best of body varnish that money can buy, together with choice pigments and vehicles, assembled and applied under the supervision of the head of the department in a judicious manner, after the method I am about to describe, we will, I am sure, have cars of continuously neat and dignified appearance, which should be commended by all who criticise from a reasonable standpoint and at a comparatively low cost.

Our procedure is what is known as the knifing process. After due care has been given to the steel and iron work, all rust, scales and imperfections eradicated, the woodwork as smooth as the cabinetmaker and sandpaper can make it, all parts thoroughly dry, all crevices, nail and screw holes well dusted, we proceed to prime with pure lead and a liberal supply of linseed oil, care being taken that not the minutest part of the car is slighted and that the priming is well rubbed in. Having seen to it that the car is well primed, a very important part of the work has been accomplished. It is then we putty all nail holes and indentures, care being taken to fill all places to more than the level of the work, as after same is dry and hard it must be sandpapered to a smooth surface.

We now continue the work on a lead basis; we mix what is known as a knifing coat. This is compounded from a portion of keg lead, dry lead, japan and turpentine, mixed quite thick and applied in liberal quantities and allowed to partially dry or set, as it is termed among painters. Then with a broad putty knife it is gone over by men who have become proficient in the work until the same has become perfectly smoothed, all brush marks obliterated, and uneven places leveled up; when dry, this is gone over with fine sandpaper and is ready for the ground color which is to follow. Again a light sandpapering and the car is ready for the body color, of which two coats are applied. It is our practice to add a small portion of body varnish to the body color, as it gives a little more binding and elasticity, which is of much importance. The car is then ornamented and two coats of body varnish applied, 48 hours between coats. The exterior of the car is now finished, and the knifing process has been substituted for the rough stuff and block pumice stone; and if the work has been properly done all requirements have been met at a much reduced cost and in less time.

The time consumed to finish a car from the wood by the above process should be about two weeks; while by the rough stuff method I would say not less than double that time. If, after a newly painted car has been placed in service six months, it is then taken in and one coat of body varnish applied, I know of no better investment or guarantee for its future condition, providing it has its yearly renovating. Thus we may expect many years of good service before having to repaint.

Regarding roofs, I would add that it is our practice to cover with No. 8 duck, care being taken to paint the top side of the roof boards with a mixture composed of linseed oil, lead and whiting, the canvas to be laid while the paint is wet. We then paint with two coats of lead and oil, excluding the use of sizing. By the addition of one coat of paint every two years, we are sure of a tight roof for many years; in fact, I can go back for very many years and trace roofs that are in a good state of preservation to-day.

FREIGHT AND EXPRESS ACCOUNTS

BY IRWIN FULLERTON, GENERAL AUDITOR, DETROIT UNITED RAILWAY, DETROIT, MICH.

The freight auditor of a large railroad said to me: "A good system of accounting is, of course, better than a poor one. But the poorest system thoroughly carried out with constant attention to every detail is much better than the best system when it is not vigorously enforced; and I make it a rule to follow up every error, however small, and insist that every agent carry out my instructions and be accurate in all his reports." The steam roads have, however, some advantages over electric lines. Their consignments are larger; the rates average much higher, and their employees have grown up with them. Our earnings do not warrant employing salaried men at some stations. The work is done by storekeepers who are paid a commission. They keep the most primitive accounts of their own business, and it is necessary to make up all their reports, and we are pleased when they are willing to pay cheerfully the amount the reports show due the company.

But I presume those who have to do freight accounting know of the troubles, and are only interested in the best method of doing the work. Let us, then, commence with the way bills which the billing clerk has just made out covering all the consignments from his station to all the other stations on the line.

These way bills are copied in a tissue copy book, and an extra tissue copy is made, which is sent to the auditor's office by first mail. These tissues must be sent in full size, even if but partially filled up.

Tissues from each station are sewed into a patent book in regular order, as shown by dates and numbers. These books will hold about 1500 tissues, and keep them in condition for handy reference.

The tissues from all stations are checked daily by the rate clerk, who examines the classification of all articles, the rates, the extensions, and the additions of every way bill.

Errors are reported on a correction form, which is "Exhibit No. 1." This is copied for our reference, and an extra tissue copy made. The original is sent to the station whose accounts are affected by the correction, and the tissue to the agent at the other end, for the purpose of calling his attention to the error.

We now return to the copied way bill, which is given to the conductor who checks the freight into his car by it, and receipts in a book for the way bill and all articles enumerated thereon in good order or with exceptions.

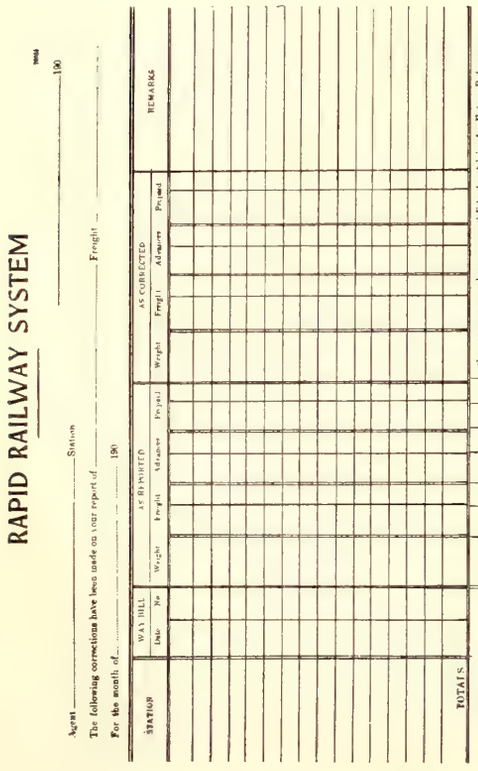
The conductor takes the way bill to destination, and gives it to the receiving agent, who checks his freight by it and receipts to the conductor. Articles over, short, or damaged, are reported at once on a form which is shown as "Exhibit No. 2." The way bills, as soon as received, are numbered in regular order, and this number—called Pro number (progressive) is used by the agent for reference.

The agent must immediately make out expense bills covering each consignement on the way bill, and show on each expense bill the Pro number of the way bill. The agent, in expensing, must check the weight, classification, rate and extensions, since he is held responsible for the collection of the correct freight charges when an error has been made by the biller. When he finds an error, he makes the expense bill for the correct amount, and makes a correction, Form "Exhibit No. 1," for the difference, sending the original correction and two tissue copies to the auditor, who approves the same, keeping one tissue on file and returning the original to the station affected, and tissue to the other station. The original figures on way bills are never changed. When the expense bills are made out they should be checked back on the way bill to see that they are all made out, and are correct.

Agents are particularly instructed to secure the receipt of consignee, or his authorized agent, at the time the freight is delivered on one-half of the expense bill, and the halves should not be torn apart until the charges are paid. The consignee cannot dispute payment of charges when the half bearing his receipt is presented attached to the bill for freight. The agent next enters an abstract of the way bill in his warehouse book. "Exhibit, No. 3" in Pro number order, and the total of the consignments should be checked with the total of the way bill. Next, the way bill is pasted in a scrap book in the same order. This scrap book makes

a convenient and safe file for the way bills, to which the agent can refer at any time. The warehouse book, being condensed, is of great benefit in checking up the month's work, and agents are always anxious to keep it, because it saves time in the end, being a check on abstracting, as will be explained later. But in the case of small stations, the checking can be done on way bills in the scrap book. At large stations it is best for agents to keep a freight forwarded book similar to the warehouse book, and abstract in this book from the tissue copy book of forwarded way bills all consignments on which freight has been billed prepaid, or with advance charges—but for the smaller stations this is not necessary.

The next record, the cash book, "Exhibit No. 4," is the most important of all; and when this book has not been properly kept the traveling auditor "is up against it." We, therefore, insist that this book be written up and balanced *daily*.


RAPID RAILWAY SYSTEM

Agent _____ Station _____ 190

The following corrections have been made on your report of _____ Freight _____

For the month of _____ 190

STATION	WAY BILL Date	WAY BILL No.	AS INVOICED Weight	AS INVOICED Freight	AS INVOICED Advances	AS INVOICED Prepaid	AS CORRECTED Weight	AS CORRECTED Freight	AS CORRECTED Advances	AS CORRECTED Prepaid	REMARKS
TOTALS											

Totals, as corrected _____

Difference—Agent's Debit _____

Difference—Agent's Credit _____

Correct your records at once and File this Advice for Future Reference
If any of the corrections are not understood write at once for particulars.

H. S. SWIFT, Auditor.

Per _____

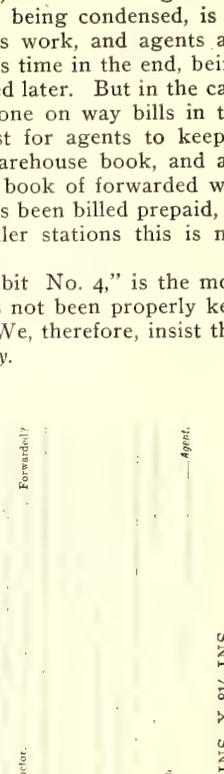
EXHIBIT NO. 1, 8¼ INS. X 10¾ INS.

Detroit United Railway.

Station, Week of 190

196 — Freight Received Account

WAYBILL Date	WAYBILL No.	FROM	STA. NO.	PREPAID Freight	PREPAID Charges	No. of Packages	Weight	CONSIGNEE	Destination	Freight	Charges	Total	Forwarded	Agent's Initial


Form No. 248

Detroit United Railway. G. E. A. Pro. No. _____

Station _____ 190 Agent's Pro. No. _____

Report of Express over, short, damaged, or wrongly consigned.

From _____ Way-Bill No. _____ Date _____ Car No. _____ Initial _____

Transferred by _____ From Car _____ to Car _____ at _____

Condition as noted at transfer

Was Car left or Express unloaded from Car?

Received from Car No _____ Date _____ 190

Conductor

Consignee, Marks and Destination	Articles Billed	State whether Over, Short or Damaged. Give Full Particulars

Agent

FORWARDING AGENT ANSWER FOLLOWING QUESTIONS.

By whom and in what condition loaded? _____

By what Car? _____ Conductor. _____ Forwarded?

For what other Stations did you load similar freight? _____

What other Cars loading at same time?

Destination of same?

If Over Express is from you, furnish billing and advise

Are you short, and on what billing?

Have you any record of express over?

Was express properly and securely stowed?

NOTE.—Agents must make a separate report of each consignment, and send one each to Billing Station and to the 1st Delivering Station on any thru passenger train on which Report of Express Agent will be filed, all delaying any train not to exceed 10 minutes.

_____ Agent.

EXHIBIT NO. 2, 9 INS. X 8½ INS.

Detroit United Railway.

RAPID RAILWAY SYSTEM

CORRECTION STATEMENT.

No. _____ Showing Way-Bill correction at _____ Station, for week ending _____ 190

Date of Way-Bill	No. of Way-Bill	Rail'd Car	Pro. No.	WHERE FROM	CONSIGNEE DESTINATION	ARTICLES	AS BILLED Weight	AS BILLED Rate	AS BILLED Charges	AS CORRECTED Weight	AS CORRECTED Rate	AS CORRECTED Charges	UNDERCHARGE (+) R. & D.	UNDERCHARGE (+) Other Items	UNDERCHARGE (+) TOTAL	OVERCHARGE (−) R. & D.	OVERCHARGE (−) Other Items	OVERCHARGE (−) TOTAL	NOT COLLECTED	NOT COLLECTED

Total, _____

Tot. diff. (1) _____ per cent. difference, if _____ per cent. or more of charges only, when billed to point beyond give destination only.

PROPER DISTRIBUTIONS ON OTHER SIDE.

(1) Insert DEBIT or CREDIT as the case may be.

EXHIBIT NO. 3, 16 INS. X 18 INS.

EXHIBIT NO. 5, 16¾ INS. X 10¾ INS.

When this is done, and the other records have been kept, it is only a question of checking to determine not only the exact balance due from the station, but also to show an agent whose accounts do not balance, the various errors he has made.

The agents check the entries in the cash book with the warehouse book, noting after each consignment paid the page in the cash book, and also noting cash-book page in the way bill tissue copy book of all prepaid items and items advanced.

The uncollected expense bills on hand should always agree with the items not checked off in the warehouse book and the unchecked prepaid items, while the advance items not checked (or advances to be paid) are a debit against the agent.

Agents are requested to remit the exact amount of each day's collections, and it is important to have a safe system for handling these remittances.

We have provided our agents with station seals, sealing wax, regular express envelopes, also needle and thread for stitching. The contents of envelope must be marked on the outside, and the agent signs and dates envelope, the signature of agent being an additional safeguard. Agents advise cashier of remittances under separate cover, and conductor receipts to agent, and cashier to conductor.

Conductors should also be provided with strong boxes in which to lock up remittances and valuable packages.

We were not anxious to take up the collection of C. O. D. packages, but found that it was necessary, in order to compete with express companies. We have done away with the return of the money collected as a needless risk and, instead, bill up the charges to be collected in the advance column. This gives the forwarding agent a credit with which to pay the consignor when the receiving agent reports on a special form that the consignee has accepted the shipment and paid the charges.

You will notice a column in the warehouse book headed "Corrections, Debit and Credit." Whenever a correction has been made, the cash-book entry is for the correct charges, and will not agree with the amount shown in the warehouse book. The amount of correction, debit or credit should be entered in the correction column, and is, of course, the difference.

The entries in the correction column should agree with those of the correction statement at the end of the period.

I have already told you that all billing is corrected in the auditor's office and that agents also make corrections, since they alone can detect errors in weight and in the description of goods. Of course, the agents duplicate a great many of the auditor's corrections, but in that case the agent's correction is made void.

There are some errors, such as mistakes in the prepaid or advance columns of a way bill, which are always a debit to one agent and a credit to the other. These are corrected by issuing a way bill showing the amount of the correction in the prepaid column only when the error is a charge against the station making out the way bill, and a credit to the station receiving the way bill.

With the amount entered in the advance column only the forwarding station is charged, and the receiving station credited.

Our baggage is all handled by checks which are sold at a uniform rate of 25 cents for each piece, and as the checks are all numbered it is quite easy to audit the agents' accounts. Separate abstracts are made for baggage. Checks are reported in numerical order on forwarding abstracts, and in numerical order by stations on received abstracts. Baggage consigned to points where there are no agents is double-checked. That is, the owner does not receive his half of the check.

I have now outlined the daily work of the agents. Our agents make out four abstracts each month, covering the 1st to the 7th inclusive, 8th to 14th, 15th to 21st, and 22d to the last of the month. But *one* balance statement is made out covering the work for the entire month.

Abstracts of forwarded way bills are made up from the tissue copy book. All way bills to each station are entered in regular order, as shown by numbers and dates. The footings of the prepaid and advance columns are proved by those in the forwarded book where one is kept; if not, the prepaid and advance columns are checked with the cash book before abstracts are sent to the auditor's office.

Received abstracts are made up in the same form from the original way bills posted in the scrap book. When totaled, the footings are checked with the footings of the received warehouse book. Forwarded abstracts are sent in promptly at the end of the period, but the received abstracts are held three days to allow all way bills forwarded each period to reach the receiving station.

A correction statement is made out on "Exhibit No. 5," shown herewith. On this blank are entered all the corrections for the month, and these entries are checked with those made on the warehouse book when checking the cash book.

The agent is next ready to make up his balance statement (Exhibit No. 6).

He first enters his balance from last month, then fills in the totals from his abstracts and correction statement, as indicated, also baggage collected, remittances made, and auditor's corrections on his previous month's abstracts. Next, the agent enters in the amount of the uncollected items made up from the uncollected expense bills on hand, and proved with the amounts unchecked on the warehouse book and in the tissue copy book. At large stations there is also a debit entry, "Charges advanced on way bills and not paid out," and a credit entry, "Advances paid and not way-billed." Another debit entry, "Charges prepaid and not way-billed," but the items billed prepaid and not collected go

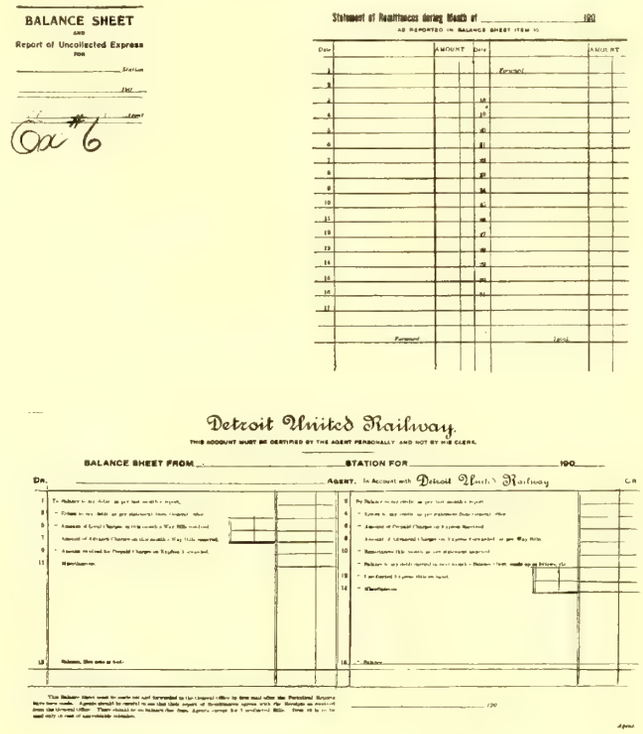


EXHIBIT NO. 6, 17 INS. X 14 INS.

in with the uncollected items. These last entries are not necessary at small stations, because they usually do a cash business.

The debit and credit sides of the balance statement should agree. If they do not, the agent should check over his month's work and locate the errors. Agents are required to list on the back of their balance statement all the items uncollected, and bring forward on the warehouse book the unchecked items, so that it is not necessary, when checking, to go back in the warehouse book further than the first of the month. At large stations, we allow the agents to hold their balance statement and make up a list of uncollected on the 10th of the month. They show the uncollected account on their balance statements in two items, "Amount paid 1st to 10th," and the "Amount unpaid on the 10th."

This reduces the work, as most of the last month's collections are made by this date. In the auditor's office the footings of abstracts are proved, and the forwarded abstracts are checked with the received abstracts. Each way bill should be checked.

I have already told you that all way bills are abstracted at original figures, so that the total of a forwarding agent's abstracts should agree with the total shown by the receiving agent's abstracts.

Errors in abstracting are corrected by reference to tissue copies of way bills. Agents' correction statements are also checked with the tissue copies on file in the auditor's office to see that they have taken up all corrections issued.

Reports of remittances are checked with the cashier's record. The abstract footings of each station for each period are entered in a freight record book (Exhibit No. 7), together with all debits and credits. In this book each agent has a separate page every month. The page is practically a balance statement made up from agents' abstracts, with the debits and credits necessary to correct errors, but, in addition, we enter the total freight and baggage forwarded. This book is, therefore, a summary of the freight movement at each station, as well as a record of total debits and credits. The balance in this book will agree with the agents' balance, if correct, after adding the remittances in transit. If agents'

balance does not agree, all errors are reported to him, and he is advised of the correct balance to bring forward the next month. From this book an abstract is made showing the earnings of each station, and the total represents the freight earnings for the month.

Our company handles most of the milk coming into the city from the districts we reach. It is shipped in 10-gal. cans. The revenue from this source is considerable.

We have a ticket (Exhibit 8) like a shipping tag, one of which must be attached to every can. This ticket has two coupons. The first reads:

2870

Detroit United Railway.
RAPID RAILWAY SYSTEM

CORRECTION STATEMENT.....

No.....Station

.....

Week ending.....190..

INSTRUCTIONS.

Report W.-B.'s at original figures. — Way-Bills must be *reported at original figures.*

Use corrected figures for Expense-Bill. — Expense-Bills must be made on corrected figures, and the difference *debited* or *credited* to the Station, as the case may be, by this blank.

Entries not in station order. — Make entries on this blank in the order of Stations, and leave one or two blank lines at least, between stations.

Extend Amount of correction. — Extend the amount of the "Undercharge" or "Overcharge" on each Expense-Bill; give divisions of the same *when such corrections affect other Roads*, and show total "Undercharge" and "Overcharge" from each station in "Total" column.

Why corrected — *Authority* for making the correction *must invariably*, but briefly, *be given* in the proper column.

How collected. — In the column at the right, note whether charges were collected *before or after the correction.*

Attach receipts etc., for refunds — When charges, for any lawful cause, are *reduced* on consignee's *or shipper's bill that have been collected*, the receipt of consignee *or shipper* for amount refunded must invariably be attached together with any correspondence or other papers giving special authority.

Appear in Fr't Rec'd. account Book. — All corrections *other than "refunds"* will appear in detail on the Freight Received Account Book.

When to be made, etc. — Correction Statements must be completed at the same time and sent with "Abstracts of Way-Bills Received"; and must comprise all corrections made on way-bills included in such abstracts or corrections, not previously reported, on way-bills dating prior thereto.

Recapitulate and prove. — Do not carry forward the totals from one sheet to another, but recapitulate *the several sheets of each statement*, on the last page thereof, and see that the difference between the total "As Billed" and "As Received" agrees with the total of "Undercharge" and "Overcharge" columns. Do not correct recapitulations, but use a separate sheet for this purpose if necessary.

Final proof and result. — When each statement is completed as above, recapitulate the totals of each sheet of the statement, and prove the combined amounts with the total Freight Received Account Book for the same period; and insert the final amount to be "Debited" or "Credited" to the Station.

Detroit, 1901. IRWIN FULLERTON, *Auditor.*

BACK OF EXHIBIT NO. 5

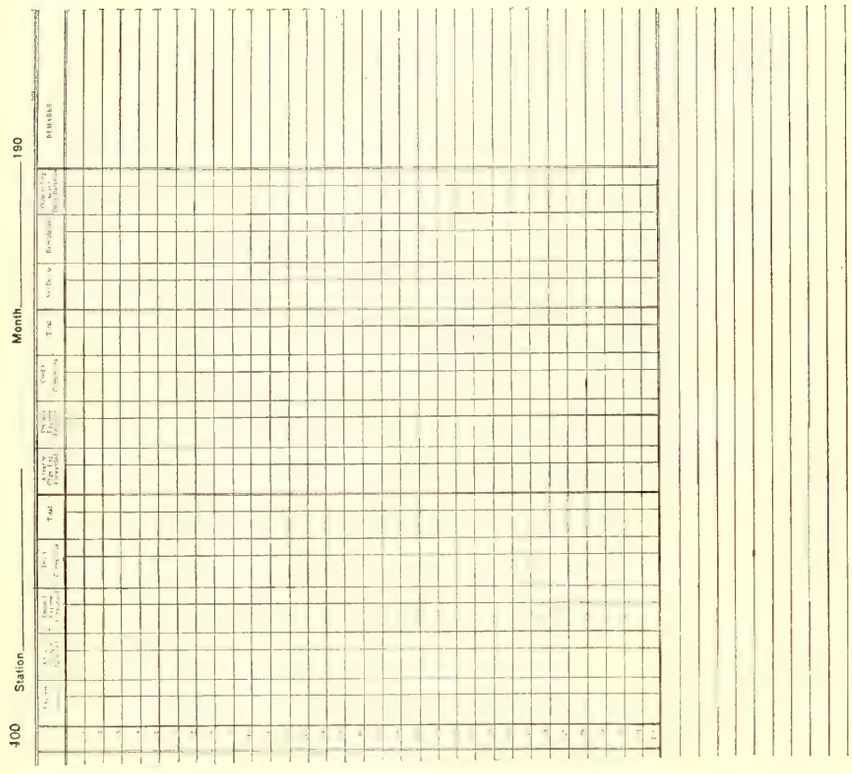


EXHIBIT NO. 7, 13½ INS. X 16 INS.

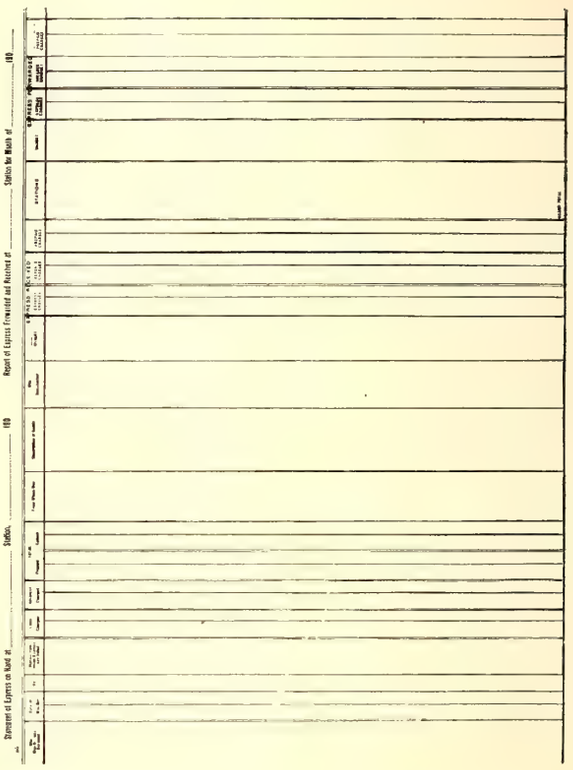


EXHIBIT NO. 6, 17 INS. X 14 INS.

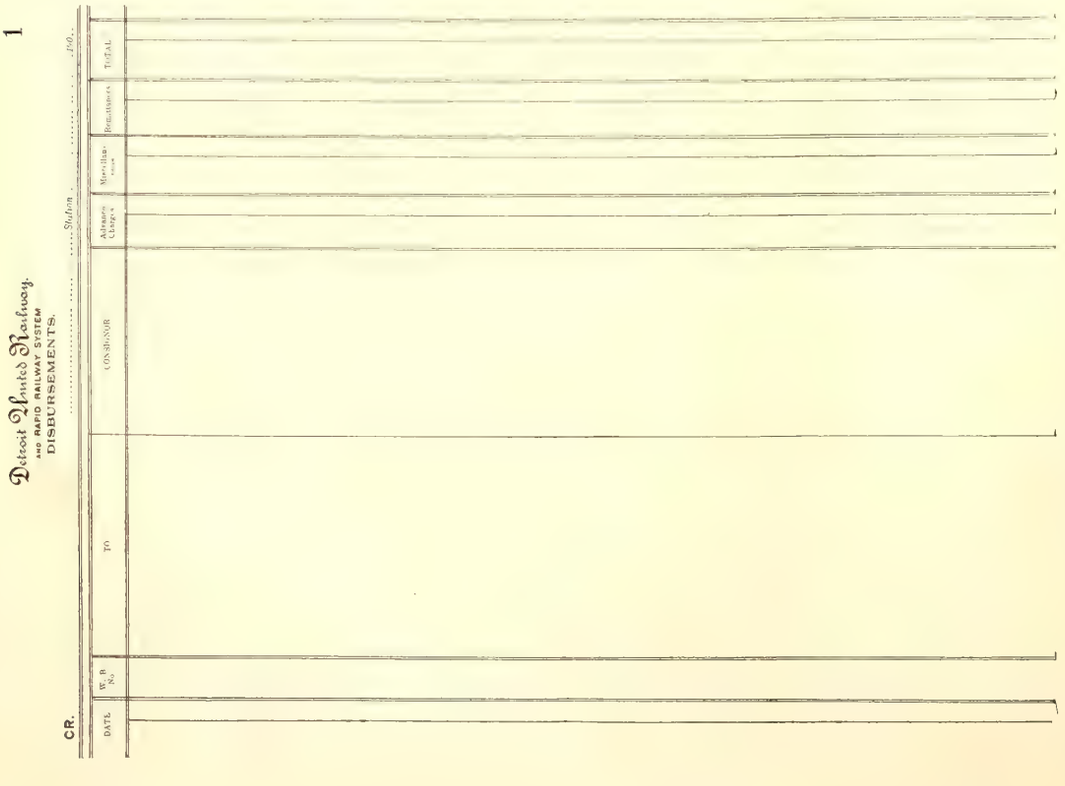


EXHIBIT NO. 4, 10 INS. X 15½ INS.

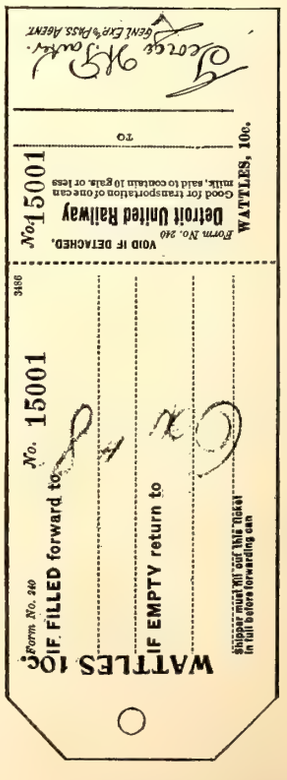


EXHIBIT NO. 8, 6¼ INS. X 2¼ INS.

"Good for the transportation of one can of milk or cream, not over ten gallons, between ———— and Detroit," and it is detached by conductor bringing the full can into the city.

The second coupon provides for the return of the empty can, and is taken up by conductor on its return.

The body of the ticket shows the address of both the consignor and consignee. The blank is printed with the name of the furthest station from which milk can be shipped at the rate at which ticket is sold. These tickets must be purchased in quantities, and in advance.

No receipts are given or taken for full or empty cans.

Conductors make daily reports of each consignment of full and empty cans, and return the coupons collected, with their report.

It is our custom to send the traveling auditor periodically to check up stations. He does not go like the bank examiner, so many times each year, but rather like the doctor, when there is sickness. Sometimes, the disease is weakness. The agent writes that he is not strong enough to make out a balance statement. Sometimes, it is a case of disordered intellect. When I went to school, one arithmetic had all the answers in the back. The teacher used often to remark sarcastically at the number of mistakes and incorrect methods which ended up with the right answer.

There are social visits when there is nothing wrong, but he has only to see that the agent's records are properly kept.

In each case, the traveling auditor should proceed in about the same manner. First, count the cash and see that it agrees with the balance shown on the cash book; then go back to the last correct balance, and check over the agent's work down to date. This is only a matter of time when you have the cash book properly written up.

Next to the inefficient agent, we find the greatest trouble with some agents who cannot understand the necessity of keeping their accounts your way.

I think that there is a certain literary instinct in everyone which suggests that a paper should be interesting, as well as instructive, but I shall be satisfied if this effort is worthy of the last adjective, and will content myself with the belief that I could have earned the first if I had written my experience with agents' accounts.

CAR MAINTENANCE RECORDS

BY S. C. STIVERS

In taking up this subject, the writer has confined himself to a description of a system of repair-shop accounting adaptable to small street railway systems, where the facilities for office work are somewhat limited, and where it is necessary to have as good results as some of the larger systems.

As the most important reason for keeping repair shop accounts is to enable the cost of maintaining individual cars, trucks and electrical apparatus, to be known in a manner that comparison of equipments may be made and an economical basis of maintenance be followed, to see whether the improvements in equipments, from time to time, are giving the results expected, and to see that the labor employed on the different classes of work is being performed in an economical, as well as satisfactory, manner, the accounting resolves itself primarily into a record which shows the amount expended for labor and material upon the different classes of repairs upon individual cars, trucks and electrical apparatus, and, secondarily, into an individual record of the more costly items of repairs, such as armatures, wheels and bearings.

Form 39

Do not write on back of this card.

Check .....

DAILY TIME CARD.

Date .....

Name .....

Order .....

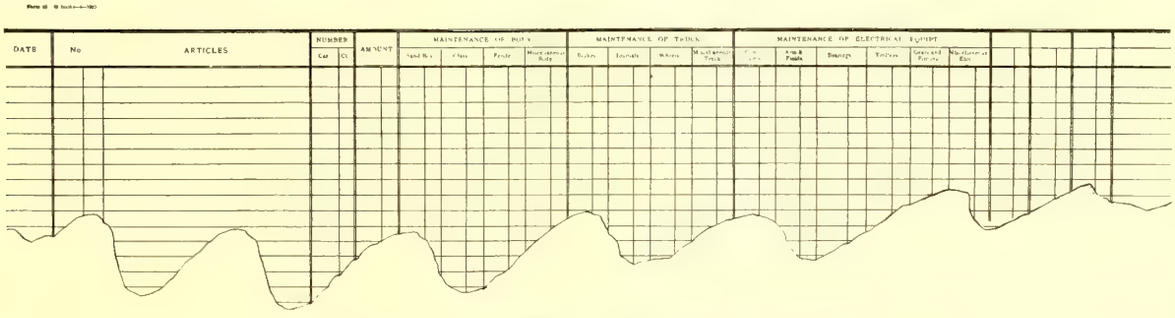
Hours ..... *Car* .....

Cl	NATURE OF REPAIRS	HOURS	REMARKS.
1	Paint		
2	Glass,		
3	Fender,		
4	Miscellaneous Body,		
5	Brakes,		
6	Journals,		
7	Wheels,		
8	Miscell. Truck.		
9	Controllers,		
10	Armatures & Fids,		
11	Bearings,		
12	Trolleys,		
13	Gears & Pinions,		
14	Miscell. Electrical.		
	Accident,		
	Other than Cars,		

DAILY TIME CARD—Original size, 3¾ ins. x 6½ ins.

The system of accounting in mind provides for these objects in having: First, an individual car record which shows the cost of all repairs, both labor and material, on any one car for any period or mileage. Second, an armature record. Third, a wheel record. Fourth, a bearing record.

The repairs are classified in fourteen classes, viz., paint, glass, fender, miscellaneous body, brakes, journals, wheels, miscellaneous



INDIVIDUAL CAR RECORD—Original size, 20½ ins. x 15 ins.

JERSEY CITY, HOBOKEN & PATERSON STREET RAILWAY COMPANY

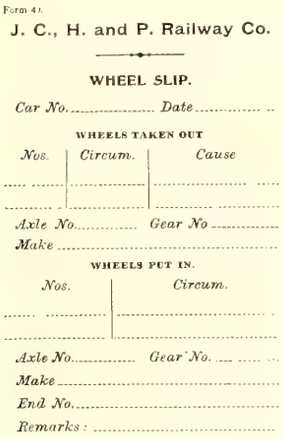
Car No. ..... Division.

Date	MAINTENANCE OF BODY					MAINTENANCE OF TRUCK					ELECTRICAL EQUIPMENT							
	Paint	Glass	Fender	Miscellaneous	Total	Brakes	Journals	Wheels	Miscellaneous	Total	Controllers	Arm. & Fields	Bearings	Trolleys	Gears & Pin.	Miscellaneous	Total	AMOUNT
	1	2	3	4		5	6	7	8		9	10	11	12	13	14		

STOREROOM RECORD OF MATERIAL ISSUED —Original size, 3¾ ins. x 6½ ins.

trucks, controller, armature and fields, bearings, trolleys, gears and pinions, miscellaneous electrical, which are numbered from 1 to 14, respectively.

The car record, which, as mentioned above, shows the amounts expended for both labor and material on the different classes of repairs which may be done on each car complete, is operated in the following manner. When a car is received at the repair shop for repairs it undergoes a thorough inspection, of which a report, showing the necessary work to de done, is made. An order bearing the car number as an order number is issued to the shop, and time cards are issued to the men employed on the repairs. These


Form 41.

J. C., H. and P. Railway Co.

WHEEL SLIP.

Car No...... *Date*.....

WHEELS TAKEN OUT

Nos.	*Circum.*	*Cause*

Axle No...... *Gear No*.....

Make.....

WHEELS PUT IN.

Nos.	*Circum.*

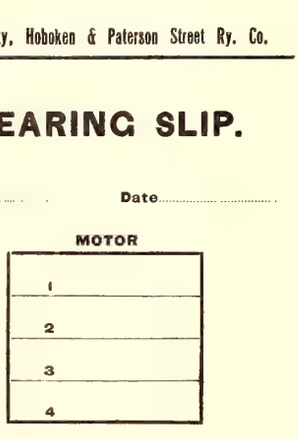
Axle No...... *Gear No.*.....

Make.....

End No......

Remarks:.....

WHEEL SLIP
Original size, 3⅜ ins. x 5 ins.


Form 6.

Jersey City, Hoboken & Paterson Street Ry. Co.

BEARING SLIP.

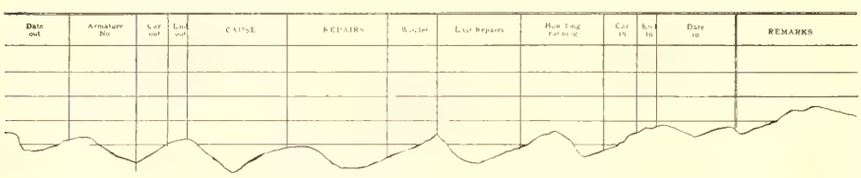
Car No..... Date.....

MOTOR

1
2
3
4

BEARING SLIP
Original size, 3⅜ ins. x 4¾ ins.

time cards are printed to show the date, name of employee, total hours worked and car number, and are subdivided into fourteen spaces, each space being for one of the classes of repairs. These cards also have columns which allow the number of hours spent on each class of work to be inserted opposite the respective class. The foreman of each department enters the time worked on each class of repairs in the proper space on each employee's time card



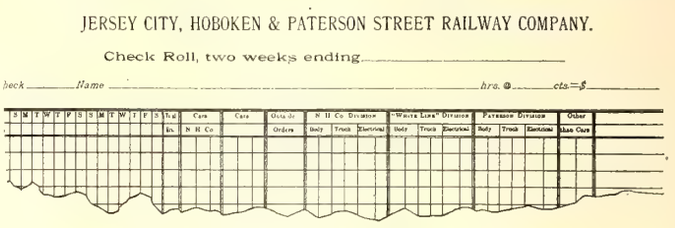
ARMATURE RECORD—Original size, 12¾ ins. x 10 ins.

and forwards it to the shop clerk, who enters this time in his time book. A summary is then made of the items on the cards which shows the amount spent for each class of work for each car. This is then entered on a daily report of repairs to all cars for that day. From this last report entry is made of each car in the car record, in which is provided for each car a page ruled in lines for the date and with a column for each class of repairs as enumerated above.

The material for the repairs is drawn from the storeroom upon an order issued by the foreman of each department. These orders show the material desired, car and order number, class number of repairs, and are entered by the storekeeper in a record book showing material delivered, price, class number and car number. The amount chargeable to each class of repairs for each car is daily abstracted from these books and entered on a report similar to the daily car report of labor mentioned above; entry is made from this report to the individual car record in the same manner as for labor. It is therefore evident by this means that a complete and detailed record of the repairs to each car is kept and by referring to the proper page and column one can learn at once the cost of any particular class of repairs on any car.

The armature record is important as a record of one of the more costly class of repairs, and it not only shows by the time the armature was in service whether the material used was up to the standard, but also acts as a check on the armature winder. This record consists of a properly ruled sheet with columns having the following headings, viz.: Date Out, Armature Number, Car Out, End Out, Cause Repairs, Winder, Last Repairs, How Long in Service, Car in, End in, Date in, Remarks. When an armature is removed from a car the motor repairer makes an entry of it on the blackboard in the motor shop, stating car number, armature number, end number and cause of removal. The foreman of the motor shop makes a report at the end of the day, using this blackboard as a basis, and entry is made in the record under the proper columns. The armatures are removed to the armature room, the repairs made and a report is made stating the nature of repairs and who worked on the same. Entry is made from this report to the armature record. The report of installations is made in the same manner. Thus the master mechanic is able at any time by looking up the record of the work to tell the value of any man in the armature room.

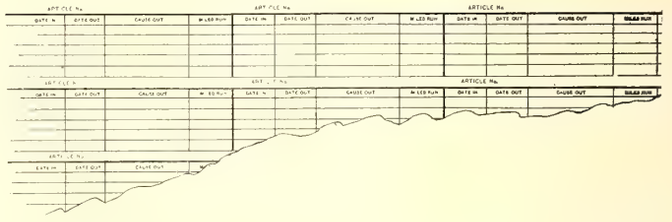
All of the wheels purchased by the company in mind have an


JERSEY CITY, HOBOKEN & PATERSON STREET RAILWAY COMPANY.

Check Roll, two weeks ending.....

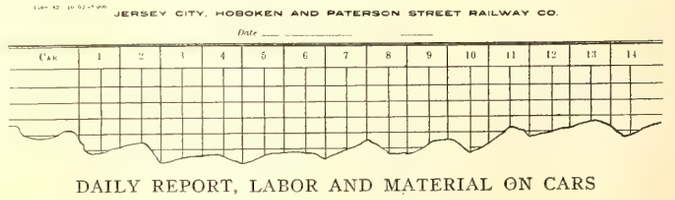
Check..... Name..... hrs. @..... cts.=$.....

TIME BOOK—Original size, 12¾ ins. x 16¾ ins.


WHEEL AND BEARING RECORD—Original size, 15½ ins. x 9¼ ins.

individual guarantee to make a certain mileage, and it is therefore important that a record should be kept for the purpose of seeing that the guarantee is fulfilled. This record consists of a sheet having spaces for Wheel Number, Date In, Date Out, Cause Out and Mileage, and is operated in the following manner, viz.: A report is made to the office by the foreman of the motor shop on a blank which is printed to show the car number, date, wheels taken out and wheels put in. The heading of "Wheels Taken Out" is subdivided as follows: Numbers, Circumference, Axle Number, Make, End Number and Cause. Under the heading, "Wheels Put In," the subdivisions, Numbers, Circumference, Axle, Number, Make, End Number, likewise appear. Entry is made from this blank to the wheel record. The individual car mileage for the car under which the wheel was placed is procured for the time that the wheel was in service and is entered in its proper column in the wheel record, and if the mileage made is not up to that guaranteed, the proper parties are notified and demand is made on the wheel company for replacement.

The armature bearing record is used principally for the purpose of keeping track of the bearings, and is very desirable, as it enables the master mechanic to see if the bearing metal furnished is of the proper quality and makes the mileage desired. A report called the bearing slip is made by the foreman of the motor shop, giving the car number, date and motor from which bearing was removed


JERSEY CITY, HOBOKEN AND PATERSON STREET RAILWAY CO.

Date.....

Car	1	2	3	4	5	6	7	8	9	10	11	12	13	14

DAILY REPORT, LABOR AND MATERIAL ON CARS
Original size, 10 ins. x 13¾ ins.

and this report, with the mileage made by the bearing, is entered in the bearing record. When a bearing is installed a report giving the car number, date and motor is made and entered accordingly.

In conclusion a few words about the time book may be of interest. The book provides spaces for the date of the pay roll, employee's name and rate, also columns for the days of the week, total hours and for the distribution of the charges which are headed Maintenance of Body, Maintenance of Truck, Maintenance of Electrical Equipment and Other Than Cars. When a time card is received the number of hours worked is entered under the respective day and the number of hours chargeable to the different accounts, as above, is extended to the proper columns. At the end of the pay roll the totals of the charge columns should equal the total hours worked. By multiplying the total number of hours of each charge

column by the rate the amount chargeable to each account is ascertained and entered accordingly on the distribution sheet which accompanies the pay roll to the auditor's office.

The total number of hours worked each day is entered on the pay roll, totalized and amount due set opposite the employee's name.

I might add that where work chargeable to other than maintenance account is done, that the same method described in the portion of this paper relating to the car record is used, with the exception that order numbers are given and an order number book is used instead of the car record.

The time is handled as for maintenance and amounts chargeable to the different accounts are extended to column headed, "Other than Cars," and the order number entered opposite charge.

Among the advantages to be obtained by the use of this system are economical office operation and elasticity of records.

One company, which has been using this system for some time with satisfactory results, operates upwards of four hundred cars and has repairs done at six of its car barns besides the repair shop, with shop office force consisting of two clerks, who, in addition to keeping the accounts, attend to the other office work connected with the shop, including correspondence, making reports, etc., which are called for from time to time.

The equipment of the company using this system might be increased within certain limits without increasing the expense of the office, it being necessary only to have pages enough in the record books to accommodate the additional car numbers, etc.

IMPROVEMENTS IN STREET CAR MOTORS

BY E. W. OLDS, SUPERINTENDENT OF ROLLING STOCK, MILWAUKEE ELECTRIC RAILWAY & LIGHT CO., MILWAUKEE, WIS.

We live in a progressive age and have to look back but a few years to see that improvements in street car motors have been made at a very rapid rate. The growth of electric railways in this and other countries has certainly been wonderful. Many of us remember when the first street car motors were put into successful operation—the old Sprague No. 6 and T. H. F.-20 being wonders of their day, the Sprague equipped with Sprague controllers, and T. H. with the so-called rheostat coffee mill. With them we were able to haul a 14-ft. or 16-ft. car with an eight or ten-bench trailer at a speed of from 5 m. p. h. to 12 m. p. h. We remember the trouble caused by burning out of controllers, breaking of rheostat cables, also short circuiting and burning out of brush holders, armatures and fields, caused by water and the picking up of wires, etc.

To meet the demands of to-day, our service must be rapid, reliable and safe. Our manufacturers and designers have not been idle. We now have reliable equipments, all motors being constructed practically waterproof, with the gears entirely inclosed, and are well lubricated (except when the gear cases are broken or out of order). The controllers are practically all series parallel and are giving good satisfaction.

Some of our street railway companies have had, and are having special motors built according to their ideas and to meet their conditions, the manufacturers being not only willing but anxious to push the development of the machines to meet the railway company's requirements. One of the weak points being covered by the manufacturers and railroad companies in their special machines is the construction of the motor frame to make it more accessible for inspection and repairs. Nearly all of our motors, as now designed, are arranged to open at the bottom, doing practically all of the repair work in the pit. In repairing double-truck equipments it has been found more satisfactory to lift the car body from the truck, making it possible to do all of the repair work from the top. To do this the top half of the motor frame should be designed to lift off, giving access to the armature, bearings, fields, brush holders, etc.

The dimensions of our gears have not been increased in proportion to the motors, as they show excessive wear, causing, very often, the swedging of the teeth. This should be remedied by making the gears with wider face. The quality of the steel should be better, that is, closer grained, and tough, thereby increasing the life of the gear with but little additional cost. The life of our present gears is from eighteen months to twenty-four months, and of pinions from twelve months to eighteen months. This should be increased 100 per cent. The advisability of using split or solid axle gears is an open question, each having its advantages and disadvantages. If split gears are used the bolts should be made larger and provided with nut locks, double nuts and cotters, making it impossible for them to become loose and fall out.

The gear case should be so constructed that it would stand abuse as well as use. To make such a case I believe it would be necessary to cast it as a part of the lower half of the motor frame, doing away with bolts and giving the gears absolute protection.

The armature bearings should be made longer and larger, with linings that may be easily removed and either rebabbitted or renewed. This would, we believe, make a saving of 50 per cent in our bearing expense. Their lubrication, also, is a very important matter. Until recently nearly all of our motors have been designed to use grease. Some manufacturers have used both grease and oil, feeding the oil with a wick from below and grease from cups above the bearings. Bearings have been designed to use only oil, to be fed through wool waste or wicks placed in oil wells below the bearings, both of which have been found very satisfactory.

Upon comparing notes with other master mechanics I find that a great many of them are using a cheap grade of babbitt. My experience is that the best is not good enough. We should have a metal that is hard, tough and close grained. Our motors must necessarily run more or less in the dust, the soft or open-grained metal will hold the small particles, thus causing excessive wear of the shafts. The average life of bearing linings on our city cars at present is about six months. It should be increased to not less than one year. On interurban cars the average is about eight months, and should be increased to eighteen months or twenty-four months.

The contact between commutators and carbon brushes should certainly be improved. This can be done by making the commutator bars longer and deeper, giving better contact with the brushes and longer life. The best manufacturers do not produce a carbon brush that is always reliable, the brush being, very often, either too hard or too soft, which makes poor contact and causes the commutator to become rough and black, thereby causing the motors to become overheated, burning out the armatures and fields. A better connection should be made between the carbon brushes and brush holders. Motors have been constructed to use the so-called "pig tail." Some users report that it is very satisfactory, and others that it is of no value. Without the "pig tail" the current is practically all carried by the brush hammers and springs, often causing the springs to become overheated, destroying their tension and making poor contact between commutator and brush.

One of the weakest points of our motors is the insulation of the magnet wire used for fields and armature coils. There have been a great many experiments made to find a satisfactory substitute for the cotton covering, but nothing better has been found. After all the skill and thought that has been put upon our motors to make them perfect, mechanically and electrically, it seems too bad that we are obliged to use the same cotton covering we did years ago, as their electrical life depends, to a very great extent, upon our being able to produce an insulation that will not carbonize.

As previously mentioned, we are living in a rapid age, and to keep up with it we must give the people rapid transit, not only rapid, but reliable and safe, and at the same time as attractive as possible. To meet these conditions our motors must be improved with the balance of the equipment. The high speed and quicker acceleration makes the strain greater and we must design our motors to meet the conditions, making them stand not only hard use but abuse, ever keeping in mind that the cost of maintenance must be as low as possible.

The Milwaukee Electric Railway & Light Company has had designed and manufactured, for its city and interurban service, motors embodying some of the special features previously suggested. The gear case is made more substantial and is well secured with bolts to the motor frame. The motor frame itself is constructed in two parts, the top half of which can be removed by loosening four bolts. The axle and armature bearings are constructed with oil wells, packed with wool waste and are lubricated with oil. For city use the axle bearings are 5 ins., and for interurban service 5½ ins. Armature bearings are made larger and longer, the commutator end increased about 30 per cent and the pinion end about 16 per cent. The commutator is made longer, increasing the contact surface 20 per cent, and the depth of bars is increased 30 per cent. The gear fit is made ½ in. larger than the body of the axle. The face of the gears is increased about 15 per cent. The brush holders, their springs and hammers are better insulated and made more durable. The construction and insulation of all electrical parts have been given careful consideration to bring them to as high a degree of perfection as possible.

SHOP KINKS

BY H. H. ADAMS, SUPERINTENDENT OF SHOPS, THE UNITED RAILWAYS & ELECTRIC COMPANY, OF BALTIMORE, MD.

I do not know who it was that suggested the name for this paper, or what part of the shop was to have the "kinks," but I shall endeavor to submit a few ideas covering some of the things I have

found useful in a repair shop. If any of them appear old, kindly remember the title of the paper, and think it is because they have been "kinked" so long that they have been unable to take on new life. But also remember they are still doing good service, and the idea, though old, may have a new feature which will be useful.

In visiting the repair shops of the different roads, I have found

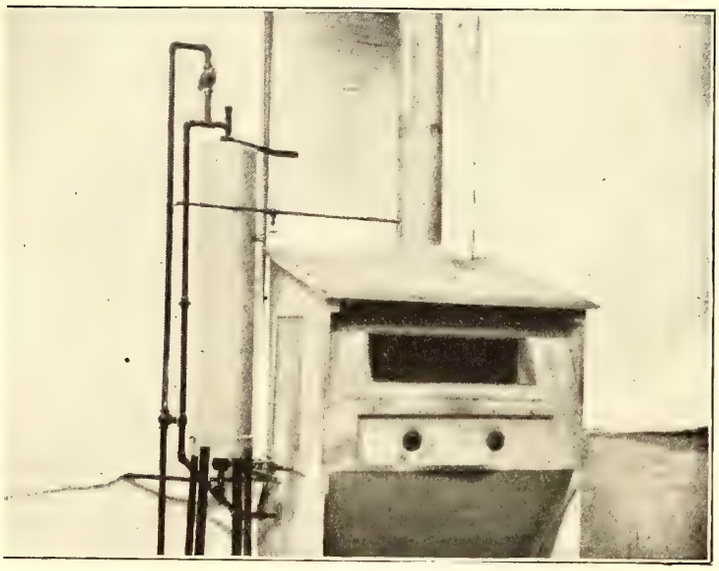
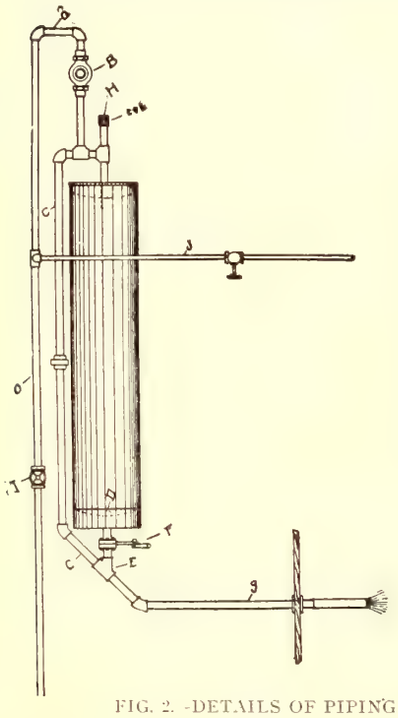


FIG. 4.—ILLUMINATED SIGN

that each shop has its individual kinks, and I have also noticed that it is not necessarily the shops of the large roads which have the best kinks, or the best ideas, as I have frequently seen in the shops of some of the smaller roads unique devices for accomplishing various results, which are common to railway work. I have often thought that if it were possible to have more frequent interchange of ideas in this line alone, it would be a great advantage to all concerned, and in presenting the few ideas which are in this paper it is with the hope that they will be of assistance to others, and may, in turn, bring forth ideas of a like nature from some one else.



A. Supply pipe; air pressure, 80 lbs.
B. Reducing valve.
C. Pipe supplying air pressure on sand; pressure, 10 lbs.
D. Outlet for sand.
E. Sand and air union.
F. Valve controlling sand.
G. Pipe leading to enclosure for sanding.
H. Cap over opening used for filling tank with sand.
I. Valve in supply pipe.
J. Small pipe supplying air to exhaust the dust.

FIG. 2.—DETAILS OF PIPING FOR SAND BLAST

Sand Blast.—The sand blast is a very old device, and probably familiar to most of my hearers, but I desire to submit the arrangement installed in our repair shop, and describe the work done with it in connection with our glass work, particularly as applied to signs. Illustrated in Fig. 1 is the apparatus, which consists of a 14-in. x 48-in. tank, with piping arranged as shown in Fig. 2. The small inclosure shown at the side of the sand blast is arranged so that the blasting may be done with as little disturbance from dust as possible. The operator stands at the front, placing his arms through the two holes, and directs the sand blast against the glass to be ground. There is also a vent leading out of the top of this inclosure, which runs to the outside of the building, and the small pipe leading into it from the main pipe is used to supply a small jet of air to blow the dust outside the building.

Our repair shop is supplied with compressed air at a pressure of 80 lbs., and by means of a reducing valve, the working pressure



FIG. 3.—ILLUMINATED SIGN

for the sand blast is reduced to 10 lbs. The reducing valve is shown in Fig. 1 at the extreme top of the apparatus.

The method pursued in grinding or frosting glass is as follows: The glass to be ground or frosted is placed in the inclosed house or box. The air pressure is then turned on, care being taken to remove all moisture from the air by draining the pipes leading to the



FIG. 4.—ILLUMINATED SIGN

sand blast previous to starting operations. The sand valve is then opened, and the blast from the end of the nozzle directed against the glass, passing over the same gradually until the surface is ground. The time required to grind a glass of 6 ins. x 40 ins., on one side only, is 3 minutes.

To illustrate the use this ground or frosted glass has been put to,

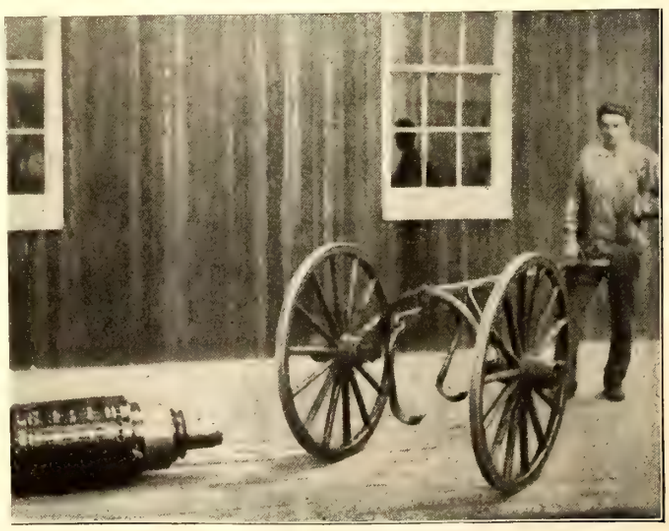


FIG. 7.—ARMATURE CART

Fig. 3 shows an illuminated sign, which consists of a glass ground on both sides, and the letters painted on one side in black. This is placed in the end of the deck of the car with the lettered side of the glass out, making a sign which is prominent in the day time, as

well as being an excellent illuminated sign for the night.

It is also possible to grind various designs by the use of patterns, which may be placed over the plain glass previous to the grinding. Fig. 4 illustrates what may be done in this connection. These glasses were ground for use in a United States mail car as ventilator glasses, and show how a plain glass may be ground to resemble bevelled glass, this being accomplished by cutting the pattern at the corners on the proper angle, and leaving a small strip of the plain glass exposed to the blast.

A further use for this apparatus is in making chipped glass, which is used so extensively in the cars of to-day. This is done as follows: A glass to be chipped is ground on one side only. This is then covered with hot glue, and the same is allowed to dry. As it dries, the glue will chip the grinding from the surface of the glass, and will produce the effect desired. In this, as well as in the simple grinding of the glass, various designs may be worked out by the use of patterns on the ground glass before the glue is applied. The patterns used are generally made of heavy paper, and fastened with paste to the surface of the glass. The sand used in this apparatus is a clean white sand, known as "Brunswick Sand."



FIG. 6.—DEVICE FOR LIFTING CARS

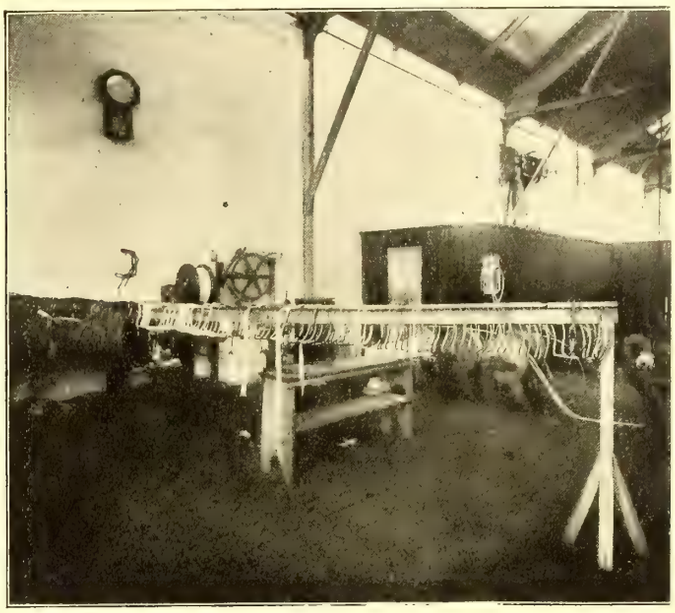


FIG. 9.—RE-INSULATING FIELDS

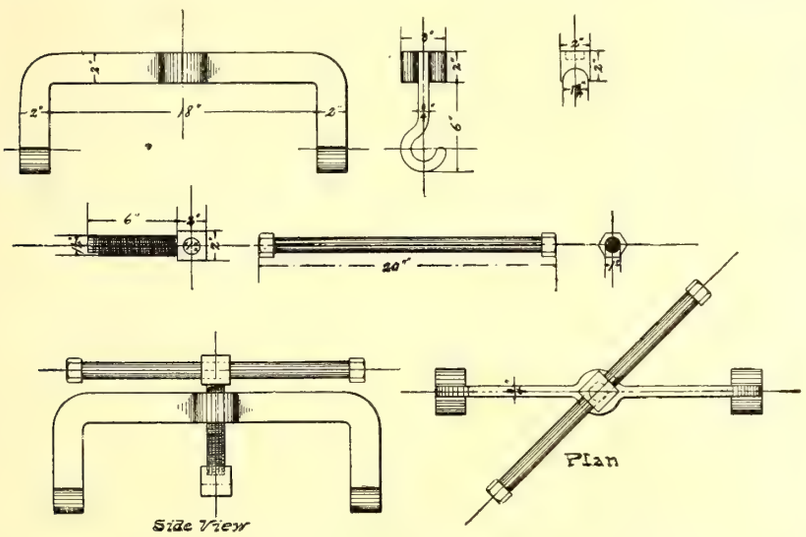


FIG. 8.—DETAIL, SIDE ELEVATION, AND PLAN OF JIM CROW



FIG. 5.—DEVICE FOR CUTTING DASHES FOR HEADLIGHTS

A DEVICE FOR CUTTING DASHERS FOR HEADLIGHTS

The apparatus illustrated in Fig. 5 is used for cutting the dashers for electric headlights. It consists of a circular plate, ¾ in. thick and 12 ins. in diameter, and a forging, which is arranged at each end to hold a standard pipe cutter. On each end of the forging there is bolted a handle, which is used to turn the cutters. The circular plate and the forging are connected with a spindle, which is threaded at each end, and has a collar in the center. The collar is ½ in. thick and 2½ ins. in diameter. The diameter of the spindle, which passes through the center of the circular plate, is ⅝ in., and the diameter of the other end of the spindle, which passes through a hole in the center of the forging, is ¾ in. On the side of the plate which is farthest away from the cutters is the feed arrangement, which consists of a "U" shaped piece, threaded in the center to receive the ⅝-in. end of the spindle.

The method of operation is as follows: The center of the headlight hole in the dasher is determined, and an 11-16-in. hole drilled. The apparatus is then set up with the circular plate inside the dasher, and the forging with the cutters on the outside. Two men are required to operate it; one on the inside of the dasher to manipulate the feed, and the other on the outside to turn the cutters. With a device of this kind, a dasher of No. 12 soft steel can be cut for a 10-in. headlight in about 8 minutes.

AN ARRANGEMENT FOR UNLOADING CARS

The question of unloading cars from railroad flats is one which most roads have to contend with, and in the majority of cases it is done by some makeshift device, frequently at the expense of a long operation, and attended with more or less danger of accident to the workmen, or damage to the car.

A simple device for unloading cars and the method pursued in the operation of the same, is illustrated in Fig. 6. It consists of four upright posts, 12 ins. x 12 ins., placed two on each side of the track, with sufficient clearance to pass all types of steam railroad cars. A 12-in. I-beam is framed into the top of each pair of posts, and the posts are tied together across the tracks at the top by means of tie-rods, using pipe as spacers. The pipes are also fastened to the posts by flanges and lag screws. On each I-beam there are two 7000-lb. chain hoists, which are suspended from rollers by means of a U-iron. The connection between the lower

hook of the hoist and the truck consists of a flat bar, 1 in. x 4 ins., bent into the form of a square hook to fit the side of the truck, with an eye at the upper end. This hook is made of a flat bar in order to allow it to be slipped into the opening between the top of the toe-board and the bottom of the sill plate.

A few words as to the time required for unloading cars with this arrangement will show its value. A shipment of 110 open cars on

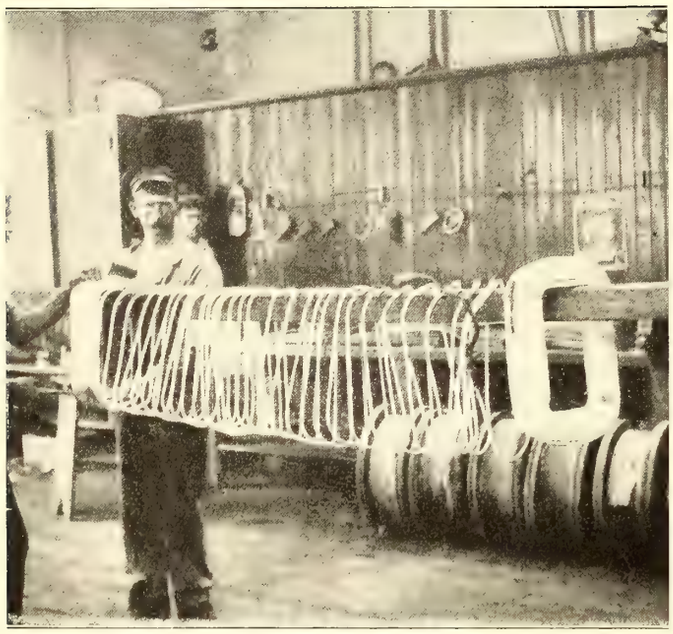


FIG. 10.—RE-INSULATING FIELDS

trucks was received by the United Railways & Electric Company of Baltimore, all of which were unloaded by this device, and for a number of days the time required for unloading was taken. The average was 10 minutes to the car, with a gang of six men; this time including the placing of the car in the shop and the shifting of the railroad flat car outside of the yard. The whole cost of erecting this device did not exceed $100.

ARMATURE CART

An armature cart is illustrated in Fig. 7. The armature is carried at a good height from the floor, and as the wheels of the cart

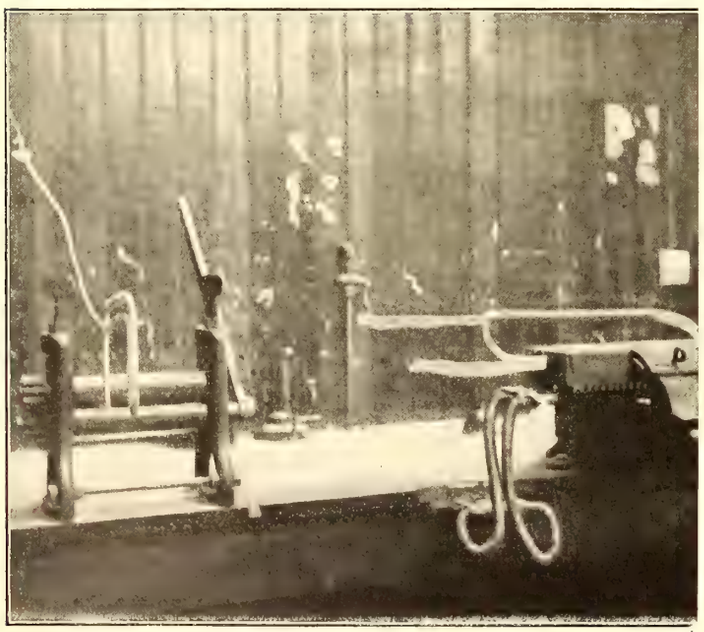


FIG. 12.—DEVICES USED IN THE MAKING OF ARMATURE COILS

are 36 ins. in diameter, it is moved very easily from place to place.

A cart of this kind removes all necessity of rolling an armature on the floor, which is a practice that is dangerous in the cleanest of shops, as a metal chip, too small to be readily distinguished, is frequently picked up by the armature in rolling it over the floor. This chip may not be discovered until the armature has been placed in the motor ready for service, when it is very liable to make itself known in a disastrous way.

As soon as the armature is removed from the motor it is placed on one of these armature carts and carried just outside the building, where there is an attachment for cleaning the armature with compressed air. The armature may be readily revolved in the hooks on this cart without placing same on the ground, and in this way the compressed air is blown into all the openings in the armature, thus clearing out all the carbon dust it is possible to reach in this manner.

TROLLEY-POLE STRAIGHTENER

A small Jim Crow is a very useful device about a repair shop or car house. Fig. 8 gives the details of one, which may be used to straighten trolley poles, dash posts, etc. It is not too heavy to take on the roof of the car, and a trolley pole may be straightened without removing it from the stand.

REINSULATING FIELDS

The question of reinsulating fields is one which has been before the electric railway repair men for some time. Some have adopted



FIG. 11.—TESTING ARMATURE FOR SHORT CIRCUITS

a scheme and others have passed it by. I consider that there is a large amount of economy to be gained in the reinsulation of fields.

In using the reinsulating machine for this purpose great care must be exercised not to stretch the wire excessively in putting it through the machine. The tension placed upon the wire in order to straighten it must be as light as possible.

Illustrated in Figs. 9 and 10 is another scheme for reinsulating fields, the wire of which is too heavy to be handled by a reinsulating machine. The method pursued in this case is to reinsulate the field by hand. The field which is burned out has its exterior cover removed, and if it is badly charred it is taken outside the building and as much of the insulation and dust removed as can be blown out by 80 lbs. of compressed air. The field is then placed on a long wooden bar, opened up, and stretched along the same. The insulation which remains on the wire is cleaned off by hand with the use of scrapers. After being thoroughly cleaned the new insulation, which consists of a reinsulating tape, is placed on the wire by hand. This being accomplished, the field is assembled, beginning with the inner turns, and following turn for turn to the outer ones, as shown in Fig. 10. The field is then recovered and ready for service, and I consider that it is just as good as when new.

A field assembled after being reinsulated is shown in Fig. 10. The field shown in the illustration is the Westinghouse No. 56 field, which is made up of No. 1 wire. There have been 281 fields

successfully reinsulated from October, 1902, to July, 1903, which are at present in service and giving us no trouble.

INDUCTION TESTS FOR SHORT CIRCUITS

Fig. 11 illustrates the method pursued in testing armatures for short circuits. The apparatus used in this case consists of an old Baxter motor field suspended between two uprights, and balanced with a counterweight, so that it may be adjusted to conform to the various heights of the different armatures. This field is wound with No. 9 wire, and supplied with alternate current from a small alternator, which is belt-driven. The armature is placed in the magnetic circuit of this field and revolved slowly, and a small tell-tale piece, consisting of a light piece of sheet metal, is held at the top of the armature, as shown in the illustration. If there are any short circuits they will easily be determined, as the tell-tale piece will set up a vibration, which can readily be felt by the hand. A device of this kind is one of the greatest money savers possible to put in an armature repair shop, and it will save many an armature from being needlessly burned out, as the short circuits can be detected in the shop, instead of their developing after the armature has been placed in the motor.

Fig. 12 illustrates two devices which are used in connection with the making of armature coils. The one shown on the right-hand side of the illustration consists of an ordinary vise, to which is attached cast-iron jaws. The jaws are each heated by a gas burner. The use this device is put to is in drying the glue which is used in fastening the insulating cell of the coil. Also, as shown in the illustration, it is used in pressing two coils together, where the coils are to be assembled in this manner, as, for instance, the Westinghouse No. 56 coils, which consist of two coils of three wires, having two turns to a coil. This device drives out a large amount of moisture, and puts the coils in shape to be taped. Various lengths of jaws are used for the different types of coils.

The device on the left-hand side of the illustration consists of a pair of rollers, these being used to flatten the leads of the coil, and by a very simple trick removes, at the same time, the insulation of these leads, instead of having to scrape it off by hand, as is usual. This is accomplished by the use of a little glue upon the rollers.

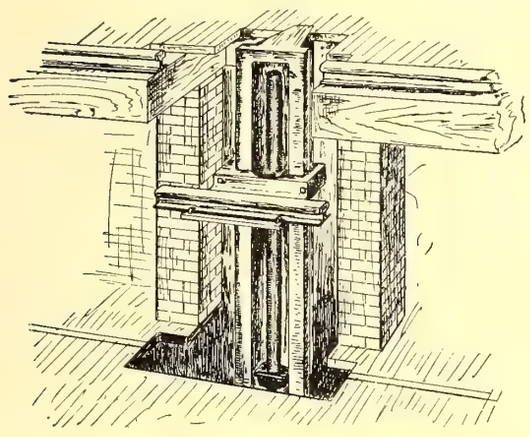


FIG. 1.—WHEEL ELEVATOR

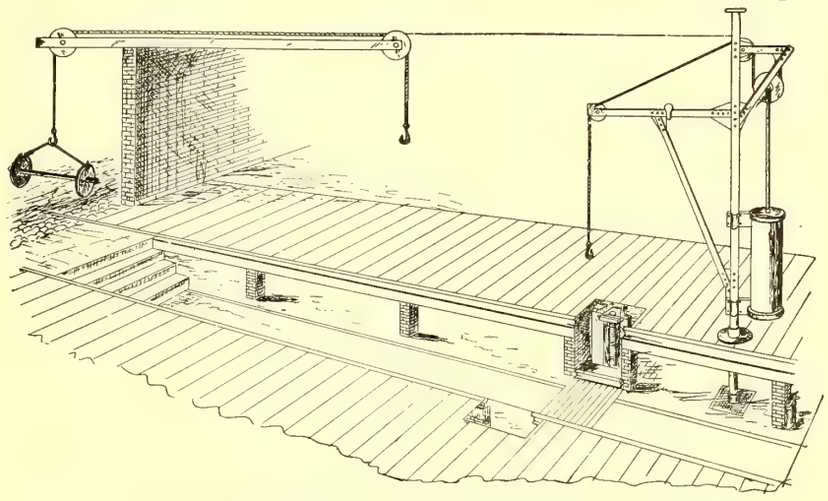


FIG. 2. AIR CRANE AND PIT, WITH ELECTRIC ELEVATOR

SHOP PRACTICE

BY ALFRED GREEN, M. M., ROCHESTER RAILWAY COMPANY, ROCHESTER, N. Y.

In my opinion the best way of treating the subject which has been assigned to me will be simply to give my own experience, describing the plant of the Rochester Railway Company and some of the practices in vogue.

Our shops have a frontage of 166 ft. and a depth of 191 ft., being divided into three parts by walls at right angles with the front of the building. On the north side are the carpenter and paint shops, on the south side the motor repair and machine shops, the center being occupied by the office and store room, with the blacksmith shop at the rear. A door leads from each department into the store room; a very convenient arrangement. All orders for material are signed by the foremen of the various departments, and are filled by the stockkeeper. The store room is 126 ft. wide and 143 ft. deep. All necessary equipment for the entire system is kept in stock, the small material on the ground floor and the heavy material in the basement. The basement is also provided with a large room for the storage of car wheels, extra motors, controllers, etc., and is equipped with a narrow-gage track and overhead travelers for the handling of heavy machinery. For the floor plan of the building see the STREET RAILWAY JOURNAL of April 11, 1903.

Our road being a small one, of course, we have not the facilities for doing work that perhaps larger roads have. In the motor and truck department at the main shops on St. Paul Street, we have eight men. The special tools in this department are two wheel elevators, as shown in Fig. 1, one piston air crane and one motor air lift. The wheel elevators are operated by an electric motor

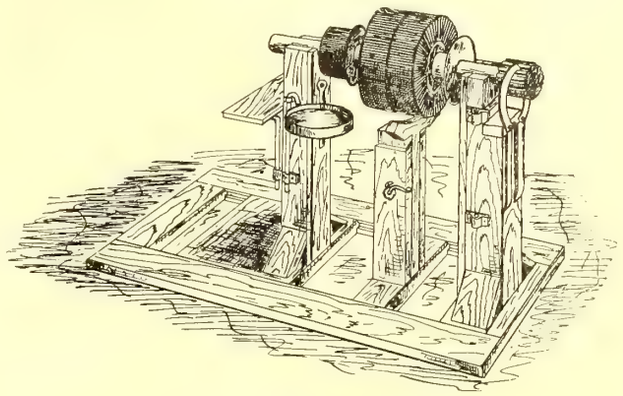


FIG. 3.—ARMATURE HOLDER

at the bottom of the pits; the construction of the wheel elevators being two long vertical screws set in a casting having a face for two large iron castings, with a section of rail fastened to the top of them, and working on the screw the same as a large nut, the two sides being connected by a longitudinal shaft with bevel gears on each end.

On the floor line of the pit there are two transfer tables, one to take the old wheels and set them to one side, the other to get a new pair and bring them on a line with the floor of the pit, where they can be placed on the elevator and carried up, directly under the car and into their place.

As you will note by Fig. 2 the air crane is near the wheel elevator, so that we have two ways of taking wheels out of the pits. With this arrangement we are able to take out a pair of old wheels, replace them with new ones, and have the car ready to leave the building in 40 minutes.

The air compressor which furnishes the air for all departments is placed in one corner of this room, and is belt-driven, being operated by two 20-hp motors, placed on the floor line of the motor repair pits. All repairs to motors are made from underneath the car, and the car body is not taken off the trucks unless the car is going through the shops for general overhauling.

The armature repair department and machine shop are in one large room, 100 ft. x 96 ft. In this room all the field and armature coil work is done.

The machine shop contains five lathes, five drills, one taping machine, large shears, thread-cutting machine, pinion press, drill grinder, speed lathe, cold cutting-off saw, shaper and planer, two milling machines, two emery wheels, also buffing machines for brass polishing. This department is operated by a 30-hp motor.

In the field and armature room we have one lathe for winding fields and one taping machine, one armature band-wire machine

and two armature coil winders with interchangeable heads for different kinds of coils, also the necessary dipping tanks and dry boxes. One of the novel features in our armature room is the

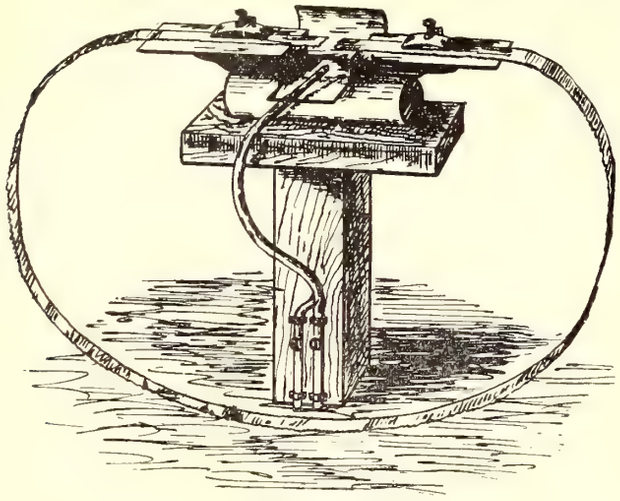


FIG. 4.—BAND SAW BRAZER

horse used for holding armatures while being repaired, which is shown in Fig. 3. This armature holder can be raised to any height and stretched out to accommodate any length of armature shaft. It is provided with a center support operated by a rack, which can be arranged to take the weight of the armature, so that the front part of the armature rack can be removed to take off or repair the commutator. Attached to this frame is a holder for a seat, so that the man doing the work can sit down to connect his commutator. There is also attached to this horse a removable table for holding the workman's tools, and on the back end are two adjustable hooks that can be thrown over the pinion in case the commutator is to be tightened or loosened. The room is fitted up with overhead tracks and air lift for handling the armatures and carrying them to the different parts of the shop. The armature room is also equipped with small furnaces for heating soldering irons, air and gas being used, which can be so regulated as to heat the soldering irons to the necessary temperature without burning the face of the iron. This does away with all charcoal furnaces and gasolene laamps. All hard soldered joints in the motor fields are also made with an air and gas burner of very simple construction.

The blacksmith shop is directly over the boiler room, 18 feet above the ground, and consists of five forges and one power hammer. The coal for this department is delivered into a bin in the boiler room and is carried up into the blacksmith shop by an endless chain with buckets. The blower is operated by a 20-hp motor. The furnace in the blacksmith shop is both a soldering furnace for tinning and a babbitting furnace for babbitting all motor journals.

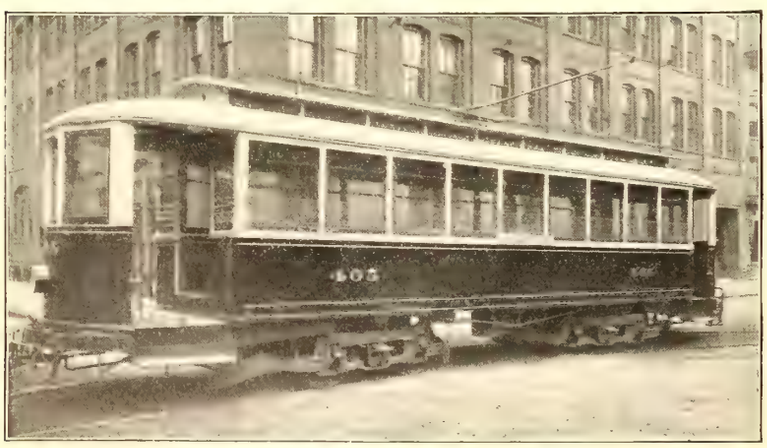


FIG. 7.—EXTERIOR OF LATEST TYPE OF CAR

In the babbitting of motor journals, we have tried to arrange our mandrels and babbitting devices so as to leave as little work as possible to be done on them after the boxes have been rebabbitted.

One of the features in making repairs on double-truck cars is the use of the transfer table, which, you can readily see, saves a large amount of work by being able to take the truck out sideways, in which case we have to jack the body only high enough to clear the truck, and it certainly saves a great deal of labor, as it is only necessary to raise the end of the body from which you are going to take the truck, six inches.

Our carpenter department is 76 ft. by 98 ft., having five tracks running its entire length. Under one of these tracks is a pit 4 ft. deep for the examination and repairing of cars. At one side of the pit is an entrance to a large storeroom, where all parts are put away while the car is being repaired. By having this room, all unnecessary material is kept off the carpenter shop floor, there is no possible chance of anything being damaged by careless handling, and we know where every part is when we want it.

This department has a complete equipment of wood-working machinery, including all tools necessary for car building and repairing. These machines occupy a space 24 ft. by 98 ft. on the north side of the building, and include the following: Mortiser, one large cut-off saw, rip saw, band saw, tenoner, jointer, shaper, sticker, turning lathe, router and planer.

All shafts and counter-shafts are in the basement underneath the carpenter shop, and all belts come up from below directly to the machines which they drive, thus doing away with the inconvenience of having belting in the way when handling timbers. These machines are driven by two 25-hp motors, one-half of the machinery being entirely independent of the other, so that in case of repairs or break-down, one-half of the shop can be run independently of the other half.

Special attention is given to cleanliness and keeping the shop



FIG. 5.—SEMI-CONVERTIBLE CAR

neat at all times, this being accomplished by a large Sturtevant exhaust fan piped to the different wood-working machines, which blows all the shavings and sawdust into a large shaving bin in the rear of the building.

This department is also piped for air the same as the other departments, and is equipped with connections between the tracks, so that it is convenient at all times, and at any part of the shop, to connect the Little Giant pneumatic tools, of which we have two. Also, in connection with this, we have a device for brazing our band saws, of very simple design, which is shown in Fig. 4. We were unable to find anything for this class of work, so necessity forced us to make the present arrangement. It is simple, and, as you will note by the sketch, the two ends of the band saw are held by clamps and hard-soldered, borax being used with a Bunsen burner for doing the brazing.

Among the conveniences in this department, there is also a panel bender which is heated by gas, and a set of glue pots, which in the winter are heated by steam and in the summer by gas.

All finished material for car construction is kept in a large storeroom in the basement, which is provided with racks. These racks are numbered, thus enabling the man in charge of this room to keep his stock up, and doing away with unnecessary waiting for materials.

In another large room in the basement is kept all rough lumber until it becomes thoroughly well seasoned. The runway is so arranged as to take all lumber directly to the large cut-off saw, thus enabling us to keep down all extra expense of handling same.

In regard to shifting cars from one department to another or

getting cars from the carpenter shop to the paint shop and out to the street, there are only two ways in which this can be accomplished with any economy. The first is to have the carpenter shop at one side of the paint shop; the second is to have the paint shop directly in the rear of the carpenter shop, with a rear exit, so that cars can be moved from one department into the other without interfering with work in other departments.

The arrangement depends upon the amount of room you have for buildings and tracks. In the laying out of the Rochester Railway Company's shops it was impossible to accomplish the first-named plan, on account of the scarcity of land, and, therefore, the second was followed.

We have all kinds of rolling stock in operation on the Rochester Railway and Rochester and Sodus Bay, giving us a number of different classes of cars which we both build and repair, including flat cars for hauling gravel, box and flat cars for freight, combination cars for express and passenger service, cars with longitudinal seats for the winter, and cross-seat open cars with center aisle for summer service.

There are no cross-bench open cars in operation on this system, on account of the number of miles of track which are placed

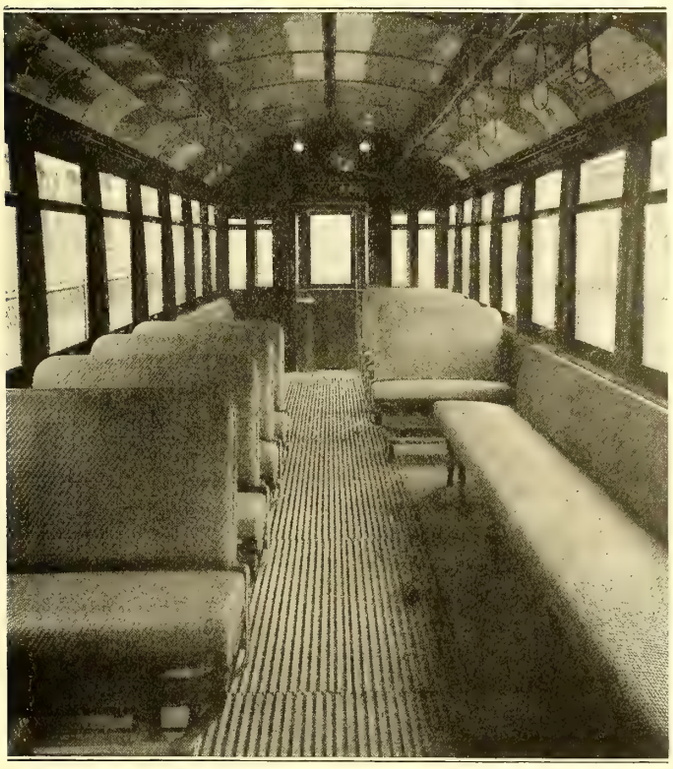


FIG. 6.—INTERIOR OF LATEST TYPE OF CAR

between the curb and the sidewalk, making it unsafe to operate this style of car. We have no funeral cars on this system.

Figure 5 shows one of our 27-foot, convertible type mounted on maximum traction trucks.

Another detriment to the building of cars for this system is the number of low, iron railroad and canal bridges under which our lines run, making it impossible for us to operate a car over 11 1-3 ft. from the rail to the top of the bridge board. Still another bad feature, in regard to our tracks being inside the curb, is that it only allows us to use a car 8 ft. wide over all, which gives, in a cross-seat car, a very narrow aisle.

The interior of our latest type of car, with the seats arranged part cross and part longitudinal, is illustrated in Fig. 6, and Fig. 7 shows the exterior. In one of the last cars that we rebuilt out of two trail cars, not having sills on hand long enough, we built up our sills of four pieces of 2-in. by 9-in oak. The length of this car over corner posts is 40 ft. This car is 51½ ft. over all, and is to be used on the Rochester and Sodus Bay road, which runs between Rochester and Sodus Bay, a distance of 40 miles. Undoubtedly there will be much criticism of the building of sills out of 2-in. oak, but while there are some things against it, there are others in its favor. The most that can be said against it is that the water will work in between the joints and rot the timber. But each and everyone must admit that it gives us a sill of greater strength than we could possibly get from a solid timber, so that by putting the planks together with white lead, breaking joints by 6 ft., and bolting same together thoroughly, I do not think we are liable to have any trouble with water. Additional strength may be readily obtained in a built-up side sill by placing a steel plate from ⅜ in. to ⅝ in. thick between the second and third planks.

In regard to the paint shop, there is a great deal that can be taken up and thoroughly discussed for the benefit of everyone concerned, but as the painting of cars will more correctly come under the head of "Care and Maintenance of Car Bodies," which paper is to be handled by Mr. Baker, I will say only a word on this subject.

Our paint room is 100 ft. by 69 ft., with five tracks, each capable of holding two cars 44 ft. long, or three cars 26 ft. over all. Part of this room is used for washing and varnishing sash and other car parts, which are kept on a rack, and faucets attached. A graduated stick, which is fastened to a float, passes through a slot in the cover indicating the quantity of material in the tank. The bench beneath the rack used for mixing paints, putty and colors, is covered with zinc, which is easily cleaned. In connection with this is a box or paint brush holder, which is simple in design but very effective. No one can take a brush without the master painter first unlocking the rack, which enables him to know at all times where his brushes are, and that they are properly cared for when returned. We keep our paint brushes in water suspended on a wire and the end of the brush about 2 ins. from the keeper. Varnish brushes are kept in oil and turpentine in the same manner.

The next important feature in this department is the use of gas and air for burning paint off cars. In our opinion, it is not so much the question of economy in the use of air and gas as against the gasolene torch, but the burner is safer and more convenient to carry about. It is also light and durable, and when once regulated will remain so as long as it is in use.

In regard to the grinding of colors, I do not think it economy for any ordinary-sized road to go to the expense of equipping a shop with the necessary apparatus for grinding colors, when we can buy them ground in any shade ready to thin down with turpentine, and we know then just what they cost.

As to the paint skins, we have a slush bucket that all odds and ends go into. We stir in with this a little Princess brown and other material necessary to make paint that will do for slushing bottoms and canvas panels of cars, so that we waste very little material.

In every department, a great deal depends upon the ability of the foreman in getting the best results, not only out of his tools, but also from his men, and it is for the master mechanic or chief engineer to demonstrate to his company the value of tools and equipment, and prove to them that they are not luxuries, but every-day necessities.

THE ADVANTAGES AND DISADVANTAGES OF THE "BAG SYSTEM," AS COMPARED WITH THE "RECEIVER SYSTEM" OF HANDLING CONDUCTORS' REMITTANCES.

BY FRANK R. HENRY, AUDITOR ST. LOUIS TRANSIT COMPANY, ST. LOUIS, MO.

I shall begin my subject at a time when street railroading was in its infancy; especially, when the accountant and the accounting department were not considered as a necessary adjunct to the operation of the road. In those days the bob-tail cars were in use and passengers deposited their fares in a box at the end of the car, or in a slot connected with the box.

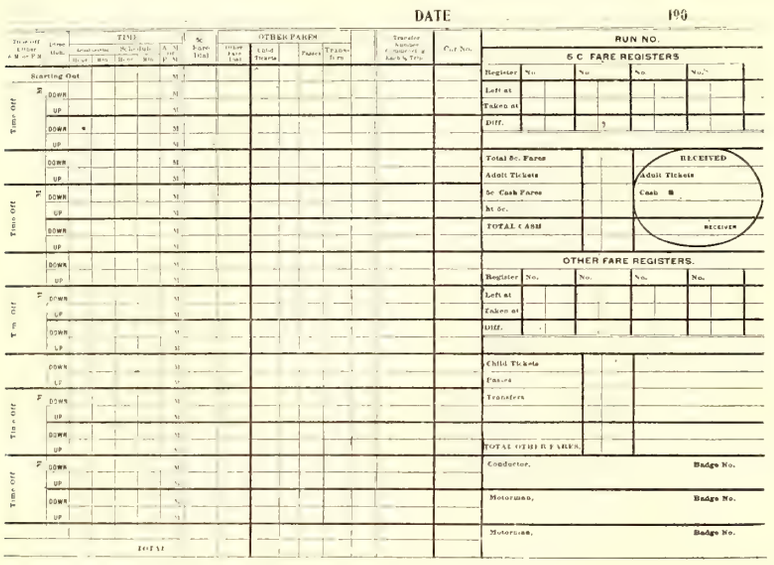
It became necessary afterwards, on account of increased travel, to abolish these cars for larger ones and employ conductors to operate the cars and to collect fares. Tickets were then introduced to the public and generally used by passengers, who were induced to buy them in slips of five at five cents each, in preference to paying seven cents cash fare. The system in vogue was to have the tickets collected each half trip, put in packages marked with the number of the trip and the number of fares and deposited by conductors into their individual receptacles communicated with by a slot arrangement above which their numbers were indicated; the company adhering to the box and slot arrangement, as used in the bob-tail days, by aggregating the boxes at the stations for the conductors to make their deposits in. At the end of the day these packages were taken out and sent to the general office to be compared and checked against the trip cards.

After the general use of the tickets was discontinued, passengers paid their fares in cash and registers were inaugurated. The system of having conductors make remittances in boxes at the stations still remained in force for some time, however, but eventually proved so unsatisfactory that it was abandoned. The frequent mistakes of the conductors depositing their cash and tickets

through the wrong slot arrangements, and claiming money had been deposited when it had not, were the chief dissatisfaction.

It was then that the system of having conductors place their money in bags, together with deposit slips showing the contents, and deposited into a safe of special construction located at the stations, was adopted. This, too, was abandoned and we are now using the "Receiver System."

By comparison the quickest and most accurate knowledge is



FORM A (FRONT)

gained. I shall therefore present as concisely as possible the "Bag System" and "Receiver System," as operated by the St. Louis Transit Company, with the comparative advantages and disadvantages that have been experienced. The description to SOME may be *short* and *over* to OTHERS.

THE BAG SYSTEM

(1) The conductors were required to register all fares. Each car was provided with two registers, one on which the 5-cent fares

E 26

ST. LOUIS TRANSIT COMPANY.

DAILY CAR REGISTER REPORT.

Date 190 Car No.

LINE NO.	RUN NO.	NAME OF CONDUCTOR	TIME	A. M. OR P. M.		STATEMENT OF REGISTERS 5c FARE REGISTER	ALL OTHER FARE REGISTER
		REPORT OF REGISTER TAKER		M	Out at		
				M	Taken at		
				M	Left at		
				M	Taken at		
				M	Left at		
				M	Taken at		
				M	Left at		
				M	Taken at		
				M	Left at		
				M	Taken at		
				M	Left at		
				M	Taken at		
				M	Left at		
				M	Taken at		
				M	Left at		
		REPORT OF REGISTER TAKER			In at		

FORM B (BACK)

(cash and adult tickets) were registered, the other on which all other fares (transfers, half-fares and passes) were registered. The conductors were provided with trip cards (Form "A") of their respective lines, on which were columns to indicate the operation of the car (or cars) each half-trip.

(2) Each conductor on taking his car (or when taking car from another conductor) found a register card (Form "B") in the rack located under the registers. On this card were indicated the starting-out readings of the registers (or readings of previous conductor). He examined the card to see if it agreed with the readings of the register taker (or readings of previous conductor taken in each other's presence). If so, he placed his readings beneath. If not, he called the attention of the foreman (or motorman, or another conductor) who made a statement of the difference on the register card, signing it; failing to call anyone's attention to the difference, conductor was charged with the register taker's (or previous conductor's) readings. Next, he wrote in the proper place his line number, run number, name and time of taking car. He then took his trip card and enumerated the register readings on it.

(3) When completing each half-trip, all ticket-fares (excepting adult tickets) collected were placed in an envelope with name, number of car, number of trip, time and the number of the several kinds of fares, and deposited in a small locked box located under the registers. From time to time he recorded on the trip card the operations of the car each trip, and before leaving the car he took the register card and wrote below the first (or last) readings, the time of leaving and the readings of the registers. On his trip card he recorded the register readings and filled out the spaces showing the results of the day's operation.

(4) Then he counted his money and adult tickets and made up a conductor's deposit slip showing the different denominations, adult tickets, name and badge number of conductor, placed the money, adult tickets and deposit slip in a bag with the number of his line on it, tied it with a string and deposited the bag through a slot arrangement into a safe, specially made for conductors' deposits. His trip card he disposed of by depositing it in a box.

(5) Each register taker, in gathering up the register cards and envelopes from each car, took the register card, read the registers and checked off the last statement made on the card; if not correct or figures were indistinct, he wrote the correct readings on the bottom. On a new card he wrote (with indelible pencil) a statement of the register showing what the registers were charged in with (what they would start with next morning) and placed the same in the rack. After collecting the envelopes from the box beneath the registers he tied them together. Upon completing the collections, all register cards and envelopes were taken to the office and locked up.

(6) Seven or eight buggies were used by money counters from the treasurer's office to make the rounds every morning to collect the bags, reports, etc. Each counter was accompanied by a clerk who took the bags out of the safe, counted them in the foreman's presence and gave him a receipt showing number taken. These bags were brought to the treasurer's office and opened and contents counted by the money counters, and checked against the conductor's deposit slips. If correct, the money was separated and thrown into different receptacles. If not, an actual inventory was made opposite the conductor's inventory.

(7) When the remittances (money and adult tickets) from each line were counted, the money was placed on trays for each denomination. The deposit slips were then taken to an adding machine and totalized to find out the amount of cash received from each line. The trays of money and deposits were then passed to the head money counter, who checked the contents against the counter's deposit slip. When all the money counters had finished, he put the money up into bankable shape to be deposited the following morning. The deposit slips, fastened with a slip attached showing total cash received from each line, together with adult tickets, were sent to the auditor's office.

Operation in the Auditor's Office:

(8) Each register clerk, upon receiving the register cards and trip cards allotted, arranged the register cards numerically according to their number, and the trip cards according to their run number. The outgoing register statements were then checked against the incoming statements on the register cards of the previous day to see if the readings recorded by the conductors were correct.

(9) In the meantime the ticket boys (who counted the contents of the envelopes) checked the different fares (transfers, half-fares and passes) indicated by each conductor on the outside of his envelopes against the fares as entered on each trip card. As the envelopes and trip cards from each line were checked, the trip cards were handed to the register clerks who had that particular line. Each ticket counter then proceeded to count his tickets and check

the contents against the number of different fares indicated on the outside of each envelope. If any discrepancies were found, an actual inventory was made on the envelopes which were handed to the register clerk, who made a note of said differences on each conductor's trip card.

(10) As the contents of the envelopes and bags were being verified, each register clerk took the register cards and checked the various statements of the conductors against the readings made by each conductor on his trip card to ascertain if all of the operations of each car were accounted for.

(11) After all of the register cards were checked against the trip cards and additions and subtractions verified, the deposit slips received from the treasurer's office from time to time were next checked against the total cash and adult tickets as indicated on the trip cards to find out if each conductor had remitted for all of the five-cent fares collected. As fast as one line was completed, or the trip cards were checked in their entirety, they were entered on their respective statements of passenger receipts (Form "C") in run order, and the conductor's name and the results of the day's operation, together with all shorts and overs, were entered in their proper columns. The entire returns from the treasurer's office were not received until about 3 o'clock in the afternoon.

(12) Before recapitulating the receipts for each line, the register clerks made out an original and two carbons of over and short report, stating the nature of each difference. Two of these were sent to the treasurer's office to the over and short clerk, who in turn sent one copy with an over or short envelope made out for each conductor, to a clerk at each station to collect or pay, and return. The shortages, when collected, were placed in the short envelopes; the overs, when paid, were taken on the over envelopes and returned every morning.

THE RECEIVER SYSTEM

Each receiver should be conveniently located and afforded proper protection. Therefore, the station is considered the most accessible and suitable place for the reason that the conductors turn in their cars there, and because they generally reside near the station. Another reason is that the receiver can be better protected in case an attempt is made to hold him up, as an alarm can quickly bring the men working in and around the station to his assistance.

Our receivers are protected by iron cages, in which are located one or two foot push buttons which ring a gong in the shed. It is their duty to test these signals at six o'clock every night, same being answered by one of the men.

The "Receiver System" is practically the same as described in

ST. LOUIS TRANSIT CO. DATE 190

TRANSFERS.				REMARKS.
	Number Commencing	Number Ending.	Number Used.	
TOTAL No. USED.				
Punched and not Issued.				
TOTAL ISSUED.				

CHILDREN TICKETS.

Book No.	No. of the Stub Ticket.		Number Used.
	Starting Out.	Turning In.	
TOTAL USED.			

FORM A (BACK)

paragraphs one (1) to three (3) inclusive, of the "Bag System" in setting forth the operations of the conductors and register takers, except the following changes which were found necessary:

Instead of conductors depositing their money and adult tickets in safes and trip cards in boxes, they are required to present them to the receiver. This is done so the receiver can determine whether he has received the full number of five-cent fares.

Instead of the clerks in the auditor's office making out the statements of passenger receipts as to 5-cent fares, each receiver makes his own statement, so that he can kept an account and check off each conductor as he turns in.

Each receiver upon commencing his work is provided with a run sheet by the foreman. On the statements of passenger receipts for each line, he fills in the run number in numerical order, afterwards writing in the name of each conductor opposite his run.

When a conductor presents his money and trip card the receiver counts the money and adult tickets in his presence, checks and verifies the subtractions and additions of the 5-cent fare register, indicates the amount of each received on the trip card, and signs his initials thereto and deposits it in its proper place.

From time to time, as opportunity presents, results of each trip card are entered (so far as the five-cent register fares are concerned) upon their respective statements of passenger receipts

ST. LOUIS TRANSIT COMPANY. STATEMENT OF CAR RECEIPTS.

No. LINE.

M.C.B. No.	CONDUCTORS NAME	Initial	TOTAL CASH	5c FARE REGISTER	5c Cash Fares	Adult Tickets	Short	Over	Nature of Shortage	Other Fare Register	Child Tickets	Passes	Transfers	Short	Nature of Shortage

Shorts.
Overs.
Cash Receipts.
5c Fares. Cash.
Tickets.
Child Tickets, @ 2½c.
Total Revenue Passengers.
Passes.
Transfers.
Total Passengers.
Tickets. Receipts.
Loss.
Actual Car Receipts.

FORM C

opposite the indicated run number and name of conductor, the total cash, total five-cent fare register (as indicated on trip card), 5-cent cash fares and adult tickets.

Each receiver is supposed to keep posted about when the conductors turn in their runs, and if they are not in promptly he immediately makes out three notices (original and two carbons), sending one to the night foreman and one to the treasurer's office along with his cash.

When all of the conductors have reported a total is made of the cash—five-cent fares and adult tickets—on each of the respective statements of passenger receipts.

Two receiver's remittance blanks (Form "D") and a bank deposit slip are then made out. On the two receiver's remittance blanks (made out in duplicate for auditor and treasurer) he recapitulates the total of each line at the bottom by entering opposite their respective line numbers, the total cash and adult tickets from each line. These added together give the total amount of money and adult tickets he should have.

The money, separated into different denominations, is counted. Totals of each denomination are then entered on the two receiver's remittance blanks and bank deposit slip opposite their respective class, and when totalized should agree with the grand total of the different lines. The adult tickets are next counted to see if they agree with the grand total of the different lines and then entered on the two receivers' remittance blanks in a space provided, after which they are placed in an envelope marked with receiver's name and number of tickets.

The money, together with envelopes containing adult tickets, receiver's remittance blank (for treasurer) and bank deposit slip, is placed in a metallic box (locked with a Yale lock) marked with the number of that particular station, then placed in a safe and locked up.

The statements of passenger receipts, fastened together with receiver's remittance blank (for auditor) and trip cards, are placed in a drawer. These, as well as the envelopes and register cards, are collected every morning by a collector from the auditor's office.

Three sets of metallic boxes (marked with station number) are kept to supply each receiver. There are two keys to each box, one held by the receiver, the other in the custody of the assistant to the treasurer. The combination to the safes is known only to the receivers, relief receiver and collectors.

Three cars are now used to make the rounds every morning to collect the money boxes. Each car, operated by a motorman and conductor, is accompanied by a guard and clerk from the treasurer's office. The boxes are taken out of the safes and brought to the general office (which is centrally located and a convenient place to have the three cars meet), where they are collected by two cars and transferred to the special money car.

The assistant to the treasurer boards this car, unlocks each box, checks the receiver's remittance blank and deposit slip against the total on the packages of paper and bags of silver, leaving each receiver's bank deposit slip in its respective box, only taking the receiver's remittance blank with him. The adult tickets are taken

from each box and sent to the auditor's office, receiving receipt therefor. He then selects the boxes to go to a certain bank and makes out a regular bank deposit slip specifying thereon the number of each box and setting opposite total amount in said box. These amounts added together show the total deposit for that particular bank.

The money is then taken to the bank by the assistant to the treasurer, two guards, conductor and motorman. The boxes are passed into the receiving teller, who checks the total on the packages of paper and bags of silver against the receiver's bank deposit slip, likewise checking the total of each station box against the deposit slip made out by the assistant to the treasurer.

All shortages in money and adult tickets are charged against the receiver.

All persons handling money are bonded in surety companies.

The company carries hold-up insurance.

The actual passenger earnings are deposited each day, a separate deposit being made for miscellaneous cash received from any other source.

The work in the auditor's office is practically the same as that described in paragraphs 8, 9, 10, 11 and 12 of the "bag system," except the following:

Instead of checking the conductor's deposit slips, which formerly came through the treasurer's office, against the trip cards, the report of the receiver, now on the trip cards, is checked against the five-cent register fares on the statements of passenger receipts; besides, the other preliminary changes previously mentioned.

ADVANTAGES AND DISADVANTAGES OF THE BAG SYSTEM

When the "bag system" was in use, we operated cars, during the greater portion of the time, from nineteen stations over twenty-eight routes. Five of the stations were very small, and the clerical work was done by the foremen. Five money counters were employed in the treasurer's office and twelve register clerks were engaged in the auditor's office in checking registers and conductor's cash remittances. To have adopted the "receiver system" under the above conditions would have required nineteen night and nineteen day receivers. Allowing that the assistants to the foremen could have done the day receiving, and that a portion of the work in the auditor's office could have been done by the receivers, it would have necessitated the employment of at least twelve additional clerks, which would have been an additional running expense. Besides, cages and receiver's equipment would had to have been installed in nineteen stations. The advantages to be obtained by the institution of the "receiver system" under these conditions, we did not believe would justify the outlay. Economy in operation is a single advantage the "bag system" possesses over the "receiver system," under the above or like conditions.

The disadvantages we experienced were as follows:

(1) Numerous errors and shortages occurred daily, classified and proportioned as follows:

First. Errors in register readings, 15 per cent.

Second. Errors in calculations, 15 per cent.

Third. (*a*) Failure to deposit money bags and half-trip envelopes.

(*b*) Errors in contents of bags and half-trip envelopes.

In disputes arising over errors of the first and second class, we were always able satisfactorily to show to the conductors that they were responsible for the discrepancies.

When disputes arose from the third class, we were unable to produce any convincing evidence whatsoever. Conductors would claim that they deposited money bags when they had not done so; and contend they had turned in one amount while we claimed they had turned in another amount. According to their way of putting it, the office clerks made all the mistakes. The utmost care was exercised in handling the bags and counting the contents; every courtesy was shown the conductors who called to investigate errors; nevertheless, the greater proportion of the conductors who were compelled to pay shortages of the third class firmly believed they had been treated unfairly, which we believed had a tendency to make conductors dishonest, because they desired to get even with the company. Up to the time of the consolidation, the constituent companies of the Transit Company had not experienced any serious dissatisfaction, but a short time thereafter, and especially during our labor trouble, the dissatisfaction among the conductors became very great. I attribute this principally to the fact that the offices of the constituent companies were consolidated into one general office which required most of the conductors to go a great distance (from some stations, consuming as much as two hours), in order to investigate their errors; also, a desire to find fault with everything in general.

(2) It took about twenty-four (24) hours after conductors were supposed to have made their returns before a failure to do so was detected. This enabled the conductors to borrow the company's money for a few days, which was especially evidenced just before pay day.

(3) The loss of two days' collections was possible.

(4) Deposit in bank was delayed two days.

(5) The work in the auditor's office was delayed by having to wait for returns from the treasurer's office.

(6) The general office had to be kept open on Sunday and holidays until 2 p. m. in order to count and check remittances. If this had not been done, conductors would have had a good opportunity to purloin two or three days' collections.

ADVANTAGES AND DISADVANTAGES OF THE RECEIVER SYSTEM

When the "receiver system" was adopted the stations were reduced to eight. This required ten receivers; one each at seven stations, two at one station, and a relief man to relieve the nine men once in ten days. Under the above condition and arrangement we found the running expenses no greater than under the "bag system."

The results we experienced, enumerated in order of their importance, were as follows:

(1) Reduction in number of charges for errors about sixty (60) per cent., and about ninety (90) per cent., in the value of same. This reduction was caused by the money being counted in the presence of the conductors and any errors as to amount (foreign or counterfeit money) being corrected instantly, as conductors are required to account for the amount as shown on trip cards, therefore making it impossible (except by doctoring trip cards) to borrow the company's money. The number of charges under the "bag system" was reduced as follows:

First. Errors in register readings, none.

Second. Errors in calculations, 10 per cent.

Third. (*a*) Failure to deposit money bags and half-trip envelopes.

(*b*) Errors in contents of bags and half-trip envelopes.

This reduced the work necessary to keep account of charges.

Much satisfaction has been experienced in the reduction in charges of the third class, as it removed the dissatisfaction among the conductors, and confusion in office force, growing out of the futile attempts to substantiate our claims for shortages; also, reduced losses from dishonesty of conductors by removing the incentive "to get even" for imaginary wrongs.

Receiver's Remittance.

STATION NO. _____ DATE _____

	Dollars	Cts.
Currency—Large Bills		
do Ones and Twos		
Gold		
Dollars		
Halves		
Quarters		
Dimes		
Nickels		
Coppers		
Canadian Dimes		
Total Cash		
Adult Tickets		

Line	A. T.	Dollars	Cts.
Total			

Receiver.

FORM D

(2) Failure of conductors to make remittances for cash collections at the proper time and for the correct amount can be detected quicker.

(3) Opportunity for purloining receipts reduced to one day's collections.

(4) Money can be deposited in bank one day earlier, thereby saving interest on one day's earnings.

(5) Facilitates work in the auditor's office, as no delay is caused by waiting for returns from treasurer's office; also, receipts for the day can be ascertained earlier the following morning without having to do the unnecessary work of recapitulating trip cards on adding machine to ascertain same.

(6) The general office can be closed on Sundays and occasionally on holidays.

(7) A better system and uniform hours can be established in the offices.

Final—The local conditions in some cases would have to be the determining factor as to the advantages of either system, but matters of accounting should be less susceptible to the influence of local conditions than matters of operation and construction.

The choice would also rest upon the consideration of accuracy in accounting and economy in operation.

However, it will be conceded, I think, by all that the ideal

method of having conductors make returns, is to have them settle in person with the company's agents.

"TYPE-M" CONTROL

BY W. O. MUNDY, M. M., ST. LOUIS TRANSIT CO., ST. LOUIS, MO.

In view of the fact that we should be very careful not to allow our association to be in any way an advertising medium for the manufacturer, I had intended making this paper somewhat broader than indicated by the title, or, in other words, to cover the subject of "Train Control."

There are but three recognized systems of control in use in this country, namely, the Sprague pilot motor control, used on the South Side Chicago, Boston Elevated and Brooklyn Elevated; the Westinghouse electropneumatic control, used on the Brooklyn Elevated and several small installations, and the General Electric "type-M" control, used by the Manhattan Elevated, and adopted by the Interborough, both of New York, the Chicago-Aurora & Wheaton, and a large number of others.

Taking these three in order, I find that the Sprague Company has been absorbed by the General Electric Company, and is no longer pushing the pilot motor control; and, in fact, the Sprague Company, before said consolidation, had proposed and was advocating a scheme somewhat similar to the contactor system. Thus we can safely drop the pilot motor control from our discussion, considering it as not being up to date.

Referring next to the Westinghouse electropneumatic drum control used in Brooklyn, we find that the manufacturers are no longer advocating same, but have recently come upon the market with their so-called turret controller. However, upon investigation, I find that they are not ready to give to the public details of the system, and we are, therefore, compelled to drop it from our considerations to-day. This, unfortunately, places us so that the only remaining system for discussion is the "type-M" control of the General Electric Company.

It is safe to say that in no part of the electrical equipments of our cars are the effects of the different conditions imposed upon us by the constantly heavier and faster cars we are putting into service more markedly shown than in the operation of the controllers themselves. Apparatus that was almost ideal when used with motors of comparatively small power has been both enlarged and strengthened to meet the more severe conditions, and yet, with the very best of construction has failed to be entirely satisfactory; consequently, the majority of us are looking for something better. Whether or not we will be able to find it is as yet problematical, and the future alone can tell.

Undoubtedly, the principal causes of our troubles are that the necessarily heavier working parts of the controllers must move more slowly, and the arc is, therefore, longer in being broken. That, combined with the greater amount of metal vapor caused by the larger currents, makes the arc the harder to break, even if the voltage is no higher, and in the majority of cases we are compelled to use higher voltages in order to give the proper service.

These three causes combine to make the problem a most serious one to meet, and is, without doubt, the reason that while the Sprague controllers were very successful in Chicago when used with 80-hp motors, they were not nearly so satisfactory when used in Brooklyn and Boston with 160-hp motors; hence the newer electric switch control proposed by the Sprague Company before its absorption.

Although having no definite information on the subject, it is probably safe to say that these same reasons were of prime importance in causing the change of front of the Westinghouse Company, as, without knowing positively, I think that the turret controller is a segregated piece of apparatus having small working parts that act somewhat independently.

As most of you are probably aware, the "type-M" control consists of a number of electrically-operated switches or contactors that make the motor current connections, the contactors being controlled in turn by a small master controller operated by the motorman. The only current passing through the master controller is that small amount necessary to operate the contactors, and as the contactors on every car are connected in the same kind of groups, and these groups in multiple, the operation becomes the same whether one or more cars are connected together, the only difference being that the master controller in use must handle an additional small amount of current for each car attached to the train. But the operation of the motors themselves is identical and simultaneous from necessity, no matter in what part of the train they may be.

This apparatus has been so well described in the excellent articles that have appeared in our technical journals that I shall not go further into details at present, but will be glad to give further information, if it is desired, when we come to the discussion of the paper.

While developed particularly to meet the conditions of train control, the use of the "type-M" apparatus has created for itself many uses, and has demonstrated a number of almost self-evident facts that were not fully appreciated before.

The almost absolute necessity of increasing the rapidity of the movement of the contact-making and braking devices as much as possible, especially when handling heavy currents at high voltage, is one of these facts, and it is undoubtedly due to the use of a working member weighing not over 5 lbs. together with a large excess of power, that the contactors are such a success.

The apparent greater capacity per inch width of contact and much longer life of same is readily traceable to this cause, combined with the better type of blow-out possible when used for one arc each. Why these differences should exist is apparent when it is considered that drum controller cylinders, to do the same work, must weigh not pounds, but hundreds of pounds each, and the gap between the arc blowing poles must be much greater and the field more indirect.

From experiments made to determine the rapidity of movement it was found that the average contactor requires less than 1-50 of a a second to attain its widest gap from the instant the contacts first take part in breaking the circuit, and accordingly, only a small amount of metal vapor is formed; hence, the small amount of arc developed.

The "type-M" control is of necessity more complicated than an ordinary series-parallel controller, but there are some advantages that will give it a field outside of train use; for instance, as nearly all the weight can be placed under the car body, the platforms have much less to carry, besides making more room for passengers. Again, as the motorman has a much smaller handle to operate and there is so much less work to do, he should do it more carefully, but whether he will is quite another question.

The ease of handling has caused quite a few electric locomotives to be equipped with this apparatus, although they will in all probability never be connected so as to use the train system feature.

Of course, as the system readily lends itself to distance control, new uses will continually develop, such as hoists, cranes, rolling mills, printing presses, etc. But these are aside from the question and do not particularly interest us, as they have almost nothing to do with our lines of work.

THE USE AND ABUSE OF CONTROLLING MECHANISM.

BY D. F. CARVER, CHIEF ENGINEER, PUBLIC SERVICE CORPORATION OF NEW JERSEY, JERSEY CITY, N. J.

This paper presupposes that the driving and controlling machinery of the rolling equipment has been bought and installed in a manner best adapted to meet the special conditions of service which vary on many of our roads, subject to local conditions of grade and alignment, operating management, stops and starts to be made, vehicle traffic to be avoided, acceleration desired, and laws and restrictions imposed by the community through the municipal government. With the machinery at hand properly designed to work under the conditions imposed, it is not a difficult matter nor an expensive one to keep the controlling mechanism in first-class condition and prevent it from depreciating in earning value to its owners at a faster rate than has been caused in the past by the progression in the art of design and construction of operating machinery. It now seems probable that the present type of magnetic blow-out controller for city cars has come to stay, and that the future changes in it will be only in detail and not radical.

Therefore, it is a good investment to spend necessary money in maintaining these controllers and keep their depreciation through wear and tear as small as possible, and it is good railroading to watch them and care for them and protect them from the abuse which they too often get from inexperienced and untrained handling while being in use on the road.

The secret of successful mechanical management is watchfulness, care, systematic inspection. It is not often that machinery breaks down as the Deacon's One-Horse Chaise. It gives indications and warnings beforehand that something about it is not doing the right thing. Our difficulties are to provide methods to watch the operations of our mechanism, so that the first indications of internal trouble may be made known; after that there must be provided the experienced inspector who is trained to know what causes the peculiarities he discovers, and he must know how to remove the cause of trouble. Several times every day, while the cars are at once off the suburban terminals, the controller cases should be opened and the whole interior mechanism given a hasty cleaning and a little lubrication of the contact

fingers with a good quality of refined lubricant, vaseline being one of the best, though somewhat expensive.

There is a tendency on some well-managed roads to have only two points on the controller, viz., on and off—the various graduations of resistances being largely a matter of form. This method gets the cars over the road and pleases passengers who like a jolt now and then, but it is exceedingly hard on the motor equipment, and runs its cost of maintenance into large proportions.

There are some methods provided to limit the rate of turn of the controller handle in going towards the loop and in the larger equipments the rate of application is automatic and not under the control of the motorman. In city traffic, where cars and vehicles have to go over the same ground and where the vehicle has, by common consent, the right of way, it is not good practice to limit very much the rate of travel of the controller handle, because the men will find they cannot make ordinary slow-downs for the vehicle traffic with a controller slow of application and cover the ground on schedule time, so they resort to the much worse evil of only operating the controller in case of a last resort and using the brake to hold down the speed, making the motors work against the load on cars, as well as the brake. This is especially easy to do with power brakes—except the electric—and is a violation of rules which is very hard to detect.

A somewhat common form of abuse for which no one in the service can be held directly responsible is due to the fact that, on many of the roads, there are now running small equipments which were designed to haul small cars and small loads. The great growth of traffic which has come so rapidly on the trolley systems was not anticipated ten years ago, so many of us are in the position of having a large number of equipments partly worn out, which are always overloaded by any loads they now have to carry; consequently, they are running on our roads mixed with motor equipments of recent design and ample strength, and the poor old inadequate equipment must be driven along out of the way of the new and fast cars, and it usually gets all the abuse of heavy loads, fast schedule and frequent stops; without any friends, it runs along somehow, because it was so well built that it takes its own time about failing.

THE WESTINGHOUSE TURRET SYSTEM OF ELECTRO-PNEUMATIC CONTROL

One of the exhibits which attracted a great deal of interest at the Saratoga Convention was the new pneumatic system of multiple unit control recently brought out by the Westinghouse Air Brake Company, and known as the "Turret System." Several references have been made to this system in recent issues of this paper, but no details have been published. For this reason the exhibition of the complete system at the Saratoga Convention attracted great attention.

Briefly described, the connections are made by a series of "unit switches," or contactors, grouped in a circular case, or "turret," underneath the car, the movement of the individual switches or contactors being secured by air power, controlled by magnets from a battery circuit through a master controller.

As the actuating mechanism is not directly connected to the main source of electrical energy, the connections for the low voltage control circuits are the only ones which have to be established between the cars of the circuits, no air connections being required outside of the ordinary brake hose. Seven wires only are required in the train line battery cable. Another advantage claimed for the use of the separate electrical circuit is that the controlling apparatus can be worked while the main current is cut-off. This makes the control independent of any momentary interruption of the current from the blowing of a fuse, etc.

The master controller, which is carried on the platform or in the motorman's cab, is a small piece of apparatus, and weighs, complete, only 16 lbs. It contains a separate reverser handle, which is interlocking. The master controller handle is capable of four positions, viz.: (1) Closes circuit breaker, (2) motors in series with all resistances, (3) motors in straight series, and (4) motors in parallel. The battery circuit used with this controller is of 14 volts only.

The main controller, i. e., the one carried under the car, is made up of thirteen unit switches, or contactors, arranged radially around an air cylinder, with one blow-out coil in the center for the entire number of switches. Each unit switch, as stated, is operated by compressed air, working against spring pressure, the air valves being controlled by solenoids, operated by the battery current.

The acceleration is regulated by a limit switch, which is a shunt across the No. 2 motor field. The reverse switch and circuit breaker are interlocked, so that the former can not be thrown when the circuit breaker is closed. The reverse and circuit breaker are operated pneumatically. The weights of the different parts for a long double-truck car, similar to those used on the New York subway, would be, approximately, as follows: Main controller, 695 lbs.; reverse switch, 118 lbs.; resistances, 490 lbs.; two master controllers, 32 lbs. Fuller details of the system will appear in an early issue.

EXHIBITS AT SARATOGA

The display by manufacturers and supply men at Saratoga last week was exceptionally interesting, and was much larger than had been anticipated. The Grand Union Court, the hotel veranda and the cottages were occupied by exhibitors. Owing to the necessity of providing covered temporary booths for the displays that were assigned space in the court, there was some delay in getting everything in readiness. No extended description of these exhibits will be attempted this week, but they will be fully discussed, and illustrated in the next issue.

WABASH SPECIAL

The Wabash Special, carrying a large number of Western members of the three associations, left Chicago at 5:20 p. m. Aug. 31, with five Pullmans, a dining car and a baggage car. At Detroit two extra Pullman cars were attached—one from Detroit and the other from St. Louis. About ninety persons were on this train.

N. C. Keeran was in charge of this special train, and did all that was possible for the comfort of the travelers.

KUHN-LOEB HOLDINGS IN METROPOLITAN SECURITIES COMPANY SOLD

On Saturday, Aug. 29, the announcement was made that Thomas F. Ryan and his associates had purchased the holdings of Kuhn, Loeb & Company in the Metropolitan Securities Company, of New York, which holds the stock and bonds of the Interurban Street Railway Company, which in turn operates under lease the Metropolitan Street Railway Company. The stock held by Kuhn, Loeb & Company, the underwriters of the company, amounted to $6,600,000. The Herald and The Times say the purchase presages a gigantic deal in tractions in New York, but the Wall Street Journal says: "There is no reason to suppose that anything more is involved than a transfer of these holdings to the Whitney-Ryan interests already so largely identified with the company." Kuhn, Loeb & Company say they sold because the details of the management of the properties and the practical operation of the roads required more time than they found practicable to give to the work.

CHICAGO & MILWAUKEE ELECTRIC RAILROAD OPENS BRANCH

The Chicago & Milwaukee Electric Railroad Company, which operates an interurban line along the lake shore north of Chicago from Evanston to Waukegan, celebrated the opening of its 6-mile branch from Lake Bluff to Libertyville on Saturday, Aug. 29. Over 100 guests of the road were taken by special car to the large new depot and sub-station at Libertyville, where lunch was served. President A. C. Frost included in his invitations officers and citizens of the suburban towns along the road and a few railroad men. The new Libertyville branch, besides being a passenger road, will also give certain steam railroads an entrance to the manufacturing town of Waukegan. It is intended to extend the Libertyville line to the Northern Illinois lakes, and possibly to connect with the Rockford & Belvidere line.

During the course of some after-luncheon speeches E. C. Noe, general superintendent of the Northwestern Elevated Railroad, announced that negotiations were under way which were likely soon to result in the operation of the Northwestern Elevated trains from their present Wilson Avenue terminus to Evanston, over the Chicago, Milwaukee & St. Paul Railroad tracks on the surface, thus giving both Evanston people and those living along the Chicago & Milwaukee Electric Railroad much improved transportation facilities to Chicago. A number of other important improvements are being made by the Chicago & Milwaukee Electric Railroad, and during the celebration speeches President Frost received many compliments for his enterprise in improving this property.

MR. WESTINGHOUSE ON THIRD-RAIL DANGERS.

Mr. George Westinghouse contributes a long letter to the New York Times of Sept. 1 on the dangers of third-rail electric roads and the proper methods of guarding against them. The letter will undoubtedly attract a great deal of attention, and for this reason is published in full:

Erskine Park, Lenox, Mass., Aug. 29, 1903.

To the Editor of The New York Times:

The public as well as those financially interested in the development of electric traction should feel indebted to The Times for its thoughtful editorial articles on the recent Paris underground electric railway accident, in which it makes doubly clear by quoting Mr. Yerkes that combustible materials should be avoided, particularly in train construction and in station work of underground and elevated railways.

I agree with The Times that the lessons to be drawn from this accident are important, and believe they will lead to the adoption of apparatus and methods which ought to make an electrically propelled train as safe as one drawn by a steam locomotive, and thus insure a realization of the great advantages of electrically-driven trains.

The supreme importance of the subject prompts me again to urge such a revision in the heretofore accepted plans as will insure safety to passengers and employees, as well as the avoidance of ultimate great losses to companies operating electric railways.

It will be recalled that, following the collision between steam-propelled trains in New York City in the Fourth Avenue tunnel on the New York Central Railroad in January, 1902, involving great loss of life due to escaping steam, there was an exciting discussion of the event, with a widespread expression of a belief that had such trains been operated by electricity there would have been no loss of life; and for days almost the entire press of New York devoted columns to the subject and urged prompt legislation which would compel the New York Central Railroad Company to use electricity instead of steam for the operation of its trains within the city tunnels.

Having had a long experience in matters pertaining to the safe working of railway trains, and having acquired a very considerable knowledge of the power and pecularities of electricity, I believed I might do a public service by drawing attention through the press to the elementary fact that the electric operation of trains could not lesson some of the risks, but might, on the contrary, add new ones of a serious character, and I therefore wrote a letter which you published in your columns at the time, and which has recently been extensively republished.

That letter was criticised favorably by some, but was belittled and denounced by interested parties as calculated to impede the introduction of electricity for traction purposes.

Since then, as a result of that discussion, there have undoubtedly been great improvements demanded and made in the character of electrical apparatus for railway use; but, as often happens, it has required an awful experience to bring home to those charged with the responsibility of guarding against railway accidents the fact that there is no margin for use in tunnels of combustible material in proximity to a heavily charged electric conductor.

The recent injury to a number of workmen engaged upon the elevated railway is only another illustration of the need for a revision of the plans which have heretofore prevailed and which have evidently been regarded by many railway officials as reasonably safe.

The realization of the great cost of such an accident as the recent one in Paris, regardless of the horror of it, will undoubtedly cause the plans already decided upon to be most carefully reviewed, and should bring to the officials of the companies interested the highest skill in determining the requirements, the compliance with which will render the carrying of passengers on trains operated by electricity as safe at least as if propelled by other means.

It seems almost axiomatic that the third rail should only be charged with electricity when required to operates a train; that there should never be more electric energy at any point of a third rail than sufficient to operate one train; that the electric machinery required upon a train should be reduced to a minimum, and should be so located as to be under the convenient supervision of the train attendants, and in all tunnel and elevated railroad work there should be no material to create fire or dense smoke.

The following requirements, among others, can easily be complied with, and are respectfully suggested for consideration and discussion:

1. Trains to be constructed of iron or steel, with the interior finish of incombustible materials.

2. The division of the third rail for the supply of electric current into suitable sections, each section being supplied with current only when required to propel a train.

3. The limitation, by suitable devices, of the amount of current supplied to each section so that in the event of a short circuit on the train the current will be automatically and instantaneously cut off at a point some distance from such section of the third rail.

4. Provision for the cutting off of the current from each supply section of the third rail at the will of the motorman.

5. No other live conductors than the third rail to be in close proximity to the line.

6. No wires carrying high voltages except upon motor cars, and motor cars only at the ends of a train.

The state of the electric art has so advanced that compliance with the foregoing requirements is simply a matter of additional expense incomparable, however, to the financial losses which the companies will suffer if they do not make the electric operation of their railways absolutely safe.

Believing the foregoing requirements can be complied with, I have read with amazement the opinions quoted in your Friday's issue under the heading "No Device to Stop Third-Rail Killings." I am sure Mr. Hedley must have been misquoted in regard to the possibility of collisions due to the temporary shutting off of the current from the third rail, for, as a matter of fact, the stopping of the trains on the elevated railway is not in the slightest degree affected by the temporary cessation of the current on the third rail.

It is true, however, that the system of train control in use upon the elevated road, and which has been ordered for the rapid transit trains, is so organized that its correct operation is dependent upon a constant supply of current to the third rail, and that, therefore, the division of the third rail into sections and the temporary supply of current only as needed, might, with the existing system of train control, be inoperative, but there are available well-tried train controls which are operative regardless of a temporary interruption in the supply of current.

It is well and sorrowfully recognized by our great railway engineers that early mistakes, due to inexperience, in the dimensions adopted for tunnels, gage of track, and in the method of coupling cars have established practices which cannot now be escaped from, because of the necessity for a uniform practice, in the points cited, on connecting railways.

The advantages to accrue from this necessity for uniformity in railway practice to that concern which can secure the adoption of its plans covered by patents has led to a commercial rivalry the influence of which for evil cannot well be appreciated.

This intense rivalry between the two great electric manufacturing companies of the country, each enjoying the same rights under numerous patents, has undoubtedly led to a great improvement in the electric art, but to that rivalry, where none should exist, can also be attributed much of the cause for the present alarm concerning the unsatisfactory method of electric operation of trains.

If, therefore, a frequently adopted practice be adhered to, viz., that having already expended a large sum for electric plant and equipment of a certain character, there must hereafter be used for extensions and upon connecting lines only such apparatus and methods as will fit in with the existing plans, however imperfect they may be, then there is small hope for a safe system of electric traction.

The most recent accident on the Paris underground railway, where passengers were frightened and jumped from the train, illustrates how necessary it is to so install electric apparatus that there can be no such alarming occurrences.

Being sure of my ground and of the necessity for public pressure in securing the desired reforms, and with a full belief that electric traction can be made safe, I am, respectfully yours.

GEORGE WESTINGHOUSE.

THE RICHMOND STRIKE ENDED.

The strike of the employees of the Richmond Passenger & Power Company, of Richmond, Va., has been formally declared off. The strike lasted just sixty-nine days, and is estimated to have cost the company $125,000; the strikers, in loss of wages, $50,000; the State, by reason of the necessity for troops to maintain order, $75,000; and the city, for special police, etc., $5,000. One man was shot and killed by soldiers during the trouble, and one motorman was fatally stabbed by another, while scores of persons were more or less seriously injured in various ways.

NEW PUBLICATIONS

Cram's Atlas. Published by George F. Cram, of New York and Chicago.

Cram's Business Atlas for 1903 is to be commended for the attention it has given to electric railways. Practically all of the longer and older interurban roads are included in the maps in this atlas, interurban lines being designated in a way which distinguishes them from steam railroads. In view of the fact that our prominent map makers have heretofore been rather lax as regards the showing of interurban lines, the efforts of this publisher along this line show a realization of the important part interurban roads are now taking in the transportation world.

The World's Commerce and American Industries. Published by the Philadelphia Commercial Museum, of Philadelphia, Pa. Price, 50 cents per copy.

This little volume was prepared by John J. Macfarlane, A. M., librarian of the Philadelphia Commercial Museum, and illustrates graphically by charts the progress and present condition of the commerce of the world, of the manufacturing industries of the United States, and of British and American shipping. In all there are eighty-six charts, and in addition there is an alphabetical list of the cities of the United States having an output of over $20,000,000 of manufactured goods according to the census of 1900, with the leading industries of each city. This graphic method shows more clearly than statistics alone would do, what proportion of the world's trade belongs to each of the principal nations, and the relative importance, from a manufacturing standpoint, of the leading cities of the United States.

STREET RAILWAY PATENTS

[This department is conducted by W. A. Rosenbaum, patent attorney, Room No. 1203-7 Nassau-Beekman Building, New York.]

UNITED STATES PATENTS ISSUED AUG. 18, 1903

736,345. Electric Railway Signal; Henry A. Ammann and Albert D. Campbell, Spokane, Wash. App. filed Nov. 19, 1902. Relates to the details of construction of a circuit closer to be attached to the trolley wire and actuated by the passing trolley wheel.

736,350. Brake-Shoe; Thomas M. Bell, Philadelphia, Pa. App. filed Nov. 19, 1902. A brake-shoe having a reinforcing web of steel casting and an external portion indicating the safety limit to which the shoe may be worn.

736,539. Center Bearing; John E. Norwood, Baltimore, Md. App. filed Oct. 18, 1902. Details of construction of a center ball-bearing to be employed between the bodies and trucks of railway cars.

736,610. Trolley; Louis Lavagne and Louis Bertrand, Marseilles, France. App. filed Feb. 21, 1902. A guard to prevent the wheel from leaving the wire and adapted to tilt backward when an obstruction is encountered.

736,620.—Car Strap for Street Cars; Julio S. Navarro, Havana, Cuba. App. filed March 11, 1903. The main part of the strap is formed in the shape of a diamond and doubled around the supporting bar, the hand strap being pivoted between the two ends of the main strap.

736,641. Trolley; Thomas P. Seastrunk and James P. Archer, Dallas, Tex. App. filed Jan. 14, 1903. The trolley is permitted to swing or tilt in passing around curves.

736,721. Trolley; Edward Hall, Whitestone, N. Y. App. filed May 28, 1903. Details of a trolley wheel guard.

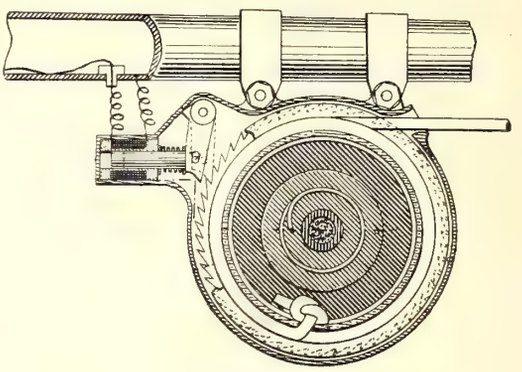
736,752. Electric Railway System; Timothy Mahoney, San Francisco, Cal. App. filed Feb. 7, 1903. In surface contact systems a circuit closer consisting of a hermatically sealed casing having a pivoted bar therein which is swung on its axis by a magnet carried by the car to close and open the circuit between the feeder and contact button or rail.

736,816. System of Train Control; Frank E. Case, Schenectady, N. Y. App. filed Feb. 28, 1898. Comprises a master controller provided with power, reversing and brake switch, motor controllers provided with power, reversing and brake switches and mechanism regulating the action of the motor controllers under the control of the master controller.

736,817. Electric Brake; Frank E. Case, Schenectady, N. Y. App. filed Dec. 17, 1898. In a system where the motors are used as generators to supply current for operating brake-shoes an auxiliary source of current is used to increase the current supplied to the shoes as the current generated by the motors decreases with the decrease of momentum.

736,861. Fare Register Operating Device; Buren B. Moad, Webb City, Mo. App. filed Oct. 28, 1902. Consists of a revoluble rod mounted in brackets adjacent to the register, which is so constructed and arranged as to obviate the necessity of running the ordinary operating cord at various angles at points adjacent to the register and which permits the use of an operating cord which extends in a straight line from one end of the car to the other.

736,897. Trolley Catch; Morris C. White and Otho C. Duryea, Los Angeles, Cal. App. filed July 5, 1902. Consists of a spring



PATENT NO. 736,897

drum, pawl and ratchet attached to the trolley pole, adapted to be tripped by an electromagnet in the trolley circuit, when the wheel leaves the wire, to lock the cord and prevent the trolley pole from rising.

736,914. Method of Operating Electric Brakes; Frank E. Case, Schenectady, N. Y. App. filed Dec. 17, 1898. This method is carried out in connection with the apparatus described in patent No. 736,817.

UNITED STATES PATENTS ISSUED AUG. 25, 1903

736,941. Convertible Car; Henry Covert, Waterford, N. Y. App. filed June 19, 1903. The car is provided with side openings, the lower portions of which are adapted to be closed by horizontally movable doors and the upper portions by vertically movable panels.

736,942. Trolley Base; Albert D. Crossley, South Norwalk, Conn. App. filed March 4, 1903. Relates to an arrangement of contact plates upon the pole base.

736,997. Brake; George E. Moffett, Jarilla, Territory of New Mexico. App. filed Jan. 31, 1903. A brake mechanism comprising a vertically-disposed rocker-arm, a draft rod connecting the rocker-arm with the brake mechanism, a toggle moving in a vertical plane and connected to the rocker-arm and means for actuating the toggle.

737,053. Electric Railway Signal; Henry A. Ammann and Albert D. Campbell, Spokane, Wash. App. filed March 9, 1903. A device for attachment to the trolley wire adapted to be actuated by the passing trolley wheel to close a signal circuit.

737,076. Automatic Car Fender and Sweeper; Charles P. Cathcart, Kansas City, Mo. App. filed March 30, 1903. A rotatable guard or brush normally held in an elevated position above the car track and disposed transversely thereto, is provided with means by which the guard may be lowered adjacent to the track and caused to rotate by a motor, and means by which the motor is controlled by the raising and lowering of the guard.

737,132. Four-Wheeled Truck for Tramway Cars, Railway Carriages, etc.; Andrew S. Nelson, Albert Stewart and Thomas J. Foster, Motherwell, Scotland. App. filed Dec. 27, 1902. Details of construction.

737,185. Railway Brake-Shoe; Bruce Willhide, Grafton, W. Va. App. filed Feb. 13, 1903. A brake-shoe so constructed that the suction created by the rotation of the wheel in connection with which the shoe is used is enabled to draw sand or dust through the shoe to the face thereof; also contemplates the provision in the face of the shoe of one or more chambers adapted to receive the air drawn in with the sand or dust.

737,265. Electric Brake; Frank C. Newell, Wilkinsburg, Pa. App. filed Dec. 31, 1902. An automatic reversing switch adapted to set up the proper combination of circuits for braking when the car is moving in either direction.

737,528. Car Fender; Herman Thiele, Milwaukee, Wis. App. filed Jan. 10, 1903. Details of an automatic fender.

PERSONAL MENTION

MR. A. H. METZELAAR, who has so efficiently filled the position of general manager of the Knell Air Brake Company, of Battle Creek, Mich., has severed his connection with that company.

MR. TOM L. JOHNSON, Mayor of Cleveland, municipal ownership advocate, single-taxer, and former street railway magnate, has been nominated by the Democrats for Governor of Ohio. It

has been unkindly said by some of his friends that Mr. Johnson has "Presidential aspirations."

MR. H. S. BEATTIE, formerly treasurer of the Metropolitan Street Railway, of New York, and at one time a Street Commissioner of New York, was seriously injured in a fall from a car of the Union Railway Company in Mt. Vernon, N. Y., on Aug. 29.

MR. WILLIAM F. BREIDENBACH has resigned as manager of contracting and installation departments of the Ohmer Fare Register Company, of Dayton, Ohio, and is now assistant manager of the N. Thomas Brewing Company, of Dayton, in which company Mr. Breidenbach is financially interested.

MR. CHARLES M. SHIPMAN, formerly general superintendent of the North Jersey Street Railway Company, was presented with a massive loving cup and $365 in gold by employees of the company, on Friday evening, Aug. 28. The gifts were given in appreciation of Mr. Shipman's kindness and fair dealing with the men while he was connected with the company.

MR. JOHN B. PARSONS, president of the Philadelphia Rapid Transit Company, of Philadelphia, Pa., returned from Europe Tuesday, Sept. 1, after an extensive tour of the continent. Mr. Parsons left Philadelphia June 19, last, and returned on the Kronprinz Wilhelm from Bremen. While in Europe he spent considerable time in Russia, visiting St. Petersburg and Warsaw, in Russian Poland. He also toured Germany, and made a visit to Vienna. Mr. Parsons was particularly impressed with the advancement made in Germany.

MR. W. T. VAN DORN, of Chicago, has just returned from a six weeks' European pleasure trip. He visited the electric underground road in Paris, on which the recent appalling accident occurred, and naturally was interested in the coupling methods. He criticises the practice there of coupling cars permanently together by bolts and chains in the shops, so that they cannot be uncoupled on the road. Had it been possible quickly to uncouple the burning car from the rest of the train, he thinks the accident would not have been as serious as it was.

MR. CHARLES E. DONNATIN, superintendent of the mechanical department of the Pacific Electric Railway Company, at Los Angeles, Cal., has resigned, and will devote his time hereafter to his private business, which has become extensive. For twenty-seven years Mr. Donnatin was master car repairer of the Southern Pacific Railroad, and left that position about eighteen months ago to accept service with Mr. H. E. Huntington in his street railway systems. Among many other business ventures, Mr. Donnatin is interested in the pneumatic trolley base recently adopted for use by the Pacific Electric Railway Company on the high-speed cars of its interurban lines.

MR. MAURICE FITZMAURICE, chief engineer of the London County Council, who came to this country for the express purpose of studying the New York Subway, returned to London on the Cunard liner Umbria, which sailed for Liverpool on Saturday, Aug. 29, after a short stay in the city. He was all over the work with Chief Engineer William Barclay Parsons, and had nothing but praise for the work. Mr. Fitzmaurice's work is entirely independent of the Royal Commission on London Locomotion, five or six members of which are coming to the United States within a month to make an exhaustive study of the transit facilities of the larger cities. The Blackwall tunnel under the Thames was built under the supervision of Mr. Fitzmaurice.

MR. J. D. HAWKS, of Detroit, is the subject of a complimentary biographical notice in "The Gateway" for August. An excellent portrait accompanies the article. Mr. Hawkes is president of the Detroit, Ypsilanti, Ann Arbor & Jackson Electric Railway, the Grand Rapids, Grand Haven & Muskegon Electric Railway, and the Lansing City Electric Railway Companies, and has taken a very prominent part in the development of electric interurban lines in Michigan. Mr. Hawks is a member of the American Society of Civil Engineers and of the Institution of Civil Engineers of Great Britain. He has been in the railway service since Feb. 1, 1870, and had an extended experience in all the departments of steam railway work before taking up the electrical service.

MR. BENJAMIN J. WEEKS has resigned his position as general superintendent of the Tacoma Railway & Power Company, of Tacoma, Wash., and has accepted that of manager of the Spokane Traction Company, of Spokane, Wash. He assumed the duties of his new position Aug. 20. Mr. Weeks is well and most favorably known in street railway circles, especially in New England, and has been connected with street railways for about twenty years, having worked up from the positions of driver and conductor on the old horse cars in Boston. He was later appointed superintendent of the Framingham Street Railway, of South Framingham, Mass., but upon the development of the electric system entered the employ of the Thomson-Houston Electric Company, at Lynn, Mass., as expert. From there he went to Newport, R. I., as superintendent of the Newport Street Railway, and then to Quincy, Mass., to take the position of superintendent of the Quincy & Boston Street Railway, Quincy, Mass. When Mr. Weeks commenced with that road it had only 7 miles of track, but during the years he acted as superintendent he saw the road grow to 56 miles. He resigned from the Quincy & Boston two years ago last February to accept the position of general superintendent of the Tacoma Railway & Power Company, which position he has held until the present time.

GENERAL FRANCISCO ALTSCHUL, late Minister a'Fomento of the Republic of Honduras, Central America, is in New York on business connected with Central American projects. Among other important matters he is looking up details and getting estimates and plans for the conversion of the present street railway of Puerto Cortez, the Atlantic seaport of Honduras, into an electric line. The road is about 5 miles long and extends from the city of Puerto Cortez to the village of Laguna. Senor Altschul says there are many fine opportunities all over Central America in populous and prosperous cities in Costa Rica and Nicaragua, as well as Honduras, to put in paying electric railway lines. Leon, Nicaragua, a large and prosperous town, is a particularly fine field.

MR. C. NESBITT DUFFY, secretary and auditor of the Chicago City Railway, has resigned from that company and has accepted the position of controller of the Interurban Street Railway Company of New York, a new position which has been created for him. Mr. Duffy expects to move to New York within a few weeks. Mr. Duffy is recognized as one of the ablest street railway accountants of the country, and the Interurban Street Railway Company is to be congratulated upon having secured his services. He is a native of St. Louis and entered the street railway business in 1886 as secretary and treasurer of the Union Railroad Company of that city. During the subsequent consolidations which followed the organization of the National Railway Company, Mr. Duffy continued his association with the companies as secretary and treasurer, but resigned about four years ago on the organization of the St. Louis Transit Company, to become auditor of the Chicago City Railway. The title and duties of secretary were later added to those of auditor, as were also those of assistant to the president. Mr. Duffy has been prominently identified with the Association of Street Railway Accountants since its organization and has done much to advance its standing and welfare. He was first vice-president of the association during the first year of its existence, and president during 1899-90, and has been a member of a number of the most important committees which have been appointed by the association on different subjects.

MR. FRANK WARREN EVERETT, recently one of the engineers of Wendell & MacDuffie, died on June 28, at North Creek, N. Y. Mr. Everett graduated from the Massachusetts Institute of Technology in the class of 1897, where he afterward took a post-graduate course. Some time after leaving this institute Mr. Everett was with the Union Iron Works, of San Francisco, leaving there to go into partnership with Frederick C. Field, in the firm of Field & Everett, consulting engineers of New York city. In the fall of 1899, Mr. Everett associated himself with Wendell & MacDuffie, of New York, and while with this firm undertook and brought to completion the installation of the Gamewell Fire Alarm and Police Telegraph System, in the city of Havana. The work in Havana occupied the best part of a year, during which time Mr. Everett applied himself so closely to his work that his health failed, and on the day his work was accepted by the Havana authorities, he was obliged to leave Cuba, returning to this country in the hope of regaining his health and strength. Mr. Everett was married in the fall of 1900 to Miss Julia Kimball, and leaves a widow and one son. Mr. Everett's manliness, ability and integrity made him hosts of friends wherever he went, who greatly deplore his untimely death.



FRANK WARREN EVERETT

NEWS OF THE WEEK

CONSTRUCTION NOTES

COLLEGE HILL, ARK.—The College Hill Light & Traction Company has been chartered, with $195,000 capital; E. K. Smith, president; J. D. Sanderson, vice-president; E. J. Spencer, secretary; J. L. Chatfield, treasurer, and F. W. Offenhauser, assistant secretary.

EUREKA, CAL.—The Humboldt Transit Company began work here Aug. 3 on the construction of 10 miles of line. The company is doing its own construction work, but the National Construction Company is doing the overhead work. Power will be secured from the Eureka Power Company. During 1904 and 1905 the company plans to build 27 miles of interurban line. The officers of the company are: J. C. Bull, Jr., president; George Henderson, vice-president; Charles P. Cullen, secretary; Bank of Eureka, treasurer; George Henderson, manager; F. Herrick, manager.

LOS ANGELES, CAL.—The Pacific Electric Railway is preparing specifications for a new type of car to be used on its interurban lines, with which it is to make a speed of 60 miles an hour. The cars will be 60 ft. long and weigh 93,000 pounds. Each car will be equipped with four 150-hp motors. Fittings similar to those used in steam railway coaches and separate smoking compartments will be provided. Each car will have a carrying capacity of seventy-two passengers. An order for fifteen or twenty of these cars will be placed soon, according to announcement made at the offices of the company. They will be used on the projected line to Riverside, a distance of 60 miles, which it is proposed to cover in an hour, and also on the other interurban lines of the company.

OAKLAND, CAL.—The Street Railroad Committee of the City Council has favorably recommended a petition of the Oakland & East Side Railroad Company for a franchise in connection with the Emeryville terminal. The hearing was recommended for Tuesday, Sept. 8.

PETALUMA, CAL.—Bids will be received up to 7 o'clock p. m. Sept. 8 for a franchise to operate an electric railway on certain streets and highways within Petaluma as applied for by Burke Corbett.

SAN JOSE, CAL.—The San Jose-Los Gatos Interurban Electric Railway has secured a franchise for a city terminal here.

SANTA ROSA, CAL.—The Board of Supervisors of Sonoma County has sold an electric franchise over the county roads leading from Petaluma to Sebastopol and then through Green Valley to Forestville. The price obtained was $100, this being the highest bid received for the franchise offered for sale. It was sold to Burke Corbett. The franchise goes into effect in fifteen days, and within four months from that time the construction of the electric line must commence. The Board exacted a bond of $1,000 from the successful bidder.

NEW LONDON, CONN.—The incorporators of the Groton & Stonington Street Railway Company have voted to accept the charter recently granted by the General Assembly. The capital stock of the company is fixed at $600,000, and the proposed road will run from New London through Groton, Mystic and Stonington to the Rhode Island boundary at Westerly. The company will organize soon.

WILLIMANTIC, CONN.—The Willimantic Traction Company has placed in operation its line between here and Baltic, where connections are made with the lines of the Norwich Street Railway Company, thus completing a line between Willimantic, Baltic and Norwich. Willimantic, in the center of the State and on the Air Line of the New York, New Haven & Hartford Railroad, is a city of only 10,000 inhabitants, but the territory contiguous to it is thickly, but it cannot be said densely, populated. Located at Willimantic are several mills, which employ thousands of operatives, who are drawn in many cases from the territory through which the new road operates. South Windham, where the power house is located, is a beautiful little village whose residents are for the most part well to do and who have long desired trolley facilities. The new road will eventually form an important link in a through line from Harttord to Norwich.

DENVER, COL.—The engineers of the Denver, Northwestern & Pacific Railway, known as the Moffat Short Line, now building between Denver and Salt Lake City, have under consideration the use of electric locomotives for hauling the trains through the 2-mile tunnel that is to be bored through James Peak. Electric locomotives similar to those in use on the Baltimore & Ohio tunnel will probably be employed.

APALACHICOLA, FLA.—The Apalachicola Street Railway Company has been granted a franchise by the City Council to build a street railway on Market, Live Oak, St. Vincent's, Pine, Chestnut, Juniper, Franklin, Columbus, Locust and other streets. The incorporators are: H. W. Grady, John M. Fowler, Andrew L. Wing and Domingo Cattanetti.

MARIETTA, GA.—A petition for a franchise to operate an electric railway between Marietta and Atlanta via Pace's Ferry, will be filed with the Fulton County Commissioners by Attorney W. R. Power, who represents the Atlanta & Marietta Electric Company. The proposed line will run out Donaldson Avenue, between the reservoirs, along Howell's Mill Road to Ross' store, thence northerly and westerly to the Chattahoochee River; along Pace's Ferry Road, crossing Buckhead and Pace's Ferry Roads. Also crossing the Seaboard Air Line tracks and Peachtree Creek in Fulton County.

OCILLA, GA.—The Ocilla & Valdosta Railroad Company has given notice of application to the Secretary of State for incorporation. According to the application, the road will run from Ocilla, in Irwin County, to Valdosta, in Lowndes County, a distance of 80 miles. It is also proposed to build an extension from Ocilla to Helena, in Wilcox County, connecting there with the Southern Railway. It is proposed to issue capital stock in the road to the amount of $10,000 per mile, or a total of $800,000, for the 80 miles. The general offices will be in Ocilla.

CHICAGO, ILL.—The directors of the South Side Elevated Railroad have declared the regular quarterly dividend of 1 per cent, payable Sept. 30.

CHICAGO, ILL.—The Union Elevated Loop has completed arrangements with the Commissioner of Public Works for permits to extend its platforms and so relieve the present congestion of traffic, which is due to the fact that two trains can stop at a station at once. This extension of platforms has been recommended by several experts as a plan which will relieve the present congestion. Most of the platforms will be more than doubled in length, according to the plans which are made. The stations at State and Dearborn Streets on Van Buren Street will be combined, so that there will be one continuous platform from State Street to Dearborn Street.

CHICAGO, ILL.—The new coal station of the Metropolitan Elevated at Forty-sixth Street and the belt line is nearly completed, and it will only be a short time before it will be in operation. With the exception of the downtown terminal the road has no new construction work under way. It is not believed the new terminals will be completed in time to have them in operation during the present calendar year owing to a certain amount of litigation over the property which stands partially on the proposed right of way and the inability to get structural material.

MARSEILLES, ILL.—The Illinois Valley Traction Company proposes to extend its line from Marseilles through to Morris and Joliet as soon as the road between LaSalle and Marseilles is completed and in operation.

MT. VERNON, ILL.—The preliminary surveys are made and the calculations, maps, profiles, etc., well under way for the Southern Illinois Electric Railway. This line will extend from Mt. Vernon to St. Louis, passing through Drivers, Webb, Boyd, Irvington, Hoyleton, New Mindon, Covington, Okawville, Club House, New Memphis, Mascoutah, Rentchler, Belleville, French Village and East St. Louis, a distance of 90 miles. There will be a branch line 23 miles long beginning at Irvington, on the main line, and running to Centralia, Central City, Sandoval and Odin to Salem. Rights of way are nearly all obtained, as are also the franchises to use public streets in towns where needed. The estimated cost of the line is $2,000,000. The road is to be operated by the trolley system, and will handle passengers and freight traffic. It is expected that the road will be finished in time for the World's Fair at St. Louis. John R. Piercy, of Mt. Vernon, is president of the company.

NASHVILLE, ILL.—The Southern Illinois Electric Railway Company has filed articles of incorporation. The articles provide for building an electric railway through Washington, Marion, Jefferson, Hamilton and White Counties to a point near Maunie, Ill. The incorporation papers are for a period of fifty years, with a capital stock of $50,000. The principal offices are at Mount Vernon, Ill., and the organizers are: John R. Piercy, George F. M. Ward, Samuel Casey, Louis G. Pavey, Samuel T. Maxey and Albert L. Johnson, of Mount Vernon, Ill.

SPRINGFIELD, ILL.—The Kewanee Short Line Electric Railroad, Kewanee, Ill., has been incorporated with a capital of $15,000, to be constructed from Kewanee to Annawan, Henry County. Incorporators and first Board of Directors are: W. V. Eddy, F. H. Davis, H. S. White, A. P. Eddy, A. C. Scott, all of Kewanee.

ANDERSON, IND.—President McCulloch says that it is impossible to foretell at this time just when the Indianapolis Northern line will be placed in operation. The distance from Broad Ripple to Tipton is 32 miles. About 16 miles of track have been laid. The bridges are in course of construction. Substantially the entire grade between Indianapolis and Tipton is completed, and the tracks are down in Tipton and Noblesville. The work north of Tipton is being pushed. Work on the bridges over the Wabash River at Logansport and Peru will be begun within a few days. The material for the entire work is on the ground. The company hopes to be able to operate cars between Indianapolis and Tipton early in October, and hopes to be able to operate cars from Indianapolis to Logansport and Peru by Christmas.

FT. WAYNE, IND.—The contract for grading the Ft. Wayne & Springfield traction line between Ft. Wayne and Decatur has been awarded to H. Tubman & Company, of Cleveland.

EVANSVILLE, IND.—The Evansville, Boonville & Rockport Electric Company has filed a $10,000 bond with the City Treasurer, guaranteeing to build its line. The survey is completed and work will begin this fall.

EVANSVILLE, IND.—The Evansville, Boonville & Rockport Traction Company has filed a bond for $10,000 with the Board of Public Works to insure the carrying out of the provisions of its franchise, as granted a few weeks ago. In six months the company will have to file a bond for $3000, to be forfeited to the city in case all of the provisions of the franchise are not carried out.

INDIANAPOLIS, IND.—Charles F. Smith, general manager of the Indianapolis & Martinsville Rapid Transit Company, is advertising for bids to construct 24 miles of road between Martinsville and Bloomington. There will be about a quarter of a mile of tunneling.

INDIANAPOLIS, IND.—The commissioners have granted a franchise to the Indianapolis, Danville & Rockville Traction Company to enter the county by way of the Rockville pike. The road will enter the city by way of West Washington Street.

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Saratoga as a Meeting Place

Saratoga differs from any place selected in previous years for a convention of the American Street Railway Association in being a small city, but opinion is divided as to whether a decision to meet in Saratoga next year would be advisable. The place has many points to recommend it, and there is ample hotel accommodation which, for the most part, is fairly good. There is also present none of the outside entertainments which exist in a large city to distract the attention of the delegates from the meetings and from the exhibits. On the other hand, Saratoga is off the line of the main trunk routes, and for this reason is somewhat inconvenient of access, especially to visitors from the West; besides the arrangements made for the exhibits during the recent convention were by no means satisfactory.

There is no association in the country at whose annual meetings the manufacturers go to such expense and trouble in exhibiting apparatus as at those of the American Street Railway Association. This fact has always constituted one of the most valuable features of the Street Railway Conventions, and all of the members of the Association are united in encouraging the supply men to make comprehensive exhibits of their apparatus at these annual gatherings.

The exhibits have grown in number and size during recent years to such an extent that it has become difficult, we acknowledge, to find in many cities a combination of convention hall, exhibit space and hotel accommodations which is entirely satisfactory. Nevertheless, we feel that we are voicing popular sentiment not only of the majority of the exhibitors but also of the delegates, to whom the exhibits constitute an important part of the convention, when we say that the facilities for the exhibits at Saratoga were inferior to those which have existed at any convention since probably that in 1891.

It was extremely fortunate that the convention this year was held during a period of fair weather, but it is easy to realize the discomfort and loss which would have been occasioned to all if the rain which prevailed during the four days just preceding the opening of the convention had continued during the days in which the associations were in session. Such an event, which was by no means unlikely, would have practically prevented all inspection of exhibits and would thus have deprived the convention, in the opinions of many delegates, of a large portion of its value. As it was, the exhibits as a whole, according to our observation, were not given the attention which has been extended to them in the past. This was undoubtedly in part due to the fact that many of the exhibitors were not favorably located, while the completion of other exhibits was delayed by the bad weather just preceding the convention. The fact that there were no facilities for the receipt and display of heavy apparatus was also a factor which affected the number and attractiveness of the exhibits.

We offer these remarks in no sense as a criticism of the selection of Saratoga as the meeting place in 1903. Many of the conditions could not have been foreseen, and others, it was thought, would be remedied. We believe, however, that the use of an adequate building to house the exhibits during the convention, or at least a more satisfactory arrangement for this portion of the convention than employed this year, should be made a condition before Saratoga is again selected as a meeting place for the American Street Railway Association.

The Proceedings of the American Street Railway Association

In many respects the convention of the American Street Railway Association was a very successful one in spite of the very poor acoustic properties of the hall, which made it difficult to understand the speakers unless one was only a few feet away. All of the papers prepared were of a high grade, and represented the most painstaking care on the parts of the authors. We expect to discuss each of these papers in detail, but it is not too much to say of them that individually and collectively they constitute an important addition to the technical literature on street railway operation.

There is a general feeling, however, that more time should have been provided for a thorough discussion of these papers. This sentiment was expressed in the meeting by several delegates, who united in the belief that the time spent in excursions and other social features of the convention should be reduced if necessary to secure sufficient time for a thorough discussion of the papers. We believe, with one speaker, that arrange-

ments should be made for holding sessions in the morning, afternoon and evening of each day, if necessary, to accomplish the results for which the convention is nominally held, and that no other course is fair either to the gentlemen who are asked to prepare the papers or to those delegates who attend the convention to discuss the papers and hear the opinions of others on the topics under consideration. As an actual matter of fact, out of the eight papers on the programme, only one was presented during the first two days of the session, and that paper was discussed by only three members. The other papers, which included all of those which were printed in advance of the meeting, as well as the important report of the Committee on Rules, were considered in a single session, that on Friday morning, at which the election of officers also took place and the final business of the Association had to be concluded.

The fault of this confessedly inadequate treatment of the literary and technical side of the Street Railway Convention cannot be laid at the door of any one individual. It is partly due to the fact that the social features of the convention have almost insensibly encroached upon the periods assigned to the business of the Association, and partly to the indifference of the delegates as a body in meeting promptly at the time of opening the sessions. The purpose outlined by Mr. Ely in his discussion of this subject to increase the value of this portion of the work of the Association will, we believe, receive the support of the great majority of the members, and in view of the benefit which all derive from a careful consideration of the topics discussed at the annual meetings, no effort should be spared to condense into every session the greatest amount of business.

We do not intend to discuss here the proper procedure for securing the most valuable results from the meetings of the Association, except to say briefly that it should be similar to that followed by all other important bodies of this kind. This includes the assignment of topics at least six months before the meeting of the Association, the publication and distribution of papers and reports to be read to the members in ample time to allow of the study of their contents, the adoption of a programme indicating the days on which the different topics are to be discussed, the appointment of gentlemen to open the discussion on each of the topics, facilities for the submission of pertinent communications and requests for information by members who cannot be present, the prompt convening of the sessions and allowance of plenty of time to complete the programme arranged. We believe that if those members who are asked to submit papers on different topics were assured of the careful consideration of their papers which such a plan as this would insure, there would be much less difficulty in securing authors than now exists. The Association is extremely fortunate at this juncture of its career in having as president a gentleman of the ability of Mr. Ely, who made such an admirable presiding officer during the sessions which have just passed, who will possess the confidence and support of the members in every step he takes to advance the interests of the Association, and who has already expressed himself as anxious to secure from the meetings of the Association the best possible results. In Secretary Penington also the members have an official who thoroughly understands the business of the Association, whose conduct of the finances has established this department of the Association on a very firm footing, and whose efficiency and ability eminently fit him for carrying out any programme which the president-elect and the executive committee may determine upon.

The Meeting Place in 1904

The question of the place of meeting in 1904 has wisely been left to the determination of the executive committee. As Mr. Ely pointed out, whatever decision is made as to the place of meeting, it should be thoroughly understood that the Association ought not to look to the representatives of the local street railway company to provide for the social entertainment of the delegates during the convention. In his discussion of this topic, Mr. Ely paid a gracious tribute to the courtesy and hospitality extended to the Association by Hon. A. B. Colvin and the officials of the Hudson Valley Railway Company, as well as by the General Electric Company and the Schenectady Railway Company, who also entertained the Association during the Saratoga Convention. The trips afforded by these companies to the delegates, as well as the special trips to the visiting ladies, for which invitations were also extended, were most enjoyable and were appreciated by the recipients of these courtesies. Every one in the Association, however, realizes that the entertainment of such a large body as attends the meetings of the American Street Railway Association is an undertaking of very considerable magnitude, and that if the Association should decide to meet next year in a large city it would be an appropriate action to take to relieve the local company of the expense now required in its entertainment.

Standard Rules for the Government of Employees

The code presented by the committee on rules for the government of employees differs radically from that proposed last year; not only has the form been materially changed but hardly any of the rules have been reproduced from the list presented a year ago. This does not mean, however, that the practice recommended by the Association is entirely different. The committee has been wise in recasting the form of the standard rules of the Association, and in doing so has adopted a different wording and arrangement than that previously used, and one which is much superior to that in the former code. This difference can, perhaps, be more clearly expressed by saying that the new rules applicable to city practice, or those through Rule 72, comprise about 4000 words, with an addition of about 2000 words on interurban signaling, while the old rules consisted of about 13,700 words, with no special rules for interurban roads except about 900 words on the subjects of semaphore and color signals.

This condensation has been accomplished principally by omitting a large part of the detail instructions for inspectors, depot masters, conductors and motormen. Instructions of this kind, while advisable in the case of individual roads, are usually not of such general application that they can properly form a part of a national code, and the members of the committee have done wisely, in our opinion, in eliminating them. The committee might even have gone a step farther and omitted for the same reason a few of the present rules, such as possibly the one providing that the car shall stop only at the farther corner, and that passengers shall not be permitted to ride on the steps. The practice recommended in each case, while it is the one generally observed, is not of such uniform adoption or so essential to safety in operation that it should be required of all companies. We assume, however, that the rules were drawn up to represent the best practice in the opinions of the members of the committee, and they are certainly worthy of the highest commendation for their conciseness, clearness and the operating methods which they prescribe.

Perhaps, the portion of the rules which will attract the most

attention are those which are classed as "interurban rules," and which relate to flag, lantern and whistle signaling. In this department of the rules the committee has very closely followed the practice of the American Railway Association, adopting the method of signaling employed on the steam railroads. The only important departure from the steam railroad rules is in spacing of trains where no block signal system is in use, which in the steam railroad rules is 5 minutes, while in the electric railroading rules the space limit of 1 mile has been adopted. There is no doubt that, as developed during the discussion on this subject at the last convention of the New York State Street Railway Association, a space limit is safer than a time limit; but whether the space limit can always be followed in electric railway work is another question. We do not presume the committee intends to have this rule applied to single-track roads with turnouts where double-headers are used, as the rear car must catch up to the forward car at the turnout, and, whether it is good practice or not, must usually follow the forward car within a much shorter distance than a mile, unless the schedule is greatly to be disorganized. Nevertheless, such a rule is undoubtedly advisable under many interurban conditions, and on a double-track road on which high speeds are attained the limit laid down by the committee is none too large. The fact that some of the longest high-speed roads in the country were represented on the committee is indicative of the satisfaction that this code of signal rules gives. It will be of interest, too, to mention that the committee had several conferences with the State Railroad Commissioners of New York, and that the rules as reported are satisfactory to these officials. This endorsement of the work of the committee should be gratifying to its members, and give confidence to operating companies which adopt them that they represent the most advanced practice.

The Association is to be congratulated upon the report of the committee on rules, and we believe that the advance made in the subject this year will be of the greatest benefit to the industry in establishing a national code, which is certainly greatly needed.

Alternating Current Distribution

We have already covered in substance much of the matter contained in Mr. McCulloch's valuable American Street Railway Association paper, but certain portions of it seem to call for additional comment. On the whole it is a very discreet and judicious study of an interesting and difficult problem, and admirably summarizes the present state of the art. The summary of present practice in power station construction is particularly instructive. The salient points in which the designs of to-day vary from those of a few years since are the almost universal use of coal-handling machinery and mechanical stokers, the greater relative importance of the boiler room in the modern station, due to large generating units, particularly turbines, and a better practice as regards steam pressures and condensation.

It takes a very short memory to run back to the time when compound condensing engines were regarded as a fad, quite unworthy of the "practical" (otherwise ignorant and untrained) engineer. Even now a relic of similar tradition is found in the common prejudice against triple-expansion engines. When one considers the design of big city power stations the comparison should not be between compound engines and turbines, but with triple-expansion engines at 200 lbs. pressure and above and the highest practicable superheating. Such an engine, as foreign tests have very plainly shown, are capable of reaching an efficiency which is considerably beyond anything yet reached with turbines. And while the turbine has a very fine efficiency over a wide range of load, this property is not a particularly valuable one in the class of stations here under discussion. If the turbine was available for direct-current generation, its high and uniform efficiency would make it invaluable and unapproachable in small stations, but on the immense scale of urban central stations, with relatively steady load, this advantage is of comparatively minor importance. There is, however, a considerable class of stations to which the steam turbine is singularly well suited, but its usefulness in any particular case must be determined on its merits and not assumed as a general and established principle.

Mr. McCulloch's tables of data upon alternating power stations is very well worth study, as showing almost every phase of current practice. Perhaps the most instructive portion is that which gives a clue to the average size of the sub-stations in use. It is observed from a glance that not a few of these are of a size that precludes any considerable gain over separate power stations so far as mere size is concerned. As we have more than once pointed out, when a huge central station is subdivided into independent units of approximately the size of its sub-stations, the ordinary operating expense would not be greatly changed by abolishing the sub-stations and replacing them by the "independent units." The gain by aggregation hinges on the cost of real estate and of fuel handling and water for condensation. It would be of great use to engineers if pretty full data were at hand on the relation of these specific charges to the total power expense in stations operated under various conditions. Cost of power, as usually given, includes no fixed charges, and the cost of handling fuel is seldom separated from the general cost of fuel.

We are inclined to think the estimate given of the efficiency of the alternating transmission system in the paper under discussion is somewhat optimistic. To begin with it omits any consideration of the raising transformers, which are, it is true, seldom used in city stations, but are likely to be as voltages increase. Then 95 per cent is a rather stiff figure for converter efficiency under practical working conditions, although it can conceivably be reached, and we very much doubt whether the losses in an actual working system from the generator switchboard to the direct-current bus-bars of the rotary can fairly be estimated at less than about 15 per cent. Often they will be more than this figure, as Professor Goldsborough's recent results show. The greatest chance for saving, in fact about the only chance for coming out square on the power bill in transmission to large sub-stations, lies in a possible reduction of the general direct-current feeder losses. The exact relation between the number of sub-stations in a given area and the total amount of copper required outside of the trolley wires is not an easy matter to figure out. It depends on the nature of the network, and particularly upon the wandering of the load, which requires a somewhat increased total capacity of sub-stations as their number is increased. It is, however, probably safe to say that the total feeder copper for a given loss may vary nearly inversely with the number of feeding stations. If sub-stations with rotaries were more nearly automatic in their operation their number could be so increased as to gain very materially in efficiency or in cost of the feeding system. This phase of the matter has not received the attention which it deserves. We do not think that the subject of supply by alternating current versus supply by direct-current stations is one that admits of being judged by definitive laws. On the contrary, the choice of the most economical system in a given

case demands a deal of skill and finesse. The present fashion is for sub-stations with rotaries, but as we have many times remarked, data on the actual performance of such systems are rather scant. We wish the Metropolitan system and the Boston Elevated system, the types of the alternating and direct-current feeding systems, would come to a friendly show-down for the benefit of the street railway fraternity at large.

Freight and Express Service

The paper presented on this feature of interurban electric operation by J. B. McClary contains not only the experience of the company with which the author is connected but that acquired by a large number of properties throughout the country, especially in the Middle West. Mr. McClary has gone very thoroughly into the investigation of this subject, and during the last year has communicated with most of the railway managers who have given it any consideration whatever. In response to about 500 inquiries for data, replies were received from 182 companies, and the information contained therein has been very carefully compiled and classified, so that the following summary may be said to represent fairly the present status of this industry.

The 182 roads from which reports were received included 71 that are now engaged in this traffic, and 111 that have thus far confined themselves exclusively to the transportation of passengers. Of the 71 roads upon which freight is carried 45 admit that it is profitable and that they contemplate further extensions along this line, and only 9 report that while they are engaged in this work they do not think well of it. Of those not now carrying freight and express 37 look upon it as a most attractive feature, and 17 are convinced that it could be done profitably. Special considerations have in some cases kept the trolley companies from invading this field when they might do so with profit.

Mr. McClary presents some interesting data regarding the character of the service which is given and the results as they appear to the railway manager. Thirty-five roads use the steam railroad classification of their States or railroad districts, others have rate sheets of their own based upon local conditions and generally much lower than the steam railroads. Thirty-eight have depots at terminals and along their lines, and nine say they have none. Eighteen handle steam railroad cars on their line, but this cannot be done in many cities and towns, excepting on the outskirts and suburbs, where factories and mills are located. Fifty roads have separate freight cars or trains, three have trailers attached to passenger cars, and eight handle packages on passenger cars. Several have tried the experiment of running wagons in the principal towns along the route to collect parcels from shippers and to deliver them to the consignees. It was thought that this would prove a great inducement, but the reports seem to indicate that thus far at least it has not proved a profitable undertaking. It seems to be the consensus of opinion that a service of this character should be organized and conducted by a local express company entirely independent of the railway organization, although, of course, there is no reason why it should not be controlled by the same interests; in fact, it has been deemed advisable to have the stockholders of the railway company and the express company identical, in order to insure retaining the business when it has been developed to considerable proportions. Five cases of this kind are reported in the paper under consideration, but there are doubtless many more examples of this practice throughout the country. Under such an arrangement it is usual for the express company to pay the railway company a certain amount for cars or space, or a percentage of the gross receipts, thus relieving the railway of all responsibility excepting merely the hauling of the goods, while the express company attends to the minor details, for which its organization should be better fitted.

Many of the roads are using a ticket or tag system, which simplifies matters and admits of much more economical operation, especially where the volume of business is comparatively small. These tags are sold in large quantities to patrons of the company, and each has a certain valuation, so that packages of different sizes may be sent merely by attaching a ticket representing the equivalent of the rate to carry it to its destination. The practice of several roads in this particular is described and illustrated very clearly, and their methods of accounting and rates for service shown.

It is evident that the interest in this subject is constantly growing, and the reports obtained by Mr. McClary warrant the assumption that the railway companies are working upon a much better basis now than at any former period, although it is apparent from the reports that many are carrying on this branch of the service at considerable loss, and others are still adhering to slip-shod methods, which must of necessity prove expensive and retard their progress. This, in some cases, is due to the fact that the facilities are inadequate, but in many it is simply poor management. In any event it must be conceded that it is the part of wisdom for the manager to look carefully into the problem before committing his company to such an important and radical innovation. In the first place, the investment required for properly developing such business, and then for handling it after it has once been established, is much larger than is usually anticipated. This has brought many of the pioneers in this department to grief, and it explains to a considerable extent the failure of some of the companies mentioned herein. Again, the possibilities of certain fields had been overestimated, and some were already occupied by steam lines having much better facilities than the electric companies could possibly hope to command at the outset. This handicapped the newcomer, and oftentimes the failure of the service in the earliest stages condemned it for all time with the shippers who were disappointed. These are only a few of the reasons which have made the freight and express business a ticklish proposition for electric railways to undertake. Experience in this branch, although dearly bought, has proved extremely valuable to those who are now engaged in developing important properties. We are not prepared to go as far as Mr. McClary in asserting "That electric railways can serve the public in transporting passengers to their satisfaction is proof that they can surely serve the same people in hauling freight and express matter, and do it safely and profitably." On the contrary, they are entirely different propositions and depend upon different conditions. But we do believe, and we think that it must be admitted even by those who are not favorable to this innovation, that there are splendid opportunities in this line, as are exemplified by the experience of several of the companies operating in the vicinity of Saratoga.

The Status of the Steam Turbine

Mr. Emmet's Association paper is a most interesting account of the evolution and capabilities of the Curtis turbine, which has already forced its way into commercial prominence. The turbine generator, as developed by the General Electric Company, is certainly a very striking and successful machine, and the probable effect of this development on future central station practice is a highly interesting subject of discussion. As between the Curtis and other forms of steam turbine it is not

our purpose to institute comparisons. In due season, when turbines have been long enough in use to furnish adequate data, such a comparison would have force, but at present the whole class of turbines rather than any one form is on trial. The Curtis machine presents many striking features of design, particularly the vertical shaft and electrical valve gear. The desirability of the former feature is a question of fact rather than of theory, involving the use of daring mechanical expedients, which must be judged by their results after considerable experience. We see no reason why the vertical shaft design should not be successful, considering the nature of the lubrication, but whether it presents any material advantage practically over the horizontal shaft turbine, save in the matter of floor space, remains to be seen. And considering the fact that turbines are not yet adapted to use with direct-current dynamos, which must needs be located near the center of load, we are inclined to think that economy of floor space is a matter to which overmuch weight is at present attached. The electrical valve gear, too, must be judged by its results—it certainly is not vital to the success of the turbine, and if it should be advisable to turn to a purely mechanical gear the ultimate usefulness of the turbine will be in no way impaired.

The main question is the final economy of the turbine as a prime mover for general purposes. It has many strong points in its favor—the very high mechanical efficiency, the ease of using superheated steam, and the high rotative speed so well adapted to the direct connection of alternators. The low frictional losses insure high efficiency over a wide range of load, and the whole combination is most compact and easy to operate, which tends to keep down the cost of power. On the other hand, the turbine runs at enormous peripheral speed, which reduces the factor of safety. Still more tremendous, the condensation must be exceptionally perfect to insure high efficiency, and the actual working efficiency is not yet definitely known. We greatly regret that Mr. Emmet was unable to give the final results from the tests of the splendid 5000-kw unit installed in Chicago, which would have thrown a great deal of light on the economics of the situation. It has already been shown by numerous tests that turbine generators of some hundreds of kilowatts capacity are capable of remarkable results, quite comparable with those attained by first-class compound condensing engines. But how about the larger units? Are they able to cope in point of steam consumption with high-pressure triple expansion engines, working with high superheating and giving results like those obtained from the Sulzer engine noted in Mr. Dawson's recent paper? Unless they are so able the bitter necessity for keeping down the fuel bill will tell somewhat against them. Good as the turbine is we are by no means convinced that the reciprocating engine is a dead dog yet, and the competition now in evidence will have the result of improving the economy of both classes of machines, for which the purchaser should be duly grateful.

We think, also, with one of the speakers at the session on Thursday, that they err who underestimate the capabilities of the gas engine. It is a grievous mistake to judge these engines by the wheezy little abominations with which Americans have until recently been contented. It is highly probable that both the first cost and efficiency of the gas engine will be greatly bettered in the near future, and we do not believe the depreciation on the large units will be so serious as many believe. As the price of fuel rises it looks now as though we should be treated to a magnificent triangular competition between gas engines, steam turbines and improved steam engines, and the higher the cost and the lower the rate for money the less first cost will count in the game.

Meanwhile, the turbine has unquestionably a great field before it. In certain lines of electrical and other work its known economy is ample to insure it precedence and to give it a very material advantage over all competitors. If it shall prove feasible to arrange the turbine for direct coupling to continuous-current generators, the scope of turbine work will be enormously widened, and this step in advance, though difficult, is one which should be taken if possible, and taken at once. Meanwhile, there will be accumulated in the very near future a vast store of practical experience which will show definitely the uses and limitations of the turbine. In any event we can clearly see that there are to be notable improvements in the economy of prime movers within the next few years, to the great advantage of their users. We applaud the skill and daring of the engineers who have already brought the turbine to so promising a position in the art, and wish them the best of luck in the struggle for supremacy upon which they have now fairly entered. They cannot be definitely repulsed, for part of the field is already assured them, and every hard-won gain will be a gain for the world as well. Improvement in prime movers is of so great importance in the world's industry that he who makes it is a benefactor.

The Supply Dealers' Association

For some time past there has been a feeling on the part of many of the manufacturers who make annual exhibits at the Street Railway Association, as well as that of many of the members and leading officials of the Association itself, that the interests of both could be promoted by an intelligent plan of co-operation between the executive committee of the Association and the supply men. Heretofore all of the work of preparing for the convention and all the details relating to the exhibits has devolved upon the officers of the Association or upon the local committee appointed by them. The supply men attend the conventions upon exactly the same basis as they did ten or fifteen years ago, when their number was one-half or one-quarter what it is at present. They are practically the guests of the Association and are permitted to attend the meetings and participate in all of the excursions and other entertainments which may have been provided. The only difference in treatment between a supply man at the convention and a delegate is that the former, not being a member of the Association, does not have the right of the floor during debate and that he has to pay no annual dues.

The representatives of many of the supply houses have felt for a long time that they would be glad to relieve the Street Railway Association of much of the detail work connected with an annual convention, or in some other way to assist in the success of the meetings to which they are invited. While this sentiment has been respected, it has been accompanied, in the minds of many of the members of the Association, with a feeling that the Association could preserve a more independent course if all arrangements for the annual conventions were carried out directly by its own officials. This idea has to a considerable extent passed away, and it is now the opinion of many members of the Association that an association of the supply men, if conducted along the proper lines, would be advantageous in affording a means for friendly co-operation between those who make the exhibits at the annual conventions and those who inspect them. We give the details, elsewhere in this issue, of the appointment of a committee at a meeting of the supply men at Saratoga to organize such an association and confer with the executive committee of the American Street Railway Association on the subject.

PROCEEDINGS OF THE SARATOGA CONVENTIONS

THE AMERICAN STREET RAILWAY ASSOCIATION

THURSDAY'S SESSION

Vice-President Ely called the meeting to order on Thursday, Sept. 3, at 10:15 a. m.

The Vice-President—The first business which we shall consider this morning is the matter which was under consideration at the time of adjournment yesterday—that relating to the carrying of the United States mail. The chair understands that Mr. Grant has a resolution to offer on that subject.

Mr. Grant—Mr. President, I offer the following resolution:

Resolved, That the president of this organization be empowered to appoint a committee of three to confer with the Postmaster-General in relation to compensation for the carrying of mail by interurban cars, for mail in pouches and mail cars in cities; said committee to enter upon its duties forthwith and report to the secretary of the Association immediately upon the completion of its work.

The resolution was seconded and adopted.

The Vice-President—We will now take up the paper by W. L. R. Emmet on "Steam Turbines."

Mr. Emmet's paper is published in this issue on another page.

The Vice-President—Gentlemen, the paper is open for discussion, and we are all very much indebted to Mr. Emmet for the valuable paper which he has presented to the meeting. I will ask John I. Beggs, of Milwaukee, if he will kindly open the discussion.

Mr. Beggs—I did not expect to be called upon to discuss this question of steam turbines—the request to do so is a surprise, yet it is a subject I am deeply interested in, as I believe is also every other member of this Association who is required to spend such a large amount of money as we are called upon to do in producing steam. I have listened with a great deal of interest to Mr. Emmet's paper, having discussed the subject personally with him to some extent, and having a great deal of confidence in Mr. Emmet's engineering skill and in his predictions. It was my pleasure and privilege some years ago to be associated with Mr. Emmet.

I believe that engineering circles generally are waiting with a great deal of interest the results of the tests now being made in the power plant of the Commonwealth Electric Company, of Chicago, upon the first 5000-kw turbine unit that has been installed. I went to see the turbine during the time of its construction, and I am very hopeful that the prediction of the General Electric Company that steam turbines would come into quite general use, and which they have given us reason to expect might be realized, is about to be fulfilled. I have had considerable doubt about this at times, for the reason that some of the most eminent, I may say those among the very first engineers of this country, those whose reputations have been tested by almost a half century of work, whose experience is large, have given expression to a doubt as to the successful operation and economy which would be shown by the steam turbine. Being pretty closely brought in contact with some of those engineers, and having discussed the question with them from time to time in the past two or three years, I naturally have had greater doubts upon the question of the steam turbine than I might otherwise have had. But I am hopeful that the predictions now made for the steam turbine are about to be realized. I do not see, however, that there is anything we can do except to wait until the curves and tests which Mr. Emmet indicates are going to be made have been made and we have the results before us.

In this connection I desire to throw out a suggestion as to whether or not, about the time that the steam turbine has reached the stage of perfection suggested by Mr. Emmet and the manufacturers of it, there is not a new power now looming up which may as far surpass the steam turbine as the steam turbine surpasses the reciprocating engine, at least so far as the matter of economy goes. I refer to the gas engine. We have given considerable thought to it for the last two years. If the predictions made for the gas engine, in using gas now produced as by-products, or in using the ordinary illuminating gas or producer gas from plants installed in connection with our own steam plants, are carried out, we can cut the cost of a kilowatt-hour of current, no matter how high the economy of the plant may be, in half, and possibly reduce it two-thirds in cost. I think this is an important question. There is one large engine building concern in this country which has recently acquired the right to build in this country the Nuremberg gas engine. They propose to have one of these engines installed in St. Louis twelve months hence. There is also a 3000-hp gas engine to be direct-connected to a 2000-kw generator, which it is likewise proposed to install in the St. Louis Exposition. In the Northwest, where coal is such a factor that we are paying $3.50 for 2000 lbs. for screenings, which four years ago cost us only $1.70, you can appreciate that any device which will bring down the cost of producing steam is of great moment. The element of power in the cost of operating a car mile to-day becomes a very serious question, and if the cost of generating the power can be cut in half, and that without the use of a steam power plant, anything which will tend to that end becomes a very important factor.

As I said at the outset, I appreciate very greatly the labor Mr. Emmet has personally put on this question, because he has devoted two or three years of his time almost continuously to the matter of steam turbines. I also appreciate the efforts of the General Electric Company to reduce the cost of steam turbines—that is one of the important elements in the proposition. Some of you gentlemen will recollect our discussion at Detroit, and when the paper was read at that time the author of it, I have no doubt inspired by the manufacturers, was generous enough to propose to give us the steam turbine and the generator with it at a cost not exceeding that of the reciprocating engine and the generator. I remember at that time that I raised the point that the cost of the production of that unit must be very greatly under that of a reciprocating engine and a generator. I am pleased to state that we can now buy a steam turbine unit, such as has been described this morning, the entire unit, for about the cost of a reciprocating engine. That much progress has been made in eleven months. The paper presented at Detroit was by a representative of the Westinghouse Company, building the Parsons turbine, and I took direct issue with him at that time that the users of this apparatus were entitled to some of the saving that was effected in the greatly reduced cost of producing the apparatus. I do not think I am divulging any secret when I state that the cost of this unit is greatly reduced; in fact, inquiries which I have made, of recent date, indicate that I can buy a steam turbine unit, with generator complete, at about the cost of a reciprocating engine of equal capacity; of course, with the slower speed of the reciprocating engine the cost of the generator becomes one-half of the engine itself—in other words, the cost of the generator on a reciprocating engine, running 75 r. p. m., is about one-half the cost of the engine. That amount is saved in the turbine, and that is important. I may say further, that one element which will come up in the question of the use of gas engines will be the greatly increased cost of the engine itself. It is a question of commercial calculation, as to whether the greatly increased investment will be saved in the greatly reduced cost of producing power.

The Vice-President—This is an interesting subject, and Mr. Beggs' remarks are of much value, and I hope that others will take part in this discussion. Referring to the very interesting subject of gas engines, of which Mr. Beggs spoke, I might merely allude to the fact that in the new plant of the Lackawanna Steel Company, at Buffalo, by apparatus quite simple in its nature, the escaping gases from stacks of the blast furnace and the ovens are recovered, washed and conducted to the engine room, where they are used as fuel, costing nothing to the plant, yet supplying fuel for an installation of 40,000-hp of gas engines. I have seen the plant several times. The engineer in charge is a Russian—of course, you all know that in the matter of gas engines, their manufacture and use, we are far behind Europe. I think the units are of 2000 hp each, perhaps there are some of 5000 hp, but my impression is that most of them are 2000-hp units.

Mr. Beggs—I wish to say a word further. It is a very important point, particularly to investors in these properties. We have sometimes on that account to look at matters differently than from the purely operating standpoint of these plants. The tendency of the time is for consolidation of electric railway and electric lighting properties in the various cities. It is a natural combination in the interests of the public; the public gets the benefit of it. There has been formed in the West a large manufacturing establishment to produce coke for domestic use, furnace and foundry use. This company is building eighty ovens at the present time, and has some 28 acres of land, and in the manufacture of the coke their gas becomes a by-product.

E. G. Connette, Syracuse—It occurs to me, Mr. Chairman, that while the discussion of the gas engine is interesting, the real subject of discussion is steam turbines, and that is what I think the members of the Association would like to have considered.

The Vice-President—I was about to suggest that perhaps it is not quite correct to enter upon a discussion of gas engines at length, when the subject of steam turbines is up and such a fine paper upon that subject has been read to us.

Mr. Connette—That is what I refer to. I suggest, however, as the gas engine question is a very interesting one, that the executive committee might take cognizance of the fact and have the matter brought up at the next annual convention for discussion; but I think it would be proper, in deference to Mr. Emmet, who has presented this able paper, that we should discuss the question of steam turbines.

C. O. Mailloux, New York—I would claim your indulgence for a few minutes of your time for the purpose of discussing the relation between the gas engine and steam turbine, although it has just been pointed out that a discussion of the gas engine is not exactly relevant to the subject before the house; but it seems to me, since the matter has been brought before the house, that I would be negligent in my duty to my fellow delegates in this meeting if I did not also contribute the information which I have in regard to the relationship or comparison between the two. I have had occasion to investigate the question of gas engines, as well as the question of turbines, in my professional capacity to my clients, and I think I can sum up my view of the applicability of the gas engine by the old, trite saying, "Circumstances alter cases." I find it makes all the difference in the world whether you get gas for nothing or have to produce it. In a case where the gas costs nothing, as at Buffalo, or in places similarly situated, or the gas is obtained at a cost which is below 20 cents per 1000 cu. ft., I think gas engines will undoubtedly be more economical, or at any rate as economical, as steam turbines, especially when coal is relatively high. But when the power producer is compelled to produce his own gas the situation is quite different. I had occasion to institute an interesting comparison recently in the case of a plant of 15,000 kw, where I received estimates from a concern that offered to do the entire work by gas engines—the same gas engine as is used in Buffalo—and where I also had estimates based upon the use of steam turbines. It is for that reason I thought I would speak of this comparison, since it is a case in point. I found as the first point in the comparison that in the gas engine system the largest unit was about 2000 hp. It would be necessary to have something like ten units, and, therefore, a larger building would be required for the plant, and a larger maintenance account, because the number of units is greater. The gas engine is not a simple device and has a certain maintenance account. I found, also, in order to get the economy promised to me by the representative of the system, that I would have to go into the chemical business—in other words, I was told that out of the combustion of the gas or manufacture of the gas, I would get certain chemical by-products, and would have to go into the chemical business to sell them. I understood that in an installation of 3000 kw there would be something like $50,000 a year or more recovered in the form of chemical by-products. The principal objection was that it required an initial outlay of over $1,000,000—that was the crucial thing. If you consider the interest upon the extra initial investment—the depreciation, insurance, taxes and all things which constitute fixed charges, you will find you must have greater efficiency and economy in your coal to come out even. In that particular case I found that instead of coming out $100,000 ahead as against the steam turbines, we would be more nearly that much behind each year. It is needless to say I did not advise my clients to adopt the gas engine plant in that case. On the other hand, I had a case of a pumping plant in Mexico, where coal is $15 a ton, delivered on the mountain 700 miles from the nearest coal mine. I found in that case a gas engine, operated with producer gas, though it might cost more than the steam turbine, would pay for itself in something like three or four years. The pumping duty is constant and it lasts 24 hours a day. There is an ideal load curve, which is an exactly suitable condition for the best economy to be obtained by the use of the gas engine.

I also had occasion to investigate a case in Arizona, where the power was to be used for lighting and traction, and found in that case that the cost was very nearly even. The company was one which produced gas as well as electricity. They make the gas and could procure it at the lowest cost, but after a careful investigation they decided to adopt steam turbines. Further investigation in the case shows that in the present state of manufacture the cost per kilowatt of the gas engine outfit is at least twice that of the steam turbine outfit. I have had a station operating under my direction which has been installed for a year, running one unit per year, and for the last five or six months running two units of 400 kw each. The results have been extremely satisfactory and we have recently ordered two units of 3000 kw each. I do not think I am telling any trade secrets if I state that the cost per kilowatt for the last two units ordered is under $28 for the unit installed, not including the piping or condensers.

The great point in the steam turbine which appeals to me, as the result of my experience, is that it enables the station equipment to be greatly simplified, not only in detail, but also in those things which eventually tell on the maintenance. You have fewer parts; there are no adjusting parts and various other things of that kind are much simpler in the steam turbine. But there is one other feature which is, I think, of the greatest utility, and that is the ability to apply superheat in the use of the steam turbine. I pointed out in the discussion last year that there is no limit to the superheat that you can apply in the case of the turbine; there are no conditions of lubrication to impose limitations; no packing, nothing to prevent you from applying all of the superheat possible to get. The steam turbine is related to the question of the design of the plant in another way—heretofore we have been accustomed, when we

wanted a higher efficiency in our steam-producing outfit, to consider the introduction of fuel economizers. We have also been obliged to resort to extremely high steam pressures. We find with the steam turbine, allowing for ample superheating, with a moderate steam pressure, 150 lbs., which is high as compared to ten years ago, but low as compared with the practice of to-day—with a steam pressure of 150 lbs. and superheating up to 600 degs.—it is possible to get as good economy as with, perhaps, 175 lbs. or 180 lbs. of steam pressure, using fuel economizers. The cost of the station is less, the expense of running is much less, and, all things considered, the cost of producing power is much reduced.

The only possible drawback which I have thus far had brought to my attention connected with the steam turbine, is the fact that it is not economical without condensation, and in fact without very good condensation. One needs with the steam turbine a very good vacuum, and I have experienced some difficulty hitherto in getting a satisfactory vacuum; but others have attained it, and I have no doubt that I shall be able, by slight changes which I contemplate, and which I shall introduce in new apparatus, to overcome the difficulty. I feel convinced that the design of the condensing outfit requires much more care and involves some more cost, perhaps $3 or $4 per horse-power, for the condensing outfit of the turbine than for the condensing outfit of the ordinary engine. I know from the results obtained that there are no difficulties which lie in the way of carrying out perfectly a system of condensation giving results which would lead to the best economy; and I do not know of any other respect in which, even in the present state of the art, the steam turbine is inferior to the other method. When you consider the saving of space in the building, the reduction in materials, oils, supplies, etc., there is no doubt that if the pounds of steam were the same there would be a saving in the use of the turbine. In conclusion, I will say that while I was a strong partisan of the steam turbine last year, as the result of my experience during the past twelve months I am to-day a stronger advocate of the steam turbine than ever.

J. G. White, of New York—I assume many of the gentlemen are in practically the same position as myself in reference to this important subject. Probably most of those who have given the subject any consideration appreciate the necessity of high vacuum, and also the advantages of reduced space, saving in initial investment, oil and other supplies; but what most of us want to know is what can be depended upon as to reliability? Can we install steam turbines to-day and be certain that they will start off without serious interruption, or at least that after a few weeks of operation they can be depended upon to take up the regular load and carry it day after day? On this particular point I wish to ask a question of Mr. Emmet and Mr. Mailloux. Mr. Emmet, fortunately for all of us, does not claim that either he or his company is infallible. He is frank in acknowledging the developmental defects which must come into any large new experimental work, and for that reason all of us have a great deal of confidence in any statement made by him. Mr. Emmet talks very frankly to us, when he is speaking to us informally, and it may be that on such occasions he makes statements which he would not care to have published; but I wish to ask him what can be depended upon in the steam turbine as to reliability? I understand that at Newport there are two turbines in operation, the original one of which gave considerable trouble in its experimental stages, but is now said to be on a regular working basis and running with considerable regularity, and also that there is a second unit, which I understand is in operation and running satisfactorily. I also ask Mr. Mailloux as to how many stoppages there have been during the last sixty days, or some definite period, in the plant to which he referred. My object is to get a statement of what we could naturally expect from an installation of two, three or four turbines, as to perfect reliability of service.

The Vice-President—I will ask Mr. Emmet, in answering Mr. White's question, also to close the discussion as far as he wishes and say anything further he desires upon the subject.

Mr. Emmet—We have had experience with two turbines, one of 600 kw in Schenectady, which is of the older type, and a vertical shaft turbine at Newport, which is of the newest type. The machine at Schenectady involved no radically new or peculiar mechanical devices, and was put in service two years ago, and has run almost continuously without having any interruption of service or trouble of any kind. The machine located at Newport has carried its load continuously, and it is only through an excess of conscientiousness that in the paper I refer to any of the troubles we have had, because there have been practically none which interrupted the service. We have made a record of all stoppages, and I think there were three stoppages which interrupted the service in Newport between June and September, and the longest stoppage was less than 20 minutes. This, however, was inspired by a certain amount of trouble going on in the valves, which had to be corrected from time to time. However, the Newport machine, as it stands, if it had to be kept in its present condition, without improvement, and simply maintained by the renewal of those valve parts as they give out, would be maintained and run at a small fraction of what it would cost to maintain any reciprocating engine of equal capacity.

In comparing turbines and gas engines I think Mr. Mailloux's statement of the comparison is a very just one—it is purely a question of the cost of fuel; that is, with the turbine in its present state of development. The actual fuel economy of the gas engine in its greatest state of perfection is greater than that of any steam engine heretofore produced. However, the very highest results obtained so far with steam turbines, in the matter of fuel economy, that is, actual consumption of combustibles, are not so far below the thermic results obtained from gas engines. The very best gas engine that has ever been operated on a theoretical basis produced a fuel economy something like 32 per cent total work units or mechanical equivalent from the heat in the coal. The best results produced with highly superheated steam under favorable conditions I cannot exactly quote, but the thermal economy of the steam turbines would be something like 23 per cent or 24 per cent. The gas engines which actually operate on commercial basis do not run anywhere near the engine which had an efficiency of 32 per cent. They run nearly 26 per cent or 27 per cent, and while they compare favorably with ordinary engine performances, they are not very much in advance of the best steam turbine performances. Furthermore, the cost of the gas engine is, as Mr. Mailloux says, possibly twice the cost of the steam turbine unit. If, however, the steam turbine unit is credited with the possible simplifications which surround it, the difference will be much greater. The steam turbine needs no heavy foundation. A power station for boilers and turbines could be floated on 3 ft. of concrete on any salt meadow, and a like inexpensive structure made to shelter it, and its efficiency be as good as if it were installed in the most expensive station. There will be simplifications in this direction—the ideal turbine station which will be far removed, maybe, from the city, will be laid out more on the lines of a coal yard, or any similar place, than on lines where a large and expensive building will be required. On this basis the difference of cost will be greater than Mr. Mailloux stated, and even now, if we capitalize the difference in fuel consumption between the two engines, it will not cover the first cost.

Furthermore, the turbine is ideally simple and the gas engine is very complicated. Everyone knows how simple the steam turbine is in a proper state of development. The only experience we have had in this country with steam turbines is with very new steam turbines. The troubles now experienced, we think, are of a purely temporary character. The

steam turbine, as it will be in six months from to-day, can be operated by a child indefinitely, virtually without maintenance. The wear and deterioration is nothing and the whole plant can be reduced to an ideal condition of simplification. Against this we must consider a gas plant, in which gas must be produced, and in which an immense maintenance cost goes on in connection with deterioration and renewal of converters and mechanism which must be attended to—the maintenance of engines twice the size of steam engines, twice as complicated and less perfectly lubricated. The gas engine is a gasolene automobile on a large scale, and perhaps some of you have had experience with those machines; whereas the steam turbine is as simple as an ordinary grindstone. Naturally every one is interested in the development of the gas engine, and we all realize that some day, if coal continues to increase in cost, and gas engines are improved at the same rate that the turbine has been improved, the time will come when fuel economy will be the only consideration and gas engines will come into more extensive use. I think, however, the introduction of a steam turbine is certain to give the gas engine a long set-back.

Mr. Beggs—I rise to a question of personal privilege. I presume I should feel rebuked by our good friend Mr. Connette's remarks. I do not, however, and I have no apology to make, either to the Association or to the writer of this very able paper upon steam turbines. I think it is perfectly germane to this question and vital to it that in considering the methods by which we shall produce electric current, that if there is any other question directly connected with it, it is important this Association should know it and give consideration to it at this time. The closing remark of Mr. Emmet is the very point I wanted to bring out before this convention. It is only eleven months ago that we were told the cost of a steam turbine unit was double what it really is to-day. What brought that about, gentlemen? It is obvious, from discussion, it is because of competition between the builders who have acquired the right to construct steam turbines in this country. With regard to the gas engine in this country, we are in the same position that we were in three years ago with respect to the steam turbine—we scarcely know anything about it. Even the builders of the steam turbines to-day question whether it is not more economical and more advisable to install units of 2000-kw capacity than units of 5000-kw capacity. There is a 3000-hp gas engine being built at the present time for installation in St. Louis. I feel that it is becoming a question with many of us whether we get all the benefit we should from our meetings. If we are not to be at liberty to discuss the papers which are read at the meeting in any and all directions that will throw light upon the subject, we shall fail to get the full results that should follow the discussion of subjects before this Association.

The Vice-President—Mr. Beggs misunderstood the chair, and lest that misunderstanding may be general, let me say that it seems to the chair quite proper that there should be the widest discussion on all these subjects and the comparative merits of these engines should be gone into at this time. My thought was that while the discussion of the paper was up, and until the author of the paper made his final remarks, it might be well to confine the discussion to the subject of turbines at the present time. I think, however, that the discussion should be as wide as the field of the various classes of engines will permit; but it seemed to the chair that we should at first discuss the subject directly before the meeting.

Mr. Beggs—It was my idea to arouse the manufacturers of gas engines to the necessity of putting forth their best efforts to improve those engines. I also desire to put on the record that I had no intention of any discourtesy toward Mr. Emmet in discussing the question of the gas engine, because I opened my remarks by saying there is not a man in the engineering field in the United States to-day for whom I have greater respect and admiration, having been associated with him ten or twelve years ago as the engineer of the department of which I was the head.

Mr. Mailloux—A question was asked me by Mr. White, and if it be the pleasure of the meeting to have me answer the question, although the discussion has apparently been closed, I shall be happy to do so.

The Vice-President—We shall be glad to have you answer the question, Mr. Mailloux.

Mr. Mailloux—I shall confine myself merely to a statement of fact. The first 400-kw unit was ready some time early in the winter. We were expecting to run the turbine light on Saturday, and to put it in regular service on Monday. We started it up a little on the morning of Friday. That afternoon we had a burn-out in one of the units that was carrying the load. It left us entirely unprepared to carry on the work of the station unless we pressed a turbine into service. Even though the packing was not finished, we started the turbine and have not been able to spare it since. It has not stopped except during periods of light loads, when it became possible for us to dispense with it, that we might complete the piping and adjustment of the unit. If any trouble has occurred with it, it must have occurred since I left New York. So far as I know there has not been any interruption whatever. We experienced a little difficulty in paralleling the two units, there was a slight hunting or some disturbance due to imperfect belting, but it was remedied. At first the attendants were careful to exercise a strict supervision of the turbine, and remained around the unit while it was running, feeling they should be there in case of emergency, but they have become accustomed to the machine and do not feel it is necessary to be there so much and the unit is left to take care of itself. In closing, I want to state again, to save Mr. Beggs' feeling, I am not at all averse to the use of gas engines myself. I was careful to state that "circumstances alter cases," which is the keynote of the whole question. I also stated that there was one case, that of a mountain plant, in which I recommended a gas engine.

After the conclusion of Mr. Mailloux's remarks there was a general discussion on the question as to what extent the proceedings of the convention should be given to the technical press for publication before the remarks were revised by the various speakers. The enterprise of the technical press in publishing the discussions was commended. Some of the members thought there might be a freer expression of opinion if the report of the proceedings was not printed before revision by the speakers, and some members expressed the opinion that a member should have the privilege of having expunged from the record any remarks he did not wish to have printed. The discussion was participated in by W. Worth Bean, St. Joseph, Mich.; L. E. Myers, Peoria, Ill.; H. H. Vreeland, New York; C. C. Mailloux, New York; G. Tracy Rogers, Binghamton, N. Y.; John I. Beggs, Milwaukee, and J. G. White, New York.

The vice-president appointed the following committee to consider the matter and report to the convention: Messrs. Mailloux, White and Beggs.

The following named gentlemen were appointed as a committee on resolutions to report at this convention: W. Worth Bean, St. Joseph, Mich.; C. Loomis Allen, Utica, N. Y.; Thomas Hawken, Rockland, Maine.

The following named gentlemen were appointed a committee on rules to report at the next convention: E. G. Connette, Syracuse, N. Y.; T. E. Mitten, Buffalo, N. Y.; W. E. Harrington, Camden, N. J.; Richard McCulloch, Chicago, and John J. Stanley, Cleveland.

Mr. Beggs offered the following resolution:

Resolved, That the executive committee to be elected at this annual meeting be requested and directed to make an earnest effort to have prepared and presented at the next annual meeting papers from prominent and experienced manufacturers of reciprocating engines, manufacturers of steam turbines, and manufacturers of gas engines, as to their respective merits.

The resolution was seconded by Mr. Connette and carried.

The secretary read the following communication:

Binghamton, N. Y., Sept. 1, 1903.

T. C. Penington, Secretary American Street Railway Association, Saratoga, N. Y.

Dear Sir: The twenty-first annual meeting of the Street Railway Association of the State of New York will occur at the Yates Hotel, Syracuse, Tuesday and Wednesday, October 6th and 7th.

An unusually interesting State meeting is anticipated. Papers upon practical street railway subjects will be presented and topics of general interest discussed. In addition to the interesting and profitable features of the meeting, a splendid programme of entertainment (including the annual dinner on Tuesday evening, October 6th) has been arranged by the local committee.

All in attendance (including street railway and supply men) at the twenty-second annual meeting of the American Street Railway Association are respectfully invited and urged to attend the State meeting at Syracuse and participate in the benefits and pleasures thereof.

It is the aim of the officials of the Street Railway Association of the State of New York to make the twenty-first annual the most largely attended, interesting and profitable meeting in the history of the Association. Yours respectfully,

G. T. Rogers, President.

On motion the meeting adjourned until 9 o'clock Friday morning.

FRIDAY'S SESSION

Vice-President Ely called the meeting to order at 9 o'clock and requested H. H. Vreeland to preside.

The Chairman—The first business to be considered this morning is the paper on "Electric Welded Joints," by William Pestell, superintendent of motive power and machinery of the Worcester Consolidated Street Railway Company. Inasmuch as this paper is printed and has been distributed to the members of the Association, it will not be necessary to have it read. I learn that Mr. Pestell, the writer of the paper, is not present. I intended to ask him to make a brief statement of the points contained in his paper. (This paper is printed elsewhere in this issue.)

Mr. Gotshall—I move that we pass to the next paper. Perhaps Mr. Pestell will come in later and we can take up the discussion of his paper then.

The motion was seconded and carried.

The Chairman—As Richard McCulloch, the author of the paper on "The Production and Distribution of Alternating Currents for Large City Systems," is present, we will consider that paper now. It has been distributed to the members, and I will ask Mr. McCulloch to open the discussion of the paper, calling attention of the members to such points as he particularly desires to emphasize. Mr. McCulloch is the assistant general manager of the Chicago City Railway Company.

Mr. McCulloch—The paper consists of a description of the general practice in large city power plants of producing alternating current, with limited discussion of the advantages of some of the newer forms. In general terms, the conclusion of the paper is that in cities of less than 250,000 inhabitants, unless special conditions are found to exist, the best practice would be to generate direct current, and the alternating current will be serviceable more particularly to the very large cities and for cities where the greater part of the load comes from the interurban or suburban places.

Mr. Mailloux—The paper is primarily a statement of facts—an analysis of the present state of the art of producing and distributing alternating current—and it will be very useful to the members as a work of reference, because it so concisely, and yet comprehensively, gives a resume of the entire situation. In my opinion, all that is necessary to state is that the work of Mr. McCulloch has been admirably done and deserves the thanks of the Association.

W. C. Gotshall, Portchester, N. Y.—Some data are given as to the relative areas and cubical contents of stations designed to use the existing reciprocating engines and also to use turbines. I have no doubt Mr. McCulloch got considerable information while he was gathering the data for his paper as to the cost of some stations which have been in operation for a short time producing power by turbines and the details of the cost. It occurred to me that he must have obtained some data of the cost of producing a unit quantity of energy and the distribution of cost for those places. If he has done so, it would be well for him to give the information to the Association if he can do so consistently.

Mr. McCulloch—In answer to Mr. Gotshall's question, I will state that I made no effort to incorporate in the paper any data in regard to the cost of power, because that depends largely on load conditions. The cost in most of the large stations is not a secret at all and is pretty generally known, so that I made no effort to put anything of that sort in the paper.

The Vice-President—We will now pass to the paper entitled "The Evils of Maintenance and Champerty in Personal Injury Cases," by Michael Brennan, counsel of the Detroit United Railway. (The paper will be found on another page of this issue.)

Mr. Gotshall—Is the writer of the paper here?

The Vice-President—He is not. The chair will say, no one else offering anything, that the committee in selecting this topic was actuated by the feeling that while it would be impossible to harmonize the statutes and rules and practices of courts that affect this matter, by reason of the Association extending to all the States, still it was along the line of standardization, and the thought upon the matter and the consideration of it might be useful in bringing about, or in assisting to bring about some line of thought that would be common to all. Of course, the laws that affect the subjects treated in the paper differ widely in the several parts of the country. If there is no discussion desired we will pass the paper. It has been printed and distributed in due season and I hope it has been read by all.

The next paper is entitled "Train Orders and Train Signals on Interurban Roads," by C. A. Coons, superintendent of transportation International Railway Company, Buffalo, N. Y. I would ask Mr. Coons if he has anything in particular to point out in connection with his paper other than as set forth in the paper itself. (It will be found on another page.)

Mr. Coons—I have nothing to add to the paper.

The Vice-President—This paper has also been printed and distributed. If that is a sufficient consideration of it and no member wishes to discuss it, we will pass to the next paper, "Freight and Express on Electric Railways," by J. B. McClary, manager of the railway department of the Birmingham Railway, Light & Power Company, Birmingham, Alabama. (This paper appears elsewhere.)

Mr. Gotshall—It appears to me that this is one of the most important subjects in connection with what are undoubtedly the coming electric railways; that is, the lines connecting the centers of population adjoining and about large cities. For about a year I have been trying to get some information on this matter, and the trend of what I have been doing has been to ascertain the income from this service and the amount of money it is costing to do a given amount of business. I do not find that there is any statement in this paper showing anything from which you could derive much information concerning the income or the cost of doing business. I have found in going over the matter and corresponding with railroads in different parts of the country, as to the express and freight business, that they are receiving all the way from $500 to $900 per mile of single track, that is, the gross receipts for the freight and express business they are doing. I have not been able to get satisfactory information which would indicate the cost of doing that business. It is certainly unfortunate that our time is limited and that there is no disposition to discuss the paper in detail, and it appears to me the matter might well be brought up in some other form at the next session, when we trust we

shall have sufficient time to discuss all these papers. It would require three or four hours to discuss this paper properly.

Mr. Mailloux—I have often noticed that it is only upon reading papers, after they have become cold in the transactions of an association, one gets ideas and suggestions which might lead to important questions and discussion. It seems to me, therefore, that in the case of this Association many of the subjects which form the basis of papers or reports at one annual meeting might well serve as the basis of topical discussions at a subsequent meeting. In this way the members would have time during the year to read the papers and collate their ideas, and come prepared at the next meeting to discuss and finish any consideration of a subject which might not have been accomplished at the meeting at which the papers were read. There are many of these subjects which are still live questions, even after the lapse of a year. The paper on "Express and Freight on Electric Railways" will not only be a live topic next year, but of greater interest than it is to-day, and will continue to be so for many years; hence there will be no harm in bringing that subject up again at a subsequent meeting. The same thing may be said concerning the paper on "The Right of Way," which will be as lively a question next year as it is this year. In looking over the list it seems to me that all of the subjects will be just as interesting next year as they are to-day, and I think it would be well for the committee on programme to bear in mind that fact and recommend as subjects for topical discussion many of the points which do not receive a comprehensive and satisfactory discussion to-day.

John I. Beggs, Milwaukee—This question of freight and express is likely to become much more important with electric railways as time passes on. It is being tried by quite a number of the roads, but in many States of the Union we are not permitted to carry freight, and therefore some who attend the convention have not given attention to it, except in a general way. In the State of Wisconsin, where our company has large interests, it is impracticable to carry even small parcels, unless it is in charge of the passenger, and we have no right to make an extra charge for it anywhere in the State of Wisconsin. Under the statutes of that State we are prohibited from doing it. In the State of Wisconsin if we attempted to carry package freight, we would have to condemn every foot of every street in any city or highway on which the company operated cars, which would make it absolutely impracticable; and that is a condition which meets many of those operating street railways. I believe it is generally admitted throughout the East that electric railways do not possess the right to carry freight. I am not prepared, for this reason, to discuss the question. I am watching the matter with much interest and am awaiting the time when a demand shall be made in all the cities of the Union that the electric railways shall be permitted to perform the great service to the community, particularly in the rural districts, of carrying express and freight matter, so that this service can be performed with dispatch and economy for the people.

G. Tracy Rogers, Binghamton—Some years ago we started an express business in a small way on our interurban road, about 10 miles in length, in a small town of 1500 persons at the other end. We used a trailer first, and then we used a larger one, and then we bought a freight car. We had no terminal, and left the freight car standing in the middle of one of our city streets. Some of the city officials objected to the car being left on the street, and resolutions were introduced in the Common Council to have the car taken off the street, but the merchants in the city came forward and protested, and wished the car to remain anywhere we wanted to leave it, as the service was a great accommodation to them and the people on the line. The result has been that in our small way we have made a little money on the enterprise, and to-day we are buying real estate as near as we can to the heart of the city in each of the towns we reach with the freight and express service.

Our plan is to farm the business out to an express man. He pays so much of the expense, and then we have a percentage, and I will state that the business has been fairly profitable.

Mr. Gotshall—If Mr. Rogers has no objection, I would ask him what the duty of the car is—the car mileage; how many trips a day it makes, and what is the basis on which the business is computed.

Mr. Rogers—The car makes two trips, the distance being about 9 miles. One of the principal reasons why we inaugurated the service and continue to put money into it is that it helps to develop outlying sections of our district; opens up new fields for passenger service. New towns are starting up in our vicinity, and we wish to encourage them. We have the competition of two steam roads to meet.

Mr. Gotshall.—In investigating this subject I find that electric railways carry parcels at about one-half the price charged by steam railroads. Reports which some roads make are very interesting, and it will be a very important subject, for the reason that the introduction of these frequent units, carrying parcels at relatively low cost compared with existing conditions, will work radical changes in and about the districts located near the large cities. I think the subject should be continued and given more attention than it has received in the paper and the short discussions.

C. Loomis Allen, Utica, N. Y.—In December last we organized an express department on the Utica & Mohawk Valley Railroad. We did not undertake to handle anything in the way of heavy material or freight matter. We operate three express cars for about twelve hours a day. We do not take any material for shipment unless it is to be delivered at the terminal point of shipment. By that I mean we have at each village or municipality where we give service, teams for the delivery of the express matter. In each of the cities we maintain teams for the purpose of collecting express matter, on the same system as that adopted by the old-line express companies. The expense, which, of course, must be very large, due to the maintenance of the drivers and agents in each of the municipalities, has been in the neighborhood of about 70 per cent of the gross receipts.

W. K. Morley, Grand Rapids—We have about 45 miles of track, and we have three freight cars. We make a round trip with these freight cars every day. The management thinks that the freight business is susceptible of development, and proposes to invest considerable more money for freight equipment next year. We handle almost any kind of freight, except the lower classes of freight, which we do not want. We have an agent at all terminals and sub-stations, which costs us nothing additional, as we should need some one at the substation to help out. We figure that the freight business pays us, and we are going to develop it. We get the same rates as the steam roads. We do not devote ourselves entirely to the high class of express business, but handle anything except low-class freight. We cannot handle, and do not want to handle, carload business.

The Vice-President—As to the suggestion made by Mr. Gotshall, unless there is some direction from the convention, the matter will be brought to the attention of the executive committee when selecting the subjects for next year's papers. It would seem in the light of the experience which we are having on the International Railway Company of Buffalo, where we operate several interurban lines, one of them being 35 miles long, and a high-speed road under steam railroad rules, with freight trains drawn by electric locomotives, handling mail, express, fruit, small crops and all kinds of baggage freight—it would seem to be a subject that might occupy the attention of the convention again with great profit. Some of the statements contained in the paper which has been presented are

very true, and especially one where the manager has shown his profits and added "that it is 'velvet,' there is no doubt, if you would engage in the business, and not let expenses eat it up." Where I have seen this business best done, the expenses are eating it up. It is all right enough to say you will go into the freight and express business, but when you establish a freight station and go there to get freight, then you must have a station master, someone to unlock the car and let the stuff out to the farmer who calls for a bale of wire or something of that sort, and when he comes with stuff to ship you must have someone there to receive it and take care of it. That means you are going into the equipment of a full-fledged freight-operating department, and that is a branch of steam-railroad operation that is technical in the highest degree. Many railway managers have gone up against this railway proposition like a lot of boys. That is not a reflection on anyone at all. The street railway man says: "Everybody concedes that in the steam railroad business the freight is the cream of the business; the big roads make their money out of the freight and carry passengers in many cases at a loss; therefore, we can make money out of freight." The big roads have long hauls; we have short hauls. If you are going to handle freight to any extent you must make an arrangement with steam railroads for cars. We cannot equip our roads with standard freight cars to haul freight 15 miles, 20 miles, or 40 miles. We must make an arrangement with the steam railroad companies not only to furnish freight-car equipment, but to take freight from us and haul it to the center for which it is destined. That means you go to a steam railroad manager, prejudiced against you very often, and ask them to take the stuff from you. The answer is invariably that they will be glad to do it, because the electric railroad will be able to originate freight for the steam roads. It is within the knowledge of some present that there exists as beautiful a gentlemen's agreement between steam railroad people to discourage this kind of business as there ever was to regulate the distribution of the proceeds of the mail-coach robberies. When you visit the steam railroad manager you are received with courtesy and politeness, entertained by the hour, and taken out to lunch, but you do not get anything, except what you eat. They do not propose we shall get into that business if they can stop it, and I know of my own knowledge where a steam railroad—a trunk line extending from New York to Chicago—operating large freight steamers on the Great Lakes, one of the greatest trunk lines in this country, had an arrangement with an electric railroad whereunder the trunk line furnished the freight cars to the electric road and received freight originating on the line of the electric railway in the cars of the trunk line, and in turn delivered cars to the electric railway. The steam railroad transported these freight cars to another trunk line, which had then to carry it to points not reached by the first trunk line, but the second steam road refused to receive the car. One of the roads refusing these cars is a trunk line in the New England States, and the parties who have the matter in hand got around the question by making an arrangement with another line, which was a competitor of the first named.

I agree with Mr. Gotshall that this is a subject of the greatest importance, and its fair consideration, with the idea of arriving at some practical determination, might save those about to institute electric express and freight routes a great deal of money.

If there is no further discussion on this paper we will proceed to the next one, entitled "The Right of Way," by H. H. Vreeland, president of the Interurban Street Railway Company of New York. (This paper will be found on another page.)

Mr. Vreeland read the paper, and said: In the preparation of a paper of this character, not having to do with statistics, or illustrations, it has always been my purpose to make it concise, to endeavor to have it bristle with points which could be taken up for discussion.

The necessity of approaching questions of this character from the right point of view is very important. Last winter there was a great agitation in New York City, as you all know, on the question of transportation. The existing facilities in the city were clogged and hampered in every way by abnormal conditions—elevated lines by reason of reconstruction, and the surface lines by subway construction, and all that went with that. It was declared that proper facilities were not offered to the public. There were two ways to approach that state of affairs: One way was to say that the company was giving all the service it could give, and doing the best it could do, and that is all that could be done, which would at once raise a controversy as to whether the company was really doing it or not. There was another way to approach the matter, and that was that the conditions that existed at that time, and surrounded the operation of the cars in the city were apparent to the eye of everybody, but in the rush of business had been lost sight of. It was no new point, nothing novel; everyone saw it every day, and yet when I made the statement in a public meeting the matter was viewed in an entirely different way. We elaborated that point after making a careful study of the general traffic conditions of the city, and went on to show that until there was a recognition on the part of public authorities that the movement of thousands of citizens should be considered of greater importance than the delivery of a ton of coal or a barrel of flour, the railways were helpless to improve the condition of affairs, the matter was taken up as an almost entirely new proposition. Any number of letters were written to me at that time by persons who rode in the cars of our company on Broadway, and who would say that a man with a truck of coal had held the car up for five or ten minutes, and they would all close with saying that the position which the company had taken in the matter was right. The man with the truckload of coal had been running on the tracks for the last twenty years, but the public had become so used to this condition of affairs that it did not exercise enough thought to understand that the true cause of the delay in local transportation was not any fault of the operating company, but of the conditions of traffic which existed on the streets of the city, and had existed all the while. The agitation resulted in strong public sentiment. The regulation of city vehicular traffic was taken up by the police authorities and by other civil bodies, in the interest of the movement of car traffic, and treated from the standpoint, not of the company, but of the public; that the public were in the cars, and that no one lost his right to free movement, etc., by reason of being in a car, and while the car itself might not have the same rights as an individual who was obstructing it in the street, the passengers in the cars lost none of their right to free and easy passage through the city streets; that it was a question of the convenience of the few standing aside for the convenience of the many. This agitation resulted in quite a revolution, which has had a lasting and improving effect all the time on the question of our transportation.

On the same line as I indicated in my paper last year, and on the same general lines as taken in his opening address by the presiding officer a few days ago, it seems to me on this question of right of way and other important questions connected with our work, that they are not taken hold of in a strong enough manner; that our side of the question is not put in proper shape before the public in many instances. We are prone to consider that we know it all, and the other fellow does not know anything; that the newspaper man does not know anything when he criticises us; that the citizen who writes a letter of complaint or criticism to the company does not know anything, but we know it all. We make ourselves believe that we are carrying on our particular business better than anyone

else could do it, and we resent suggestions and criticisms, when we really should study every criticism which is made to see whether we are right or not, and get some good out of the criticism and produce a better result. It is the one thing, in my opinion, which has created much of the antagonism that exists in the public mind and in the public press regarding matters connected with the operation of all our systems of transportation, some of the new systems as well as some of the old, the point that we think we know it all. I find when you approach any question from that standpoint that you can create not only a good deal of disturbance in the minds of others, but a good deal of disturbance in connection with the management of the property you have to do with.

I will take up another point which occurred to me as a strong point, and that is the moving of the United States mail. When you consider the rights of the many as against the rights of the few, the United States mail wagon affords one of the strongest examples. A mail wagon leaves the General Postoffice in New York to go to the Grand Central Depot. It has mails destined for the Pacific Coast, Honolulu, Japan, etc.—nothing local in its character whatever—yet I as a citizen of New York and you as a citizen of New York, or of any other city, if you happen to be in New York, must stand aside and let that mail wagon go by. The mail wagon and its contents are of no interest to us; add nothing to the comfort or convenience of our lives; there is no mail destined for our office or our houses; we have no interest in it whatever. Yet the consideration of the interests of the world as a whole in the movement of its mail matter is such that the consideration of the rights of the millions against the few makes it necessary that you all must go a little to one side and give the mail wagon the freedom of the streets.

We do not ask in our business for the freedom of the street in the operation of our cars, except for the operation of the cars in the interests of the general public and the quick handling of the people who are entrusted in our care. Of course, it is absolutely unnecessary, in view of the many addresses we have had on the subject of what a boon street railways have been to the United States, to go over that old ground again and say why all this should be done, except to leave the statement in this shape—that we should consider this question in a broad way and see if we cannot get the general authorities, not only of one State, but of all the States, educated up to that point where they will consider this question from the standpoint of the public itself. Our regulations are just as crude with reference to municipal propositions connected with railway properties, lighting properties, etc., as are many of our rules and regulations with reference to the operation of a property. The conditions have changed so quickly in street railway operation that they have not been met at all by any change in municipal regulations. When this question was receiving so much consideration in New York City last winter and the matter discussed very thoroughly in the newspapers, the newspaper men were surprised to find that the movement of electric cars was governed by regulations and laws established in the '60s and '70s. It was necessary to collate these laws to show the absurdity of attempting to regulate this vast traffic by rules which had been framed for conditions which existed thirty or forty years ago. It was like an experience I had not long ago where, in looking over some questions connected with an accident, I took up the rules and regulations of a certain company, and found that they were dated in July, 1872, when the property was a horse-car line with less than one hundred employees, and operated about twenty cars. That same property by consolidation had grown into a system employing more than 1200 men, with a corresponding increase in service, and all the operations of the company increased in proportion, yet the road was operated under rules and regulations dated in 1872, telling how the man should care for the horses, etc., and nothing was said with reference to electric motors.

I am free to say that although there are certain limitations, restrictions and conditions imposed on the operation of street railways abroad, I would be willing to accept these restrictions and limitations and bear whatever loss might ensue, to gain the advantage of having a proper regulation of all kinds of street traffic, and have such regulations thoroughly and intelligently enforced, such as exists abroad in the operation of the various transportation systems. The systematic manner in which regulations governing street traffic of all kinds are enforced was one of the things which appealed to me very much in looking over the conditions that existed on the other side of the water.

On the question as applied to this association, I think that the importance of a proposition of this kind may be minimized in the minds of men who have to do with the operation of lines in the smaller cities and towns, but the importance of matters of this character is emphasized when you consider that a compilation was made last winter of the laws and regulations governing the movement of all street traffic of the United States by the authorities of the city of New York to determine what was reasonable regulation. Some gentleman in this room may consider that this matter is of no interest to him, because of the condition which prevails in the city where his lines are located, but you must consider these two points: First, that whatever your regulations are, when this question comes up in other sections of the country, your regulations become a part of the consideration of what is being done in other places, large or small, and the next fact is that some of you bright young men may be operating the lines in the city of New York within the next few years and will have to face this condition yourself. The same thing is true of the franchise proposition, and franchise regulations and limitations, which could just as well be included in this general proposition, in my mind. On this point of franchise limitations and conditions you gentlemen of the association who have to do with the operation of properties cannot in fairness to the country as a whole consider these things as entirely of your locality. To-day inquiry is being made abroad as to what we are doing in this country, and the limitations and restrictions that you may have in a weak moment accepted in securing something for your property may be a keynote and turning point on which hundreds of enterprises abroad may be stranded, and ultimately some in our own country. Without going into a discussion of the details of this matter, from the standpoint of franchise limitations, restrictions and conditions, from the standpoint of vehicular traffic and regulations, and from the standpoint of rules and regulations which govern the employees of the properties throughout the country, we cannot consider any one of these points as individual, but they must be considered collectively and as a part of the whole number of the railroad properties of the United States, if not of the world.

The chairman, in his address, referred to the matter of rules and regulations of the steam railroads, which I was very glad to have brought out in connection with the work of this association. I had occasion back in the early '80s to examine a number of engineers and conductors for appointment on a property that required a large summer service, and among the number were some men from the West. In examining them on our train orders and regulations, the most important and essential in the operation of a railroad, there was not one man who understood our orders. They were men who had run trains for fifteen or twenty years in the West. As the chairman pointed out, to-day an engineer, under the rules and regulations for the movement of trains, by telegraphic orders, who may have been running a train in California last week can to-morrow step on an engine in Maine, and his rules are just the same, and the engine is run under the same orders. The thing is important to us, for the reason that in New York City we are every day hiring men as motormen, and they come from all parts of the United States. We have a school of exami-

nation and instruction in which these matters are gone over thoroughly, and it is the most surprising thing to find what a diversity there is in regulations in cities and States that border on each other, where there should be no difference whatever.

J. G. White, New York—There is, perhaps, no need to elaborate on the point of view offered by Mr. Vreeland, who has brought this subject to our attention. It seems to me that it is a self-evident proposition that to secure attention at the hands of municipal authorities the subject must be presented as conducive to the comfort and welfare of the citizens, and not as increasing the earnings of the street railway companies. If a car is delayed for fifteen minutes by a coal truck unloading it is of comparatively little use to say that the wages of the motorman and conductor for that fifteen minutes amounted to 11½ cents, or whatever it may be, and that that much of the street railway company's earnings are wasted. But if we point out that seventy-five or more passengers have been delayed for that fifteen minutes, then it begins to be of interest to the traveling public, and they will assist in bringing about some reasonable regulations.

The general impression in this country is that electric railroading has advanced far beyond anything known on the other side of the Atlantic. Mr. Vreeland implied that this is not entirely correct, without going into details. In this matter of regulating vehicular traffic and imposing municipal regulations which tend to minimize the delays to the traveling public, European cities are far ahead of those in this country. Frequently one sees on Broadway, in New York, perhaps a 5-ton truck loaded with coal or fireproofing material for a new building, which is backed around with its rear wheels toward the pavement, and which prevents the passage of street cars, and there is a string of cars extending down three or four blocks before the wagon will move or its load is discharged. In most of the municipalities abroad wagons are not allowed to back to the curb in that way, and if any particularly heavy material is to be unloaded it has to be done within certain hours, say between 8 and 10 o'clock in the evening, and at no other time during the twenty-four hours is it permitted, but if the material to be unloaded is not of a nature to cause much noise and keep people awake, it may be done during the entire night. Coal, for example, is not permitted to be unloaded unless the wagon is drawn along the curb and the coal taken away in sacks or baskets. The crying need for some regulations in this country applies more particularly to cities like New York, where the traffic is dense and the best facilities possible to provide will scarcely take care of it, and to cities like Boston and Chicago, where the traffic is condensed into restricted business areas, and consequently where special regulations should be formulated in justice to the city and to the people in the city, and should be rigidly enforced.

It seems to me this association might perhaps partly collate the rules and regulations on this subject in foreign cities and gather the information in convenient form so that it could be used by the members of the Association to bring about police and municipal regulations in their respective cities, and such an action by this Association would be very advantageous in this respect.

The Vice-President—It seems to me that the questions brought up by Mr. Vreeland in his paper and in his remarks concerning it are very important, and that in the investigation of these questions along the lines of an honest and earnest attempt to get something better lies as much money saved for our corporations as in any other branch of the business. We who use alternating current in the operation of cars know what "out of step" means. Has it ever occurred to us that we are a little out of step with the public and the authorities? It seems to me that we are. The field is wide open for useful tillage. In what public school in the United States is a word ever said to a boy or a girl about the rule and law of the road? The city schools are filled with hundreds of thousands of children who are not instructed in the simplest rules as to how to cross a street, how to go along the street, or how to drive a horse or a dog attached to a vehicle, or anything of the kind. What little instructions children receive in this particular they get from thoughtful parents, but many of the parents in large cities are in utter ignorance of the common rules and laws governing the conduct of individuals passing along the public way. There are few, if any, ordinances in force giving anything like proper regulation to the passage over the public ways or streets. It is as simple as the nose on a man's face—the portion of the street or highway from curb to curb should be reserved for the passage of vehicles; pedestrians should be limited to the sidewalks, and should be compelled to cross the streets at the crossing, and not to make a parlor floor of a city street, using the street as if they were in their own homes, as is done in Buffalo and other large cities. Women, without looking up, step into the street in every part of Buffalo, where we have asphalt pavements, meandering along the street with the cars passing by them in quick succession, the women acting as if they were threading the mazes of the dance. How the motormen can escape hitting them is a wonder to me. Yesterday those who took the ride by the courtesy of the Schenectady Road, and looked out of the window, saw several cases where women, and in one case a large fleshy woman, with an infant in her arms, risked their lives by crossing the track, with perfect recklessness, in front of the swiftly moving car. In Nuremburg, Germany, it is a criminal offense to attempt to board or alight from a moving car. Why should there not be a law like that in every State in this country? There is a law in the State of New York that makes an attempt to commit suicide a criminal offense, and it is just as much an attempt to commit suicide to jump off a moving car, in many instances, as to draw a razor across one's throat, and is followed with as bad results in many cases. It is a perfectly simple and easy matter to get at, for the reason that our interests and the interests of the public are identical, as pointed out by Mr. Vreeland. No sane person wants to get hurt or to be killed, and therefore the method of controlling transportation problems should be carefully examined by the public authorities and public men, and the people should be convinced that we are not trying to establish rules arbitrarily, so that the street car shall not have any obstacle, and shall be free to run through the streets at 30 miles an hour without let or hindrance, but that we are endeavoring to work for the people, for the benefit of everyone in town, and that is all we want to do.

It suggested itself to me a short time ago that possibly I might accomplish some good by sending a letter to School Superintendent Emerson, of the city of Buffalo, asking him if he would not think it a wise thing to set aside several periods each week, two or three, consisting of a few minutes each, in which the teachers might in a very simple way instruct the children as to the rule of the road and what they ought to do. If that plan were adopted, it seems to me that after a while we would have a lot of people walking on the streets that know something about the rules of the road and their individual rights and the rights of others.

There have been some unusual decisions of the courts recently. In New York State the law has been laid down by courts that at street intersections the rights of any vehicle, and the vehicle known as a street car, are equal; that is to say, a milk peddler, driving a wagon of milk or a man bringing in garden truck from the country, has as much right to our tracks at the intersection of streets as our car with 150 busy men going to business. I do not believe that such a decision would be maintained in a court of last resort.

Mr. Beggs—I reduced the obstructions to our lines in the city of Milwaukee very largely by a personal appeal to the users of large numbers of teams. For instance, the brewing

interests, with hundreds of large 3 and 4-horse teams, occupied and obstructed our lines until I made a personal request to them to reduce this annoyance as much as possible. The same course was followed in the case of large manufacturers who many times with their wagons loaded with castings and things of that kind would delay a car for several blocks rather than turn out of the tracks. By co-operation much can be done, especially when it is educational. What the teamsters of one class of business will do the others drop into after a while and adopt. It seems to me if we could enlist the co-operation, for instance, of the express companies which have a large number of teams, with drivers who are usually very indifferent as to the accommodation of any one else, and the ice distributors, large coal dealers, and people of that kind, we would accomplish more in our respective cities than in any other way. In some of the cities where the railways provide a steel tramway for vehicular traffic, which is done by municipal requirement in those cities that have a flat girder rail, it is difficult to keep them out of the track, as it is the easiest place in which they can run. This is one of the advantages that come in with the grooved rail; one of the greatest advantages which we have is where we have finally converted our city officials to realize the benefit of a high T-rail with granite headers on each side. Such a form of track construction does not make a convenient place for driving, and our obstructions from vehicles in the city of Milwaukee have been reduced 50 per cent in five years.

In our State we are fortunate enough to have from the Supreme Court, two or three years ago, a very sensible decision, which has accorded to street cars, at street intersections at least and in most parts of the city, rights superior to a vehicle, upon the reasoning that a street car is restricted to the rails upon which it runs and cannot turn out or in, and that therefore other vehicles must give way to it; and at street intersections the law of steam railroads applies—"stop, look and listen." It is also held that where a team continues for several blocks, or any considerable distance, in a track, and is struck by a street car, the driver is guilty of contributory negligence and cannot recover damages from the street car company—that it is his duty to keep watch, knowing he is in the line of street car track and to keep out of the way. In a case where a man had not looked back for 300 feet the case was turned out of court.

John Grant, St. Louis—I may state an experience we had in St. Louis. We found in 1901 that the authorities of the city did not know the law. We went to the police department and tried to have the delays caused to cars eliminated to some extent, and were informed that there was a law which allowed a wagon to hold a car for five minutes. We thought that was peculiar and had our attorneys look the matter up and found the law provided that when a car came up the wagon must move out of the track immediately. Some of our friends started a crusade against wagons on the track, with the result that drivers delaying cars are arrested and fined. We had some trouble from wagons and pursued the method Mr. Beggs mentioned, going to a large number of the livery and express companies and breweries and making appeals to them. One very large concern which employs in the neighborhood of fifty wagons made it a rule that any of their drivers whose wagon was hit by a street car paid the damages to the wagon and lost his position. In that way much can be accomplished, but it may be that in the great number of changes being made around the country in the different roads, some of the men do not know the laws of their city in relation to cars. Some of our city authorities did not know the law, and as soon as we pointed it out they helped us to do away with a great many of the delays. In the last two years 50 per cent of the delays on our line have been eliminated. It means hard work all the time—you have to keep after the drivers, and the authorities also have to keep them up to the mark. If the laws to keep wagons off the tracks could be passed in different cities generally, the law being a reasonable one, it would be a good thing.

The Vice-President—Is there anything further to be said? If not, we will take up the next subject, "Comparative Merits of Single and Double Truck Cars for City Service," by John I. Beggs, Milwaukee Electric Railway & Light Company, Milwaukee, Wis. Mr. Beggs has not prepared a paper, but as he is present he will probably give us his views on the subject.

Mr. Beggs—The principal point of advantage to result from the use of double-truck cars is, in the first place, a much higher speed, of which the public receives the benefit. As soon as the public realizes that it does not seriously affect the street railway company to have its cars obstructed, but that it is the people on the car who are discommoded, the public will awaken to the fact that it up to them to get a better condition of affairs, so that in running double-truck cars the first point is the smooth and comfortable riding of the passengers as compared with the single-truck car, with the great oscillation sometimes experienced running over a track which is indifferently maintained. The track may be really twice as bad, but to the riding public it would not be evident in a double-truck car. The next thing is that the large double-truck car, equipped with four motors, one on each axle, which has been our practice for six or seven years, enables the car to be accelerated much quicker; in other words, in many of our cities, the blocks are only 300 ft. or 400 ft. long, some shorter than that. If we follow out the rules as laid out in the usual book of rules, we would not get a street car up to speed between crossings. The car is limited as to the number of trips it can make over a line during the day, and consequently the cost of operation is unnecessarily increased. The quicker acceleration means higher average speed; in other words, I believe that it is applicable in most cities, even where there is pretty dense traffic. I am not referring to Broadway, New York, as the conditions there are unusual, but on our city lines, where traffic is sometimes quite dense, we maintain an average schedule speed of 9 miles an hour. With the large cars you are enabled, because of the greater seating capacity, to maintain long headway on the lines and still take care of the traveling public. Longer headway means less car miles and less car hours and less trainmen, and that your trainmen are performing more service for the company, and thereby reducing the cost per car hour or car mile for trainmen alone. The consumption of power is possibly increased yet not more than would be necessary, in all probability, to put the same number of single-truck cars, with two motor equipment, in operation. Then the cost of track repair and maintenance is less, as we discovered after an experience of seven years with double-truck cars, which run smoother, than single-truck cars.

These are the principal points which seven years of use and the adoption of heavy truck cars as standard has brought out, and which in our experience have been more than satisfactory. We established several years ago as a standard a large double-truck car, fitted with cross-seats for forty-four passengers. They have a capacity, when passengers stand, of over 100. These are the reasons for maintaining that it is much more advantageous, both to the general public and the operating company, to maintain and operate large double-truck cars equipped with a motor on each axle, and with a motor of sufficient capacity to warrant you in quickly accelerating the car and getting it up to speed within about 200 ft., so that you are able to make the average speed of the car with the usual number of stops, of about 9 miles an hour.

Mr. Gotshall—I believe that a great deal of good could be accomplished by this Association as a national body if there were appointed a number of standing committees, such as I believe now exists in the New York State Association. My idea is that there should be a committee on legislation, another

committee on standards and operation, and other similar committees. It appears to me that if the important matters of the Association were taken up by special committees in this manner much good could be accomplished along the lines that have been indicated by Mr. Vreeland and other speakers. A representative committee of this Association, embodying the views of our members, could present these matters to legislators throughout the country and seek to have laws enacted which will remedy some of the troubles complained of. I would suggest that the executive committee of the Association take up the matter of the appointment of the committee on legislation, and it seems to me the matter could be extended by having subcommittees subsidiary to the main committee in each one of the cities of the Union.

The Vice-President—It is quite evident from very extended investigation among the members of the Association and the supply men that the time is ripe for the making of new arrangements in the affairs of the Association, and it is no reflection upon any of us at all. There seems to be a general acquiescence in the thought and its expression that we have outgrown the clothes that were cut for a much smaller association and an association under different conditions.

It is my opinion that a motion to refer to the executive committee the consideration of the subjects which have been suggested would be the proper way to have these matters formulated and presented to the members.

(Mr. Gotshall then presented a resolution that the suggestions made be referred to the executive committee for consideration. The motion was carried.)

Vice-President Arkwright in the chair.

The Chairman—The next business in order is the report of the committee on rules for the government of employees, of which E. G. Connette, of Syracuse, is chairman.

Mr. Connette—Mr. Chairman, the report of the rules committee has been printed and distributed among the members of this Association, and the members have had the report in their possession long enough to know what it contains without my undertaking to read any portion of it. The committee, of course, in undertaking to compile a standard code of rules met with more difficulties than any of you would imagine. For instance, when we undertook to make a rule that was applicable to the small roads as well as to the very large roads, in a good many cases we encountered serious difficulty. We have, therefore, only presented to you a code of rules general in their nature, applicable only to conductors and motormen, because they are the employees principally to whom the rules apply. A rule that will apply to a motorman and conductor running upon a small road can also be applied to one similarly employed upon a large road. The rules pertaining to interurban service, I am free to say, were practically appropriated from the rules of the American Railway Association, which is composed of the steam railroads, and the rules which are in effect upon steam railroads are the result of years of experience and study—we believe of over twenty-five, perhaps forty, years' experience. The committee did not think it could compile a set of rules which would be an improvement on the rules which were adopted and are now in effect upon the various steam railroads of the country, especially so far as the movement of trains is concerned and the use of signals.

I am now going to diverge just a little from the report. I brought this question up before the committee, but it was deemed to be perhaps not within its scope to embrace a suggestion of the plan which I am about to make. Upon long single-track interurban lines, it is better practice, or it would be better practice when it was adopted, instead of running a greater number of separate cars, or changing the headway as the business fluctuates, to maintain a uniform schedule of headway and use the multiple control system and increase the length of the train as the business may require it, instead of changing the headway or instead of running trains in sections. In my opinion, this method of operation would be more satisfactory, because of: First, less liability of accident, which is a great factor in the operation of cars; secondly, it would reduce the expense of operation, so far as the platform expense goes; third, it would take care of the traveling public, I believe, in a more satisfactory manner, because if the schedule is thirty minutes' headway on an interurban line, and that schedule is uniformly maintained, no matter what the business may be, the public will know that a car will be at a given point at a given time, and that ample cars will be provided, that the same time will be made as with one, on the multiple control system. I put this out as an opinion of my own. I believe the interurban roads will come to it, and run trains as steam roads run trains. I believe the running of separate cars to meet increased demands will be done away with ultimately, and that we will adhere to the time-table instead of changing the headway and mixing up the motormen and conductors and multiplying the duties of the train despatcher and causing accidents, at least increasing the hazard of them, the danger would be reduced to a minimum, and I believe the service, in every respect, would be the more appreciated by the public.

You will note the report of the committee in regard to the signals for interurban lines. I have said that we practically appropriated the rules and regulations of the American Railway Association. I may say that we changed the signals, not in respect to color, but instead of using flags, as on steam roads, we use the colored plate hanging over the dash of the car. That was done for several reasons. In the first place, when a flag is stuck on the end of a car, while the car is running it is difficult for a motorman on an approaching car to distinguish what the signal is until he has passed by it, whereas with the signal on the front of the car he sees it and notices whether it is the regular car, a section of the regular train, or an extra car.

Mr. Mailloux—I desire to make a suggestion that every individual member present, who has the authority to do so, should make a careful study of these rules and endeavor to apply them if possible and report the results to the committee. In that way, every member of the Association becomes a cooperative factor in the development and perfecting of a system of rules and regulations, signals, etc., by sending opinions, criticisms, suggestions of changes, etc., to the committee during the next ten months, the committee would be able, at the next annual meeting, to give us valuable information tending to the further development and perfection of the system of signals, etc.

I want to take issue with Mr. Connette in regard to what he said about the single-headway system. I think that depends entirely on the form of load curve with which he has to deal. It would be influenced by the line and the service the line is expected to give. In an ordinary interurban line, where the stations are relatively far apart and the load curve, so to speak, fairly even, that method might well apply, but I submit, in cases where your interurban line approximates rapid transit conditions such a method will be absolutely impossible.

Take a case like the New York & Portchester Railroad; if you plot the number of passengers carried per hour during the twenty-four hours, you will find enormous peaks which represent the hours when people go to New York and come back. Evidently, the service must be adequate for the maximum demands made upon it. That service, with a four-track road, requires five minutes headway with as long trains as we can possibly operate on the local track and ten minutes headway on express trains. We cannot maintain such a headway as that during the entire day. There are times when it is necessary to reduce the number of trains, as well as the number of cars.

Mr. Connette—I refer to a single-track road.

Mr. Mailloux—It may be on a single-track road it would be valuable, but it depends on the load curve. When the curve is

flat and does not have enormous peaks, the method suggested is most satisfactory and preferable, but where the curve shows peaks it would not be.

Mr. Myers—I understand that the committee is to continue for another year, and is to go on with its work. I assume that these rules are to be adopted by the association. I have been waiting for seven months to get these standard rules, in order to apply them to a property we took over some time ago. I want to start off with a firm foundation, and I told our superintendent we would wait until the Association met, when these rules were to be presented, and that, as they were to be adopted generally, we would also adopt them. I would like an expression as to how many members will adopt these rules.

Mr. Connette—There is no use in this Association continuing a committee on rules unless when the committee has given a report that is satisfactory to the Association it is adopted and becomes the standard of the members of the Association. Of course, there is nothing binding or compulsory on the members of the Association to adopt the code of rules that might be presented by this committee and approved by the Association, but there is no use in the Association considering the question of a standard code of rules unless the members are willing to adopt the rules, if the Association finds that the committee has presented a code of rules that is satisfactory. I will say, in this connection, that the New York State Association has had a committee on standard rules for nearly three years, of which I have the honor to be chairman, and this report is to a large extent the result of the work of that committee, supplemented by the committee of this Association. The New York State Board of Railroad Commissioners, I think, met with the committee two or three times, and finally approved the report of the committee, but requested that the committee pursue the matter of rules applying to interurban roads a little further. In fact, the committee has presented very few rules applicable to interurban service, and the Board of Railroad Commissioners asked that we might continue the committee to further consider the rules applicable to interurban roads which is now being done by the New York State Association. This report is before the convention. It is for you to do as you please with it. I do not think we have the time to consider even a half dozen of these rules, if we take them rule by rule, even two or three of the principal topics in connection with these rules, concerning which there may be a difference of opinion. I would suggest that if you do not want to take action on this report, at this meeting, each member of this Association carefully consider the rules, and write all suggestions or recommend actions to the committee, either direct or through the secretary of the Association.

Mr. Beggs—I desire to say a word in commendation of the work of this committee, and I say it as freely and as cheerfully as I severely criticised the report presented to us twelve months ago, which did not seem to have been compiled for street railway management at all, but was apparently compiled for limited trains on trunk lines. I may say that for two years we have had no books of rules to give our 1000 trainmen or 1200 trainmen, waiting, as a matter of courtesy to this Association, until it should have had presented to and approved by it a code of rules that we could feel might be fairly adopted by all the roads connected with the Association, if not all the roads of the country. That code I now have in my hand, and I would like to have it receive the sanction of this Association, but whether it does or not, with a few trifling modifications in these rules, they will be printed for our company within the next thirty days. I have read every section in the report very carefully. As you know, we operate nearly 200 miles if interurban lines in connection with our metropolitan system, and I think there is very little to be desired, from my point of view at least, in these rules. I have been responsible for putting many of them into effect in the operation of interurban lines for several years. I, therefore, propose, after I have suggested slight modifications, to move the adoption of this report by the Association. I want to suggest changes in three paragraphs. There may be some slight modification necessary in the rules due to the local conditions. I do not think the fact that this committee is to be continued should be taken as an inference that the report is not to be adopted.

In paragraph 5, section i, I should advocate prohibiting the smoking of tobacco while on duty in any part of the company's buildings, except in the conductors' and motormen's room, and would likewise prohibit the trainmen from smoking when riding on the company's equipment in uniform and not on duty. I have seen, on many roads (we do not permit it on ours), the employees of the company smoking while in uniform on the equipment of the company. I propose to prohibit that when the men are in uniform. If the man has paid his fare and is riding like any other passenger, he may exercise the rights of other passengers.

I would like to enlarge rule 14, just to broaden it slightly. From my observation, the violation of this rule on many roads is the cause of great inconvenience to the public. The rule says "Do not remove trolley from wire at end of run, or elsewhere, at night, until passengers have alighted from the car." I would add to that rule "nor until those waiting to enter the car have entered it and are seated." I think that is just as important. I have seen dozens of people scrambling in the dark, and they stumble up the steps, while the motorman carries his trolley around.

Rule 24 raises an important question. I seriously consider the advisability of assuming that street railways generally are going to continue to stop on the far side of the streets, as it is called. There are some municipalities which are now enacting ordinances requiring the street cars to stop on the near side of the street, and I am in favor of that. The city of Cincinnati is at present considering the enactment of an ordinance requiring street cars to stop on the near side of the street; and in answer to an inquiry received a few days before leaving my office, from Mr. Foraker, second vice-president of the Cincinnati Traction Company, as to my opinion on that point, I told him I favored the cars stopping at the near side of the crossing. It gives the car an opportunity to slow up before crossing the street, and avoids its coming in contact with vehicles or other cars. The statement as to which side of the street the car should stop may be left out. There are some cities that require you to stop on the near side of the street, and I much prefer this plan. I shall take steps to have it enacted into law in my own city. I suggest that rule 24, as to where the car shall stop, might, with advantage, be stricken out.

The committee, in the first paragraph in the report, directs special attention to rules 61 and 62. I believe it would be advantageous to leave the matters referred to in those rules to the decision of the local companies, because we must give our conductors and motormen authority to put off the cars passengers who refuse to pay fare; otherwise, they will discuss the matter while they ride out the distance they want to go. It is not unusual on street railways to have a man present a large bill which the conductor is unable to change. Under this rule the man would not be put off. We put him off on our road. We require passengers to pay their fare, but here you say they must not be ejected from the car, but the facts of the case must be brought to the attention of the first inspector, starter or official of the company, who is met, and the conductor must act according to the instructions received from such inspector, starter or other official. In the heart of the city, the conductor would not go very far before coming to a superior officer, but in sparsely-settled sections the chances would be, in many parts of the day, that he would have to go to the heart of the city before he found an officer whom he could consult. I think most of the provisions you have made for protecting the

passenger and keeping the company from being involved in litigation by unauthorized ejectment of the passenger are carefully taken up.

In order to bring the matter regularly before the Association, Mr. President, I move that the rules, as presented by this committee, be adopted as the standard code of rules of the street railway companies in the jurisdiction of this Association.

Mr. White—I will second the motion of Mr. Beggs, and if he will allow it, suggest an amendment—that is, that the set of rules, as presented, be adopted by the Association, and that the members of the Association be requested to adopt these rules as their standard rules, with such modifications as may be necessary to meet local conditions; and that the members of the Association be requested to communicate with this committee, which is to be continued during the current year, any amendments which their experience with the rules leads them to think advisable, and the committee report to the next meeting such amendments as they think will be advantageous, to be embodied into the later standard rules.

Mr. Beggs—I cheerfully accept the amendment.

Mr. Myers—I want to bring to the attention of the Association a scheme we have recently adopted. I do not know that it is original with us, but on the backs of our accident reports we have placed all possible forms of construction for special work, cross-overs, single and double track, turn-outs, etc., and we require the employees to illustrate on the back of the accident report just where an accident happened, whether to a person or vehicle. I think such a provision, in connection with these rules, in regard to reports, would be very valuable. The average motorman or conductor is not usually intellectual, and his report is often confused. I make this suggestion to work in with the form of reports of accidents recommended in the book of rules. I wish specially to refer to the last paragraph of rule 8, which refers to railroad crossings. It says that where a crossing is protected by a derailing switch, interlocking plant or flagman, employed by the company, this rule does not apply, but special instructions are to be issued to cover it. I would ask why this provision is restricted to crossings protected by flagmen, or operated by interlocking plants employed by the company. I venture to say that we are operating the largest interlocking plant of any street railway in the United States. We have thirteen crossings in some 1400 feet, with seven semaphores in our tower. As is the rule among the Western railway lines, the jurisdiction of the plant rests with the company seeking the crossing. In that case, it controls and operates it with its own men. Suppose some company seeks to cross the tracks? The burden of the operation is divided equally in Illinois and other Western States, and we appoint the operator. We have the right to ask for his dismissal, without giving cause, but I want to know from Mr. Connette why he applies this rule only to the employees of the company working under this rule? Why do not these rules apply, regardless of who is paying the operator of the signals his salary?

John Grant, St. Louis—I understand the idea is that where a company requires a modification in the rules to meet the conditions in its city, they make it under the rule; for example, in rule 8, relating to railroad crossings, we are required, by ordinance, to stop at our own crossing. So if we adopt these rules we would have to embody an amendment to the rule, and that would be in the nature of an amendment to rule 8, the present rule 8 to remain as the standard. The rule, however, will still be rule 8, and any amendments to it would be rule 8, section a, b, c, etc.

Mr. Connette—Referring to rule 8, I will say that that rule gave the committee perhaps more trouble than any other in the book. In fact, the committee gave this subject much time and attention, because the State Railroad Commissioners of New York have a pretty close supervision over the railroads in the State, and they were particularly insistent on this rule. Explaining this last paragraph of rule 8, I will say that a crossing protected by a derailing switch, or by an interlocking plant, leaves no necessity for the conductor to flag the car over the crossing.

Mr. Myers—I understand that.

Mr. Connette—As to the part which says "the flagman employed by the company," etc., of course if there is a flagman at the crossing employed by the company to flag the car across the crossing it becomes unnecessary for the conductor to perform that duty. If there is a flagman at the crossing, not employed by the company operating the cars, the company operating the cars has no jurisdiction over that flagman, and cannot require him to flag the cars over the crossing, and, therefore, it becomes necessary for the conductor to perform this duty. For instance, at Washington Street and Salina Street, in the city of Syracuse, we have two flagmen to flag our cars over the crossing of the New York Central tracks. The New York Central people also have flagmen there to signal their trains across Salina Street, but our men pay no attention to the signals of the flagmen of the New York Central, but are required to obey the signals of our own men.

Mr. Myers—How about the joint employee? I mean where A petitions for the right of crossing the tracks of B, it is the custom in many of the Western cities for the company seeking the crossing to install the safety appliances. The maintenance and cost of operation is divided equally between them. The manual labor is furnished by the company petitioning the right to cross and installing the protection, but half, or whatever the proportion agreed upon may be, of operating the tower or other form of protection, is paid by the company whose tracks are crossed. He is not the employee of both companies, but each pays half his salary.

Mr. Connette—Then, as a matter of protection, you ought to require your men to comply with this rule.

Mr. Myers—That is what I want to bring out.

Mr. Connette—It is not a question of who employs the man or who he is working for. This rule is intended as a matter of safety, because there are two railroads, one crossing the other, and this rule is framed for the purpose of avoiding the possibility of an accident at this crossing.

J. N. Shannahan, Fonda, N. Y.—We have a peculiar proposition on our road in the fact that we operate both steam and electric lines, and on all grade crossings we do not permit the flagmen to signal the electric cars, but have incorporated rule 8 in our book of electric rules and rigidly enforce it.

H. M. Sloan, Chicago—It seems to me if these rules are to be adopted as standard there are many which will not cover the operation of cars in all cities. Some companies are not operating interurban lines, and it seems to me that if the rules are to be standard they should not be changed as to their numbers. If a rule is not to be used by any given road it can be omitted, but the rule number should stand. A road might use rule 3, for example, and have no use for rules 4, 5 and 6, but these numbers should be given, and rule 7 retain its original number as embodied in the report of the committee.

W. Worth Bean, St. Joseph, Mich.—In Michigan the statute requires that conductor shall proceed ahead of the car, according to rule 8, and if he fails to do so the company is not censured, but there is a fine of $20 imposed upon the conductor. It is not a fine upon the company but upon the employee.

Mr. Connette—Referring to the remarks of Messrs. Grant and Sloan, suggesting that perhaps the local conditions of some of the railways represented in the association are such as to require some additional rule, or perhaps the adoption of a substitute which would not conflict with these rules—for instance, in the case Mr. Grant cites, of the city of St. Louis requiring that they shall flag their own cars across their own crossing, all that is necessary for Mr. Grant to do is to supplement rule 8 by adding rule 8-a, and put in the condition

he refers to. As to Mr. Sloan's suggestion that if these rules are adopted the numbers ought to remain, that is the plan, so that rule 5, for instance, is always rule 5. If there is a rule in this book that is absolutely impracticable of adoption by any member of this Association let the rule be omitted, but the number of the rule should be printed and the space left blank, so that whatever rules are used will have the same number on all the roads using them.

The motion of Mr. Beggs, as amended by Mr. White, covering the adoption of the rules, was then carried.

The Chairman—The special committee appointed at the session yesterday to consider the matter of furnishing reports to the press is ready to report. The secretary will present the report.

The secretary read the following:

TO THE AMERICAN STREET RAILWAY ASSOCIATION.

Gentlemen.—Your special committee, after duly considering the question of the revision of papers and discussions prior to publication, reports as follows:

We recognize the importance and desirability of encouraging and securing a comprehensive and even confidential discussion of topics presented before the Association.

We also recognize the importance and utility of the press and the desirability of not unduly restricting its privileges.

We are of the opinion that the realization of these two objects necessitates intelligent censorship of the proceedings. We recommend for adoption the following rules:

1. Upon the request of any delegate any remarks or data submitted by him shall be considered privileged communications, and withheld from publication in both the press and the annual report.

2. At the first session of each meeting of the Association the chairman shall appoint from the delegates in attendance a censorship committee of three members. All reports of proceedings shall be submitted to this committee, and approved by at least one member thereof before being made accessible to the press.

So far as possible all persons participating in the discussion shall be given an opportunity by the committee to revise and correct their remarks before publication.

The committee also recommends that, to promote the best interests of the Association, the technical press be respectfully requested to refrain from the daily publication of the proceedings.

Respectfully submitted,
C. O. MAILLOUX,
JOHN I. BEGGS,
J. G. WHITE.

The report of the committee was adopted and approved.

Mr. Beggs offered the following resolution:

Resolved, That the president of this Association be requested to appoint a committee of three members to confer with the so-called "steel rail pool," to obtain, if possible, a discontinuance of or material reduction in the differential charged for high tee girder and grooved rails used in street railway construction.

W. K. Morley offered the following resolution:

Whereas, Owing to the change of conditions, and especially to the growth of the suburban and interurban railway interests, and the fact that the mule has been relegated to the plow, and that electricity is the motive power more generally used in street, suburban and interurban railway service; therefore, be it

Resolved, That the name of this Association be and is hereby changed from "The American Street Railway Association" to "The American Electric Railway Association."

On motion the resolution was referred to the executive committee.

The Vice-President—The chair announces the appointment of the following committee on compensation for carrying the mails: Messrs. Grant, of St. Louis, chairman; Beggs, of Milwaukee; Rogers, of Binghamton.

The report of the committee on nominations was presented as follows:

Your committee on nominations respectfully report recommending the following list of officers for the ensuing year:

For president, W. Caryl Ely, president International Railway Company, Buffalo, N. Y.

First vice-president, Elwin C. Foster, president New Orleans Railways Company, New Orleans, La.

Second vice-president, John Grant, general superintendent St. Louis Transit Company, St. Louis, Mo.

Third vice-president, James F. Shaw, president Boston & Worcester Street Railway Company, Boston, Mass.

Secretary and treasurer, T. C. Penington, treasurer Chicago City Railway, Chicago, Ill.

For executive committee, president, vice-president, and Jere C. Hutchins, president Detroit United Railway, Detroit, Mich.; A. B. Colvin, president Hudson Valley Railway Company, Glens Falls, N. Y.; G. Tracy Rogers, president Binghamton Railway Company, Binghamton, N. Y.; W. A. Smith, general manager Omaha & Council Bluffs Railway Company, Omaha, Neb.; S. L. Nelson, vice-president and general manager Fort Wayne & Southwestern Traction Company, Fort Wayne, Ind.

The committee have received but one invitation for a place for holding the next annual meeting. The Mayor, secretary of the Chamber of Commerce and one business man of Chattanooga, Tenn., have extended an invitation to the Association to meet in their city next year. Owing to the limited information in the possession of your committee we do not feel warranted in recommending Chattanooga as the next meeting place, but do recommend that the matter be referred, with full power, to the incoming executive committee.

Respectfully submitted,
R. T. LAFFIN, Chairman.
H. M. SLOAN,
FRANK R. HENRY,
ALBERT H. STANLEY,
E. S. GOODRICH,
Committee on Nominations.

On motion the secretary was authorized to cast a ballot for the gentlemen named as the officers of the Association.

On motion the question of a place for the next meeting was referred to the executive committee.

The committee on resolutions reported the following:

Resolved, That a vote of thanks of this Association be given to the officers and executive committee for the able manner in which the affairs of the Association have been conducted the past year.

Resolved, That a vote of thanks be extended to the General Electric Company for the excursion and luncheon, and general cordial reception given to the delegates and their friends at Schenectady.

Resolved, That a vote of thanks be given to the Hudson Valley Railway Company for courtesies extended to this Association. Also to the Schenectady Railway, the United Railway Company, of Albany; the telephone and telegraph companies, the local committee of arrangements and the railroad passenger associations for courtesies extended to us.

Resolved, That a vote of thanks be given to the supply men for the splendid exhibit given the delegates of this Association.

The above resolutions were unanimously carried.

Mr. Worth Bean—Mr. Chairman, if you will pardon me, I want to say a word. We are twenty-one years old as an Association, and we have met for twenty-two consecutive conventions. I have been to all the conventions, and I have seen the time when the nominating committee has had considerable trouble in selecting the place of meeting, owing to the fact that numerous invitations were extended to the Association. We have grown to such magnitude and such proportions that the American Street Railway Association to-day has no invitation to visit a city for its next meeting where ample hotel accommodations can be afforded us. I hope the time will come when we shall not expect such invitations. I hope the incoming executive committee will take decided action to the effect that we do not desire to have it understood that we expect these generous invitations from our friends in the business, and to be entertained by them at enormous expense, in the future. I went to the meeting in Boston in 1882; there were twenty-five delegates. To-day we have at this convention 300 delegates, and our membership is 206 companies. I trust the executive committee will consider the selection of a place where this Association can meet, and where we individually can pay our bills and pay our car fares, and not expect courtesies to be extended so that burdens are put on local companies; but let us go to any proper place, any city in the United States that the executive committee sees fit to select, transact our business as business people, and not junket and waste so much time. Let

us also give the attention to the supply men that is proper, and in a measure repay them for going to the enormous expense to show us the interesting exhibits which are a part and parcel of our exhibits; and if we do not want to examine and look into the supply men's exhibits we should inform the gentlemen we do not want them around us. I want them. They have helped to increase our business and helped us in many other ways, and it is a matter of courtesy to them that we should give them attention.

I am informed they feel that at this convention we have had so many other things to do that we have failed to visit them and give them the attention they deserve, after offering the exhibit they have for our special benefit. I do not know that it is germane to the matters before the house, but I felt it was my duty to speak on these points. I hope the executive committee will take this matter up seriously and let us do our business in the manner it should be done. We have just elected a very able board of officers and executive committee, and the next meeting of the Association should see the most radical changes in our methods of doing business.

W. E. Harrington, Camden, N. J.—I wish to supplement Mr. Bean's statement by some observations I have made since I have been here that struck me forcibly. I think we can draw lessons from the new association composed of the master mechanics, which has just started in. They have decided to hold their meeting two days in advance of the meeting of this Association, and to hold three sessions each day to accomplish their work. I have been here since Tuesday morning and have not been able to accomplish anything like what I wished to do in the matter of seeing certain exhibits and talking with certain people as to details in connection with our business. I think the pleasure trips have been of such a character that we have lost too much valuable time. I know from talks I have had with general managers of different companies that they will not come again to our meetings unless we make some very great changes in the way of handling our business. I think the practice of spending so much time in sightseeing and things of that kind should be done away with, and we should devote ourselves strictly to the business for which the delegates attend the convention.

President Ely—Gentlemen of the convention, I desire to return to you my sincere thanks for the very great honor which you have conferred upon me in selecting me president of the Association. I accept the place with a full realization of the responsibility. I deem it a position of great responsibility. I will endeavor, with the help of the other officers and the executive committee, and all concerned in the welfare of the Association and the business represented by it, to devote such an amount of whatever ability and energy I may be possessed of together with a sufficient amount of time, in an earnest endeavor to bring about good results during the next year.

The convention then adjourned to meet at the banquet in the evening.

THE THREE NEW PRESIDENTS

The three gentlemen who have been elected to fill the offices of presidents of the three associations which met in Saratoga last week have all been prominent in railway affairs as well as in the work of the associations over whose interests they will preside during the coming year.

W. Caryl Ely, who is president of the International Railway Company, of Buffalo, is of New England descent, but was born in Middlefield, Otsego County, in 1856. He is a member of the New York bar, to which he was admitted in 1882 at Ithaca. In 1885 he moved to Niagara Falls to practice law, and in 1899 was elected to the presidency of the Buffalo Railway and its allied companies. He was one of the original promoters and incorporators of the Niagara Falls Power Company, and was the chief promoter and first president of the Buffalo & Niagara Falls Electric Railway Company. In 1898, largely owing to his initiative, all of the electric railways in Buffalo, Niagara Falls, Tonawanda, Lockport and vicinity were consolidated into the International Railway Company, whose capital stock is owned and held by the International Traction Company, and Mr. Ely was elected president of both corporations. Mr. Ely has twice served as first vice-president of the American Street Railway Association, and has also been a member for a number of terms of the executive committee of the New York State Street Railway Association.



W. CARYL ELY
American Street Railway Association



F. E. SMITH
Street Railway Accountants' Association of America



E. W. OLDS
American Railway Mechanical and Electrical Association

THE PRESIDENTS-ELECT OF THE THREE ASSOCIATIONS

F. E. Smith, who has been elected president of the Street Railway Accountants' Association of America, has been an active member of that organization since its incorporation, and was elected one of the vice-presidents in 1898. He is auditor for the receivers of the Chicago Union Traction Company, and is also auditor of the Chicago Consolidated Traction Company. Previous to going to Chicago in 1898 Mr. Smith was auditor of the Massachusetts Electric Companies, of Boston, and for five years before that of the Lynn & Boston system.

Edwin W. Olds, who has been elected second president of the American Railway Mechanical and Electrical Association, at the Saratoga Convention, is a native of Vermont, and has had a long mechanical experience. He first became connected with street railway work in 1890, when he entered the service of the Denver Tramway Company, of Denver, Col. In 1896 Mr. Olds was offered the position of superintendent of rolling stock of the Milwaukee Electric Railway & Light Company, which position he has since held. Mr. Olds was a member of the executive committee of the American Railway Mechanical and Electrical Association last year, and his elevation to the presidency is a well-merited tribute to his ability and standing in mechanical and electrical affairs.

THE AMERICAN RAILWAY MECHANICAL AND ELECTRICAL ASSOCIATION

THURSDAY'S SESSION

The final session of the American Railway Mechanical and Electrical Association was called to order at 10:10 by President Farmer.

D. F. Carver's paper, "Use and Abuse of Controlling Mechanism," was read by the president in Mr. Carver's absence. This paper was published on page 475 of the STREET RAILWAY JOURNAL last week.

Mr. Mundy—Regarding Mr. Carver's statement that the controller has only two points, and about the rheostat being merely a matter of form, I can state that some few months ago we were blowing up and completely destroying the interiors of controllers at the rate of about sixty per week, and we have now reduced that trouble to a very small percentage of what it was at first. But we have accomplished this result, not by going to work on the controllers, but by getting the rheostat on the cars in proper condition. The condition of the rheostat affects the controller more than anything else. The older type of resistances made were made of layers of iron with asbestos between them. They would burn out, short-circuit, and have all kinds of trouble. We have been substituting the grid rheostat, which will break sometimes, but does not change materially in its resistance, and you can take a controller, throw it around to the same points, and it will not blow out, provided the stops are graded on the rheostat properly. It has reduced the cost of our controller repairs—it is hard to give the repair cost percentages, but it is hardly comparable with what it was before.

Mr. Morgan—One question in that regard. We have had that same trouble and particularly so on our interurban line. We run there with the K-14 type of control, and run as high as 45 miles per hour, and down a long grade we have between New Castle and Sharon we run probably from 50 miles to 53 miles an hour. We have had the greatest trouble with the resistance on account of the asbestos and iron jamming from one coil to the other. There should be absolutely no reason why a grid rheostat should not be substituted for a single one of the coil rheostats. Have you tried the substitution of one individual set of coils without taking out your full equipment and throwing it away?

Mr. Mundy—Such a plan is perfectly practicable. I would say in regard to that plan that on the rheostats, as we are placing them on our cars to-day, some are not complete equipments of grid rheostat. In other cases, we are using the grid rheostat for the highest points, viz., the R-3 to R-5, and the first points, R-1 to R-2, seldom burn up. The latter we keep in service, using both the General Electric ribbon type between vitrified granite blocks and the Westinghouse round type, and we find that they hold up very satisfactorily. One thing, regarding the proportioning of the resistances. I am somewhat radical and go further than the manufacturers, in that I do not make the first point in my controller a running point. I make that more an arcing point, raising the resistance probably 50 per cent to 75 per cent higher than would be proper to get the right acceleration of the car. That reduces the arc in turning off and makes considerable difference in the tendency to blow up.

Mr. Morgan—We have adopted the same plan. In fact, if we put the controller on the first point, the car will not start. The second point is really the running point on our controller.

Mr. Pestell—I quite agree with Mr. Mundy and Mr. Morgan. In regard to extra resistance on the first point, the great trouble with the blowing out of controllers, arcing and blowing through the cover, has been due principally, I think, to the fact that the controllers were put on one notch and thrown off again before the motors had time to get any speed at all; that is, if the motorman got two bells to start and then, before the car had actually gotten under way, he got a bell to stop, and threw off the controller, in nine cases out of ten it would blow through the cover of the controller. Putting on the extra resistance on the first point tends to stop that. We had a little experience here a short time ago using a S. R. G. motor on a transfer table and we found that the ordinary magnet in the controller would not take care of the arc at all. That is, there was so much self-induction in the motor, and the resistance was so high that the small amount of current would not make a strong enough magnet to blow out the arc, and the latter would be maintained for some time—in fact, until it burned out the controller, and we had to rig it up with a smaller wire. I think the same principle holds good in starting and stopping the controller, not that there are not enough turns of wire, but the fact that the motor has a high self-induction before it is started, both in the armature and the fields, and that tends to kick back and blow holes in the cover when the motor does not start before the current is shut off.

Mr. Mundy—Another cause for blowing up controllers is very serious, and is practically impossible to overcome from the motorman's standpoint, and that is where the motorman sees he is getting into a tight place and has either a car or a wagon ahead of him. His first inclination is to throw the reverse handle. With a four-motor equipment this means that the motors would buck at once. After the track is clear the motorman goes ahead and throws the reverse handle back into the forward position. There is nothing to break the arc except the reverse cylinder, because the motors generate and the arc chars the reverse cylinder, short circuiting it. The next thing we have is the outside shell of the controller. The rest of it has gone up in smoke. To overcome this the manufacturers are making for me to-day what might be called a special controller, but which is one which I think they expect to make a standard. In this controller the reverse cylinder is made with much longer breaks and the arc effect is between each finger. This, of course, does not overcome the bucking tendency, but it does keep the arc from going from finger to finger. I think that it is practically impossible to educate the motormen not to do it, because I find that when I am running a car myself my first inclination is to commit the same fault.

Mr. Morgan—I would like to say in that connection I had very much the same trouble, but I have posted rules on the subject, as I have charge of the mechanical department as well as the operating department. These rules require the motorman to wait before he reverses. I have also experienced the inclination to do things that you don't want the motorman to do. But I argue he is running the car every day and he should do it a great deal better than I. A motorman has no right to assume because a man running a car once a week does something which is, perhaps, a little wrong, that he is also justified in doing it. I always point out to the men that I am not a motorman.

Mr. Pestell—I would like to ask whether anybody here has had any experience with flashing over the controllers on the connecting board below the blow-out magnet for no apparent cause, that is, when the board is apparently clean and all right previous to the time of flashing over?

Mr. Mundy—As I think I said yesterday, I was recently testing some fuses on a car and purposely applied the brake as tight as possible in throwing the controller around to the full multiple position to try the fuse. The controller drew some arcs at the top end, and there was an arc from the controller finger to the cover of the controller, but when I opened it up I also found that the head of every screw in the connection board had simply been burned off. You could not use a screwdriver in getting any screw out. The cause of the trouble was that the gases formed by the arc completely filled the controller and short-circuited the different connections.

Mr. Olds—We have that same trouble. Sometimes in a short circuit, as you throw off, you will find the connecting board contacts burned as well as possibly with the trolley, or wherever the short circuit may occur. Regarding the reversing of the car we think it is policy and best that the motorman should understand the reversing of the car, although some have thought best to take off one of the contacts on the backing-up part of the cylinder at each end, so that should they wish to back up they are obliged to do it on two motors. I think that is poor policy, because there are times when we want a man to use anything that he can to make a quick stop. I think if they get in a tight place they should strip the gears or strip the armatures—I don't care what they do—to stop the car. But we have the same trouble that Mr. Mundy speaks of, the men will use the reverse when they ought not to, and the burning of the reverse is quite a serious matter, especially during the winter. The motorman will come in with his controller burned up. You will say to him, "You have been using your reverse." "Oh, no, I never use the reverse." But open it up and you will find blisters on the back of the contact. They are all burned, whereas the go-ahead is perfectly clean. Regarding Mr. Mundy's improvement—because I consider it is his improvement—he is the man who suggested it and took it up with the General Electric Company—I think it will help us out of the trouble considerably. We are experimenting a little to-day on putting the controller in the center of the car mechanically. Just what will be the outcome of it I am not prepared to say, but we wish to get the controller off from the front platform. All our electrical appliances, if possible, should be taken from the platform. Whether we can accomplish it or not is problematical. The type-M does do that to a very great extent, although they place the circuit breaker on the platform or in the motorman's cab, which is sometimes a source of trouble.

Mr. Pestell—I would like to ask the representatives of any roads here if, on their roads, motormen are instructed relative to the generator effect of the motors in stopping a car so that they would have proper instructions for stopping a car, provided the trolley was off and they had no power and the brakes refused to work? The thought occurred to me in connection with the statement that some roads did away with some of the contacts on the reverse cylinder in the reverse position.

Mr. Morgan—I have always believed that was pretty general practice. I know I have always done so with roads with which I have been connected. I take the stand in regard to reversing a car that no matter what mechanical damage is done anything is better than personal damage, and, of course, you must stop your car in some other way, if you are in trouble with the brakes and with your trolley off. Our men understand the effect of the four-motor equipment and also understand how to reverse their cars with a two-motor equipment. We are now anticipating having a monthly examination of all men on such points, but on that particularly. An unfortunate accident a short time ago brought this point very vividly to my mind. We run a single-track system with time limit, and had an excursion train coming behind a regular. The head car had broken its trolley rope, and the trolley had gone up, and with the usual luck in such cases had struck a pole and was bent so that the front car could not be moved until a man was sent on top of the car. The motorman flagged the rear car immediately, and the conductor went on top to fix the trolley. The result was that when this rear car tried to stop the brakes refused to act. The motorman put on his reverse, but as the rails were greasy from a recent rain, the wheels skidded. If the motorman had not been instructed regarding the reverse the accident would have been more serious. I attribute the result that it was no worse to the fact that that man understood thoroughly his reversing. I believe the time is coming when we shall have to adopt very much the same practice in regard to the instruction of our motormen as is adopted by the steam roads. I think Mr. Ely mentioned in his address yesterday the well-known fact that an engineer or even a brakeman on a steam railroad is efficient on any road in the United States, and it strikes me that we are taking a stride in exactly the right direction, particularly for interurban roads, if we endorse and help in every way the movement that is on foot to instruct motormen and conductors on a general rule plan so that, understanding the rules of one road, they will understand the rules of all other roads. Of course, we cannot expect to have the rules identical, because there are going to be exceptions on different roads on account of the general lay-out of the road. But we can expect them to know just such things as this reversing item which saves accidents, and that, with our friends the ambulance chaser, is getting to be the worst thing we have to contend with.

Mr. Olds—Regarding the adoption of standard methods, I find it is a very important matter, and when we go back to the records of the master mechanics and car builders we find that practically the first thing that they adopted was a standard journal and journal box. It seemed but a small matter at that time, but we can see to-day where they are. They stand at the front in all steam railway equipment, and the managers of the steam roads will not adopt anything that is not recommended by the master mechanics or master car builders. We do not expect to be able to get everything down to a standard, but we can go a long ways toward it. In our own road, seven years ago, we put in a standard axle and journal box. Everything, up to the present day, that we have purchased or ordered has used that same journal box and axle. In three or four different styles of truck, the same car wheels can go in in any of them. On our new interurban cars we have put in the standard 4¼-in. x 8-in. journal box, M. C. B. standard. The new city cars are to have the 3¾-in. x 7-in. journal, and we propose to stay by those tactics. These remarks, of course, are out of order in the discussion of this paper, but I feel that we should, as soon as possible, decide upon standards and the instruction of our motorman can be along these same lines. A number of years ago we had an accident caused by the power going off on a very steep grade. The motorman set his brake, the conductor became rattled and went to the rear end and also set the brake. We found all eight wheels were locked. The locking of the wheels, of course, had caused the car to slide more than it would if they had simply set the brakes as they should. The motorman, in that case, did not understand that if he had left the controller at the running speed—it was a two-motor equipment—his motors would have generated and stopped. For that reason, I think it is very important that all our motormen should be instructed that the motors will generate—a two-motor when in parallel and the four-motor by simply pulling the reverse handle.

Mr. Morgan—I do not want to take up too much time of the convention, but this matter of the instruction of motormen has been something of a hobby with me for some time. If we had a large road and could afford the system of training employed on most of the large roads now, a regular school, we would be in a different position, but we cannot afford to take our men through and give them a mechanical and electrical instruction before we make motormen of them. The question of standards has been, as most of us know, a matter of discussion with the American Street Railway Association for some time, but I think the forming of this Association provides a splendid opportunity in the same direction, the standardizing of equipment, and particularly of trucks. We all recognize the fact that electrical equipment is still being improved, and we cannot expect to standardize or change the mechanical construction which has been in use for a number of years. We can standardize as well as the master car builders, and in so doing we help our supply men and ourselves, and I would strongly urge that that matter be considered seriously by this convention at this time, so as to push it forward.

The secretary announced that both the STREET RAILWAY JOURNAL and the "Street Railway Review" had offered the use of their type in printing the proceedings of the Association. A vote of thanks was extended to both papers, and the offers were referred to the executive committee.

The secretary then read the report of the nominating committee, as follows:

President, E. W. Olds, of Milwaukee.

First vice-president, Alfred Green, of Rochester.

Second vice-president, C. F. Baker, of Boston.

Third vice-president, W. O. Mundy, of St. Louis.

For members of the executive committee, the officers mentioned above and T. J. Mullen, H. H. Adams, D. F. Carver and H. J. Lake.

Secretary and treasurer, Walter Mower.

The officers, as nominated, were unanimously elected.

President Farmer then referred to the excellent work accomplished during the last year in the interests of the Association by the secretary, Mr. Mower, and, upon motion of Mr. Pestell, the Association extended a vote of thanks to Mr. Mower.

Mr. Olds—We, at this time, have a gentleman with us, occupying our chair, who was the first one to call us together one year ago. Through his efforts and the efforts of our worthy secretary we have the meeting to-day in Saratoga which, I feel, has been a grand success, and I hope that our year to come may be as successful as the year that has just flown. And I wish to thank each one of you and the companies that you represent for the honor that you have conferred upon me to-day, and at the same time I wish to make a motion that we extend to our worthy president, Mr. Farmer, a vote of thanks for his efforts in making a success of our organization, as we see it to-day.

The motion was seconded and unanimously carried.

President Farmer—I think the newly-elected officers will take hold immediately after the adjournment of this meeting, and I suggest that as Mr. Olds may have some things to say or have done, which he can do much better here than by correspondence, it would be well to adjourn the meeting, so that Mr. Olds can re-convene the Association, and I would say I am very much obliged for the courtesy that you have done me in overlooking the mistakes I have made presiding at this table. I am a better hand in the shop than I am here, and I shall never forget the kindness that you have all extended to me.

President Olds here took the chair, being escorted to it by a committee composed of Mr. Mundy and Mr. Baker.

Mr. Mundy—I think, next to keeping apparatus in proper shape, the keeping of records is of as much importance as anything else, because it soon tells us whether we are following along a line consistent with good practice and with what other roads are doing. If somebody else is doing things better than you are, you will find it out. I think the standardization of all records adopted by all roads to give this direct information is so important that we ought to have a committee to start to work on it at the present time—for something to give us, at least, grounds to work on at our next regular meeting.

Mr. Lake—The report-sheet matter is a subject that I have not heard mentioned during any of the meetings, and most of our talk has pertained to the city use of cars. I, for one, have no city cars whatever to look after, and my work is entirely interurban and I think, very likely, that there are other members of the Association that are in the same position as I.

Mr. Mundy—Our president's remark that the various members of the Association make suggestions as to the proper subjects for papers next year is certainly a very good one. If we have to rely on either one or a committee of two or three to pick out the papers and the men who are to write on them, we will not, of course, get the best papers. If each member will consider the topic that he thinks is the most important for a paper or papers at the next meeting and will give that suggestion to the secretary, the committee selecting the papers will have some ground to work upon.

Mr. Bigelow—On this subject of reports and classification, I believe that the Accountants' Association made a collection of different forms, and should think it would be very interesting for the committee, after it is formed, to make a collection of the forms used by the different companies, and have it here for the different members to look over in connection with whatever report they make.

Mr. Olds—The question of standardization, not only of our equipment, but of our system of records, needs to be gone into. That should be one of the matters that should come up at our next meeting. Regarding the appointing of committees, I wish to leave that until our executive meeting.

Mr. Miller, of Buffalo, and Mr. Matte, of Indiana, each made a few remarks in response to an invitation from the president.

The meeting then adjourned.

STREET RAILWAY ACCOUNTANTS' ASSOCIATION OF AMERICA

THURSDAY MORNING

President Davies called the meeting to order at 10:20 a. m.

In the temporary absence of Secretary Brockway the president appointed as secretary pro tem Mr. Ross, of Montreal, who read the first paper on the programme, on "Car Maintenance Records," by S. C. Stivers, lately auditor of Jersey City, Hoboken & Paterson Street Railway, Hoboken, N. J. This paper was published on page 463 of last week's issue.

The chair called for discussion of the paper, and Mr. Magilton stated that the system had been resorted to but had not been adopted to a very great extent as yet, and he asked if any instance could be cited where car wheels or other important parts of the car had been rejected as not up to standard. This work in their case was done outside of the general office, and he (the speaker) had not a very deep interest in it directly as yet, though he expected to have later on. They had from time to time rejected certain purchases, but the records were not yet complete enough to show that they had not been up to standard.

Mr. Pease said their wheels were all guaranteed to make a given number of miles. If they did not make the required mileage the company did not pay for them. His company was not keeping the car maintenance record except so far as car wheels were concerned. For that purpose the facts were ascertained by the use of the usual car mileage record, with the date when the wheel was put on and taken off, and if it were reground that date also was entered. When a wheel was removed on account of chipped flange and had not made the required mileage the company did not accept the wheel. They kept a record of each wheel and not of a few selected ones only. He did not know whether it was necessary to number each wheel, but thought it was advantageous; their wheels were all numbered by the car wheel company, and no two bore the same number.

Mr. White reported that his company kept car mileage records, but they did not buy their wheels with any special guarantee, at least did not keep the record for that. If they did not get the mileage out of the wheels that they expected they looked about for something better. They never got any rebate on any wheels that did not wear. He inquired if under the guarantee there was ever any question made of the purchaser's complaints.

Mr. Pease replied that there never had been in their experience. The cause of removal of the wheel was a determining factor. If a wheel was worn flat from sliding or skidding, was then reground and afterward made the required mileage,

the purchasing company paid for the wheel. Forty thousand miles with them covered the life of the wheel.

Mr. White pointed out that there was quite a number of things entering into the question of the life of a wheel, some of which, in the way of repairs, he thought were rather unnecessary. For instance, an armature winder should, in many cases, be held responsible for an armature that burned out, and often the motorman should be discharged rather than the armature. He thought the foreman of the shop should be able to tell what work his armature windings were doing.

Mr. Smith wished to know whether Mr. Pease's company could get the same guarantee from the manufacturers on wheels to be used with the air brake as with the hand brake, and was answered in the affimative.

At this point the president announced the arrival in the room of T. Commerford Martin, the special expert of the United States Government on street railway statistics, who had kindly consented to read, in the absence of the author, a paper prepared for the convention by W. M. Steuart, chief statistician for manufactures of the United States Census Department.

Mr. Martin was received with applause, and read the paper referred to. It is published elsewhere in this issue.

Mr. Duffy paid a high compliment to the instructiveness and interest of Mr. Steuart's paper, and moved that the thanks of the Association be extended therefor, which motion was carried.

President Davies also acknowledged on behalf of the Association the obligation felt for the statistics furnished by the Bureau, which contained valuable information for the standing committee of the Association and for the members themselves, and they would await, he felt sure, with great interest the final report, in which he understood Mr. Martin was to have a directing hand. He predicted that as a result of the work of this Association and the census statisticians the next eight or ten years would witness improvements in accounting which would perfect the art still further than it was carried at present.

Mr. Martin said that while he could not say just what the final report would be as yet, but it would have some forty or fifty tables in addition to those presented in the present bulletin, and he thought they would bring out some further points of interest.

The president then announced the presence of Ex-President Calderwood, of Brooklyn, and invited him to address the meeting.

Mr. Calderwood expressed his great pleasure at being able to meet with the Association after an unavoidable absence from the last three conventions, and that the pleasure of the meeting was mutual was amply evidenced by the welcome extended to the speaker.

The president then called for any further discussion of the paper on "Car Maintenance Records," and in response Mr. McDole said he thought the subject was one which would come more directly under the jurisdiction of the operating department, and Mr. Mitchell stated that that was the course adopted by their company, the auditing department dealing simply with the totals.

William F. Ham, on behalf of the committee on standard form of report for electric railways, then presented the report of that committee, which is published elsewhere in this issue. This report, on motion, duly seconded, was received and the thanks of the Association voted the committee for its efficient labors.

Mr. Judson, the accountant of the New York Board of Railroad Commissioners, was introduced by the president, and received with applause. He addressed a few remarks only to the Association, stating that he would be satisfied if they would just allow him to sit down and listen to what was going on.

Mr. Ross, chairman of the nominating committee, announced a meeting of that committee for 9 o'clock, p. m., to prepare its report for presentation at Friday's session.

On motion, adjourned until Friday morning at 10 o'clock.

FRIDAY MORNING

President Davies called the meeting to order at 10:20, and called for the report of the executive committee as the first order of business, which report was presented by Secretary Brockway. On motion it was duly accepted and its recommendations adopted.

Frank R. Henry, of St. Louis, then read a paper on "The Advantages and Disadvantages of the 'Bag System,' as Compared with the 'Receiver System' of Handling Conductors' Remittances." This paper was published on page 471 of last week's issue.

Mr. Ham said that the paper expressed his views and that he agreed absolutely with everything stated therein. In Washington, however, probably 90 per cent of the business was ticket business, and he (the speaker) felt satisfied that under those conditions the receiver system was impracticable. They made it a practice to deal personally with conductors in the adjustment of discrepancies, and he (the speaker) was becoming more and more impressed with the defects in the methods of making returns in bags. The better that you can treat the men, the more courtesy you can show them, the better it is for the company, and from that standpoint alone he should prefer the receiver system to the bag system, where the former could be employed.

Mr. Smith reported some valuable details, as well as the general results obtained by his company in the use of the receiver system, and stated that the expense of that system amounted, with them, to $1.93 per $1,000 collected.

Mr. Mitchell stated that in Pittsburg they had both systems, and he might say also a third system which was somewhat like the bag system. They had gone through a consolidation some eighteen months ago, and had not yet been able to make up their minds as to which system they wanted to adopt exclusively, largely owing to the fact that there were conflicting opinions among the several officers.

Mr. Fullerton said his company, at Detroit, had the tickets and transfers turned in each trip, and the cash once a day. They had the same trouble with contentions over shortages and overages that others complained of, and for that reason, among others, he was very much interested in this question and its consideration at this meeting, to see if something could not be invented to do away with that feature. One other difficulty they experienced was the delay caused conductors in turning in their receipts at times when a great many of them pulled off at about the same time.

Mr. Henry said that at their largest car house, where they ran some 240 cars, they never experienced serious trouble from that source, the men not being delayed, as a rule, more than a minute or a minute and a half. During exceptional rushes, and such conditions as they expected to arise at the World's Fair time, doubtless there would be more congestion, and then it would be a question of putting on more receivers and throwing more work on them.

Mr. Lester, of the Worcester Consolidated, said they had adopted the receiver system. They had had the bag system in vogue on some of the suburban roads before the consolidation, but it was very unsatisfactory, as, sometimes, bags were turned in as they should be and sometimes not, and there was always a dispute between the receiver and the conductor.

Mr. Henry explained that instead of having the receiver indicate the amount of money and adult tickets on the trip sheet, as described in his paper, they had since changed the procedure by cutting out that detail, and all the receiver did now was to take the amount reported to him, which he could check, if he saw fit, put his initials on the trip sheet, treating that as a teller would a deposit sheet.

Mr. Duffy stated that from his experience, both with the bag system and the receiver system, there was nothing whatever to be said in favor of the former, where the latter was practicable.

Mr. Bartlett said that in Boston they were using the bag system, more from force of circumstances, he supposed, than anything else, but he agreed with those who had already spoken in the view that the receiver system, where it could be used with reasonable economy, was the system to use.

Mr. Mitchell reported that, in their experience, the bag system was costing them about $2 for $1,000 collected, and the receiver system about $3.17 for $1,000.

Mr. Boyle stated his company used the fare-box system on four lines and the receiver system on the others—he hardly knew whether theirs would be called a receiver or a bag system, as it was a combination of both.

Mr. Mackay stated that they were using the bag system, principally, he thought, on the ground of greater economy, but they had overcome some of the difficulties that had been mentioned by preceding speakers, as, for instance, in the check provided against the purloining of receipts.

Vice-President Ely, of the American Street Railway Association, visited the Accountants' meeting at this point, and was invited by the chair to address the members.

Mr. Ely was greeted with applause and spoke briefly. He said that he came before the Accountants with fear and trembling, as he always did, because he never knew what the result was going to be until after he had gotten through. Though he had left the meeting of the American Street Railway Association in the midst of a very important discussion, and had but a moment to spare, he felt that he could not refrain from accepting their kind invitation to appear before them. He looked upon the Accountants' Association as one of the most valuable results of the existence of the American Street Railway Association, and the work which the former had accomplished spoke for itself, and was an achievement of which they might well feel proud. However, Rome was not built in a day, and perfection could not be attained without continuous labor. The only thing to do was to put their shoulders to the propositions still before them and just keep on pushing. He complimented the Accountants upon being a thoughtful, very intelligent, clean, bright and business-like body of men. He hoped to meet twice as many of them next year, and that success would crown their efforts in every branch of their work.

Messrs. Hogarth, Henry, Smith, Christ, Pease, Simpson and others contributed further to the discussion of the bag versus the receiver system of handling remittances, whereupon this subject was closed and the chair called upon C. N. Duffy to present the subject next announced on the programme, a "Comparison of the Municipal Tramways Association of Great Britain; Proposed Standard Classification and Form of Report with the American Standard."

Mr. Duffy presented this subject very interestingly in what he termed an "informal talk," beginning with the correspondence with Mr. Dalrymple, of the Glasgow Corporation Tramways Company, preliminary to the investigation that had been made, showing among other things that full credit had been given to the work accomplished by the Street Railway Accountants' Association of America. He (the speaker) had advocated very warmly the adoption by the British Association of the American classification, with a view to securing its use the world over, and was met with the argument that the difference in conditions presented obstacles to that consummation, especially in respect to those companies abroad which were municipally owned and operated. Mr. Duffy then proceeded to a comparison of the details of the respective classifications and forms, which, owing to the limited time at his disposal, was necessarily somewhat hurried and incomplete; and on motion it was voted that anything additional which Mr. Duffy would have time to write upon the subject should be included in the printed proceedings.

On motion of Mr. Ross the president was directed to appoint a committee of one to rearrange the selection of blanks, as recommended by the executive committee, and Mr. White, of Hartford, was appointed as such committee.

The committee on nominations presented the following report, which was adopted unanimously:

For president, F. E. Smith, of Chicago.

First vice-president, F. R. Henry, of St. Louis.

Second vice-president, C. O. Simpson, of Birmingham, Ala.

Third vice-president, J. J. Magilton, of Schenectady.

Secretary-treasurer, W. B. Brockway, of Yonkers.

Executive committee—H. J. Davies, of Cleveland; S. C. Rogers, of Youngstown, Ohio; S. G. Boyle, of Louisville, Ky.; H. M. Pease, of Buffalo.

President Davies said that in retiring from the chair he wished to express his thanks to the members for their attendance, for their patience with their presiding officer, to the members of the executive committee for their assistance and especially to Secretary Brockway for courtesies innumerable, which had made the work of the president almost a pastime. He congratulated the Association upon the selection made for its officers for the coming year.

President-elect Smith was then called to the chair, and pleaded the lateness of the hour as an excuse for limiting his remarks to an expression of appreciation of the honor conferred.

Secretary Brockway announced that the place of the next meeting of the American Street Railway Association had been left, as it was last year, to the executive committee, in consequence of which it would not be known until that committee had taken action where the place of meeting would be.

Mr. White moved that the executive committee be given authority to arrange for the printing of the standard report of the commissioners of the several States in the regular form for distribution to members of the Association, which motion, as amended in some of its details in the course of a brief discussion, was carried.

It was moved by Mr. Mackay that the portrait of the outgoing president be inserted in the proceedings, and that the thanks of the Association be extended to him for the very able manner in which he had discharged his duties. (Carried.)

The secretary was directed to draft a set of resolutions expressing the appreciation of the Association for the courtesies and privileges extended at this meeting.

Mr. Henry, of St. Louis, reminded the Association of the approaching World's Fair in his city and invited the members to call upon him during their visit there, when he would do all in his power to see that they were properly taken care of.

On motion of Mr. Mitchell the convention then adjourned sine die.

THE BANQUET

The twenty-second annual banquet of the American Street Railway Association was held in the large dining room of the Grand Union Hotel on the evening of Friday, Sept. 4. The tables were very tastefully decorated with gladiolus and roses, and the orchestra of the hotel provided the music. Hon. Addison B. Colvin was the toastmaster, and his introductions of the speakers were particularly felicitous. The speeches were all well received, and, as given in the official list, were as follows: "How the Wheels Go Round," Hon. Adelbert P. Knapp; "The Legal Side," Hon. Job E. Hedges; "The Empire State," Hon. George E. Green; "The Relation of Labor to Capital," Rev. John R. Mackay, D. D.; "The Perfection of Success," Herbert H. Vreeland; "The Happiness (?) of Public Service," Hon. Edgar T. Brackett; "The Best Fare—The Feminine Fair," Hon. W. Caryl Ely.

PAPERS READ AT THE SARATOGA CONVENTIONS

PRODUCTION AND DISTRIBUTION OF ALTERNATING CURRENT FOR LARGE CITY SYSTEMS

BY RICHARD McCULLOCH

The large city street railway system of to-day is due to a process of evolution. In most cities twenty years ago the business of transporting passengers through the streets on rails was divided up among several companies operated with more or less skill, each independent of the other, and each striving after the other's business and paralleling its tracks. When the electric era came on motive power was changed and a new equipment selected according to the judgment of the manager, with no particular regard for standardization of apparatus, and without any thought toward a unity of purpose in the operation of the several properties. And so it comes about that when the several roads are consolidated into one system, as has happened in all except a few of our large cities, the manager of the consolidated property finds himself in possession of all sorts and styles of equipment, chosen with a greater or less amount of wisdom, and an aggregation of power plants and feeder systems which, however suitable they might have been for the individual roads, do not lend themselves readily to an economical operation of the property as a whole. The weeding out and the standardization of apparatus, and the adjustment of generation and transmission systems is the task of to-day. The question of power plants and distribution is the most difficult of solution, and in taking it up several plans suggest themselves.

(1) To keep the best of the present plants, add to them as necessary, and adjust the distribution systems from them.

(2) To abandon the present plants, constructing an entirely new plant with a new distribution system leading from it, using the old plants as sub-stations if they are suitably located.

(3) A combination of these two systems, which consists in the beginning of a new plant, the plans of which contemplate the operation of the entire system from it at some future date; at the present time, however, only putting enough apparatus in the station to take care of the growth of the system and adding to it from year to year as other stations are abandoned.

Either of the latter schemes would lead us to consider the generation of alternating current and its transmission to sub-stations, and any change in the power plant system involves a discussion of the relative advantages of power generation in one or several power plants. This question has lately received a great deal of attention in the engineering world, and has been thoroughly discussed from an engineering standpoint.

The great and all-important question which confronts the manager and which the engineer should assist him in solving, is how to transport passengers with the greatest degree of safety, reliability and economy. The power plant and transmission system constitute only two links in the chain of many devices necessary to accomplish this task, and should not be given undue importance in the laying out of the general scheme. Economy of generation or transmission of power should never be sought after at the expense of safety or reliability of operation. True engineering should take into account the financial questions involved in the operation of the property, but, unfortunately, there are fads and fashions in engineering, just as in matters of dress. Large questions of policy which should be solved by sound engineering have sometimes been settled from a desire to be in the prevailing fashion or to have a power plant which will eclipse in daring the last one built. This cannot always be laid at the door of the engineer, who is sometimes called into consultation only after the great questions have been disposed of, leaving him only the details. All this, perhaps, has little to do with the subject of this paper, but it is given as a preface, because, after all, more important than the question of how to generate and transmit alternating current is whether or not to generate it at all.

In this paper the alternating current will be considered to be made by steam power at a central power station, transmitted at a high voltage to sub-stations located in different parts of the territory to be served, there converted into 575-volt direct current and distributed by means of feeders to the trolley sections in the usual way.

The use of alternating current motors for street cars, although the subject of a great deal of experimenting, has not yet been successful. In Switzerland on an interurban road, and in Northern Italy on a steam road which has been converted to electric traction, alternating current motors are used, and their use was seriously considered in the electric equipment of one of the London underground roads formerly operated by steam locomotives. Where the stops are frequent, however, as is the case in city service, in the present state of the art the use of alternating current motors is impracticable.

For railway and power transmission work the advantage of transmission by alternating current is that small high-tension feeders from the central station and short direct-current feeders from the sub-stations are substituted for the long, heavy lines of feeders leading from the central direct-current station. The problem is more one of current transmission than of current production.

The discussion will be taken up under the following headings:

The Production of Alternating Current.

The Transmission of Alternating Current.

The Relative Advantages of Alternating and Direct Current Transmission.

As a complete description of an alternating current station, transmission line and sub-station would be very long, and of no great novelty, the following discussion will call attention only to those general points which are most remarkable in present practice and those which should be especially looked after in the design:

THE PRODUCTION OF ALTERNATING CURRENT

Site of Station.—The central station should be located where coal may be obtained by rail or water, or both, and where large quantities of water may be obtained for condensing purposes. If a location fulfilling these requirements may be obtained in any large city near the center of gravity of the load, well and good; if not, it is not so serious as it would be if the plant were designed to furnish direct current. The location should not be in a residence district, where the plant is apt to become a nuisance, and physical obstacles to the laying of feeder mains, such as rivers, bridges, etc., should be avoided if possible in the selection of the site.

In the general principles of its construction the alternating current plant does not differ from the direct-current plant, except that the amount of power installed and the size of units usually warrants a magnitude of construction rarely attempted in direct-current plants. We have the same boiler plant, the same engines, similar generators, and a switchboard which transmits alternating current to feeders instead of direct current.

Coal Supply.—There is no point more important to the continuous operation of a power plant than regularity and infallibility in the delivery of coal. The amount of coal coming to one of our large power plants is such that extraordinary means must be taken for quickly unloading and handling it. If coal is delivered by rail a large switch-yard must be provided for handling the cars, and if bottom-dumping cars cannot be depended upon, some form of a car tipple for quick unloading should be installed. The tipple used on the ore docks suggests itself for this purpose. If coal is delivered by water, clam-shell drop-buckets are used for unloading the barges. Those of us in the West learned by last winter's experience that we must expect at times to be obliged to burn all sorts of coal in all sorts of conditions. It is, of course, preferable that the coal should be delivered crushed ready for the automatic stokers, but provision should be made in the lay-out of the station for a coal-crushing plant to handle lump and mine run coal. The quantity of coal burned in the large stations is such that if an attempt is made to furnish storage capacity within the plant for even a modest period of time, the size and cost of the building is enormously increased by the large coal tank perched high in the air above the boilers. It is perhaps a better plan, if the location of the power plant permits it, to carry only a few days' supply in the tank in the boiler room, and provide a separate building for the coal reserve, connected by conveyors to the boiler room, where the coal may be kept nearer the ground, and the cost of the iron work for its storage diminished.

The large power plants in the Eastern cities burn buckwheat anthracite, while those in the West burn bituminous screenings, which term includes all that will pass through the 1¼-in. screen at the mine, including the dust and fine coal made by the cutters. The plant should be laid out for the kind of coal it is intended to burn, and in cases where the cities are located so far from the mines that the cost of transportation becomes a large factor in the cost of the coal, it would pay to devote a great deal of attention to a determination of what is really the most economical coal

to burn, and not assume, as is often done, that that coal is the best which can be had for the lowest price per ton.

Building.—The power plant should be substantial and fireproof and just as ornate as the directors of the company wish to authorize, it being remembered that although it is creditable to a railroad company to have a handsome power plant, the gross receipts are not increased nor the operating expenses decreased thereby. The plant should be entirely closed and should be constructed with the idea that all employees and visitors should enter by one door and be checked in and out, just as in a well managed factory. When this door is closed the plant should be impregnable, and conveniences should be arranged so that if necessary the entire operating force can be lodged and fed in the building.

Coal and Ash Handling Machinery.—The apparatus to handle the coal and ashes of a large power station constitutes a formidable plant in itself. It is, perhaps, better in a large installation to keep the coal and ash handling apparatus independent, as ashes are much more abrasive than coal, and it is better to leave either set of apparatus free so that it can be used at any time. Some form of the self-dumping bucket conveyor is in general use for coal, while various apparatus has been installed for handling ashes.

Mechanical Stokers.—The use of mechanical stokers in the large plants of to-day is universal. They are more efficient on low-grade fuel, and by their use and that of coal and ash handling machinery, the employment of a large number of laborers in the boiler room is dispensed with, and the likelihood of labor troubles diminished. In fact, if it were necessary to handle the coal and ashes, and fire and boilers by hand, it would be difficult to get men enough into some of our large plants to keep them going, and these men would be a constant source of annoyance.

Boilers.—Some form of water-tube boiler is usually chosen for large plants because it may be made in large sizes without danger of explosion and occupies less ground space per horsepower than the fire-tube boiler. There is nothing remarkable about the boiler installation for an alternating current plant except that the size of the plant and the size of the units is such that a two-story boiler room is usually required. This feature, however, has already been introduced in some of our large direct-current plants. The question of pressure and superheated steam, while naturally belonging to boilers, will be taken up in the discussion of steam engines.

Engines.—Until quite recently the only prime mover for driving generators of large size in railway steam plants was the compound, condensing steam engine. The triple expansion engine has been used in no large installation. In one recent installation a duplex compound engine, with the two low-pressure cylinders horizontal and the two high-pressure cylinders vertical, drives the generator. This is a mammoth unit of 5000 kw, and is the largest which has been built.

Steam Turbines.—Of late years, however, improvements in manufacturing facilities and our increased knowledge of the properties of steam have made possible the utilization of the steam turbine, which, remarkable to state, makes use of the principle upon which the first steps toward the application of steam as a prime mover were based. It seems as if we are on the verge of a radical change in the application of steam, as the introduction of the turbine makes an entire change in the usual layout of the power station. And, as in the case of all great inventions, necessity was the mother of this one. The steam engine has reached such a size that for large units it is heavy, clumsy, delicate of adjustment and requires constant skilled attention. On account of the inertia of the valves and reciprocating parts, the speed of the steam engine must be kept so low that the cost of the electric generator is greatly increased. In fact, it would seem that the limit in the size of steam engines for driving electric generators is about reached. If the claims of its advocates are only partly realized, the steam turbine is the ideal machine for driving alternating current generators. The efficiency of the steam turbine is claimed to be fully equal to that of the best steam engine; the turbine being a rotary machine, the thrusts caused by the reciprocating motion of the steam engine are avoided, thus relieving the foundation and frame of that strain, and facilitating the operation in parallel of alternating current generators; foundations and buildings for turbines are cheaper than for engines; as the electric generator is driven by the turbine at a much higher speed than by the engine, its cost is less; there being no valve gear and reciprocating parts in connection with the turbine, its maintenance is less, and there is no need of the skilled attendance during operation so necessary with the engine; as no oil is needed for the lubrication of the turbines, the steam may be condensed in surface condensers and used over again in the boilers, thus affording practically distilled water for boiler use. All of these claims are being made for the turbine, and although all of them may not be fully realized, it is likely that there will be such advantages in the use of steam turbines that no large alternating current plant will be built in the future containing any other prime mover. One of the most important advantages of the steam turbine for electric work is that between half load and 50 per cent overload its efficiency is nearly constant, and that even at less than half load its efficiency is good.

Superheated Steam.—The amount which steam may be superheated when used for driving steam engines is limited on account of the carbonizing action of the steam on the cylinder and valve lubricants. With a special valve gear constructed for use with superheated steam, steam superheated 150 dgs. F above the temperature corresponding to its pressure may be used. With steam turbines any superheat which it is practicable to obtain may be used, and great economy is effected by its use. Some of the makers of water-tube boilers now make an attachment to be placed in the path of the heated gases within the brickwork of the boiler for superheating the steam. The amount of superheat which can be obtained by this device depends upon its heating surface, but enough heating surface may be placed within the brickwork of a boiler to obtain about 200 degrees of superheat. If it is desired to obtain a greater degree of superheat than this it is advisable to use an external superheater.

Condensers.—In order to obtain the maximum economy by the use of steam turbines, as rare a vacuum as possible should be maintained by the condenser, the usual specification calling for 28 ins. This necessitates a larger and more expensive condenser than is usually installed with the same capacity in steam engines. The economy of the steam turbine increases very rapidly, both with the quantity of superheat and the rareness of the vacuum, and the limit of 28 ins. has only been set because it is the limiting vacuum which it is practicable to maintain.

Steam Pressure.—Economy in the use of steam also increases with the steam pressure. With compound condensing engines the common pressure in use in 175 lbs., while with steam turbines the economical point seems to be about 200 lbs.

Piping.—The design and installation of the piping in a large, high-pressure plant necessitates the greatest degree of skill. The old fads of double-headers, auxiliary headers and loop systems have expired, and now the best practice is to make the piping as short and simple as possible, and make up in excellence of construction the security which it was once sought to obtain by doubling the installation. In some of the large plants recently installed, the condensers have been set directly over tunnels connected with the water supply and the heavy piping necessary for the condensing water has been entirely done away with.

Auxiliaries.—The auxiliary apparatus, such as coal crushers, coal and ash handling machinery, stoker machinery, boiler feed pumps, condenser pumps, air pumps, cranes, exciters, elevators, etc., require a large amount of power for their operation, and the piping for the engines furnishing this power is expensive of installation and maintenance. It is recommended that these auxiliaries, so far as possible, be driven by motors, preferably induction motors. There will be a gain in economy over steam operation, and a large amount of high-pressure steam-piping will be done away with. Any machine which should run at a reasonably constant speed can be operated by means of an induction motor, and one which requires a variable speed can be run with a direct-current motor.

For one large alternating current plant, the construction of which is now pending, it is proposed to furnish current for the auxiliaries and for the excitation of the generators as follows: Small alternating current generators, driven by turbines, are to be installed to furnish current of a voltage suitable for driving all the induction motors in the plant. Rotary converters, driven by this current, furnish the direct current, probably at 250 volts, for exciting the main generators, and for lighting the plant. A storage battery installed on this 250-volt circuit steadies any fluctuations and furnishes a reserve in case of a breakdown. In this way the running of the auxiliaries, the excitation of the generators and the lighting of the plant are made entirely independent of the main current supply.

Division Into Units.—Large alternating current city plants as at present installed represent a vast quantity of power under one roof. Any accident which might cripple the plant would have very serious results, and affect a large number of people and industries. The greatest care should be taken to avoid such a possibility. In order to prevent, as far as possible, the crippling of the entire plant by an accident to any part of it, some of the more recent installations have been divided into units, each unit consisting of a generator, engine and condenser, together with the necessary number of boilers to furnish steam for the engines and the auxiliaries in connection with the boilers. It is intended that

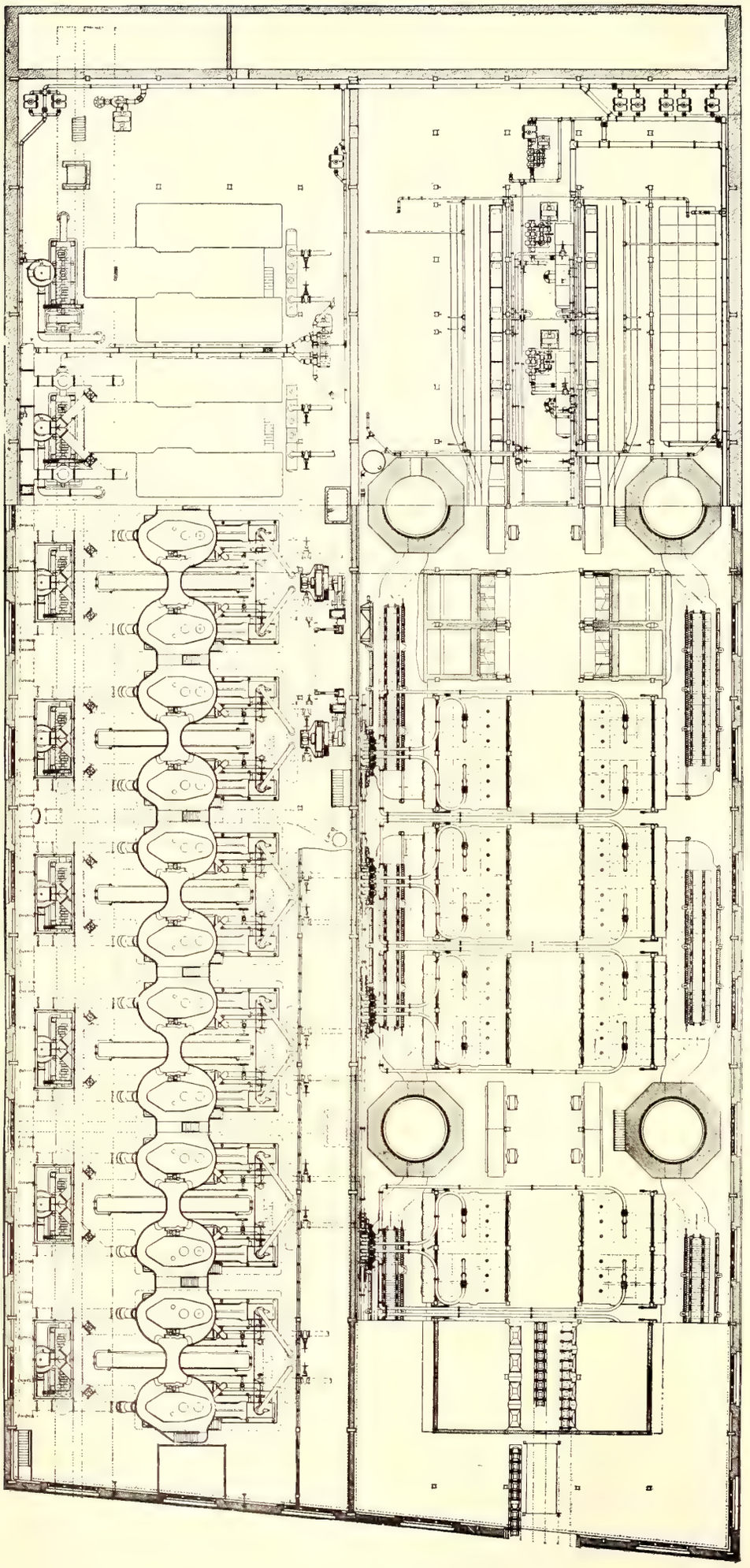


FIG. 1.—PLAN OF MANHATTAN POWER STATION

each unit shall be independent of any other; in fact, there will be as many separate power plants as there are units. An emergency steam connection is made between the steam headers, but for emergency use alone. The unit method minimizes the danger of a complete shut-down of the plant, but the price paid for it is the greater amount of reserve apparatus necessary, and also a somewhat poorer economy if the unit idea is carried out in detail as to feeders and substations.

Frequency.—By common consent a periodicity of 25 cycles per second has been adopted in the United States for alternating current power work. In Europe there seems to be no fixed standard, each installation following the ideas of its designer. Rotary converters work better at low frequency, and in a combined railway and lighting plant where alternating current lighting is to be done it is best to generate at 25 cycles, use rotary converters at this periodicity for the railway and direct-current lighting, and install motor generators to give a frequency of 60 cycles for any alternating current lighting.

Phase.—Where the generator voltage is used in transmission it is the accepted practice to generate three-phase current. Where the generator current is stepped up for transmission it is the custom with some manufacturers to generate two-phase current and in stepping up the current for transmission to change it to three-phase. In most city installations the desired transmission voltage is less than 15,000, and as this voltage can be obtained with modern insulation in well-designed generators, unquestionably the best practice is to generate at the transmission voltage, because this obviates the use of step-up transformers. Where the desired transmission voltage is above that which can be obtained in the generator, it is common to generate at a low voltage and raise to the transmission voltage by means of step-up transformers.

Operation of Generators.—For railway and power purposes there is no great difference between the running of alternating and direct-current generators. If there is any difference it should be in favor of the alternating-current machine, owing to the substitution of rings for the commutator, and the slightly greater efficiency owing to the absence of brush friction and losses. The large modern machines are made of the revolving field type, the revolving parts carrying low-voltage current and the high voltage confined to the stationary parts with little risk of accidental contact with persons. With engines of good regulation and similar types of valve gear there is no difficulty in running engine-driven alternating-current generators in parellel, and with generators driven by turbines which have a constant impulse throughout

the entire revolution, operation in parallel becomes a simple matter.

Switches.—The handling of high-voltage current in large quantities is quite a serious question, and the switches and switching devices of a large alternating-current station have become one of the most important parts of the plant. In the more recent installations, the switch contacts are broken in oil and each switch is built in a brick fireproof compartment. The bus-bars are divided into several sections, so that in case of a short circuit any section may be isolated. All switches are opened and closed by means of a motor running on an auxiliary circuit controlled by the switchboard attendant. No high-voltage current is brought to the switchboard.

Central Station Plans.—In order to indicate the general trend of modern practice in central station design, there are published with this article several power station and sub-station plans:

Figs. 1 and 2 are plan and cross section of the Manhattan Power Station, New York City.* This installation is the latest large American installation, and represents the highest development of an engine-driven station. It contains 40,000 kw, divided into eight 5000 kw units, and covers about 82,400 sq. ft., or 2.06 sq. ft. per kilowatt. The cubical contents of the building are about 8,580,000 cu. ft., or 215 cu. ft. per kilowatt capacity.

Plan and cross section are shown of the Chelsea Station, London,† now under construction, to be equipped with ten 5500-kw turbine-driven units and one smaller unit, making a total capacity of 57,000 kw. These turbines are of the horizontal shaft type, and this is the first large station to be entirely equipped with steam turbines. From a published report the ground area is 1.36 sq. ft. per kilowatt, and the cubical contents of the building 139 cu. ft. per kilowatt. These measurements include an office building adjoining the station.

Figs. 3 and 4 are sketches showing the proposed arrangement of a station to contain eight 5000-kw steam turbines of the vertical shaft type. This has the same capacity as the Manhattan, and it would be interesting to compare the relative sizes of the two buildings. The turbine station covers an area of 58,860 sq. ft., or 1.47 sq. ft. per kilowatt. The cubical contents of the building are 5,403,000 cu. ft., or 135 cu. ft. per kilowatt. This station also contains space for 12,000-kw sub-station capacity.

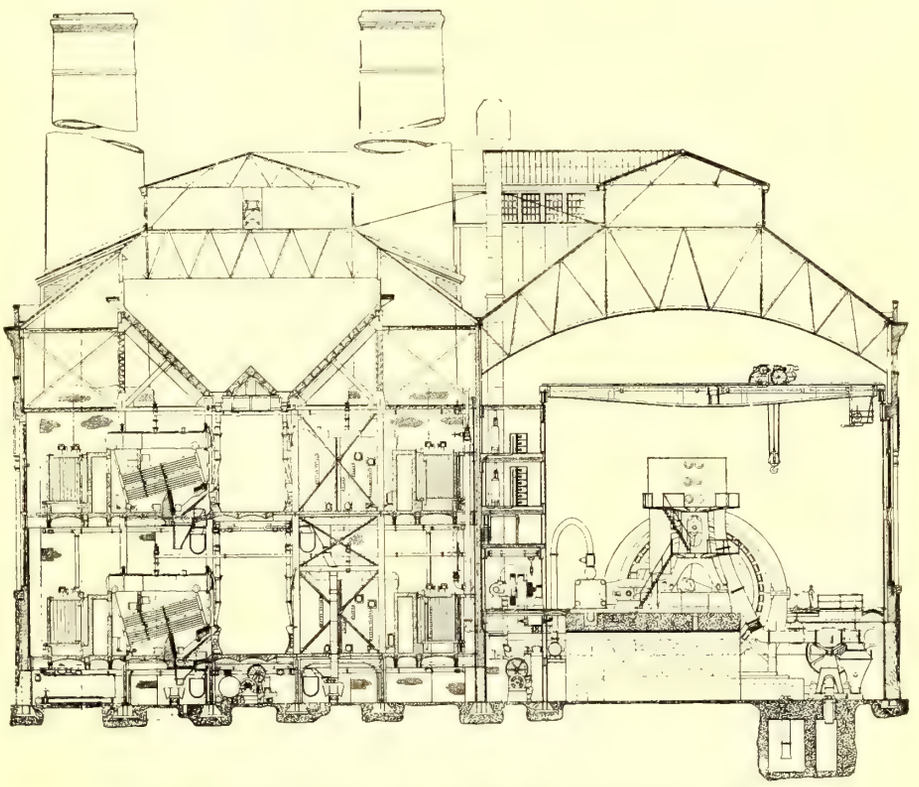


FIG. 2.—CROSS-SECTION OF MANHATTAN POWER STATION

THE TRANSMISSION.

Transmission Voltage.—In a few words the advantages which alternating-current transmission offer lie in the possibility of transmitting large amounts of power over long distances with comparatively small wire. Since the size of the wire necessary decreases as the transmission voltage increases, there seems to be no reason why for city use, where heavy loads must be transmitted, the limiting transmission voltage should not be the limiting voltage at which current can be produced in the generator, except that voltages above 15,000 require cables of high cost. It is unquestionably the best practice to carry the high-tension cables underground in conduits. There are some large cities where alternating current at a pressure of 5000 volts or higher is carried on overhead wires strung along city streets, but although quite a sum of money is saved in the initial cost of feeders, the true economy of such an installation is doubtful. Serious interruption to traffic and perhaps injury to the central station and sub-station machinery are invited by short circuits and grounds from fires, storms, lightning and accidental crosses with other wires, while the danger to human life is such that the railway company is liable at any time on account of some fatality to be ordered to place the high-tension wires underground at a greater expense than if it had been done in the first installation.

Transmission Cables.—As by three-phase transmission a minimum of copper transmits a given amount of power with a given loss, this is the system which has been generally adopted for transmission. Where the feeders are placed underground, three conductor cables are used, the three conductors being separately insulated and then surrounded by a lead sheath. Formerly rubber was the insulation used for this purpose, but paper has come rapidly to the front and at present paper insulation is preferred by many to rubber. Paper does not soften under heat like rubber, and the cable has the advantage of being cheaper than rubber and of having a somewhat greater overload capacity. The weak part of any cable is the joint, and great care should be taken in splicing to exclude all moisture. This is especially true of paper insulated cables.

In estimating the sizes of cables for carrying the high tension current it is usually necessary to figure the cable for ampere carrying capacity instead of for drop in voltage, as is customary in long-distance transmission. This is on account of the short transmission distances as compared with the high transmission voltage. The amperes per phase for three-phase transmission may be determined very simply by dividing the watts to be transmitted by the transmission voltage multiplied by the square root of three.

The cross sections of the copper may be taken very conservatively at 1000 circular mills per ampere for rubber insulated cables and 900 circular mills per ampere for paper insulated cables. The copper cross section should be checked by estimating the drop in voltage at maximum load, but for the comparatively short distances of city work it will usually be found that the drop in voltage is very small in a cable properly proportioned for the current it is to carry. The largest size three-conductor cable which it is advisable to install in an ordinary duct is one in which each conductor has a 0000 section.

Tables Nos. 1 and 2 give data and cost of rubber and paper insulated three-conductor, lead-covered cables with 00 conductors, for voltages ranging from 5000 to 20,000. It will be observed that above 10,000 volts for rubber and above 15,000 volts for paper insulated cables the cost increases so rapidly as almost to make these the limiting voltages for underground distribution.

Figs. 5 and 6 are respectively a cross section and a photograph of a three-conductor, lead-covered cable.

In some installations one cable for each rotary has been run between the power plant and the sub-station. In other instances a standard size of cable has been adopted for the system, and a number of cables run to each sub-station corresponding to the estimated load. An extra cable should always be provided, so that the maximum load of the sub-station may be carried with one cable out of service.

Conduit.—Several forms of duct have been used for underground conduits. The old wooden pump-log ducts have been abandoned because the wood rots and the juices in the wood act chemically on the lead covering of the cable. The ducts at present laid are usually of cement-lined iron pipe, tile in either single or multiple duct, and concrete tubes. It pays to imbed the ducts well in concrete, so that an excavation under the conduit line will

* Reproduced from the Street Railway Journal, Jan. 5, 1901.

† See Street Railway Journal, July 18, 1903.

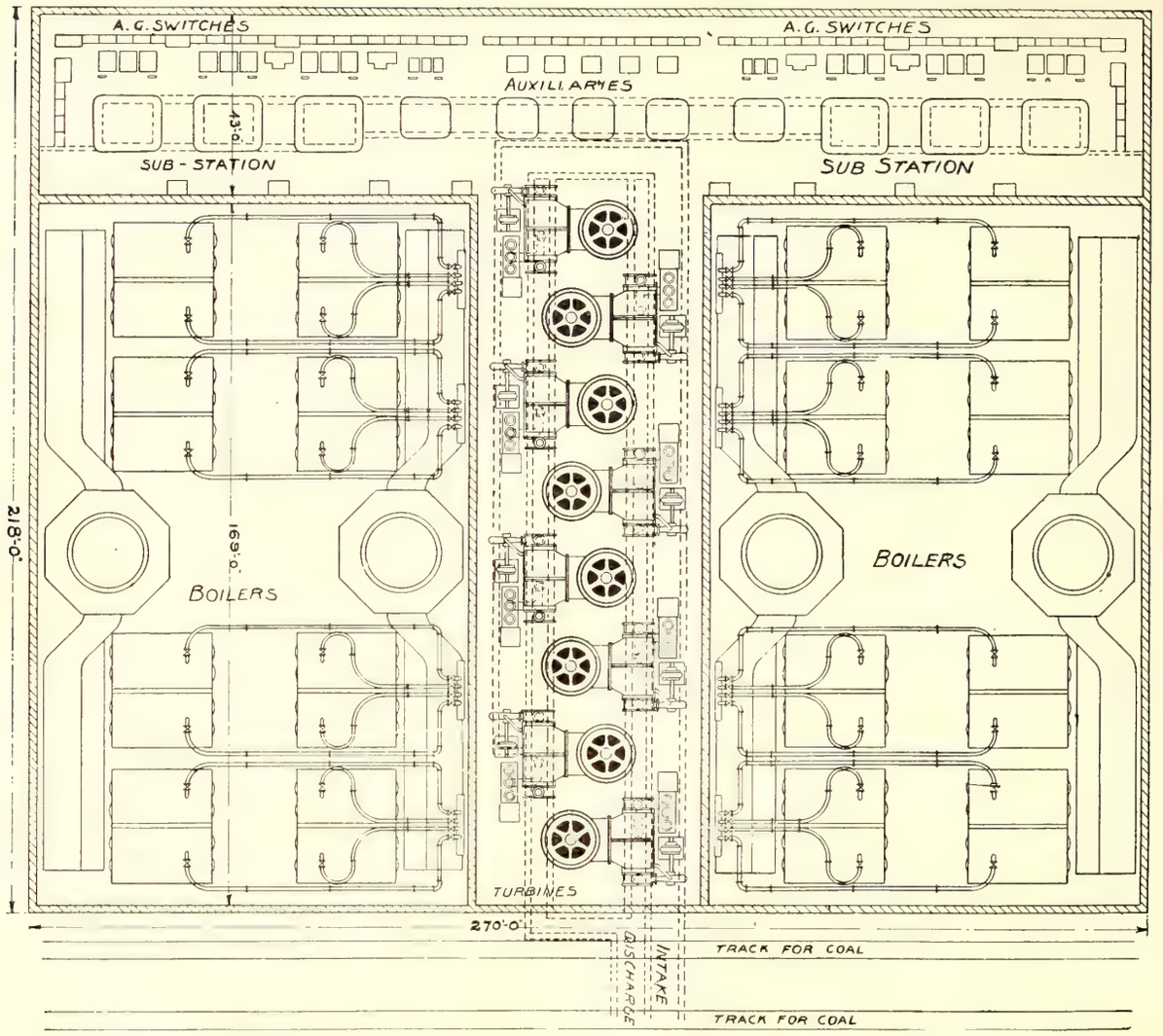


FIG. 3.—PLAN OF PROPOSED TURBINE STATION AND SUB-STATION

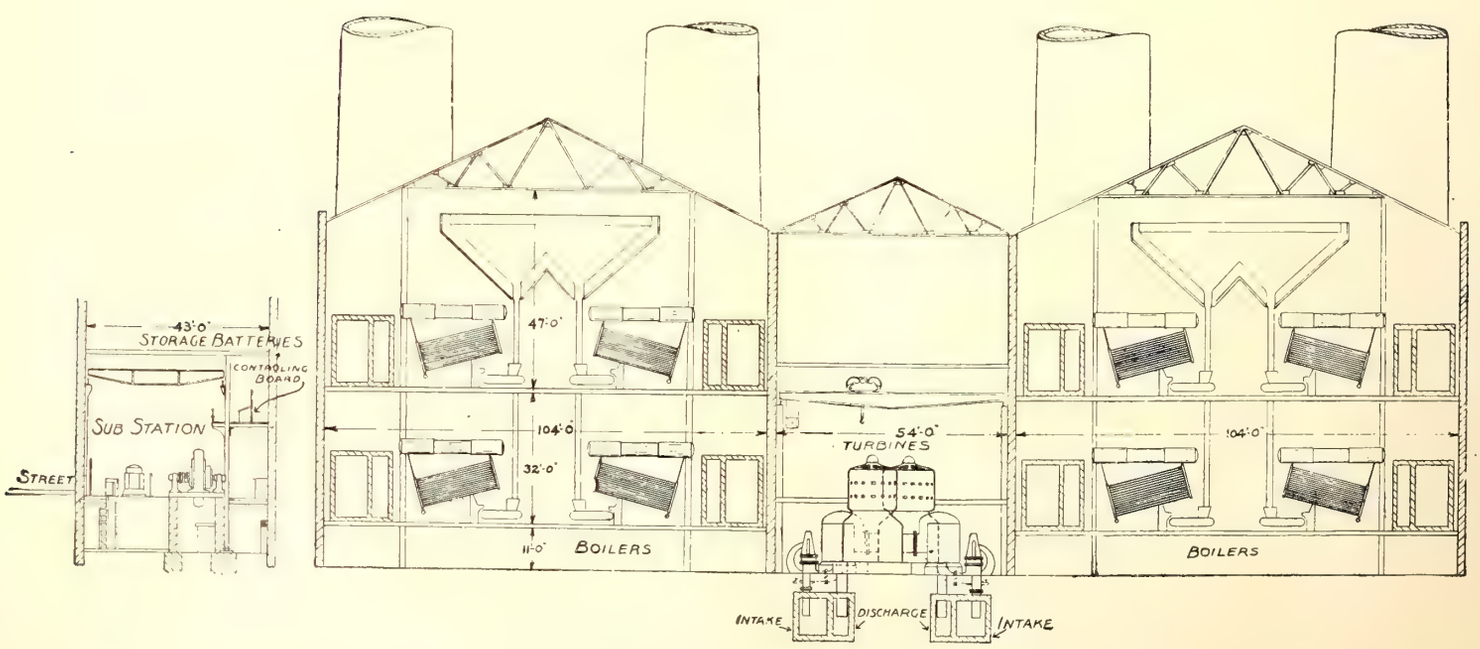


FIG. 4.—CROSS-SECTION OF PROPOSED TURBINE STATION AND SUB-STATION

not cause settling. The spacing of the brick manholes is usually determined by the obstructions met with in the street, but may be put down as averaging about 400 ft. apart. In some recent installations great precautions have been taken to avoid the danger of fire and damage to other cables, arising from a short circuit in one of the high-tension cables. The high-tension cables have been kept to themselves and at the manholes they have been wrapped with asbestos cloth. The destructiveness of a short circuit on underground high-tension cables has not proven as great as was anticipated. In one instance a laborer drove a pick through a 6600-volt three-conductor cable without experiencing any shock, or producing any great amount of pyrotechnics. It was fortunate for the laborer that the pick had a long wooden handle. The lack of destructiveness in the arc is probably due to the quick action of the automatic circuit breakers at each end of the cable, and also to the fact that although the pressure is of great intensity, the current flow is small. Fig. 7 is a photograph of several sections of duct for underground conduits.

Sub-Stations.—The location and number of sub-stations might form the subject of an interesting discussion as to the relative costs of interest on feeder investment, sub-station equipment and maintenance and operation of sub-station, were it not for the fact that for city use the location of the sub-stations is pretty closely determined by a study of the density of the traffic. The congested points are closely marked, but where doubt exists as to the wisdom of several locations, an estimate of the costs in either case, together with the expense of maintaining and operating the sub-stations, will quickly determine which is the better plan.

TABLE I.—RUBBER INSULATED LEAD COVERED, THREE NO. 00 CONDUCTOR CABLES

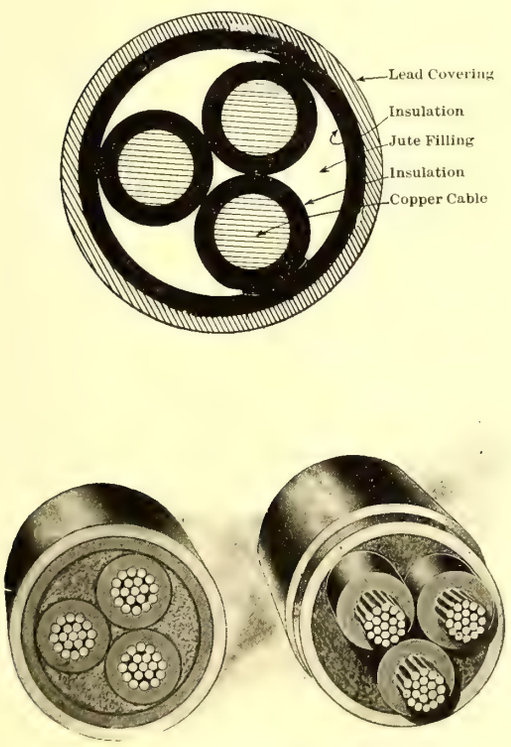
For three-phase, alternating current underground distribution. Cables to be carried in tile or concrete duct, one cable in each duct

Working Voltage	Outside Diameter of Cable	Thickness of Envelope of Each Conductor	Thickness of Envelope Around Conductors	Thickness of Lead Covering	Weight per Foot	Cost per Foot	Test Voltage for 1 Minute	Minimum Radius of Bending	Working Capacity Each Conductor Amperes per Sq. In. of Cross Section Temp. Rise, 30° C.
5,000	1 13/16 inches	3/32 inch	3/32 inch	3/32 inch	4.86 lbs.	$0.64	15,000	10⅞ inches	1,150
7,500	2 "	4/32 "	4/32 "	4/32 "	5.50 "	0.91	22,500	12 "	1,150
10,000	2 9/32 "	5/32 "	5/32 "	1/8 "	7.24 "	1.16	30,000	13⅝ "	1,150
12,500	2 13/32 "	6/32 "	6/32 "	1/8 "	8.27 "	1.37	35,000	14¾ "	1,150
15,000	2 17/32 "	7/32 "	7/32 "	1/8 "	9.29 "	1.62	40,000	16⅝ "	1,050
17,500	2 21/32 "	8/32 "	8/32 "	1/8 "	10.22 "	1.79	45,000	17¾ "	1,050
20,000	3 5/32 "	9/32 "	9/32 "	1/8 "	11.15 "	2.08	50,000	19 "	1,050

TABLE II.—PAPER INSULATED LEAD COVERED, THREE NO. 00 CONDUCTOR CABLES

For three-phase, alternating current, underground distribution. Cables to be carried in tile or concrete duct, one cable in each duct

Working Voltage	Outside Diameter of Cable	Thickness of Envelope of Each Conductor	Thickness of Envelope Around Conductors	Thickness of Lead Covering	Weight per Foot	Cost per Foot	Test Voltage for 1 Minute	Minimum Radius of Bending	Working Capacity Each Conductor Amperes per Sq. In. of Cross Section. Temp. Bise 35° C.
5,000	1⅞ inches	7/64 inches	7/64 inches	1/8 inch	5.5 lbs.	54.8 cts.	15,000	15 inches	1,150
7,500	2 5/32 "	5/32 "	5/32 "	1/8 "	6.52 "	61.6 cts.	22,500	17¼ "	1,150
10,000	2 3/8 "	6/32 "	6/32 "	1/8 "	7.26 "	66.4 cts.	30,000	19½ "	1,150
12,500	2 9/16 "	7/32 "	7/32 "	1/8 "	8.04 "	72.9 cts.	35,000	20½ "	1,150
15,000	2 3/4 "	8/32 "	8/32 "	1/8 "	8.84 "	78.5 cts.	40,000	22 "	1,050
17,500	2 31/32 "	9/32 "	9/32 "	9/64 "	10.60 "	88.5 cts.	45,000	23¾ "	1,050
20,000	3 1/16 "	10/32 "	10/32 "	9/64 "	11.28 "	93.2 cts.	50,000	25½ "	1,050



FIGS. 5 AND 6.—CROSS-SECTION OF THREE-CONDUCTOR CABLE

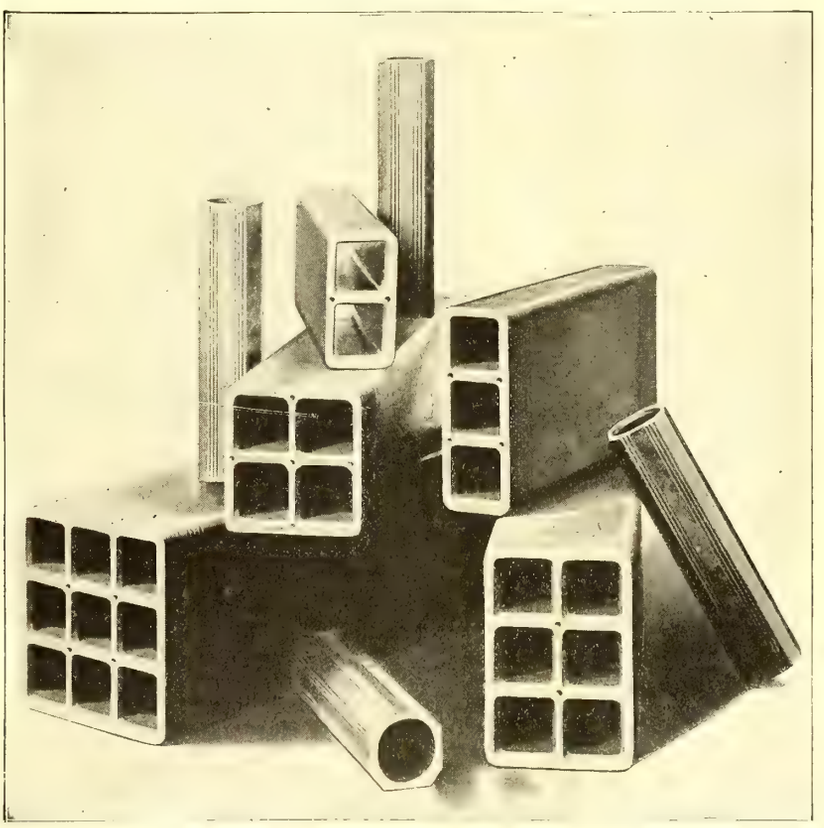


FIG. 7.—DUCTS FOR UNDERGROUND CONDUIT

In interurban construction there are two different opinions maintained regarding sub-stations. One is that sub-stations should be miniature power stations, contain a large quantity of apparatus, in charge of skilled attendants, and be spaced at rather long intervals along the road; the other idea is that sub-stations should be frequent, contain little reserve, and should be taken care of by the station agent or some other employee, whose principal duties are not the caretaking of the sub-station. In city practice, however, there is no question but that the sub-station should be designed and built with as much care as that used in the power plant construction, that it should contain reserve apparatus enough to tide over any ordinary breakdown, and that it should be constantly in charge of skilled attendants.

The high-voltage current entering the sub-stations is handled by brick-enclosed, oil-break, motor-operated switches, just as in the power station. From the switches it passes to transformers, where its voltage is decreased to that suitable for driving the converters. This current, fed in at the alternating-current end of the rotary converters, produces the 575-volt or 600-volt direct-current which is sent to the direct-current bus-bar for transmission to the trolley wire. The transformers are cooled either by water circulating around the shell or by air blown through the windings.

Rotary Converters.—A size of rotary converter which has been largely adopted for city work is 1000 kw, although one large installation has 1500 kw rotaries. There seems to be no reason why rotary converters should not be built in as large sizes as direct-current generators, which have been successfully built in sizes of 2500 kw. The rotary converter is just as reliable a machine as the direct-current generator, and there should be the same reserve capacity in sub-station as allowed in a direct-current station; that is, one reserve machine to every three or four units. Where the load is subject to sudden fluctuations, it is customary to place a reactive coil in the transformers and provide the rotaries with series windings on the pole pieces, in addition to the shunt windings. For city use rotaries have simple shunt fields, and if they are kept well loaded at all times, their direct-current voltage is uniform. The sub-station of a large city system has such a large output that the momentary fluctuations noticeable in a small system are lacking. The load varies with the time of day; the attendants usually have plenty of time to prepare for any change in load, and there is no reason why they should not keep the rotaries well loaded.

Storage Batteries for Sub-Stations.—Storage batteries have been installed in many of the large sub-stations for the purpose of steadying the load on the rotary converters, taking care of the peaks of the load and creating a reserve capacity in the sub-station in case of a breakdown of the machinery. If it is possible, with any reasonable degree of accuracy, to draw the load curve for a proposed sub-station, the question of whether it is more economical to install rotary converters or storage batteries to take care of the peaks may be determined in advance. Most railway load curves show peaks in the morning and evening, some portions of which may be taken by batteries working up to their one-hour rate, provided the duration of the peaks is not too long. In case the shape of the peak is such that no portion of it is of shorter duration than three or four hours, the cost of a battery for handling it would probably be excessive. It should be taken into account that a sub-station battery carrying the peak of the load not only takes the place of a certain amount of rotary capacity, but exercises a valuable smoothing-out effect on the load, replacing an equivalent amount of station capacity at the central power plant; so that the investment in battery should be compared with the investment in rotaries, high-tension feeders, and in generator and steam plant capacity thus dispensed with at the power plant. Figured at the one-hour discharge rate, the relative first cost of storage battery as compared with rotary converter, feeder and steam plant is approximately $90 per kilowatt for the storage battery and $130 per kilowatt for the converter plant, steam plant and transmission line, the latter figure being $30 for the rotary plant and $100 for the steam plant and transmission line. This estimate for rotary and steam plant is based on the nominal ratings of the machines and does not take into account their overload capacities. A battery worked on the peak at its one-hour rate is likely to cost about the same or somewhat less than the apparatus which it displaces.

The value of the storage battery as a reserve in heavy sub-station work depends upon the comparative amount of storage battery and rotaries which has been installed. If the sub-station contains a small amount of battery and a large amount of rotary, the reserve value of the battery is likely to be small; if, however, the short duration and sharp nature of the peaks has warranted a comparatively large battery installation, the battery may be of sufficient size to handle the entire load of the sub-station during the lighter hours of the day for a period long enough to tide over a breakdown, provided that this period is not longer than half to three-quarters of an hour. While the battery may replace those rotaries which would be operated for an hour or two on the peak, it cannot be depended upon to take the place of those machines which run throughout the entire day. The reserve feature of a storage battery is especially valuable because it may be put into service immediately, and in this it has the advantage of the steam plant, where time is required to get boilers ready for steaming.

In laying out a sub-station, it would be well to design the building with reference to the future installation of storage batteries, even if it is not intended to install them at once. No general statement can be made in regard to the advisability of their installation, as that should be figured out for each special case.*

Low Tension Switchboard.—The feeder board for the sub-station and the 500-volt feeders leading from it to the trolley sections are practically the same as those used in connection with a direct-current station, and all of the devices installed in the best direct-current stations for the detection and isolation of trouble on the trolley sections should also be placed in the sub-stations.

THE RELATIVE ADVANTAGES OF ALTERNATING AND DIRECT-CURRENT GENERATION AND TRANSMISSION

With a desire of learning exactly what are the conditions in the cities of the United States, a circular letter was mailed to roads in all cities of more than 100,000 inhabitants. The information is tabulated in Table 3 for those railways from which answers were received. It will be observed that the use of alternating current for city work is at present largely confined to the operation of suburban roads from city power stations. With the exception of New York, most of the other cities have a mixed system, direct current being used for city work and alternating current for suburban work. Brooklyn and Philadelphia are now building alternating-current stations, and Chicago will probably soon begin the change to alternating-current distribution. With the single exception of New York, all cities of more than 200,000 inhabitants have from three to eight power stations. Whether this condition is more economical or more desirable than distribution from a single power station is a problem which must be solved for each special case. The number of American roads using alternating current for purely city work is at present very small, but it is likely that within the next few years many city roads will change partially, at least, to the alternating current system.

In Table 4 is tabulated general data regarding the alternating-current installations in the large cities. It is difficult to tabulate such data because special conditions exist in nearly every case. It will be noted that three-phase distribution and a periodicity of 25 cycles per second is nearly universal.

A discussion of the relative advantages of alternating and direct-current generation and transmission involves a discussion of:

(1) The relative economy and reliability of generation and transmission, and

(2) The relative advantages of one and several power stations.

The transmission losses in the feeders and return circuit from a direct-current station depend entirely upon the quantity of copper which it is deemed advisable to put into the feeders. For a city transmission where the feeders are long, and where concentrated loads are likely to occur at long distances from the power station, the transmission losses are probably between 15 and 20 per cent at maximum load in a well-installed system.

In an alternating-current transmission, the losses at maximum load are likely to be about as follows:

High-tension feeders	3 per cent
Transformers	2½ per cent
Rotary converters	5 per cent
Low-tension feeders .....7 to 10 per cent	

making a total transmission loss between the generator and the trolley wire of 17½ to 20½ per cent, which is about the same as that estimated for the direct-current transmission. From these figures it will be seen that if the generating plant in the direct-current station is as economical as that in the alternating-current station, alternating-current generation and transmission should be no more economical than that by direct current.

As to the relative reliability of alternating and direct-current transmission, the latter has many advantages, owing to its greater simplicity. In the direct-current transmission the current is sent straight from the direct-current switchboard to the trolley feeders, while in the case of alternating-current transmission, there are interposed in the circuit, in addition to everything required in direct-current transmission, the alternating-current switches, the high-tension feeders, the step-down transformers and the rotary converters. A failure of any piece of apparatus in this chain, or a mistake of any operator, is likely to cripple the system. With equal standards of workmanship and with an equal quality of op-

* Sub-station plans are shown of the Manhattan Railway, which are reproduced from the Street Railway Journal of Jan. 5, 1901.

erating skill in the two cases, the direct-current system would be the more reliable.

The real problem which confronts most railroad companies in large cities is the question of the substitution of an alternating-current plant equipped with modern machinery in large economical units to replace several direct-current plants badly located fireproof, and if the plant is constructed on the unit system, it would be a very great calamity which would cripple more than one unit. An accident throwing out of service one unit would not be so serious as an accident incapacitating one power station, and thereby crippling the service in one part of the city. It is likely, however, that the greatest advantages of the one central

TABLE III.—GENERAL DATA CONCERNING POWER STATIONS IN THE LARGE CITIES OF THE UNITED STATES

City	Name of Railway Company	Population of City	Square Miles of Territory	Mileage in City Limits	Mileage Outside City Limits	Number of D. C. Power Stations	Capacity of D. C. Stations, Kilowatts	Number of A. C. Power Stations	Capacity of A. C. Stations, Kilowatts	Remarks
New York	Metropolitan Street Ry. Co	1,850,093	40	230	----	----	------	1	38,500	Another A.C. station soon to be put in operation
	Manhattan Ry. Co		40	84	----	----	------	1	40,000	
Chicago	Chicago City Ry. Co	1,698,575	40	175	-	3	11,580	----	------	A.C. station proposed to replace present stations
	Union Traction Co		110	80	50	5	17,250	----	------	
Philadelphia	Philadelphia Rapid Transit Co	1,223,697	----	445	30	7	31,500	2	17,000	A. C. station under construction
Brooklyn	Brooklyn Rapid Transit Co	1,166,582	200	520	----	6	28,160	1	16,200	
St. Louis	St. Louis Transit Co	575,238	65	315	44	4	26,800	1	2,500	
	St. Louis and Suburban Ry. Co		125	41	52	2	3,075	1	2,400	
Boston	Boston Elevated Ry. Co	560,892	116	----	----	8	36,844	----	------	
Baltimore	United Railways and Electric Co	508,957	----	----	----	----	------	----	------	
Pittsburg and Allegheny	Pittsburg Railways Co	451,512	375	424	179	6	19,200	2	13,050	
Cleveland	Cleveland Electric Ry. Co	381,768	----	----	----	3	16,150	----	------	
St. Paul and Minneapolis	Twin City Rapid Transit Co	366,350	150	232	20	6	6,500	1	5,600	
Buffalo	International Railway Co	352,219	----	202	156	2	3,900	1	3,000	Also rents power from Niagara Falls
San Francisco	United Railroads of San Francisco	342,782	63	249	27	5	7,695	1	4,800	
Cincinnati	The Cincinnati Traction Co	325,902	75	181	35	5	15,000	----	------	
New Orleans	New Orleans City R. R. Co	287,104	----	----	----	----	------	----	------	
Detroit	Detroit United Ry. Co	285,704	----	189	311	6	12,060	2	2,000	
Milwaukee	Milwaukee Electric Ry and Light Co.	285,315	----	----	----	----	------	----	------	
Washington	Washington Ry. and Light Co	278,718	----	107	38	4	4,750	1	600	
Newark	Public Service Corporation	246,070	----	----	----	----	------	----	------	
Kansas City, Mo. and Kan.	Metropolitan Street Ry. Co	215,170	----	167	15	5	8,950	1	9,000	A. C. station under construction
Jersey City	Public Service Corporation	206,433	----	----	----	----	------	----	------	
Louisville	Louisville Railway Co	204,731	20	122	18	1	6,000	----	------	
Providence	The Rhode Island Co	175,597	----	163	101	1	7,500	1	3,500	Combined A. C. and D. C. station under construction
Indianapolis	Indianapolis Street Ry. Co	169,104	----	----	----	----	------	----	------	
Rochester	Rochester Railway Co	162,435	68	93	59	2	2,620	1	600	A. C. for use on suburban roads
Denver	Denver City Tramway Co	133,859	67	145	3	3	5,000	1	1,500	
Toledo	Toledo Railway and Light Co	131,822	29	100	2	1	4,000	----	------	
Columbus	Columbus Railway Co	125,560	----	82	25	2	------	----	------	A. C. station proposed
Worcester	Worcester Consolidated St. Ry. Co	118,421	----	60	80	4	7,475	----	------	Change to A. C. for suburban lines under consideration
Syracuse	Syracuse Rapid Transit Ry. Co	108,374	25	56	----	1	4,090	----	------	
New Haven	Fair Haven and Westville R. R. Co	108,027	25	47	53	2	2,975	----	------	
Paterson	Public Service Corporation	105,171	----	----	----	----	------	----	------	
Fall River	Massachusetts Electric Companies	104,863	650	123	207	10	13,317	2	14,000	Largely an interurban system
St. Joseph	St. Joseph Ry., Lt., Heat & Power Co	102,979	----	----	----	----	------	----	------	
Omaha	Omaha Street Railway Co	102,555	50	120	10	2	3,500	----	------	
Los Angeles	Los Angeles Railway Co	102,479	25	100	----	1	5,000	----	------	Suburban system run independently
Memphis	Memphis Street Railway Co	102,320	50	58	14	1	3,000	----	------	
Scranton	Scranton Railway Co	102,026	140	32	45	2	2,660	----	------	

with reference to the load and containing more or less antiquated apparatus. It may be argued in favor of the operation of several power plants, as against one, that the power plants being located in different parts of the city, there is little likelihood of the same fire, flood, cyclone or other calamity destroying all of them, and thus entirely crippling the road. This, and the fact that the plant is the fact that better supervision may be obtained, as it is much easier to get one good set of operators than several, and in times of trouble it is much easier to keep one plant in operation than several. The economy of generation where the same quality of apparatus is installed would not vary greatly, as the cost per kilowatt for the generation of power decreases very slightly

TABLE IV.—DATA CONCERNING THE USE OF ALTERNATING CURRENT IN VARIOUS LARGE CITIES OF THE UNITED STATES

Name of Company	Location	No. of Alternating Current Generating Stations	Capacity of A. C. Stations. Kw.	Generating Voltage	Periodicity	Generation 1, 2 or 3 Phase	Transmission Voltage	Transmission 1, 2 or 3 Phase	No. of Sub-stations	Capacity of Sub-stations. Kw.	Remarks
Metropolitan Street Railway Co	New York	1	38,500	6,600	25	3 phase	6,600	3 phase	8	41,000	Second A. C. station under erection
Manhattan Railway Co	New York	1	40,000	11,000	25	3 phase	11,000	3 phase	8	63,900	
Philadelphia Rapid Transit Co	Philadelphia	2	17,000	13,200	25	3 phase	13,200	3 phase	Undetermined	Undetermined	Change to A.C. transmission contempl'td
Brooklyn Rapid Transit Co	Brooklyn	1	16,200	6,600	25	3 phase	6,600	3 phase	6	22,500	Intended to use both A. C. and D. C.
St. Louis Transit Co	St. Louis	1	2,500	6,600	25	3 phase	6,600	3 phase	1	2,400	
St. Louis and Suburban Ry. Co	St. Louis	1	2,400	6,600	25	3 phase	6,600	3 phase	2	2,400	
Pittsburg Railways Co	Pittsburg	2	----	1,100 / 2,200	60	2 phase	5,000 / 10,000	3 phase	8	3,200	
Twin City Rapid Transit Co	Minneapolis	1	5,000	3,500	34	3 phase	3,500 / 12,000	3 phase	4	4,800	
International Railway Co	Buffalo	1	3,000	11,000	25	3 phase	11,000 / 22,000	3 phase	8	10,200	A. C. also rented from Niagara Falls Co.
United Railways of San Francisco	San Francisco	1	9,600	13,200	25	3 phase	13,200	3 phase	3	7,000	
Detroit United Railway Co	Detroit	2	2,000	400	25	3 phase	16,000	3 phase	7	3,550	
Washington Railway and Light Co	Washington	1	600	6,600	60	2 phase	6,600	2 phase	3	1,200	
Metropolitan Street Railway Co	Kansas City	1	9,000	6,600	25	3 phase	6,600	3 phase	4	8,000	Ultimately one D.C. and one A.C. station
Rochester Railway Co	Rochester	1	600	375	25	3 phase	11,300	3 phase	2	500	
Denver City Tramway Co	Denver	1	1,500	2,300	25	3 phase	2,300 / 26,000	3 phase	3	2,000	A. C. for use on suburban roads
Massachusetts Electric Companies	Boston	2	14,000	13,200	25	3 phase	13,200	3 phase	10	12,750	Change to A. C. transmission in progress
Rhode Island Company	Providence	1	3,500	11,000	25	3 phase	11,000	3 phase	5	4,000	A. C. for use on suburban roads
Louisville Railway Co	Louisville	1	3,300	13,200	25	3 phase	13,200	3 phase	3	2,900	A. C. station under construction

direct-current system is the simpler and the more easily comprehended by ordinary power plant men, are about the only arguments which may be advanced for the several power plant plan.

In a large city convenient locations for water, coal and railroad facilities are not easy to obtain near the center of load, and it is obviously much easier to obtain one good location for a central power plant than several good locations to supply different parts of the system. A central power station should be absolutely after a large output has been reached, and it is assumed that in either case the plants would be of large size. To choose between the direct and alternating-current systems, very careful estimates of the cost of installation and operation should be made in each case, and decision should be reserved until after these estimates are compared.

In some of our largest cities, where heavy loads must be taken care of at long distances from the central station, or where the

central station cannot be located near the center of the load, or where reasons exist, such as cheap coal, water transportation, etc., for locating the central station away from the center of load, alternating current distribution from a central station will probably be found the more economical; but if a location for an economical power plant may be obtained near the center of load, and the total city load is comprised within a radius of 5 miles from this point, as is the case in most cities of less than 250,000 inhabitants, it is probable that direct-current generation and distribution from this central station will prove the more desirable. Where doubt exists, preference should be given to the direct-current system on account of its greater simplicity, unless there is likelihood of a great expansion of the system in the near future, when direct-current transmission might prove burdensome. In case the direct-current system is adopted, suburban lines too long or too heavy for 500-volt transmission may be supplied by alternating current generated in the power plant for their use, or by means of boosters. If the suburban lines are of moderate length or if they require normally only a small amount of power, and make unusual demands upon the power plant only at intervals, such as on holidays and pleasant Sundays, which is the condition on many suburban roads, these lines can best be taken care of by means of boosters, and the same boosting system may be useful in operating some of the city lines. A company which installs an alternating-current transmission system on its heavy city lines merely to furnish power for a few light straggling suburban lines more economically, would place itself in the illogical position of allowing the tail to wag the dog.

It is difficult to make any recommendations as to the choice between alternating and direct-current distribution in merely an abstract discussion. All that can be done is to give the arguments pro and con, with the advice that each case of generation should be figured out for itself, and no plan adopted until its advantages had been thoroughly demonstrated. The discussion in this paper has been on current generation and distribution for use in large cities. The question of long distance transmission has not been taken up, and no attempt has been made to discuss the question of the supply of current for interurban roads, or for cities where the principal part of the load comes from interurban or long suburban roads. For these cases, alternating-current transmission unquestionably offers great advantages.

THE RIGHT OF WAY

BY HERBERT H. VREELAND

It has always seemed to me, when the question of the right of way of street cars has been under discussion in our societies, that it has been approached from the wrong point. This defect in the discussion seems to arise from a lack of clear statement of what is meant by "right of way." Street railroads, in the sense that steam railroads enjoy this privilege, have no "right of way." A steam railroad operates along a strip of land, owned in fee, which it holds and uses for its special purposes against all intruders, and it can only be obstructed by trespassers. The case of a street railway is entirely different. It has a franchise to go along a rigid and appointed route on thoroughfares which are used in common by pedestrians and vehicles of every description.

This being the case, the question of "right of way," in so far as it is applicable to street railroads, becomes one not of right of way but of precedence, since the general public has equal rights on the road. These roads or streets being dedicated to public use, it is the duty of the authorities to see that they are so policed as to obtain for the greatest number of people the fullest and freest use of the facilities which they afford. If street railroad men would view the topic from this point of view and insist that the streets are for the use of the people instead of corporations or individuals, the whole question, in a short time, would take on a different aspect. A railroad company is permitted primarily to exist, not for the aggrandizement of its owners or operators, but for the accommodation of the public. An individual citizen who enters and pays a fare does not thereby relinquish any of his rights to free passage along a public street, and there is hardly an hour of the day or night in which he can enter a car on a street anywhere in a city without finding company, so that the vehicle in which he rides represents not only his individual right, but the assembled rights of all his fellow passengers; and so it has always seemed to me, viewing the question from the standpoint I have indicated, that a crowded car, full of people, should, by mere preponderance of the number of individuals it contained, have a superior right of passage to a vehicle with a single individual in it, or to a van containing merchandise. If, before public bodies, it was unanimously insisted by railroad men that the reason they demanded "right of way" was because of their passengers, I think it would disarm much of the resistance which has met the attempt to secure police co-operation.

A good analogy between the rights which all street railroad operators claim for their vehicles is to be found in the rules of the road concerning United States mail vans. These have the right of way everywhere, and it is a misdemeanor to obstruct their free movements. The reason of this is not because the wagon is labeled "United States Mail" or because of any superior authority vested in the driver, but because the vehicle contains hundreds—it may be thousands—of business communications involving complicated business interests. For the same reason, I have always held that a street car containing a crowd of people, necessarily in haste or they would find a cheaper and more leisurely way of reaching their destination, had rights superior to other vehicles on street surfaces.

Added to all this is the fact that these public conveyances are restricted in their movements to a fixed way, whereas the others, in addition to being lighter and more easily moved, have a flexibility of route denied to tramcars.

FREIGHT AND EXPRESS ON ELECTRIC RAILWAYS

BY J. B. McCLARY

There is no more vital subject before the street railways of the country to-day than the one assigned to the writer by this association, that is, "Freight and Express on Electric Railways." The main idea of the railway business is to make money, and any manager who attempts to operate a line without taking on everything he can find or think of that is permitted by his charter to increase his earnings, is standing in his own light. Some of the answers to my circular letters for information as to the experience of the companies were amusing, among them several underscored *"No's"* in answer to the question, "Do you handle freight?" and followed by reasons which would indicate that the parties making the answers had a supreme contempt for the idea. Others would answer that they did not, but were deeply interested in the subject and would await the publication of this paper with much interest.

Several requested advance copies of any table which might be compiled from the answers to the circulars, as they were themselves seeking information on the subject.

One enthusiastic manager courteously answered all questions, even to the figures showing his profits, and added, "This is velvet," and his "velvet" amounted to many thousands of dollars. Right here I want our people to stick a pin. It is in the word used by our enthusiastic friend.

That it is "velvet" there is no doubt, if you would engage in the business and not let expenses eat it up. There is no excuse for this, for almost under any conditions now known to the fraternity, freight and express can be cheaply hauled on the electric railway, that is, of course, where it is permitted, or rather not prohibited by charter or statute.

From the timid requests of a passenger to the conductor or motorman to "Please let me carry this box on the platform," to magnificent freight trains operated separately from passenger service or trailers attached to passenger cars, is the evolution of the freight and express business on electric railways in the past dozen years. The electric railway is responsible for more suburban towns than any other factor. Civilization itself has no more potent aid than the trolley car. Indeed, the electric motor is civilization's maid of honor, and when with the trolley cars we administer to man's need and comfort, we should not neglect anything that man wants that is within our range. From observation and research, I am sure of one thing, and that is that the personal opinions and characteristics of a railway manager directly or indirectly effect the happiness and comfort of the community served by his road. The relations of a railway to the public are varied and complex. Let a car break down and it will be very interesting to know how much each individual passenger was discommoded and the real cause of his discontent. Hence, I say we can add to the comforts or discomforts of our customers by merely following to a certain extent our personal inclinations, or be bound by our prejudices in doing or not doing things that are requested or demanded by our patrons. I am led to these remarks by the answers of over fifty managers that they did not handle freight, when I know or believe they would profit by it if they should engage in the business. The deduction follows that they would please the community if they did. Of course, local conditions have a great deal to do with this matter; in fact, no general rule can be laid down for the guidance of the street railways, except that of expediency. There is only one general prop-

osition in connection with this question, and that is that the people want everything good that can be had. That electric railways can serve the public in transporting passengers to their satisfaction is proof that they can surely serve the same people in hauling freight and express matter, and do it safely and profitably.

Upon investigation of 182 roads, we find that seventy-one roads handle freight and express, forty-five roads admit that it is profitable and that they intend to increase their facilities for handling their business, thirty-seven say that this is a very attractive feature of electric railroading, while nine answer that while they carry freight, they do not think well of it. Thirty-five roads use the steam railroad classification of their states or railroad districts, others have rate sheets of their own based upon local conditions and generally much lower than the steam railroads. Thirty-eight have depots at terminals and along their lines, and nine say they have none. Twenty-four are silent on this subject. Eighteen handle steam railroad cars on their line. This is particularly a fine feature, provided the track is good and the special work will allow it. Of course, this cannot be done in many cities and towns, but on the outskirts and suburbs, where factories and mills are located, it can be made to pay handsomely. Fifty roads have separate freight cars or trains, three have trailers attached to passenger cars, and eight handle packages on passenger cars. One hundred and eleven answered that they do not handle freight at all. Seventeen of these admit that they believe it should be done, and four of the 111 request information, stating that they are interested in the idea. Compiling our 182 letters, we have the following:

Handle freight and express on electric railways	71
Do not handle freight and express	111
	182
Profitable	45
Doubtful	9
Leased to local express companies	5
Non-committal	10
Non-profitable	2
	71
Attractive	37
Steam railroad classifications	35
Depots	38
Handle steam cars	18
Separate freight trains	50
Trailers	3
Use passenger cars	8

Thirty-three freight-carrying roads do not handle steam cars. Six have flat rates. The biggest development seems to be in the Middle West. Thirty-seven roads reported the gross earnings from freight and express for 1902 as aggregating over $1,000,000, the amounts ranging from $1,000 to $1,000,000 in round numbers, or an average of over $27,000 per road. The operating expenses of the freight department do not seem to be very accurately kept, or at least the same details in accounting are not adhered to as are other features of the business. This is of course a matter of private concern to each company, but our Accountants' Association will get this straight pretty soon, as they do all other important matters connected with railway work.

The most expensive plan we find is that of running wagons to collect parcels from shippers and to deliver them to the consignees. We are unable to find that this pays as great a profit as where it is not attempted. In a large city the most attractive plan, it would seem, would be to let a separate express or parcel company do this and pay the railroad company a certain amount for cars or space, or a per cent of the gross receipts and the railroads have nothing to do with it, except to merely haul the goods for the express company. Something on this order is done in St. Louis, Baltimore, Cleveland, New Haven, Portland (Oregon), and New York. Figures, however, that would be of interest to the association are not available from these cities, but it seems to be a safe proposition and everybody satisfied with the results.

The method of handling freight and express on electric railways is the next thing to be considered. The data obtained forms the most interesting part of this paper. As to rates, we have mentioned that thirty-five roads heard from use steam railroad classifications. There may be some very good reason for this, but it seems to the writer that if otherwise practicable, this need not be done. In Indianapolis and some other places the tag system is in use. This is very good. Tickets or tags are sold to merchants, farmers and others, and when a package is to be shipped by express or freight, the shipper merely consults a schedule of rates and attaches to his package a ticket that will carry the package to its destination. These tags are sold in certain quantities, having values of different denominations, and work satisfactorily, the tag going to the auditor in the place of cash.

The Rockford, Ill., road has a nice system in use. This was described in a recent issue of the Street Railway Review:

The express business of the company, which is in charge of Mr. J. H. Groneman, general passenger and express agent, was started on June 16, 1902, and, although but barely a year old, this branch of the company's business has already reached very creditable proportions. While this business has been well advertised locally, its rapid development has been largely due to the energetic management of Mr. Groneman, who has constantly made a personal canvass of all the shippers and merchants of Rockford and the surrounding territory. Every possible effort has been made to give prompt service and to offer every possible accommodation to the merchants and other shippers in the vicinity of the road, and the success of this undertaking is shown by the fact that, whereas it was at first almost impossible to fill one express car making two round trips daily between Rockford and Belvidere, this business has now entirely outgrown the capacity of one car, and two other cars of considerably larger size are being built as rapidly as possible to take care of this constantly increasing branch of the company's business. One of the methods employed to favor customers and to increase the express business of the company is, we believe, entirely novel and has been found very effective. For example, if a dealer in Belvidere finds that he is short of any line of goods for which he has a demand, instead of looking for the goods himself he telephones an order for what he wants to the company's express agent in his town. This order is telephoned by the local agent to the general agent in Rockford, who purchases the goods and ships them to Belvidere by the next electric express. In this way the dealer in Belvidere receives his goods in the shortest possible space of time, often not even knowing where they have been purchased. While the electric express has no traffic arrangements or other agreements with connecting steam roads, express consigned to different points is taken by the company and is afterward rebilled over other roads to its destination. The company has adopted the Illinois classification and charges practically the same rates as the steam roads, depending upon prompt and obliging service rather than cheap rates as inducements to shippers.

When freight is delivered to one of the company's agents the shipper signs the bill of lading which is made out in duplicate, the agent's stub being retained in the book in which it is bound and the duplicate being held by the shipper. The agent then makes out the way-bill, which is also in duplicate, a portion of one

Form 2

ROCKFORD & INTERURBAN RAILWAY COMPANY

From ..... To ..... Date ....., 190..

Way Bill No.	Car No.	Conductor's Name	Conductor's No.	Time

* When a through rate is used and the shipment is to be reway billed en route, the subdivisions must be shown in the rate column in road order, noting opposite each proportion the initial of the road to which it accrues.

Consignor, Connecting Line Reference, Original Car and Way Bill Number and Point of Shipment.	Marks, Consignee and Destination	Number of Packages	Articles and Classification, Conditions (O. R., C. R. Rel., Std., Etc.)	Weight	Rate and Authority *	Express	Advances	Prepaid	

WAY BILL. (SIZE OF ORIGINAL, 14 IN. X 4½ IN.)

of these way-bills being shown herewith. One of these way-bills remains in the book of the local agent, while the other accompanies the goods shipped. An express bill is also made out in triplicate showing the articles and marks, the weight, rate, express and advances. One of these triplicate forms called the "Delivery Ticket" is shown herewith. The other two similar forms are called the "Express Bill" and the "Cash Stub." One of these blanks is held by the local agent, one is given to the consignee when the goods are delivered, and the third is held by the general express and passenger agent and forms part of his cash account. The cash stub is in reality a bill, and where monthly accounts are kept with shippers it is only necessary to present this cash stub, which must agree with the delivery ticket held by the shipper, as both are carbon copies. This triplicate form therefore is very useful in that it prevents any dispute as to the amount of the bill rendered. Express matter is only delivered to the company's express stations in Rockford and Belvidere, and from these stations it is delivered to the consignee by local express

men. All regular shippers by this line fill out blanks shown in the accompanying illustration authorizing the company to deliver

ROCKFORD & BELVIDERE ELECTRIC RAILWAY COMPANY

Dear Sirs:
Please deliver to M.....
all express and freight consigned to me at .....
station. .....
Date, ..., 190

EXPRESSMEN'S ORDER FOR RECEIVING GOODS

all freight consigned to them to parties designated. The agents at Rockford and Belvidere make a daily report of all the express matter received and forwarded, this report being turned into the general office each morning covering the business of the previous day. Each agent keeps his own cash book and his own records of express received and forwarded. In addition to the daily report of express just mentioned, the agents also send in monthly an abstract of the month's business. The growth of the express business and the variety of express matter carried will be shown by a few of the principal items taken from the company's express records. These amounts cover the three months of October, November and December, 1902:

Fruit, including apples in barrels	71,305 lbs.
Sugar	14,090 lbs.
Groceries	101,744 lbs.
Flour	59,860 lbs.
Meat	63,734 lbs.
Beer	122,547 lbs.
Lumber	51,549 lbs.
Sewing machines and furniture	97,748 lbs.

We find a good form of receipt to shippers is used by the Schenectady road as follows:

ORIGINAL.

....., 190..

BY ELECTRIC EXPRESS CO.

Received from .....
The property described below, in apparent good order, except as noted (contents and condition of contents of packages unknown) marked, consigned and destined as indicated below, which said company agrees to carry to the said destination, if on its road, otherwise to deliver to another carrier on the route to said destination, charges to be collected in accordance with schedule of rates fixed or agreed for service designated by shipper under Class A, B or C, as explained below.

Class A Express Wagon Service both ends of line	Class B Freight No Wagon Service	Class C Express Wagon Service one end of line

Consignee, ...
Street and No., ...
Destination, ...

Marks		Value or C. O. D.	$	

No. Packages	Description	Weight Subject to Correction

NOT NEGOTIABLE

The delivery of said article to and its receipt for transportation by the Electric Express Company are on the express conditions, as printed on the back hereof, which are accepted and approved by the shipper.

Name of shipper, ...

Prepaid	Collect	On Account

The conditions upon which the above-mentioned property is received for transportation are printed on back hereof.

Electric Express Company,
Per, ...

Continuing, the Schenectady description below, finds a very attractive circular used by "The Electric Express Company," which is supposed to be an organization inside of the railroad company:

ELECTRIC EXPRESS COMPANY

Instructions for Shipping

This company is doing both an express and freight business, and our charges are based on the kind of service desired. We have, therefore, classified our service as follows:
"Class A"—Express service, includes collection and delivery.
"Class B"—Freight service, no wagon service whatever.
"Class C"—Freight service, includes wagon service one end.
In order that we may determine what class of service is desired it is very necessary that shippers enter on shipping orders the class under which goods are to be handled.
Unless specified on shipping order, Class "B" or "C," all shipments brought to our office or collected by our wagons will be treated as express, and charged for under "Class A."
It should be understood that express matter receives first attention at our hands, and while freight service is just as fast, preference in loading and delivery will be given to express business.
Receipt books will be furnished on application, and we respectfully request shippers to make out their own shipping orders, entering on the duplicate the class of service wanted, as per schedule given above.
Special attention should be given to blank spaces headed "charges," crossing out "collect" space when prepayment is desired.
Rates and further information will be furnished by agents or communications may be addressed to

Electric Express Company,
E. J. Ryon, Manager.

Schenectady, N. Y., March 25, 1902.

The Schenectady receipt from consignees, No. 2, is a most excellent form and is appended for the guidance of roads seeking information as to forms.

SHIPPING ORDER.

....., 190..

TO ELECTRIC EXPRESS COMPANY,

Please ship the packages enumerated below, which are in good order, marked, consigned and destined as below, to be carried to said destination, if on your road, otherwise to deliver to another carrier on the route to said destination, charges to be collected in accordance with schedule of rates fixed or agreed for service designated by shipper under Class A, B or C, as explained below.

Class A Express Wagon Service both ends of line	Class B Freight No Wagon Service	Class C Express Wagon Service one end of line

Consignee, ...
Street and No., ...
Destination, ...

Marks		Value or C. O. D.	$	

No. Packages	Description	Weight Subject to Correction

ELECTRIC EXPRESS COMPANY TAKE THIS.

The delivery of said article to and its receipt for transportation by the Electric Express Company are on the express conditions, as printed on the back hereof, which are accepted and approved by the shipper.

Name of shipper, ...

Prepaid	Collect	On Account

For Consignee:
Received from the Electric Express Company, in good order, the packages referred to and set forth in the foregoing shipping order.

....., Consignee.

The Elmira Water, Light & Railroad Company also uses the tag and stamp system.

The tariff sheet of the Des Moines, Iowa, Interurban Railway is reproduced in full as one of the simplest, yet most complete, in use.

Miles	Merchandise in Cents Per 100 Lbs.				Special Car Load Classes in Cents Per 100 Lbs.					
	1	2	3	4	5	A	B	C	D	E
5	12	10	8	6	4.7	4.8	4.7	4	3.3	2.71
10	12.5	10.5	8.5	6.5	4.97	5.2	4.97	4.22	3.51	2.75
15	13	11	9	7	5.23	5.38	5.23	4.44	3.7	2.96
20	14	11.5	9.5	7.5	5.51	5.56	5 51	4 67	3.85	3.09
25	14.5	12	10	8	5.71	5.82	5.71	4.84	4.04	3.23
30	15	13	10.5	8.5	5.91	5 95	5.91	5.06	4.18	3.34
35	15.5	13.5	11	9	6.12	6.14	6.12	5.34	4.32	3.46

Note 1.—Minimum charge, 25 cents.
Note 2.—Stations where there is no agent, charges must be prepaid.

Miles	Car Load Classes in Cents Per 100 Lbs.				Live Stock in Cents Per 100 Lbs.				In Cents Per Ton of 2000 Lbs.		
	Wheat, Flour, Millet, Flax Seed and Hungarian	Corn, Oats, Barley, Other Grain and Mill Stuffs	Hard and Soft Lumber, Lath, Shingles, Sash, Doors and Blinds	Salt, Lime, Cement, Plaster, Stucco	Horses and Mules in Car Loads; Minimum Weight, 20,000 lbs.; 31-ft. car inside	Fat Cattle in Car Loads, 19,000 lbs.; 31-ft. car inside	Hogs in Car Loads, Weight, 15,000 lbs.; 31-ft. car inside	Sheep in Car Loads, Weight, 10,000 lbs.; 31-ft. car inside	Hard Coal	Soft Coal—Lump and Nut	Soft Coal—Pea and Slack
5	4.27	3.56	3.33	3.09	5.1	4.87	5.39	8	57	28	24
10	4.46	3.72	3.48	3.22	5.46	5.25	5 7	8.36	60	32	27
15	4.65	3.88	3.62	3.35	5 81	5.62	6	8.74	64	36	29
20	4.84	4.04	3.78	3 48	6 18	6	6.34	9.12	68	40	32
25	5.03	4.20	3.93	3.61	6.62	6.37	6.65	9.5	72	44	35
30	5.22	4.37	4.08	3.75	6.89	6.75	6.96	9.88	76	48	38
35	5.41	4.53	4.04	3.88	7.24	7.12	7.29	10.26	80	50	41

Approved:
H. H. Polk, President.

J. F. Johnston,
General Freight Agent.

The Citizens' Railway & Light Company of Muscatine, Iowa, uses a stamp system, sample below:



Below will be found the list of commodity rates of the Camden Interstate Railway Company:

CAMDEN INTERSTATE RAILWAY COMPANY

Freight Department

COMMODITY RATES

Effective Jan. 1, 1903,

Between Huntington and All Points West to Ashland.

Rates subject to change without notice.

Apples, per bbl.	$0.10	Lime, per ton	1.25
Beer, per bbl.	.20	Laundry, per basket	.25
Beer, per half bbl.	.10	Liquor, per bbl.	.35
Beer, per case	.10	Liquor, per case	.10
Baby buggies, each	.25	Meal, per 100-lb. bag	.05
Bicycles, each	.25	Meats, fresh, per 100 lbs.	.25
Bread, per basket	.25	Meats, cured, per 100 lbs.	.08
Bananas, loose, per bunch	.03½	Meats, per 200-lb. box	.15
Bananas, packed, per case	.25	Meats, per 300-lb. box	.20
Bananas, packed, per half case	.15	Molasses, per bbls.	.50
Brick in flour bbls.	.25	Nails, per keg, five and over	.05
Boots and shoes, per lb	.15	Nails in 300-keg lots	.04
Cabbage, per flour bbl.	.10	Notions, per 100 lbs.	.20
Cabbage, per sugar bbl.	.15	Oil, per bbl.	.35
Calves, each	.50	Oranges, per box	.10
Cement, per 100-lb. sack	.08	Organs, each	1.00
Cement, per Louisville bbl.	.20	Pianos, each	2.00
Cement, per Portland bbl.	.25	Plaster (same as cement)	
Cider, per bbl.	.35	Potatoes and all vegetables, per flour bbl.	.10
Coffee, per case	.08	Potatoes....10c., 15c. and 20c. per bag	
Canned goods, per 100 lbs.	.06	Pop and seltzer, per case	.10
Dry goods, per 100 lbs.	.15	Sewing machines	.25
Dynamite, 400 lbs. or less	2.00	Sugar, per 100 lbs.	.07
Eggs, per crate	.05	Shingles, per M.	.50
Empty crates returned	.03	Salt, per bbl.	.15
Empty pop crates returned	.05	Stoneware, per 100 lbs.	.15
Empty beer cases returned	.05	Trunks, each	.25
Empty beer kegs returned	.05	Tar, per bbl.	.35
Fertilizer, per bag	.20	Varnish, per bbl.	.35
Flour, per bbl.	.10	Varnish, in 100-lb. cans	.10
Feed (mill), per ton	1.00	Vinegar, per bbl.	.35
Grapes, per basket	.02	Wire cable, per 1000-lb. reel	3.00
Glass, packed, per 100 lbs.	.15	Wire, barbed, per 100 lbs.	.06
Groceries, assorted, packed	.15	No single-package shipment less than 25 cents.	
Hay, per bale of 100 lbs.	.15	Special prices on car lots upon application to E. R. Cole, G. F. A., or T. H. Clay, Agent.	
Hay, per ton	2.00		
Hardware, per 100 lbs.	.08		
Ice, per 100 lbs.	.10		
Lime, per bbl.	.15		



EXPRESS CAR

In closing this paper it might be interesting to learn how the freight and express is handled in Birmingham.

The company maintains a large and commodious depot at a convenient distance from the heart of the city, where all freight for the suburban lines is received. Besides this central depot, there are five other depots with agents along the lines and at terminals. The business at the terminals is so heavy that the agents have to have an assistant and a freight handler. At the central station the help required is an agent, a bill clerk and five freight handlers.

Anything is received for shipment from a package of yeast cakes to a hogshead of sugar, and if shippers desire to do so, they may prepay shipment, and if not, goods are sent collect; that is, where they are going to an agency station, and shipments are always prepaid when shipped to stations where there is no agent, and the B. L. is stamped as shown below:

Form 55.

BIRMINGHAM RAILWAY, LIGHT & POWER COMPANY

..... Division.

Birmingham, Ala., ..., 190..

Received from .....

consigned to .....

.....Station .....

the following packages (contents and value unknown), in apparent good order:

Marks	Articles	Weight	Charges
	There is no agent at the above named station. The Birmingham Railway, Light & Power Co. will not be responsible for the articles named in this receipt after they are unloaded.		
	..... Agent		

No liability will be assumed for wrong carriage or wrong delivery of goods marked incorrectly, or with initial or number. The undersigned expressly state that they are not responsible for goods put off at way stations, and all goods to way stations must be prepaid. All goods shipped released unless otherwise specified.

....., Agent.

This, of course, renders the company not liable should the shipments be stolen or molested after they are put off.

No C. O. D. business is done, and we take this occasion to warn our friends against it, as it will be a never-ending source of expense and annoyance. This is particularly true in instances where perishable goods are shipped C. O. D. If there is any contention about it so that the goods cannot be delivered promptly they may spoil, and then someone will want the railroad company to pay for them.

The towns where the most freight is shipped have four trains per day, others three and the smaller ones only two. The smallest towns are served by freight trains, consisting of two, three or four cars, as the needs demand. These cars are drawn by large motor cars built in the company's shops, and on these trains the motorman serves as conductor and checks out the freight, the same being handled by the brakeman.

Bessemer, a large suburban town 14 miles from Birmingham, gets its daily supply of meat, bread, fruit and vegetables from Birmingham every day, and a train is run out of Birmingham every morning at 5 o'clock known as the "Fresh Meat Special."

The company has several connections with steam railroads and handles solid car load shipments to the suburban towns. This pays exceedingly well, as there is practically no expense attached to it.

The forms and office method of handling freight are the same as used by standard railroads.

When a package or packages are offered for shipment a bill of lading in duplicate is presented and the goods checked; the bill of lading is signed, one copy being retained by the consignor and the other by the agent. These bills of lading are made up in books of 100 each, and these books are distributed among the shippers. From the stub retained by the agent the way-bills are made up and a copy of same is made on tissue paper. This copy goes to the auditor, who checks it up and charges to each agent the amount due from each agent, a separate account being kept with each agent. The agents remit their receipts daily to the auditor, and he checks the accounts of each agent to see that everything has been remitted.

The receiving agent takes his way-bills, which are sent out in advance of the freight train, and makes out a combination freight bill and receipt, the two being a folded sheet perforated in the middle. When the consignee calls for his freight the agent signs the bill, which shows the receipt for the money, and the consignee signs the receipt which the company holds to show delivery of goods.

In addition to these forms the agent at the central station makes out a recapitulation sheet, showing total amount of business transacted on all lines during the day, and each agent makes out one of these sheets and these are forwarded to the auditor, who, by this means, can keep an accurate record of all business done.

The central depot agent also sends daily a recapitulation sheet, itemized as to divisions, to the manager of the railway department. The sheet each day covers all business for the previous

days of the month, and the sheet for the last day of each month, of course, shows the total business for the month.

BIRMINGHAM RAILWAY, LIGHT & POWER COMPANY
Express Trains to All Suburban Towns.
Freight Depot, First Avenue and Sixteenth Street.
ONE OF THE EXPRESS TRAINS

RATES

Bar fixtures, per 100 lbs.	$0.15	Marble, crated or boxed, owner's risk, released, per 100 lbs.	.15
Billiard tables, per 100 lbs.	.15	Organs, crated or boxed, owner's risk, released, per 100 lbs.	.15
Beer, per 100 lbs.	.06	Organs, not crated or boxed, each	.50
Beer, bottled, in casks or boxes, per 100 lbs.	.08	Oils, in barrels or cans	.08
Buggies, crated, per 100 lbs.	1.00	Produce, fruit, etc., per 100 lbs.	.08
Bellows, per 100 lbs.	.15	Pianos, boxed, owner's risk, released, per 100 lbs.	.15
Boots and shoes, per 100 lbs.	.08	Sewing machines, crated, owner's risk, released, each	.15
Coffins, per 100 lbs.	.15	Sewing machines, not crated, each	.25
Crockery, per 100 lbs.	.15	Soda water, in cases, per 100 lbs.	.10
Chickens and other poultry, per coop	.25	Stoves and stoveware, per 100 lbs.	.15
Chickens and other poultry, per coop, extra large coop	.35	Split baskets, per 100 lbs.	.25
Corpses	.50	Tinware, per 100 lbs.	.15
Carpets, per 100 lbs.	.15	Trunks, each	10c. to 25c.
Cider and vinegar, in kegs or barrels, per 100 lbs.	.08	Terra cotta pipe, owner's risk, released, per 100 lbs.	.08
Clothing, per 100 lbs.	.08	Terra cotta pipe, not released, per 100 lbs.	.15
Dry goods, notions, etc., per 100 lbs.	.08	Wagons, per 100 lbs.	.15
Empties, each	.05	Whiskey, wines, etc., in bottles or kegs, per 100 lbs.	.03
(Except empty beer kegs, 2½c. each.)		Whisky, wines, etc., in bbls. or boxes, per 100 lbs.	.15
Eggs, per 100 lbs.	.08		
Fish, fresh meat, etc., per 100 lbs.	.08		
Fruits, per 100 lbs.	.08		
Furniture, per 100 lbs.	.15		
Glassware, per 100 lbs.	.15		
Groceries, per 100 lbs.	.08		
Grain, per 100 lbs.	.05		
Hats, per 100 lbs.	.08		
Hay, per 100 lbs.	.05		
Hardware, per 100 lbs.	.08		
Household goods, owner's risk, released, per 100 lbs.	.15		
Harness, per 100 lbs.	.08		
Iron and iron pipe, per 100 lbs.	.08		
Iron safes, per 100 lbs.	.08		
Jugs, jars, etc., crated or boxed, owner's risk, released, per 100 lbs.	.15		
Loaded shells, per 100 lbs.	.08		
Lumber, per 100 lbs.	.08		
Lime, cement and plaster, per 100 lbs., Bessemer Division	.08		
Lime, cement and plaster, per 100 lbs., other division	.05		
Mattresses, per 100 lbs.	.08		
Meat, in bulk or box, per 100 lbs.	.08		
Melons, each	.02½		

All empties must be prepaid. All goods must be marked by consignor. No package for less than 10 cents.

Carload shipments, $2 per car to cotton factory, Elyton and Greens. $5 per car to points beyond.

$7.50 per car Bessemer to Birmingham and all intermediate sidings, except Wilkes.

On Ensley Division, $2 per car switching in Pratt City from Birmingham Southern Railway.

$7.50 per car Birmingham to Ensley or Pratt City.

On East Lake Division no freight will be handled in carload lots except from Wahouma to East Lake. Price, $2 per car.

On Gate City Division loaded cars are handled at East Birmingham only, at $2 per car.

Special rates on carload shipments. All rates are subject to change without notice.

SCHEDULE

Ensley, Pratt City, Thomas and Wylam
Lv. Birmingham 6 a. m.
" " 9 a. m.
" " 1 p. m.
" " 4 p. m.

Bessemer
Lv. Birmingham 5:30 a. m.
" " 10:45 a. m.
" " 2:45 p. m.

East Lake
Lv. Birmingham 10:45 a. m.
" " 3:15 p. m.

Gate City
Lv. Birmingham 10:45 a. m.

For any further information desired, call 273 Bell phone.
Go to East Lake, an Ideal Pleasure Resort. Superb Cars, Fast Schedule, Excellent Track. Beautiful Theater and Numerous Attractions.

An attractive card advertising the freight business and naming the rates on the principal articles for shipment is tacked up in the warehouses and offices of the various merchants.

A freight solicitor is employed, who is provided with an advertising card and a stub book which contains requests signed by suburban merchants requesting their freight shipped by the Birmingham Railway, Light & Power Company's fast freight.

The freight business is steadily on the increase and new facilities have to be brought into service from time to time to take care of the business.

The freight business pays very well indeed, as only about 20 per cent of the gross receipts are necessary to conduct the department.

Owing to the careful system of checking very little freight is lost or damaged.

Summing up our conclusions, we make the assertion that if it pays now in a great many instances, it can be made to pay in a great many more where it is not now paying, and that many roads that are not giving it any attention at present will soon adopt it.

Form 55
BIRMINGHAM RAILWAY, LIGHT & POWER CO.
_____ Division
Birmingham, Ala., _____ 190..
Received from _____
consigned to _____
_____ Station _____
the following packages (contents and value unknown), in apparent good order:

Marks	Articles	Weight	Charges

No liability will be assumed for wrong carriage or wrong delivery of goods marked incorrectly, or with initial or number. The undersigned expressly state that they are not responsible for goods put off at way stations, and all goods to way stations must be prepaid. All goods shipped released unless otherwise specified.

_____ Agent.

Form 55
BIRMINGHAM RAILWAY, LIGHT & POWER CO.
_____ Division
Birmingham, Ala., _____ 190..
Received from _____
consigned to _____
_____ Station _____
the following packages (contents and value unknown), in apparent good order:

Marks	Articles	Weight	Charges

No liability will be assumed for wrong carriage or wrong delivery of goods marked incorrectly, or with initial or number. The undersigned expressly state that they are not responsible for goods put off at way stations, and all goods to way stations must be prepaid. All goods shipped released unless otherwise specified.

_____ Agent

FREIGHT BILL Slip No. _____
M. _____ Station, _____, 190..
_____
To BIRMINGHAM RAILWAY, LIGHT & POWER COMPANY, Dr.

	For Transportation on the following Articles of Freight, viz.:	Weight	Rate	Freight and Charges
Way-Bill _____				
_____ 190_				
Consignor				
Original Point of Shipment				
All Bills Payable in Bankable Funds	Received Payment for the Company. _____ Agent.			

FREIGHT RECEIPT Slip No. _____
M. _____ Station, _____ 190..
_____
Received of the BIRMINGHAM RAILWAY, LIGHT & POWER CO., In Good Order, the Following-Described Property:

	ARTICLES	Weight	Rate	Freight and Charges
Way-Bill				
190..				
Consignor				
Original Point of Shipment				
All Bills Payable in Bankable Funds	_____			

_____ Ala.
_____ 190..
To _____
_____ Ala.

DEAR SIR:
Hereafter you will please route all my shipments via the BIRMINGHAM RAILWAY, LIGHT & POWER CO.'s fast freight line.

_____
_____

_____ Ala., _____ 190..
To _____
_____

DEAR SIR:
Hereafter you will please route all shipments to me via the fast freight line of the BIRMINGHAM RAILWAY, LIGHT & POWER CO. Respectfully,

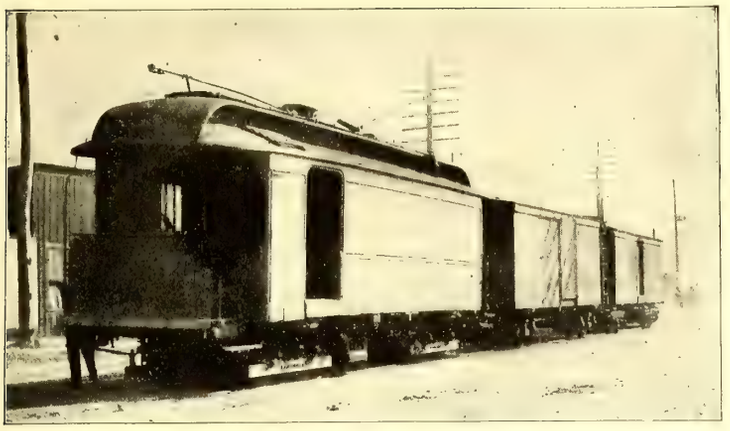
_____

_____ Division.
BIRMINGHAM RAILWAY, LIGHT & POWER COMPANY
_____ Division. No. _____
Local Freight Way-Bill _____ To _____ Date, _____, 190..

Consignor	Marks	Consignee	Articles	Weight	Rate per 100 lbs.	Charges	
						Prepaid	Collect

Form 150 Railway Department
BIRMINGHAM RAILWAY, LIGHT & POWER COMPANY
Daily Recapitulation of Freight Received and Forwarded
Birmingham, Ala., _____, 190..

	To Bessemer	To Woodward	To Bessemer Div. Locally	To Ensley	To Ida	To Wylam	To Ensley Div. Locally	To	To	Total
Freight forwarded										
" delivered										
Previously Reported										
Total to date										
Tonnage forwarded										
" delivered										
Previously reported										
Total to date										
Articles forwarded										
" delivered										
Previously reported										
Total to date										
Steam Cars Handled		Numbers and initials.								
Previously reported										
Total to date		_____ Gen'l Frt. Agt.								



ONE OF THE EXPRESS TRAINS

BIRMINGHAM RAILWAY, LIGHT & POWER COMPANY

Daily Report of Freight

..... Station. ....., 190..

No. of Way Bill	To	Prepaid	To be Collected	Total

....., Agent.

ELECTRIC WELDED JOINTS

BY WILLIAM PESTELL

Probably no one thing contributes more to the expense of operating an electric railway than bad joints in the track. First comes the wear and tear on cars, trucks, motors and equipment from the constant pounding; the loss of voltage due to the breaking of bonds with its inevitable consequence, baked-out motors, reduced schedule speeds, increased coal consumption and chances for electrolysis, then the expense of taking up paving, renewing splice-bars, bolts, etc., in an almost hopeless attempt to make the rail fit for further service. It is usually found that by the time a general overhauling of the track is decided upon the rail-ends are so badly pounded out that the simple raising of the joints and renewing of splice-bars and bolts does not extend the life of the rail to a commercially practical extent. This is particularly so in the case of girder rail in paved streets. T-rail is usually more accessible and less costly to repair, consequently does not get into as bad condition before repairs are made, and can by the use of some of the patented joints be put in such condition that many years are added to its useful life.

In 1892 the Johnson Company organized a department for electric welding of track, working under the patents of Prof. Elihu Thompson, of Lynn, Mass. In 1893 and 1894 the Johnson Company welded about fifty miles of track in the cities of Boston, Cleveland, Brooklyn, Johnstown, Detroit and St. Louis. The track welded had been laid for some time and was in bad condition, so that the first work attempted was repair work rather than construction.

It was early found that the voltage was not maintained at all points on the line at the necessary 500 volts the apparatus was designed for, and a booster was introduced to compensate for the line losses and make up the deficiency. Storage batteries were also used with the first apparatus to help maintain the voltage and prevent an excessive demand on the station for current. It was soon found that sufficient current could be obtained from the line without the use of batteries, and they were abandoned.

The first welds were made by welding a short vertical bar directly over the joint, as shown by Fig. 1. This weld was made under pressure, but the pressure was not continued after the weld was completed, and the metal became porous in cooling, leaving a mechanically weak joint. A great deal of the tendency to porosity in the metal was undoubtedly due to the burning of the rail and bars at the small points of contact then used. To overcome the tendency of burning and porosity in the metal, a form of weld, Fig. 2, was devised, two distinct welds being made at each joint, practically butt-welding the rail-ends together. As in the previous case, the welding was done under pressure, but the pressure was immediately released when the weld was completed, the welding company not yet realizing the importance of continuing the application of pressure until the weld had practically set. As in the case of the first weld, the second weld was porous and weak mechanically, and in addition, the heat being applied directly at the head of the rail, bulged same, so that it became necessary to plane it down to a working surface after welding.

A great number of breaks occurred in both these types of welds, and in each case the track opened up from ¼ in. to ½ in. The breaks occurred soon after welding, usually during the first twenty-four (24) hours. The welding company was led to believe from the nature of the breaks and from the opening in the track after breaks occurred that they were due to strains in the rail from contraction after welding.

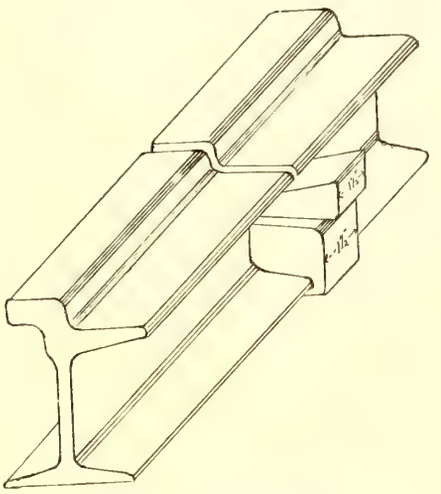


FIG. 1.—FRONT VIEW

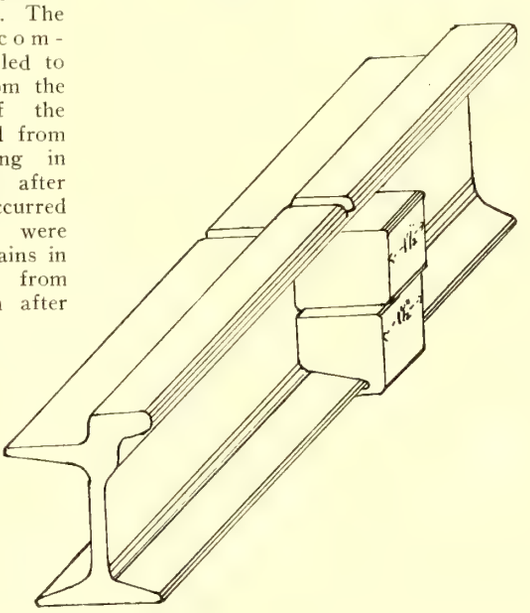


FIG. 1.—BACK VIEW

They soon devised a machine to compress a length of track before and during welding, the idea being to put enough compression into the track while welding to prevent any tendency to contraction strains after welding. While this reduced the breaks to some extent, breakage was still excessive, and the porosity of the metal at the fracture led the welding company to believe that a change had taken place in the metal from the passage of the electric current through it, and commercial welding was discontinued until some method of overcoming the defects could be devised in the company's shops. Experiments were carried on continually both from a chemical and mechanical standpoint from 1895 to 1897, and it was proven conclusively that the heating of the metal by electricity had no more injurious effect on it than heating by any other source. At the latter part of the experiments it was discovered that by making the weld under pressure and increasing the pressure as the weld was completed, continuing pressure until the weld had practically cooled, the metal was left in a dense condition, free from porosity and of high tensile strength. It was also found that any part of the weld that had not been subject to the condition mentioned was of a porous nature and weak mechanically. This led to the making of projections, or bosses, on the bars, as shown in Figs. 3, 4, 5 and 6, the bars being placed one on each side of the rail and welded in their places directly to the web of rail, the center weld being made through a loose piece of metal dropped on the bar, rather than a boss on the bar.

The welding plant consisted of five cars—the sand car, welding car, rotary converter car, booster and motor car, and motor and emery-wheel car for finishing. The cars are run on the track by their own motors and can be sent from place to place over the

different roads wherever there are connecting lines. The connections of the first welding outfit are illustrated in Fig. 7.

Recent improvements have reduced the number of cars from five to four, and instead of regulating on the direct-current side of the rotary transformer by a motor generator, the regulating is done on the alternating-current side by means of variations in the connections of a regulating transformer. The latter machine is shown diagramatically in Fig. 8. This type of machine has reduced the amount of current taken

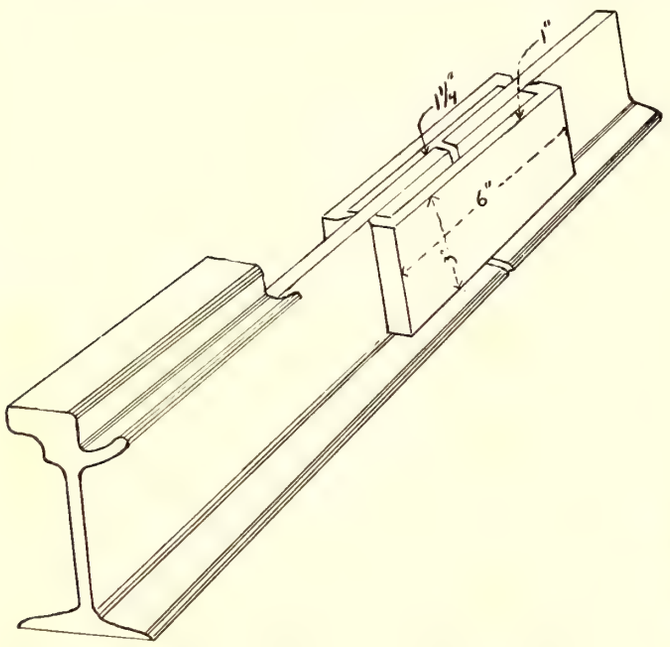


FIG. 2.—LATER TYPE OF WELDED JOINT

from the trolley from a maximum of 500 amps. to 300 amps. under adverse conditions. At the present time all welds are made by means of two steel bars, the usual size of which are 1 in. x 3½ ins., and from 18 ins. to 48 ins. long; 18 ins. being the shortest bar found practical to weld even where the holes are not drilled in the rail, the greater lengths depending on the distance of drilled or punched holes from the end of the rail. It is not safe to weld on bars where holes are nearer than 3 ins. from the end of the bar. The same size bar is used on both 6-in. and 9-in. rail, the strength of the bar being ample to support the joint directly at the weld without the bar mechanically fitting the rail.

The first mile of track welded under the system using long plates was done in the fall of 1897 on the Johnstown Passenger Railway Company, Johnstown, Pa. Rail was 6-in. girder, 78 lbs. to the yard, 78-225 Johnstown Company section. Breaks to date, three (3), street macadamized, no paving. Next welding, Nassau Electric Railway Company, Brooklyn, N. Y., Fifth Avenue, from Atlantic Avenue, to Thirty-Ninth Street, Marcy Avenue, from Fulton Street, to Flatbush and South H Street, a total of nine (9) miles. The Brooklyn rail was 9-in. girder laid in paved streets; at the end of the first year there were eight (8) breaks.

In March, 1901, seven (7) different roads in and about Worcester, Mass., were consolidated under the name of the Worcester Consolidated Street Railway Company, with headquarters at Worcester, Mass., and R. T. Laffin as general manager.

Upon investigation it was found that a number of miles of 6-in. and 9-in. girder rail, while not worn out, was so badly down at the joints that some method had to be devised to raise the joints or renewal of rails would be necessary. After careful investigation it was decided to weld electrically the joints on all 6-in. and 9-in. girder rails that had sufficient wear left to pay for the work. Arrangements were made with the Lorain Steel Company (successors to the Johnson Company) to bring their apparatus to Worcester, and work was started the latter part of April, 1902, the first year being devoted to the laying of new track.

The method of procedure was to take up paving, remove splice-bars and raise shim-joints a sufficient distance ahead of the welder so that no delay would be incurred; paving being taken up one day (where it was necessary to weld at night) and replaced the next day. We at first started to renew ties and line-up track ahead of the welder, but the rail being surface bent (see Fig. 9), it was impossible to raise joints without raising center of rail in about the same proportion, consequently the rail could not be properly lined and no allowance could be made for the rolling action of the cars after welding. In subsequent work, on advice of the Lorain Steel Company, no lining-up of track was attempted before welding, the joints being simply raised and shimmed both between and underneath the rails. It is important to see that the joints are raised a sufficient height, as the rolling action of the cars on the rail tends to straighten out the surface if the raising of joints is properly attended to. Wherever it was necessary to renew ties the work was done immediately after welding, the track being lined-up at the same time. We have found that solid joints stand up better than suspended ones, and would recommend a three-tie joint for all welded work. It is possible where ties are not more than 20 ins. apart under joints, that a suspended joint would be all right. The Lorain Steel Company recommend that no lining-up of track or renewing of ties be attempted until after

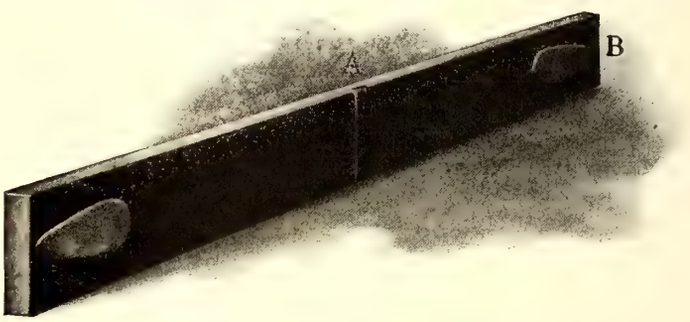
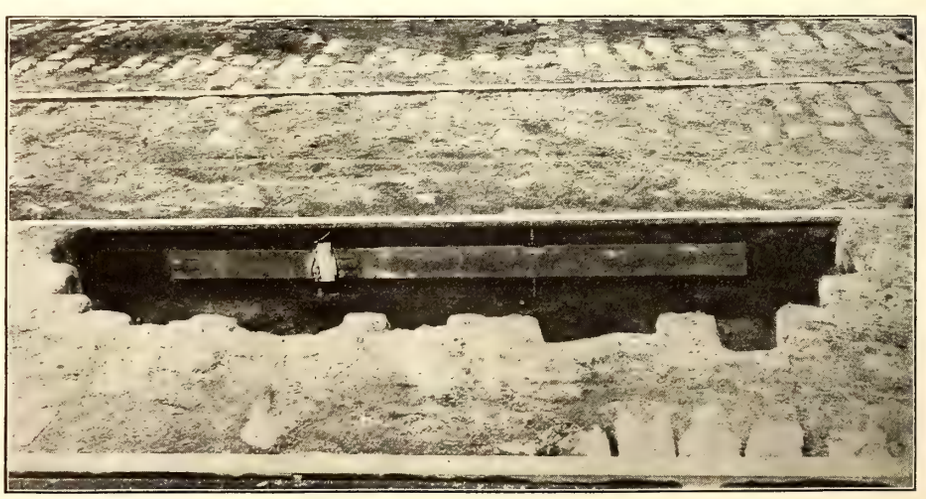


FIG. 3.—BAR FOR WELDING

the first season's run over the welded track, claiming that the roadbed should not be disturbed until the rail had been rolled back to a proper surface. They estimate that a 6-in. rail will be rolled to a proper surface in about one (1) year, while 9 ins. will take from one (1) to two (2) years, according to the traffic over it.

T. W. Wilson, of the International Traction Company, Buffalo, N. Y., says, in answer to the question what shall we do with expansion, "We forget it the same as we do the joint after it is welded." In this connection I would quote from Louis Bell, "Power Distribution for Electric Railways," "That a continuous rail is entirely feasible now admits of no dispute. Expansion does not and cannot take place longitudinally when the rails are firmly embedded in the paving, even under the extremes of temperatures encountered." Dawson, in his "The Engineering and Electric Traction Pocket Book," says, "It is easy to ascertain the strain on rails due to variations of temperature. Assuming a coefficient of expansion of steel of 0.0000065, and multiplying this by seventy-five, which is a liberal figure for the number of degrees of maximum deviation from the temperature at which the welding



PATCHING JOINT

is done, we get 0.000487, which is that part of its length which a rail would expand when exposed to a rise of 75 degs., or contract when exposed to a fall of 75 degs. in temperature. A steel bar would expand 0.00003 of its length, due to a load of 1090 lbs per square inch. Dividing the estimated expansion by this figure, we get for the strain 16,200 lbs. per square inch.

"As 40,000 lbs. per square inch is a safe value for the elastic limit of steel, it can readily be seen that the elastic limit will never be reached. This means that these expansions and contractions may go on indefinitely, and so long as the joints remain unbroken, no harm will be done to the rail, for stresses within the elastic limit work no harm. Assuming 80,000 lbs. per square inch as the ultimate strength of steel, there is still, as far as the strength of the rails themselves is concerned, a factor of safety of five.

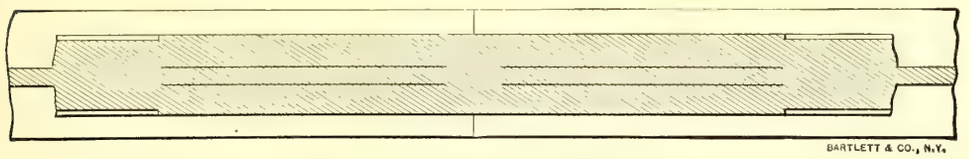
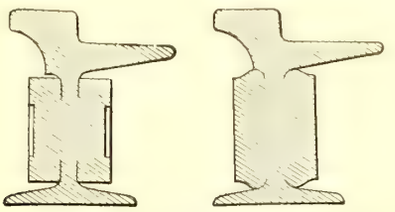
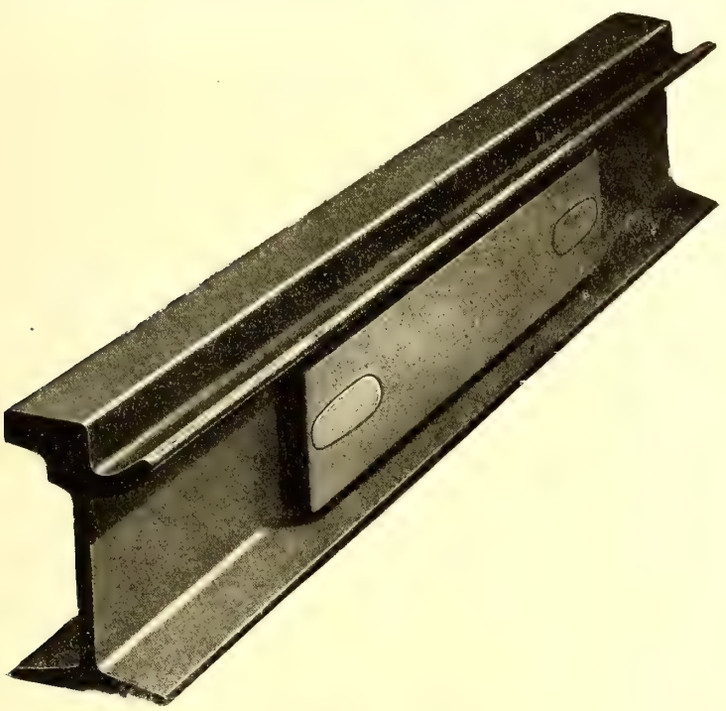


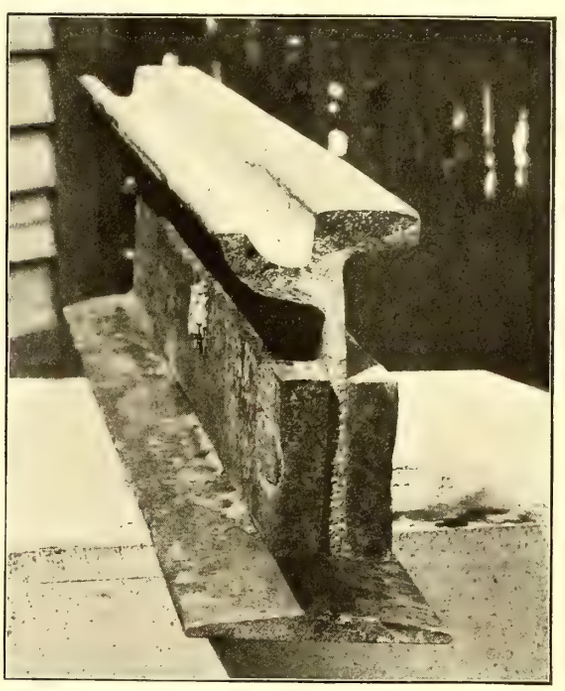
FIG. 4.—HORIZONTAL CROSS-SECTION THROUGH CENTER LINE OF BARS AND RAIL WEB



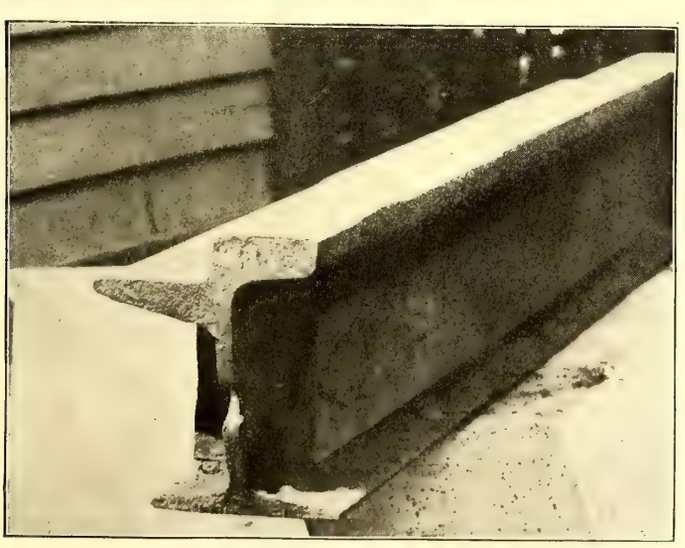
FIGS. 5 AND 6.—SECTIONS THROUGH END AND CENTER WELDS



JOINT AS APPLIED TO 6-INCH RAIL



BROKEN JOINT ON DEEP RAIL, WORCESTER

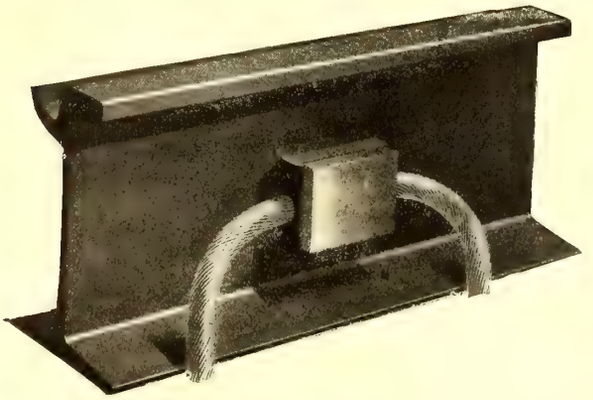


BROKEN JOINT ON SHALLOW RAIL, WORCESTER

"Wherever joints have broken, in no case have they pulled apart more than 2 ins. This would seem to show that the pull which broke the joint was not a cumulative effort extending all along the line, but merely the result of a local strain extending but a short distance on either side of the joint."

Fig. 10 is a map showing the welded track in the city of Worcester, giving some idea of the location as well as the continuous lengths of track welded. The rail welded was principally 9-in. girder, there being about 15 miles P. S. section 201, 2 miles P. S. 222, 4 miles Wharton 2-90, and about one-half mile 6 ins. and miscellaneous. The P. S. section 201 had been in use about nine (9) years, the 222 had been in use from one to four years, and the Wharton 90-lb. about ten years.

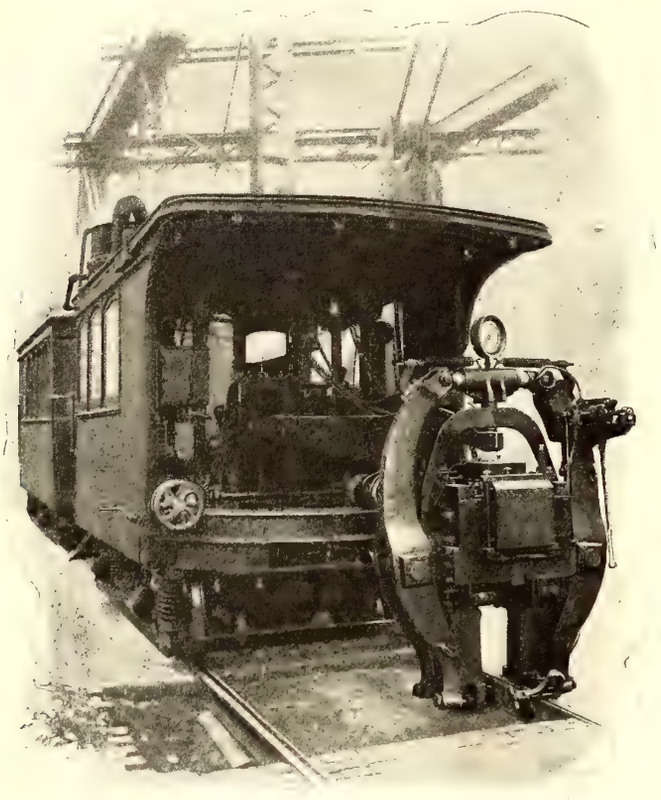
The breaks to date have been twenty-four on P. S. 201, seventeen on P. S. 222, twelve on Wharton 2-90, and one on 6 ins., a total of fifty-four (54) out of 7383, or about 7 of 1 per cent. While this seems a small proportion, the record of Rochester, N. Y., of ten (10) breaks out of 7609 welded joints is remarkable, considering the fact that 5308 were welded in 1901 and have done service through two winters. The majority of the breaks occurred



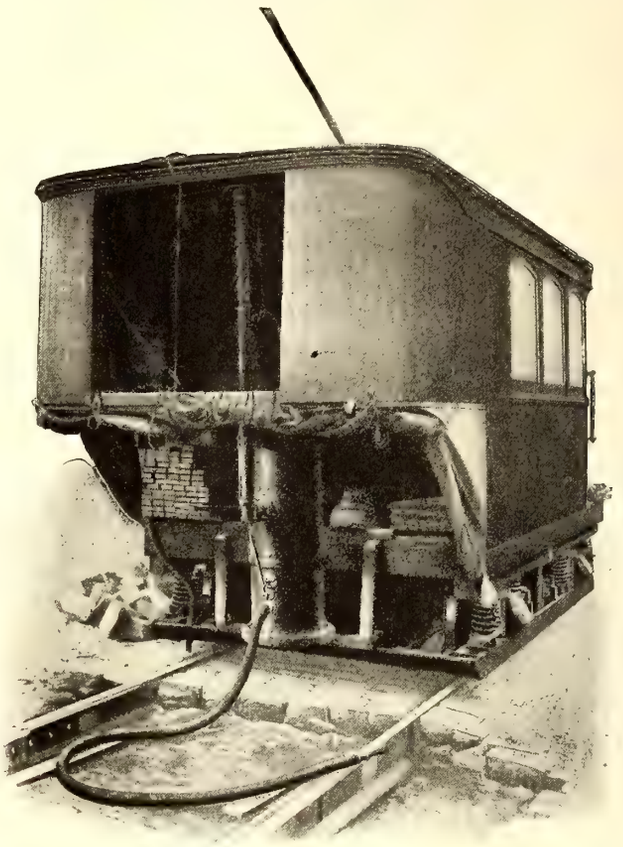
ELECTRICALLY-BRAZED COPPER CONNECTION

during the winter months, and especially during sudden changes of temperature.

In addition to the welding of track, we run 1,000,000 C. M. cable through all special work and to connect to O. H. negative feeders, using the Lorain Steel Company's electrically brazed connection for the purpose. The improvements we have made in our tracks, including new rail and bonding, electrically welded joints and supplementary cables, have reduced our track loss about 75 per cent. The cost of removing paving, welding joints, replacing paving and cleaning up the street is variously estimated by the roads which have done the most welding at from $2,000 to $2,500 per mile on a basis of 30 ft. rail lengths. These figures do not include renewal of ties.



WELDER



SAND BLAST

It is certainly obvious from the results obtained on electrically welded old track that this method is equal to any other known method for extending the useful life of the rail, decreasing the repair bills for track and equipment, and lessening the electrical losses.

From the experience of Buffalo and Rochester, N. Y., and Columbus, Ohio, where new track has been welded, it would appear that in cities where permanent grades have been established and the liability of changes in track location are apparently remote, the electric welding of new track seems advisable. The expense of original construction should certainly be much less than it would be several years later when the joints commenced to go down, and it is a question whether it would not be cheaper than a good splice-bar joint bonded to the same capacity. From tests made by the General Electric Company and the writer on electrically welded joints, the conductivity equals from 130 to 140 degs. on 6-in. girder rail, and from 110 degs. to 120 degs. on 9-in. girder, compared with equal lengths of solid rail.

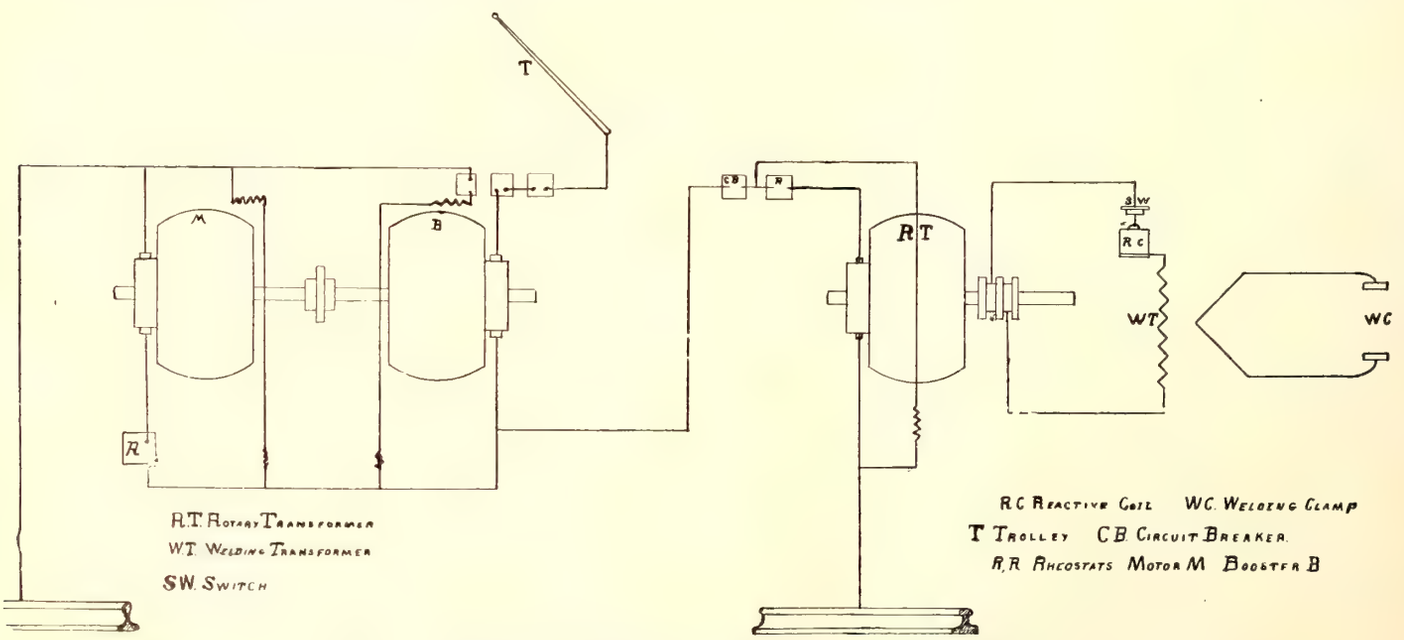


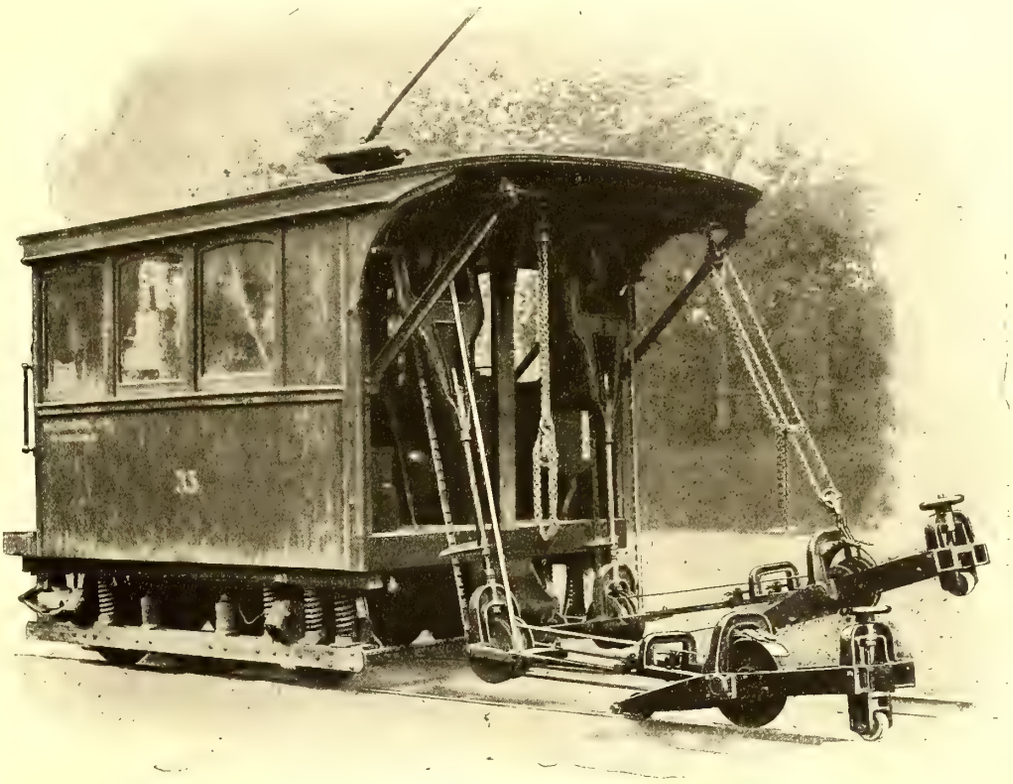
FIG. 7.—DIAGRAM OF CONNECTIONS OF FIRST WELDING MACHINE

Appended are tables showing the mileage of welded track in service, cuts showing sections of welded joints, broken joints taken out at Worcester, and a patched joint on East Merrimac Street, Lowell, Mass. The latter is especially interesting, as it shows the method used to repair a broken joint by the welding process, a short piece of bar being first welded across the break, butting up to the original bar, a chuck being then welded to both bars at the junction, practically extending the original bar beyond the break. The method used when breakage occurs after the welding outfit has left the job is to cut out about a 10-ft. section putting in a new piece of rail by means of splice-bars and bolts and bonding in the usual manner.

TABLE SHOWING MILEAGE OF ELECTRICALLY WELDED TRACK IN THIS COUNTRY TO-DAY

Place	Year	Miles
Johnstown, Pa...	1897	1.
Brooklyn, N. Y...	1898	9.
Buffalo, N. Y....	1899	39.
Buffalo, N. Y....	1900	60.5
Lockport, N. Y..	1900	1.
Buffalo, N. Y...	1901	6.
Rochester, N. Y..	1901	18.
Rochester, N. Y..	1902	8.5
Columbus, Ohio..	1902	18.
Worcester, Mass..	1902	22.
Lawrence, Mass..	1902	4.2
Lowell, Mass.....	1902	6.8
Lowell, Mass.....	1903	14.
Total miles welded.....		208

The table on page 525 is a record of the number of joints which have been welded on the lines of the International Railway Company, of Buffalo, in different years.



GRINDER

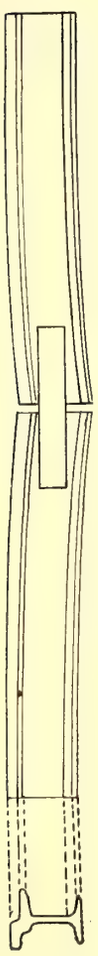


FIG. 9

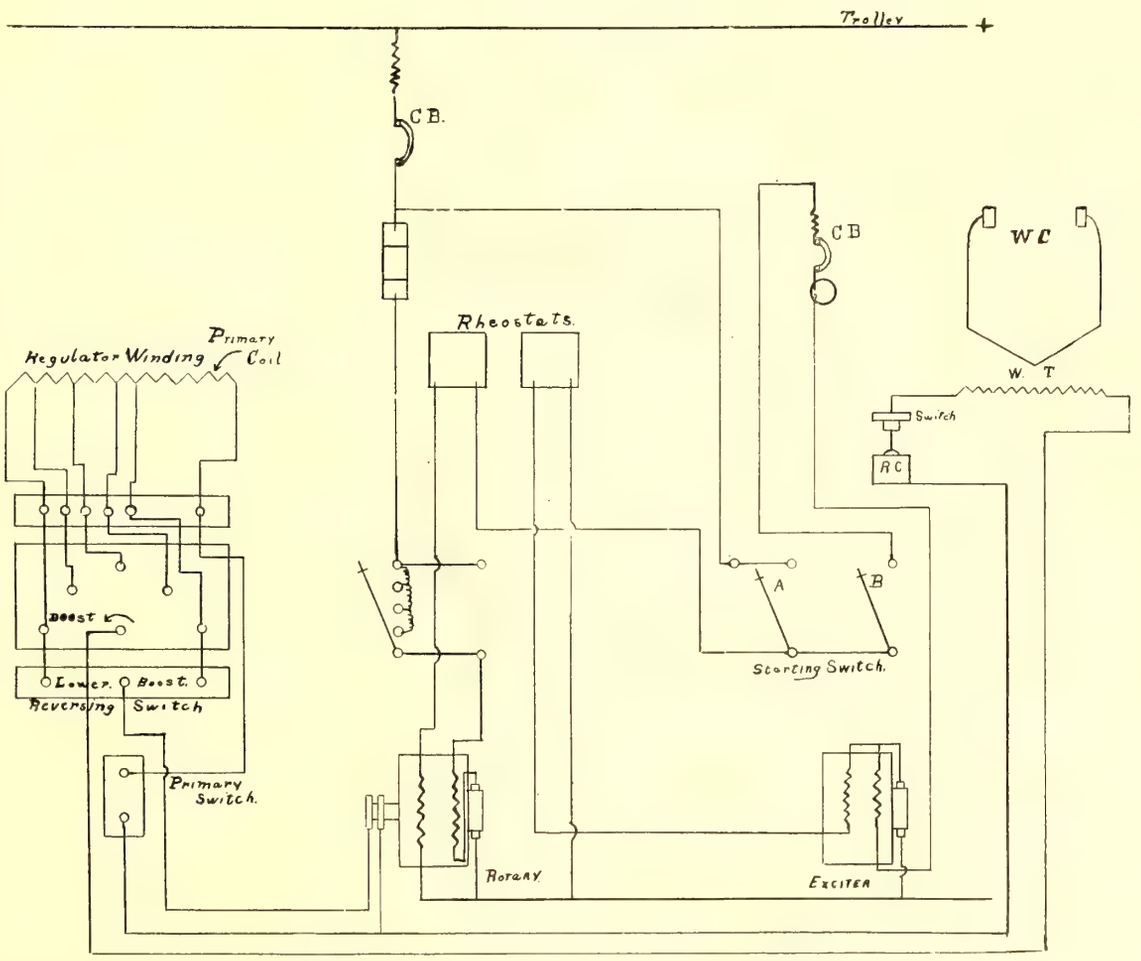


FIG. 8.—DIAGRAM OF CONNECTIONS OF LATER WELDING MACHINE

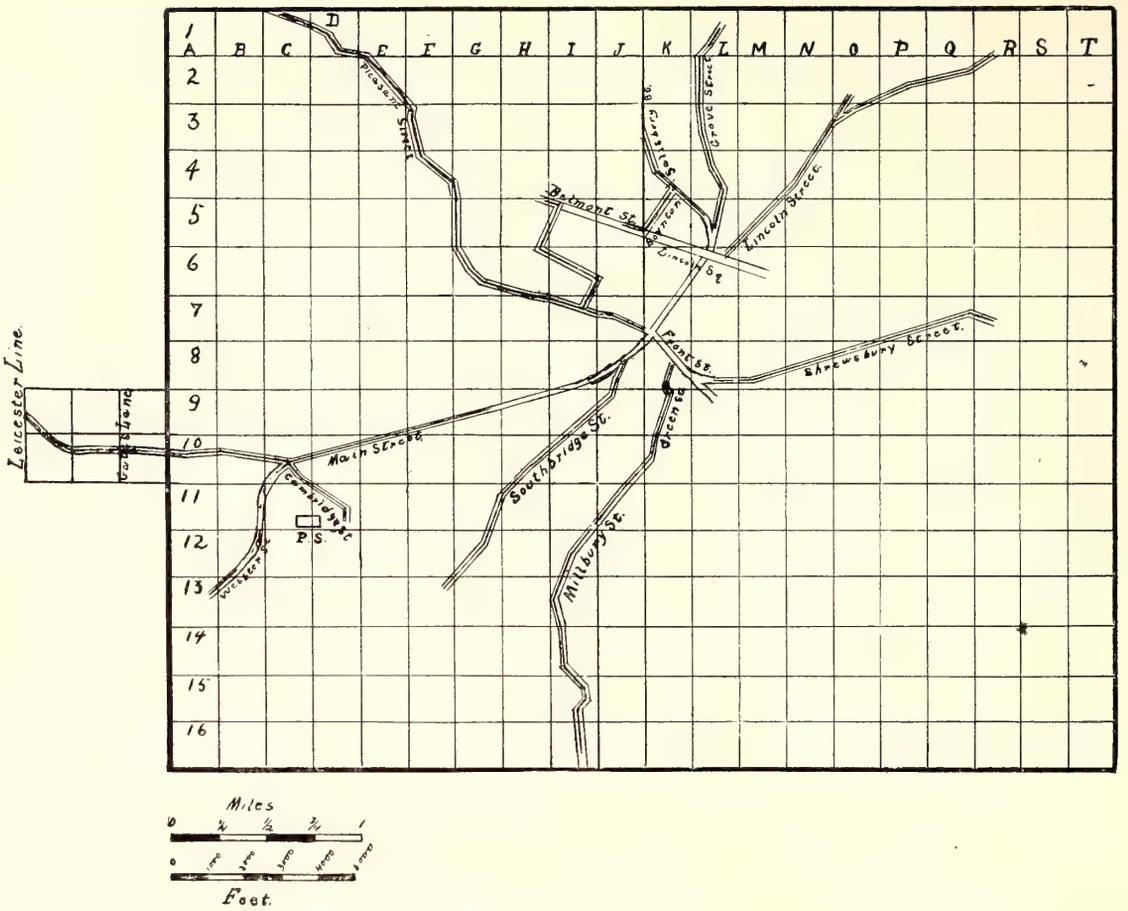
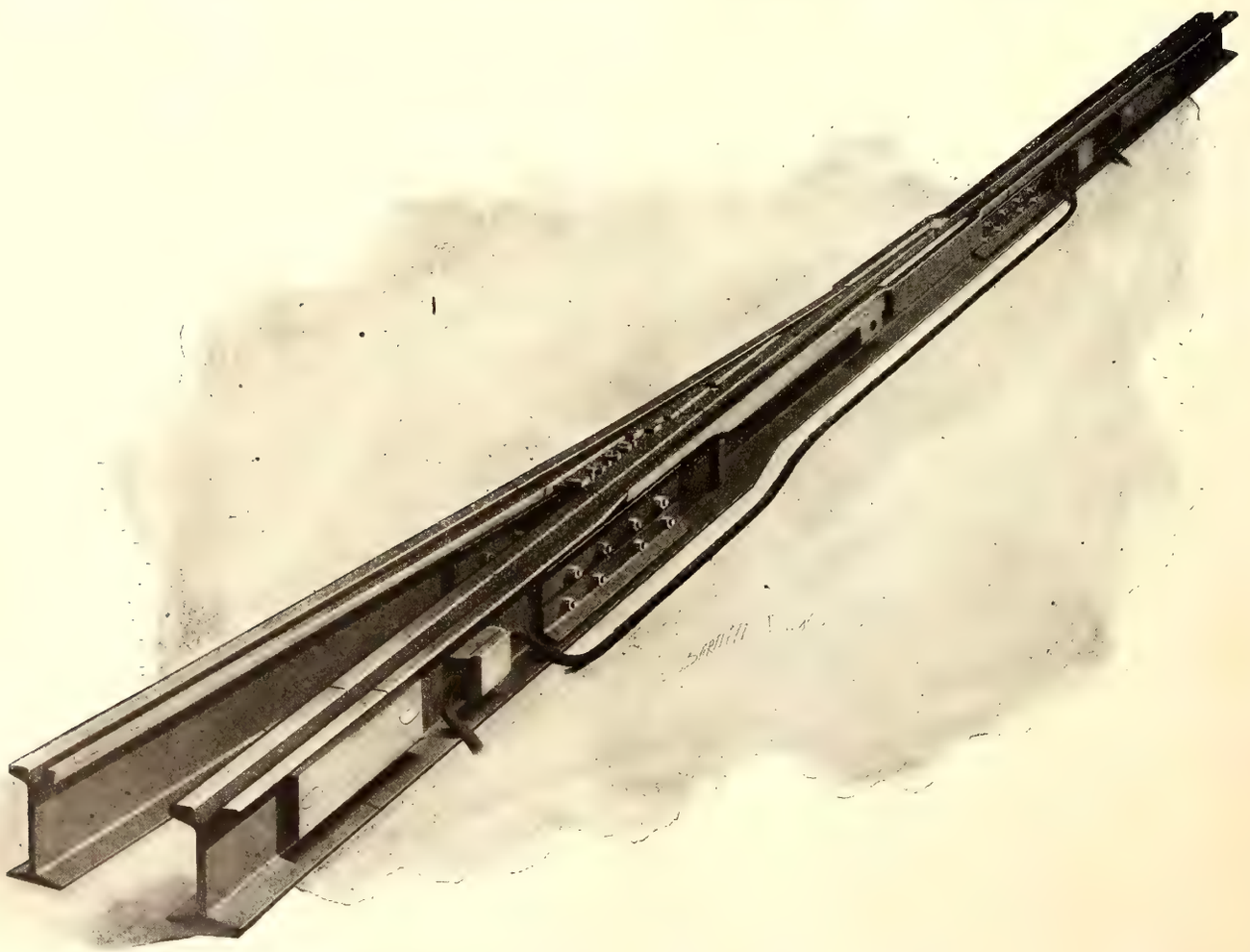


FIG. 10.—MAP OF WORCESTER, SHOWING SECTIONS WITH ELECTRICALLY-WELDED JOINTS



PROCESS OF BONDING AROUND SPECIAL WORK IN CONNECTION WITH ELECTRICALLY-WELDED TRACK, SHOWING COPPER CABLE PASSING FROM WELDED RAIL AROUND SWITCH PIECE

INTERNATIONAL RAILWAY COMPANY, BUFFALO, N. Y.

FIRST YEAR

	Joints welded in 1899	No. Broken
Old, 6-in.	4,787	18
Old, 7-in.	8	0
Old, J. Co., 9-in.	2,658	49
Old, P. S. Co., 9-in.	74	3
New, 6-in.	0	0
New, 9-in.	3,822	45
Total	11,349	115

SECOND YEAR

	Joints welded in 1900	1899-1900	No. Broken
Old, 6-in.	11,973	16,760	127
Old, 7-in.	566	574	7
Old, J. Co., 9-in.	1,894	4,552	25
Old, P. S. Co., 9-in.	146	220	6
New, 6-in.	619	619	2
New, 9-in.	2,234	6,056	16
Total	17,432	28,781	183

THIRD YEAR

	Joints welded in 1901	1899-1900	No. Broken
Old, 6-in.	482	17,242	8
Old, 7-in.	0	574	1
Old, J. Co., 9-in.	356	4,908	7
Old, P. S. Co., 9-in.	0	220	1
New, 6-in.	0	619	0
New, 9-in.	597	6,653	3
Totals	1,435	30,216	20

MAINTENANCE AND CHAMPERTY IN PERSONAL INJURY CASES

BY MICHAEL BRENNAN

I have chosen for this short paper a title that may appear to savor too much of antiquity, viz.: Maintenance and Champerty in Personal Injury Cases.

Maintenance at the common law was an officious intermeddling in a suit that in no way belonged to one, by maintaining or assisting either party with money or otherwise to prosecute or defend it. It was an offense against public justice, as it kept alive strife and contention and perverted the remedial processes of the law into an engine of oppression. A man might, however, maintain the suit of his near kinsman, servant or poor neighbor out of charity. Otherwise the punishment was fine and imprisonment.

Champerty was a species of maintenance and was punished in the same manner. It derived its name from the fact that it was a bargain with a plaintiff or defendant, *campum partire,* to divide the land sued for between them if they prevailed at law. The champerter was to carry on the litigation at his own expense and to take as a reward part of the land.

Blackstone says: "It is a practice so much abhorred by our law that it is one main reason why a chose in action is not assignable at common law, because no man should purchase any pretense to sue in another's right."

This practice was severely condemned by the Roman law and was punished by a forfeiture of a third of the goods of the guilty party and perpetual infamy.

The common law prohibition against maintenance and champerty in the various States of the Union has been substantially abrogated, and it is fair to say that in practice there is no legal punishment meted out to the champerter in any State of the Union.

As titles to land have become settled, there is nothing to do for the real champerter or divider of land, and it has been necessary for him to turn his attention to fresh fields and pastures new.

The marvelous growth of railroads in this country and the multiplication of factories and industrial establishments have necessarily increased the number of accidents accruing to employees and others. This condition of things has given rise to the existence of a class of lawyers in all large centers of population, who make a specialty of pressing cases of personal injury, and whose fees are contingent upon ultimate success, whether by compromise or at the end of a suit. In the city of New York there are on the present calendar 29,697 cases for trial, and of this number 5766 are against the surface street railway corporations. Mr. Godkin, in Hamilton's System of Legal Medicine, states that "probably half the jury cases heard in New York State alone in any one year are actions for personal injuries resulting from alleged negligence."

Mr. Bailey, in his excellent treatise on Accident and Injury, published in 1898, states that Mr. E. Parmelee Prentice has recently examined the records of the Chicago courts having jurisdiction of such cases. He states that in the year 1875 there were altogether about 200 personal injury cases pending in Cook County, and it is safe to say there are pending now in the Chicago courts 3600 of such cases. It is needless to add that only a small percentage of such cases ever come to trial or even get on the docket for trial.

The prosecution of personal injury cases has become a systematized business. Many firms employ runners, who maintain close business relations with surgeons, policemen, saloon-keepers and others, whose business brings them in touch with an accident shortly after its occurrence, so that these runners, who are furnished with blank contracts by their patrons, reach the hospital almost as soon as the ambulance, and secure a contract from the injured person, giving to the law firm fifty per cent of the damages to be recovered before the surgeon's knife has left its case.

It is undoubtedly from this well-known practice that the expression "ambulance chaser" has been coined. The incredulous may think this statement exaggeration, but it is too mildly drawn. The writer knows of an accident within the last year in the city of Detroit where by reason of a collision between two cars, a man named "A" had his foot crushed. It so happened that there was a damage lawyer on one of the cars, who was an eye witness of the accident. The ambulance was telephoned for and the first man to mount the steps after the injured man had been placed in it was the damage lawyer, who had a contract in his pocket signed by "A," giving him fifty per cent of the damages to be recovered, before the hospital was reached. I am compelled, however, to relate, that in this case the truth of the old adage that the early bird catches the worm did not prevail, as after the injured man had recovered he settled personally with the railway company, claiming that he was imposed on by the lawyer while he was only partially conscious.

Under our American jurisprudence, the offices of attorney and counselor are merged and the same lawyer consults with his client, hunts up witnesses, drafts the pleadings, examines the law, prepares the brief of facts and the law applicable to the case, and then goes into court and examines the witnesses and pleads before judge and jury.

In most European countries the offices of attorney and counsel are sharply divided, the attorney attending to the case outside the court and preparing pleadings and briefs, and the barrister, advocate or counsel taking charge of the conduct of the case at the trial or hearing. An advocate is supposed to stand at the bar demanding justice—and his relations to his client are not so close as those of the attorney—in fact, at one time he received for his compensation a *quiddam honorarium* (an honorary sum) and he could not receive any legal fee for his services from his client by an action at law.

In the United States, where one man commences at the beginning of the case and follows it to the end, there is a more intimate relation between him and his client—and where that relationship is made closer by the fact that the attorney owns a portion of the claim—it is a difficult thing for him to do his duty both to his client and to the court.

That such a lawyer does not do his duty to the court as a general rule is only too well known to those who are called upon to defend the interests of corporations which are unfortunate enough to be defendants in personal injury cases before our trial courts.

As long as litigants can rely upon the almost universal prejudice that exists in the minds of petit jurors against corporations, the temptation to bring actions to recover damages for personal injuries, no matter how trifling the injury and flimsy the pretext, will continue very great.

This temptation is sustained and aided by the personal pecuniary interest in which the plaintiff's attorney has in the cause of action—and everything tends to aid in the result sought after. No matter how trivial the injury may be—the plaintiff is egged on so to speak by his lawyer and his physician. Even when there is no external objective symptoms of injury—the expert medical witness is promptly on hand to swear that the moving cause of the accident would produce all the ills that flesh is heir to.

The expert witness under the present lack of judicial restraint which exists in the United States has become a stench in the nostrils of the judges of the land.

The late Judge John Baxter, of the United States Circuit Court for the Sixth District, said that liars were divided into three great subdivisions:

1st—The ordinary liar.

2d—The damned liar.
3d—The expert witness.

Judge Peckham, in Roberts vs. N. Y. E. R. R. Co., 128 N. Y. 464, uses this language:

"Expert evidence, so-called, or, in other words, evidence of the mere opinion of witnesses, has been used to such an extent that the evidence given by them has come to be looked upon with great suspicion by both courts and juries, and the fact has become very plain that in any case where opinion evidence is admissible, the proper kind of an opinion desired by any party to the investigation can be readily procured by paying the market price therefor."

The best men, both in the medical and legal professions, have struggled for years with the question of expert testimony, yet little progress has been made, especially in this country, on this subject. In France the court may order an investigation and report by experts whenever it deems it advisable. If the parties cannot agree upon the experts the court appoints them. They are at least three in number, and are generally, though not necessarily, selected from a list of specialists termed *"experts assermentes."* The order directing the investigation contains a statement of its precise objections and appoints a referee or *juge commissaire.* Barristers or advocates are not allowed to appear before the experts, but the parties are represented before them by solicitors. The report must be signed by all three of the experts, and if there be a dissent, the dissenting opinion and the reasons for it are set forth in the body of the report. The judges, however, are not at all bound by the report if it is opposed to their conviction.

In Germany, under the code of civil procedure, after the issues are framed on which expert testimony is sought, the parties may agree upon the experts and the court appoints those agreed upon. Sometimes the court submits to the parties the names of a number of experts and allows each side to object to a certain number of them, and then appoints those remaining.

In Prussia, it is the custom to appoint a physician and surgeon for every county, and an appeal lies to a medical college in each province, if the experts disagree or the parties desire it. There is also an appellate commission for the whole kingdom.

Several of the medical societies of Chicago recently appointed a joint committee of eighteen reputable physicians to draft a bill, which was presented to the Legislature of Illinois, and which was backed by the recommendation of the State Medical Society for that State. The chief provision of that bill was:

> That the judges of the Circuit and Superior Courts of the State of Illinois be and the same are hereby authorized to appoint in the month of January in each year, persons who shall act as expert witnesses in the medical and other sciences in giving opinion upon the evidence as presented in a hypothetical form on criminal causes that may be on hearing in the courts presided over by the said judges. Said expert witnesses shall hold their said appointments for one year or until their successors are appointed and qualified. * * * When expert opinion is desired in any cause pending in a criminal court, the trial judge presiding in any such case may, at his discretion, summon for duty under this act such expert witnesses to the number of three. Such expert witnesses shall be paid for their services by the county in which the trial for which they are summoned is held in such sums as may be named by the judge.

An attempt has also been made in Pennsylvania to pass a statute on the subject of expert testimony, but thus far without success. The State Bar Association of Michigan recently adopted a resolution recommending the appointment of legal expert witnesses by the trial judges and providing for their compensation by the court, and that such expert witnesses should have abundant opportunity to investigate the facts of the case on trial as far as they had a bearing upon the opinions they were expected to deliver.

The Hon. Seymour D. Thompson, in an able lecture delivered before the Michigan State Bar Association on "Damage Law and Damage Lawyers," made a suggestion in relation to contingent interests in damage cases held by lawyers, viz., that in all cases where the attorney had an interest in the result of a lawsuit, that he should be obliged, in order to preserve his lien, to file a statement of his claim in the particular case.

It seems to me, however, that a more complete and radical remedy should be applied, and that remedy is the re-enactment of the old common law prohibition against maintenance and champerty. It is true that some inconvenience and suffering might result therefrom, but the law cannot take care of every ill, and the greatest good for the greatest number should be the rule; in that way our courts would be purified and the terrible incentive to the perpetrator of fraud on corporations, and the commission of perjury in the trial of cases would be removed.

With a view to making connection with the electric railway in Tokyo, the Keihin Electric Railway Company has applied to the authorities to diminish the gage of its lines from 4 ft. 8½ ins. to 4 ft. 6 ins. It is reported that the company intends to employ large passenger cars, 44 ft. long.

CENSUS STATISTICS AND THE STANDARD FORM OF ELECTRIC RAILWAY ACCOUNTING

BY W. M. STEUART, CHIEF STATISTICIAN, DEPARTMENT OF MANUFACTURERS, UNITED STATES CENSUS OFFICE

There are many obstacles to the compilation of accurate statistics concerning industrial enterprises, but the two we are particularly concerned with are the absence of standardization in accounting and the disinclination of individual owners, companies, and corporations, to furnish information. Both of these impediments to good statistical work have been met, and, in a measure, overcome in gathering and compiling the statistics for street and electric railways, contained in Bulletin No. 3, recently published by the United States Census Office. This bulletin will be followed at an early date by a report which will contain an elaborate discussion of the statistics, a history of the industry tracing the development of the modern street railway system, the features peculiar to the interurban lines, and, in fact, will present every phase of the industry that is pertinent to a statistical discussion. I presume you have studied the bulletin and that you will give some attention to the final report.

The bulletin is certainly the most complete presentation of the street railway interests that has ever been published. The conditions prevailing in the industry are entirely different from those that existed at the time of the eleventh census, 1890. The electric road was then just being introduced, its possibilities were not realized, in fact, we are just now beginning to appreciate them. There could, therefore, be no more opportune time for taking a census of the industry than the year selected. In another decade the industry will have assumed much graver responsibilities, and the conditions will again be radically different. The changes that have occurred and the advances made during the past ten years are astounding, but they have by no means reached their limit. The changes in ownership and management were so rapid during the six months that the canvass was in progress that it was almost impossible in some cases to catch the right man to make the report. He had sold out, consolidated, reconsolidated, made a new issue of stock, or was remodeling the entire system. In some cases, a week or more was consumed in locating the party who could make the report. Every road appears to come out of the general mix up in better condition, so far as the physical equipment is concerned, but the finances of some are rather distressing.

The census of 1902 caught the industry in the fullness of its youth, but because of its vigor, it was difficult to control it in a cool and dignified statistical style. It would not stand still long enough to be measured. I am in hopes that the next enumeration will catch it when it is nearer maturity and when it will be more tractable, and reliable figures can be obtained for its most minute details. The census reports give you a complete picture of the street and electric railway industry as it existed during the year. This is the first time we have ever had the opportunity of studying, in such a convenient form, the finances of the roads in each section of the country and of examining the physical equipment of each individual system. It is only by a careful analysis of the conditions prevailing in each company that you can devise a system of accounting that is capable of practical application to all. Each of you has, no doubt, a thorough knowledge of the physical equipment and finances of the road with which you are connected, and possibly have the facilities for comparing these conditions with the conditions existing in a limited number of other companies, but the census reports give you an opportunity for extended comparison and analysis. They enable you to become acquainted with conditions existing in the industry in all sections of the country. They show where it predominates, the magnitude of its financial operations, the number of people it supports, its peculiarities in different localities, the reasons for peculiar features, the character of equipment and service, the extent of its patronage by the public, the advantages derived by the public, and the possibilities of its extension. The reports are a storehouse of information, and they could be made of great service as books of reference for investigations, and for the basis for researches that must be made in order to become thoroughly posted in every detail of the industry.

While it is not my purpose to discuss the statistics, I feel that some reference to them, especially to peculiar features, is necessary in this connection, and, in fact, is indispensable in order to appreciate the difficulties attending a uniform application of your system of accounts. With the exception of the food, clothing, woodworking, and iron and steel industries, there is none of more importance and that is more conducive to our happiness and prosperity than the transportation facilities. For statistical purposes, these industries are divided into three groups, steam railroads, street or electric railways, and transportation by water. While

the steam railroads form by far the most important group, the urban population of the country is more thoroughly dependent upon the electric roads for their immediate necessities. If these roads were abolished and no other means of rapid transportation substituted, I imagine that New York city would, for all practical purposes, very quickly divide itself into three distinct cities, and that a similar sub-division would occur in Chicago, Philadelphia, Boston, and all of our large cities. The suburbs would be about as inaccessible as the rural districts and would disappear or dissolve into separate cities. Not only have these roads become necessities, but I believe a larger proportion of the population depend upon them for their amusement and health than on any other line of diversion. The extent to which they are patronized is indicated by the fact that more than 5,800,000,000 passengers of all kinds were carried during the year. This is sufficient to give more than 200 rides to each inhabitant of the cities and towns having a population of 4000 or over at the census of 1900. They give employment to an army of 140,000 persons, thus making at least 560,000 dependent upon them for their support. The salaries and wages paid annually to their operatives amount to more than $88,000,000. The average annual wages per operative compare favorably with those in other lines of industry, and there are very few that give constant employment to a larger force or have a larger pay roll.

The financial transactions of the companies are rapidly approaching proportions which will outclass those of our largest industries. The authorized capitalization in 1902 amounted to $2,870,629,316, while the gross earnings from operation were $247,553,999, and the net income, after deducting all expenses, both operating and fixed charges, was $30,596,977. The statistics for the physical equipment of the roads indicate the great diversity of industries that are, in a measure, dependent upon them for their prosperity. The construction of 22,577 miles of track was a great stimulant to the steel rail market, while the building of 67,000 cars made a great demand on the numerous industries dependent upon such work. The manufacture and installation of the engines and boilers to generate more than a million horse power reported for the power plants of the electric railways was sufficient to keep our largest foundry and machine shops busy for many months. The extent to which the manufacturers of electrical apparatus are dependent upon the roads is indicated by the fact that almost 5000 large generators, transformers, boosters, auxiliary generators, rotaries and motors were in use, also over 16,000 storage battery cells, and this does not take into consideration the electrical equipment of the cars, wiring of the road, or the lighting and telephone facilities.

The Census Office received reports from 987 companies, but if the present rate of consolidation is continued for another decade we can secure reports for two-thirds of that number and still cover the entire trackage. The term company or establishment is rapidly losing its significance in all of our important industries. It is of no statistical value in the report on electric railways. If the word "system" could have been used to designate the number of separate holdings it would probably have conveyed a more exact meaning, but this was impossible because, in some instances, separate reports were made for constituent companies. The two systems in the District of Columbia insisted on making eight reports and would not be satisfied until they were counted eight times. There were nine companies operated by regular steam railroads as an auxiliary of the railroad business, and to which it was impracticable to apply your system of accounting. Eleven companies operated incline planes exclusively and, therefore, cannot be strictly classed as street railways. There were also 53 companies operated exclusively by animal power, 2 by cable, and 3 by steam. Eliminating these and the 170 lesser or non-operating companies, there remain 739 companies with 18,730.28 miles of single track to which your system of accounting could be considered as applicable. But a large number of these companies have complicating features that are difficult to overcome in the application of your system of accounting. For instance, 252 companies generate electric current for sale, and the business was of such importance that separate reports were secured for the light and power plants of 118 companies in which the revenue from the sale of current amounted to $6,469,726. The form of account recommended by you does not take sufficient cognizance of this feature of the industry. It is a feature that appears to be developing very rapidly and should be recognized in any system that is to be made of universal application. After deducting the 252 companies that generate electric current for sale we have 487 companies, and of these 50 operate gas-plants, water-works, or some other industry that has no connection with the railway business. There are, therefore, only 437 companies to which your form of accounting is strictly adaptable. These conditions illustrate the tendency toward consolidation of independent interests, which is a feature of our industrial progress in all lines of industry. All of these conditions should be considered in formulating a system of accounts or preparing a schedule for statistical work. The accounts and schedules must be changed to meet the conditions. The industries will not be conducted so as to fit the accounts or schedules.

The establishment of interurban lines is a feature of electrical railway development which is now attracting the greatest attention. It is the field which offers the greatest possibilities for expansion and for the application of improved and more powerful machinery. The improvements that have invariably followed upon the introduction of an electric road into a community, especially in the suburbs of cities, warrant the conclusion that the construction of such roads will continue with the same degree of rapidity that has characterized their advance during the past decade.

Electric roads run indiscriminately into urban and rural districts; there are none confined exclusively to interurban traffic, and it is impossible to make a separation of the roads so as to show the statistics for those engaged in rural and interurban work unless arbitrary methods are used. The census report gives the miles of track within and outside of city limits, but this can only be accepted as a rough indication of the interurban lines. A road may be considered as engaged primarily in urban business if at least one-half of its track is within city limits. On the other hand, a road may connect two or more cities and be classed as an interurban line, although more than half of its traffic is within the legal limits or suburbs of the cities it connects. In making a separation of the roads, it is found that about 300 companies can be considered as operating interurban lines. Their total single track amounted to 8,853.53 miles and their total earnings from operation for the year to $41,099,887; the total operating expenses were $26,135,031, the net earnings being $14,964,856. The single track of these companies forms 39 per cent of the total for all companies and their operating earnings 17 per cent of the total earnings from operation. The interurban traffic, therefore, forms only a very small proportion of the total electric railway business. There are about 56 companies with 3,212.75 miles of single track that operate what may be classed as fast, long-distance, interurban lines. Each of these companies operates at least 20 miles of road, the average length of single track per company being 57.37 miles. The maximum running speed outside city limits was at least 25 miles per hour. The total operating earnings amounted to $13,657,021 and the operating expenses $7,924,568, the net earnings being $5,732,453. These roads have some features which are distinctive, and the Census Office is now preparing an analysis of their statistics which will be included in the final report.

It is time to say good-bye to the horse car line. It has been electrocuted in almost every city where it was in a flourishing condition a few years ago. While there were 67 companies using animal power and 259.1 miles of track operated by such power, the greater proportion of the track was owned by companies which used other motive power on a portion of the line. There were only 53 companies which used animal power exclusively, and their single track amounted to 158.12 miles, being an average of about three miles for each company. It is strange that the metropolitan district in which the most advanced electrical appliances are in use on the street railways is also the home of the antiquated horse car. Almost half of the trackage operated by animal power is located in Manhattan, and the Dry Dock, East Broadway and Battery Railway is the largest road operated by a company using animal power exclusively. With the exception of New York, the following cities are the only places in which more than five miles of track were operated by animal power in 1902: Hutchinson, Kan., 7.83 miles; Santa Rosa, Cal., 7.33 miles; Chicago, Ill., 6.76 miles; Winfield, Kan., 6.25 miles; Los Angeles, Cal., 5.95 miles; San Francisco, Cal., 5.65 miles; Arkansas City, Kan., 5.50 miles; and Tuscon, Ariz., 5.10 miles.

The cable, which fifteen years ago had such bright prospects, is now antiquated. There are only two street railways operated exclusively by cable power. From the Census Bulletin there appear to be twelve roads of this character, but ten of them are inclined planes.

Steam has never been accepted as a proper motive power for roads of the class covered by this report, and it is doubtful if any of them should have been included. It was difficult to break away from tradition, and the few enumerated have been so classed in prior census reports and technical journals, and they were included so as to preserve the comparison.

I have referred to the different classes of roads and industries other than a legitimate railway business carried on by railway companies, to illustrate the fact that, as a whole, the street railway business is not as clearly defined as most people suppose. The temptation to engage in other lines of industry cannot be resisted, and it is impossible to compile exact statistics for the railway business exclusively. If you believe that your system of accounts is capable of practical application to all companies, and that its use would enable the government to compile exact statistics, I am

afraid you will be disappointed. It can be applied to the majority of the companies and the results of its application will be very beneficial.

As accountants, you are particularly interested in the financial statistics, but I am of the impression that the chief value of the census report lies in its detail presentation of the physical equipment of each road. These tables enable you to make an exact comparison of the power plant and rolling stock of your company with those of every other company doing a similar business. Such comparisons can be of no detriment to any company; on the contrary, they tend to better the conditions in all. Such a comparison cannot be made of the financial statistics without disclosing the operations of individual companies, and, as a number of companies expressed the desire that this should not be done, the only comparisons possible are based on the totals for several companies, in each of which slightly different conditions prevail.

The general tendency in most lines of industry is toward over capitalization, and the conditions prevailing in the electric railway business seem to have been especially conducive to this result. The par value of the common and preferred stock on which no dividends were paid during the year amounted to $667,878,624, or about 50 per cent of the total issued. The practice of some companies to equalize the cost of construction with the amount of capital stock and bonds, and the apparent inability of others to furnish definite information concerning the cost of construction made it impossible to compare the actual cost with the stock and bonds issued. Accepting the figures as reported, it appears that the stock issued and the funded debt outstanding for all roads exceeded the cost of construction by $140,648,022.

The tables presented in the bulletin show the earnings and expenses in the form prescribed by your Association for all roads in each State, and other groupings will be made in the final report which may be more instructive. The grand totals for all roads in the entire country, or for any State, are no indication of the conditions prevailing in any individual company or in companies engaged in particular lines of traffic. A grouping of these statistics for interurban or urban roads, or roads in cities of a given population would indicate the amount of income and expenditure that should prevail in the companies operated under similar conditions. Such tables are now being prepared for the final report, but the work is not sufficiently far advanced for me to give you the results.

To be of value, the totals for the same groups of receipts and expenditures should, in every case, be composed of the same items. The absence of uniformity in this respect is the cause of much uncertainty in accounting, and this is greatly emphasized in the preparation of totals so large as those given in the census reports. No more important service can be rendered the statistical science than the adoption of uniform systems of accounting, but there are comparatively few lines of industry in which the same system can be uniformly applied to all establishments. Your system was devised primarily for companies doing an electric railway business exclusively, but the census investigation developed the fact that there are comparatively few companies that do this. For instance, in reporting the analysis of operating expenses, the majority of the companies, in answering the sub-questions, included the expenses incident to the generation of electric current for sale, but there was an expenditure of $2,188,753 for such work that it was found impossible to segregate. The expenses incident to such work are, therefore, included for some companies and omitted for others. In many cases of this character the companies contended that the system was not applicable to roads operating electric light and power plants. If expenses incident to the generation of current for sale are included in the operating expenses of the road, it is manifestly wrong to use those totals to compute the expenses per mile of track, per car, or per car mile. In fact, there are comparatively few companies for which it is practicable to obtain statistics concerning a year's business that could be used to make such computations with exactness. It is probable, however, that the census totals are sufficient for general comparisons. They are uniform for all sections of the country and can be used to indicate the conditions in one locality as compared with those in another, on the theory that the elements, which are wrongly included, exist in about the same degree in all localities.

In formulating the schedule for street and electric railways, the Census Office endeavored to adopt a series of inquiries which would comply with the requirements of the law, and, at the same time, be easy to answer by all companies, and also develop information of interest and value to those engaged in the industry. The inquiries suggested by your form of accounting seemed to answer these requirements. The numerous items enumerated as the proper ones to be assigned each general sub-division indicated a careful analysis of the industry. The organization had been in existence a number of years and its system appeared to have developed very largely with the industry and had been put into a more exact and positive form by the promulgation of printed schedules. Under these conditions, the form was evidently the correct one to be used, and you are familiar with the negotiations which culminated in its adoption for census work.

The adoption of your schedule was part of an extensive scheme now being worked out by the Bureau of the Census for the collection of statistics of every description. The demands for statistical information have been so pressing during recent years that the Federal and State statistical offices have developed more rapidly than a due regard for their work would warrant. A number of railroad companies in different States complained of the numerous demands for government reports, and expressed the hope that action be taken by the Federal and State governments to secure uniformity in regard to the periods to be covered by such reports. This is particularly the case in Pennsylvania, where the railways are required to make three reports during the year at varying periods, neither one of which, as a rule, conforms to the business year of the company. The work must be systematized so as to avoid duplications, produce uniformity in schedules, and establish fixed periods for the collection of data by the different States and the United States; in a word, to "standardize."

After adopting your schedule the Census Office immediately ascertained to what extent it had been used by the State Railroad Commissions. The Commissions in New York, Massachusetts, Connecticut, Maine, and New Hampshire, were using schedules that followed the form almost exactly. These five States contain 6,386.92 miles of single track, or 28.30 per cent of the total trackage in the United States. This fact alone would have justified the office in using your form, but it was also found that a number of other States had collected information from which the schedule could be partially prepared. Pennsylvania is one of the most important States that had not adopted the standard form, but the Commissioner informed me it was his intention to do so. The adoption of this form by the officers in all States would aid greatly in its uniform application, and it seems to me you should endeavor to accomplish this by persistent work with the State Commissioners.

Under the conditions, the preparation of an acceptable schedule proved to be the easiest part of the investigation. It was necessary to secure a report on this schedule from every street and electric railway in the entire country, of which a great many had never used the form devised by the Street Railway Accountants' Association. This has been accomplished, and, with a few exceptions to which I will refer, reports have been secured from every company, irrespective of its size, location, or character of its motive power. It has been a very difficult work and the experiences of the special agents engaged in collecting the schedules were not uniformly agreeable. While the majority of the larger companies furnished the reports without any hesitation and treated the agents in a manner that was very gratifying, a number contended that the form of account was not applicable to the road, or that it had never been used, would not be adopted because it was faulty, that the furnishing of government statistics was a perfunctory matter, that the companies never gave correct information, and if the agent wanted the report he must call again.

In one case the general manager, on being questioned about the characteristics of his motive power, informed the agent that the mules—he had two of them—would insist on running on the outside of the rails instead of between the tracks. He was assured that the adoption of the standard system of accounts would remedy this evil.

The agent who worked in Delaware and Maryland reported that only one company, the United Railways and Electric Company of Baltimore, had adopted the standard form of accounting. The other companies, as a rule, charged all expenses for additions and betterments to one account and could make no segregation. For operating expenses three accounts were kept, i. e., Maintenance, Operation, and General. Separate items were not shown and had to be estimated.

The tendency with the smaller companies seemed to be to cut short all bookkeeping work by lumping many of the smaller and even some of the larger items. This is satisfactory to the stockholders and to the management. In some cases, the work is done by the manager without a special bookkeeper. To follow a detailed system would necessitate an expense not justified by the interests involved. As a rule it was not difficult to secure reports in detail from the roads in the New England States, but estimates were necessary for some of the items. One of the agents who worked in the eastern part of Massachusetts found difficulty in securing schedules for some of the companies assigned to him, and reports as follows:

"The method of accounting in vogue by the electric street railway companies in Massachusetts is not the same as the Street Rail-

way Accountants' Association of America, but it is more in conformity with a State system—I call it a sympathetic system between State and railway companies. In some cases it would seem that the simplest possible methods were adopted by the railways so long as the State could be answered, while in other cases a double system was practiced, one for the State and the other for the company.

"On the whole, it seems a pretty good guide was available for the railway census purposes of Massachusetts, the facts, in totals, being provided, the segregation had to be made, and no positive exceptions were taken to this, when possible to accomplish with any reasonable amount of effort. It was policy to insist for answers to each question in the census schedule as it undoubtedly resulted in securing data which might not otherwise have been brought out. Only upon satisfactory evidence that exact data could not be obtained were estimates accepted.

"The United States Census inquiry met with general approval, and some regrets were made that accounts were not in a condition more favorable to it. The idea was advanced that if the United States Government would notify railway companies a year in advance, filing a form with such notification, when an inquiry was to be made and to be governed accordingly, it would be agreeably received and given careful consideration."

It is probable that in Philadelphia more roads are controlled from central offices than is the case in any other city, and we supposed their system of accounting would be perfect. Very few of the companies, however, kept their accounts in conformity with the standard form. In a number of cases it was found necessary to estimate the amounts from daily reports received from superintendents or managers. In one case the account books for a considerable property consisted of a day book, a letter file and a check book. The entries on the day book were wages, expenses, and receipts. The president of this company informed the agent that this system and poor management had cost the company $60,000 during the past few years; nevertheless, they had made no improvement. Other companies in Philadelphia appear to keep their accounts in a manner to fit the peculiar conditions existing in their respective properties. There were only one or two cases in which the books were kept in the form contemplated by your system. But in many cases it was found possible to obtain answers to the different inquiries by combining several items shown separately in the account books.

After examining the schedule, the general manager of a company in Missouri stated that the system of accounting was not in strict conformity with the one used by his company, but he thought that his books would enable him to prepare the report. After considerable searching in his private offices, he returned with a bank deposit book, and, to the surprise of the Census Office agent, this was the only book kept by the company. From this they jointly prepared a schedule.

Of the different items specified in your system of accounting, the segregation of the amounts chargeable to "construction and equipment" caused the Census Office the greatest trouble. You will see by the Census Bulletin that it was impossible to obtain amounts in answer to the different sub-inquiries with sufficient accuracy to justify their publication. Referring to this inquiry, the agents in Eastern Pennsylvania reported that in many cases, and particularly in cases of leased roads, there was no sub-division of construction and equipment. In some cases not even the cost of equipment was shown in the books, the road having been built with a view to its immediate lease to an operating company which would use its own equipment for the new section. They were reported as carried on the balance sheet, and, this being more or less arbitrary, it was impossible to estimate the sub-divisions required by the inquiry. It was with great reluctance that the companies estimated the amounts that should be charged to track and roadway construction as distinct from overhead construction. The impossibility of sub-divisions of this character was due primarily to the fact that the construction was generally paid for in a lump sum of stocks or bonds. Reports for construction and equipment of lessee companies necessarily show only the gross amount as carried on the balance sheet. It was practically impossible to obtain reliable answers to the inquiry concerning cost of right of way. This item was generally charged to construction, the constructing company providing for the purchase of the rights of way. In other companies, the land through which the road passed was largely owned by persons interested in the enterprise, and the cost of rights of way was considered in making the issue of "stocks and bonds" to landowning stockholders in lieu of cash payments. These amounts appeared, as a rule, to be greatly in excess of what cash payments to disinterested parties would have been. Amounts charged to organization, engineering, and superintendence were also more or less vaguely defined. The itemized form is only applicable to companies which have constructed their own line, and but comparatively few of the present owners have done this.

If a reliable sub-division of the total cost of construction and equipment could be secured for each company, I believe it would prove to be one of the most interesting and instructive features of the investigation, but the Census Office was loath to base any conclusions whatever on the imperfect answers given to the various sub-inquiries. For a large majority of the companies the sub-divisions were purely estimates prepared by the agent in consultation with the general manager or other officer. It is possible that in time it will be practicable to have this inquiry applied systematically to all street railways. The general tendency now, however, appears to be to equalize the cost of construction with the capitalization.

No provision is made in the Construction and Equipment account for the cost of franchise. In cases where a value was given to a franchise for which no actual expense was incurred it was not considered in the construction and equipment account, but was placed as a sundry item in the balance sheet. Where a road was purchased and an amount was actually paid, as a bonus, or for franchise rights, it was treated as a miscellaneous item in the construction account. Many companies reported an item of other permanent investment, such as stock and bonds of other street railway companies which they did not entirely own, and also of gas, water, ice plants, and ferry systems, that it was impossible to segregate from the railway business and which were therefore included in the balance sheet as other permanent investments. In such cases the amounts included in the income account were the net income from operations, while the amounts paid for interest, taxes, and other fixed charges, included the total amount of such charges, irrespective of the property on which it was paid.

With comparatively few and unimportant exceptions the Census Office was able to obtain satisfactory answers to the different sub-divisions under operating expenses. While the books for a considerable number of the companies did not show the separate items for each of the various sub-divisions under the general groups of "ways and structures," "equipment," "operation of power plant," 'operation of cars," and "general," nevertheless the total amounts for these general sub-divisions were obtainable, and it was possible to make acceptable estimates for the various items included under each. A number of companies employed only such general sub-divisions as maintenance, operation, superintendence, etc. In such cases it was necessary to resort to the pay-rolls, and more or less difficulty was experienced in distinguishing between wages and other expenses. Practically all of the large companies in Pennsylvania kept their books, so far as operating expenses were concerned, in conformity with the standard form of accounting.

A peculiar condition of affairs was found at Cape Girardeau, Mo. The promoters and owners of the Citizens' Street Railway Company had operated a system for a number of years, but had not been able to make the system pay expenses and declare the dividends to which they thought they were entitled. They therefore decided to go out of business, but were unable to find any purchaser for the road. Therefore, they concluded to be public spirited citizens, and determined to give the road to some reliable party who would agree to operate it for the benefit of the community. This was apparently a very inducing opportunity to some energetic man, and was immediately taken up. The contract was executed and the whole system, including the rolling stock, horses and equipment was turned over without a dollar's compensation, the only condition being that the road would be kept in running order and operated during business hours. Eight months of operation convinced the new general manager that he had not made a good business transaction. In fact, he was constantly losing money, and not being a man of great financial responsibility, he decided to get rid of the road. He could only accomplish this by leaving the community, and the original owners have not been able to locate him.

The conditions on the Pacific Coast and in most of the Western States were in striking contrast to those in the East. The agent who worked in California reports that of the fifteen or twenty companies from which he obtained reports in and around San Francisco, only three or four had ever heard of the form of accounting recommended by the Street Railway Accountants' Association of America, and none had followed it. It must be admitted, however, that the majority of the companies were small, only four or five falling in the class of large corporations. The business methods used in San Francisco appear to prevail pretty generally over the entire State of California. In some respects the forms of bookkeeping used are antiquated, and the conditions are such in the street railway industry that the companies did not appear inclined to adopt the form recommended by your association. The agent states that corporations sacrificed good business principles and practices for immediate profits to enhance the market value of

stocks that will quickly sell at big margins for promoters. To this end expenses are kept within limits, often below the point of good business economy. One of the favorite places of curtailment is in the clerical force of the central office, which is, as a rule, ridiculously inadequate. In consequence the system of accounting is crude, simple and direct. The books are organized for large, comprehensive groupings, with few of the divisions and none of the refinements that the Street Railway Accountants' Association would have instituted. Three of the largest corporations scheduled kept fairly good sets of books. Their grouping of items was not in conformity to our schedule, but calculations could be made for the segregation of groups so that the totals returned on the schedules were correct and the individual items close approximations. With the smaller companies the grouping was not carried to such a degree of refinement, and most of the items of inquiries for construction and equipment and operating expenses had to be estimated. The totals returned, however, agreed with those shown by the books of the companies. To illustrate: If wages of conductors and motormen, in operating expenses, were consolidated and carried as *one* item on the company's books, as was frequently done, the correct total was preserved in the returns, but segregated into the two items by calculations based on the relative number of the two classes of employees, their wages, and their hours of service.

The indications are that the adoption of the form of accounting proposed by the Street Railway Accountants' Association by the street railways of the Pacific Coast is discouragingly remote. In fact, the results of the census inquiry lead me to believe that your system of accounts has not been generally accepted in the Western States.

An agent who worked in the States of Missouri and Ohio, securing reports from eighteen companies, found that only five of the eighteen had adopted your form of accounting, and in these five companies the system of accounts differed slightly from the standard form. This agent found that one or two companies were using an old form of accounting recommended by the American Street Railway Association some years ago, and which differed, in some respects, from the revised form. Five of the companies canvassed by him used a very simple form of accounting, keeping practically only two accounts, the income account and the expense account. In these companies it was necessary to make estimates for the different sub-divisions of operating expenses.

I have referred thus in detail to the experiences of the special agents employed in collecting the reports from the street railways in the different sections of the country to emphasize the fact that your form of accounting is far from being in universal use. The system, however, has been in vogue but a comparatively short time, and the tendency appears to be, among the railroad companies, to adopt it, and a number informed the office that it was their intention to change their books accordingly. While it is possible that a number of companies will adopt the form, it is also probable that they will not follow it in all of its details. The grouping of items, however, will be such as to enable the preparation of a complete report in conformity with it.

Another difficult feature of this canvass was the disinclination on the part of a few companies to furnish reports of any character. On this point the ideas of the company and the public differ, in some instances so radically that it is apt in the future to retard the compilation of reliable statistics. The present condition of society and industry makes it indispensable that statistical information be collected and published either by the government or by private enterprise. Each and every one of us is exerting his strength to the utmost, both mental and physical, to succeed in the business in which he is engaged, but no one can hope to meet with success unless he is thoroughly familiar with all the details of his industry. An essential part of such knowledge is information concerning the business methods of other persons engaged in the same lines of pursuit and data showing the extent of the industry, its relation to other industries, and to the public. The census is the only reliable source of such knowledge. These statistics show the result of our combined energies in the multitude of industrial enterprises. The man who refuses to contribute to the knowledge by declining to supply data, certainly does not have liberal ideas or is not interested in the general prosperity of the country.

Fortunately this spirit of indifference does not predominate in the street railway fraternity. The majority of the companies were very liberal in their ideas on this subject, but one or two important systems refused to furnish any information or answer certain inquiries concerning financial operations. We presume that these companies have good reason for their action, but I do not believe that they appreciate the uses made of census reports or the value that such reports are to the railway people and the public. After our negotiations with you and, as we presumed, through you placing ourselves in touch with the street railway interests, we were in hopes that every company would co-operate in compiling a report which would be a complete presentation of the industry. I cannot conceive that there is any good and sufficient reason for refusing to supply the data required by the census law. No one other than the sworn officials of the government is permitted to examine the individual schedules, and the published reports contain no information from which the financial operations of the individual companies can be identified. Therefore, competitors, if there are any, cannot obtain information that would be of the slightest advantage. If the reports should show that the electric roads are paying large dividends on watered stock, the public would not, on that account, stop patronizing them. On the contrary, the inclination would be to invest in the stock and encourage your friends to ride on the cars in order to increase the dividends. On the other hand, if there are pernicious practices existing in the industry that are contrary to honest business methods, or detrimental to public interests, I believe you will all agree with me that the sooner the census reports are printed and the methods exposed the better.

There were a number of companies that retarded the early publication of the census reports by delaying the preparation of their schedules, but there was only one that finally and definitely refused to make a report of any character. This was a large system in Kansas, and its action was based on the ground that it was not a street railway and did not desire to be so classed. This reason was persisted in notwithstanding the fact that the company was sent a schedule in which no reference whatever was made to street railways and was assured that it would be classed as an electrical company, and that all other roads in the same State operating under similar conditions had made reports. In addition to this, there were three companies in Illinois that refused answers to all inquiries concerning financial matters. There were also fourteen companies that, for various reasons, were unable to make a report for financial operations. Some of these were steam railroad companies operating electric lines for which separate accounts were not kept, some of them had been recently acquired by the present owners and the books of the original companies were not available. Two companies, one in Colorado and one in Pennsylvania, declared their inability to make a balance sheet, and two stated that they could not make a report as to the number of employees and wages. These constitute the twenty-two companies referred to in the Census Bulletin as not making complete reports.

The adoption of the Census Office of the form of accounting used by the Street Railway Accountants' Association was of benefit to the government, and I believe it was also of great assistance to your Association. It enabled the government to complete the inquiry at an earlier date than would otherwise have been possible, it brought the form to the attention of every company in existence, and they have all made at least one report in conformity with it. The indications are that the form of account will be followed by a number of companies who have not heretofore used it, thus assuring a wider application of a standard form and greatly enhancing the value of statistics that may be gathered for the industry in the future. It remains with you to perfect or change it so as to make it practicable for all companies, and then urge its universal application.

REPORT OF COMMITTEE ON RULES FOR THE GOVERNMENT OF EMPLOYEES

The committee respectfully submits the following as a standard code of rules for the government of conductors and motormen of street railways (except interurban lines), but would call the special attention of the members of the association to Rules 61-62, to determine as to the advisability of their adoption as a standard for general use.

The committee reports these rules as fundamental in their character, and therefore can be used by roads both large and small. If the local conditions of any company are such as to require additions to any of the rules, they can be added by using the same rule number and affixing letters of the alphabet; for instance, if it is desired to add to Rule 36, the addition would be embraced as Rule 36-a.

ALL EMPLOYEES WHOSE DUTIES ARE PRESCRIBED BY THESE RULES WILL BE FURNISHED WITH A COPY, FOR WHICH THEY WILL SIGN RECEIPT, AND WILL BE REQUIRED TO HAVE THE SAME IN THEIR POSSESSION AT ALL TIMES WHILE ON DUTY.

GENERAL RULES

1. Knowledge of Rules—Conductors and motormen are required to be familiar with the rules, and with every special order issued. The bulletin board must be examined daily for special orders.

Employment by the company binds the employee to comply with the rules and regulations, and ignorance thereof will not be accepted as an excuse for negligence or omission of duty. If in doubt as to the exact meaning of any rule or special order, application must be made to the proper authority for information and instruction.

2. Report for Duty—Regular conductors and motormen must report for duty ten minutes before leaving time for their first trip, or, if for any good reason unable to so report, must give notice at least ten minutes before such leaving time.

Extra men must report at such time as ordered, or must give notice at least ten minutes before such time. They must not absent themselves after answering roll call without permission.

3. Personal Appearance—Conductors and motormen must report for duty clothed in full regulation uniform, and must be clean and neat in appearance.

4. Politeness—Conductors and motormen must treat all passengers with politeness; avoid difficulty and exercise patience, forbearance and self-control under all conditions. They must not make threatening gestures, or use loud, uncivil, indecent or profane language, even under the greatest provocation.

5. Habits and Personal Conduct—The following acts are prohibited:

(a) Drinking intoxicating liquors of any kind while on duty.

(b) Entering any place where the same is sold as a beverage while in uniform or while on duty, except in a case of necessity.

(c) Constant frequenting of drinking places.

(d) Carrying any intoxicating drink about the person while on duty.

(e) Carrying intoxicating drinks on the company's premises at any time.

(f) Indulging to excess in intoxicating liquors at any time.

(g) Gambling in any form, including the laying of bets (and playing raffles) while upon the premises of the company.

(h) Smoking tobacco while on duty.

(i) Smoking tobacco while off duty in any part of the company's building, except in the conductors' or motormen's room.

6. Talking to Motormen—Motormen while operating cars are permitted to answer questions of superior officers and to give proper instructions to students only. All other conversation with motormen while car is in motion is forbidden.

7. Run on Time—Cars must never be run ahead of schedule time, but must pass time points and leave terminals promptly on time, unless unavoidably delayed.

8. Railroad Crossings—Cars must be brought to a full stop, at a safe distance, approaching steam railroad crossings at grade, and motormen must not proceed until conductor has gone ahead to the center of crossing, looking both ways, and given the "Come ahead" signal. Before starting, the motorman will look back to see that no passengers are getting on or off; and in no case proceed, even after the conductor's signal, until he has also examined the crossing and satisfied himself that steam cars are not approaching.

When there is more than one track the conductor must remain in advance of the car until the last track is reached.

Where crossing is protected by derail, interlocking plant or flagman (employed by the company) this rule does not apply, special instructions being issued to govern.

9. Starting Cars After Blockade—In the event of a blockade of cars from any cause, all cars in such blockade must not be started at one time, but only singly and at such intervals as will not burden the feeder line.

10. Reporting Defects—Conductors and motormen will report to foreman or inspector any defect in car, track or wire which needs immediate attention.

11. Hearing by Superintendent—A hearing will be given by the superintendent to every employee who desires to complain. Reports or suggestions for the betterment of the service will always receive consideration.

RULES FOR CONDUCTORS

12. Be on Rear Platform—Remain on rear platform when not collecting fares, keeping a lookout for persons desiring to board car.

Keep careful watch of passengers to observe requests to stop car.

When stops are made at principal streets, places of amusement, churches, or at any point where a considerable number of passengers enter or leave the car, conductors must be on rear platform until such point is passed.

13. Announcements.—Announce distinctly the names of streets, public places and transfer points when approaching the same.

14. Removing Trolley—Do not remove trolley from wire at end of run, or elsewhere at night, until passengers have alighted from car.

15. Route Signs—See that route signs are properly displayed on each half trip.

16. Carrying Packages—Passengers must not be allowed to carry bulky or dangerous packages aboard cars.

Do not in any way take possession of, or assume responsibility for, any package which a passenger may bring upon the car, excepting such articles as are to be turned into the Lost Article Department.

17. Watching the Trolley—Keep your hand upon the trolley rope when passing over switches, crossings, or going around curves. Should the trolley leave the wire, the conductor must at once pull down the trolley and signal the motorman to stop. After the car has stopped replace the trolley on the wire, look around and through the car and see if any persons are boarding or leaving same; ring two bells for the motorman to start. See that passengers keep their hands off the trolley rope.



PLATE 1.—POSITION OF CONDUCTOR WHEN ABOUT TO GIVE "DANGER" SIGNAL, FLAGGING TRAIN TO STOP, WITH RED LANTERN —SEE RULE I-6-a

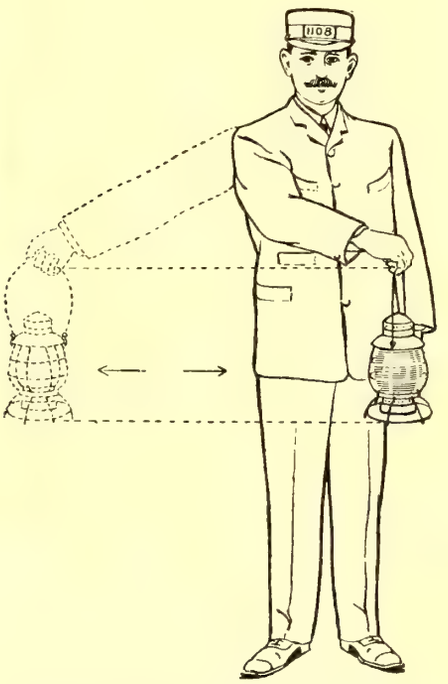


PLATE 2.—PROPER METHOD OF GIVING "STOP" SIGNAL WITH RED LANTERN—SEE RULE I-6-a

18. Keeping Gates Closed—Front and rear gates on closed cars on the side between the tracks must always be kept closed and securely fastened (when running on the road). On open cars the guard chains and guard rails must be kept fastened on the side between the tracks. When gates or chains or their fastenings are broken or out of order, prompt report must be made to foreman, inspector or starter.

19. Housing Cars—When the car is run in the house, either day or night, always shut off lights, remove trolley from the wire (if equipped with overhead trolley) and turn to position ready for leaving, also turn up longitudinal seats of closed cars.

This applies to roads having overhead trolley, ready for leaving, and turn up longitudinal seats of closed cars.

20. Moving Forward—On closed cars, when standing passengers crowd the rear door, request them to "Please step forward in car."

21. Seating Passengers—Standing passengers should be directed to vacant seats, and an effort made to provide them with seats where possible.

22. Assisting Passengers—Elderly and feeble persons, and women and children, should be given assistance getting on and off car, when possible.

23. Dogs in Cars—No dogs should be allowed on a car except such small dogs as can be carried in the laps of passengers.

RULES FOR MOTORMEN

24. Stopping for Passengers—Keep a careful lookout on both sides of the street and bring the car to a full stop for every person who signals, except that when a car has considerable headway, is overcrowded, and another car follows within the same block (or 200 feet), passengers should be requested to take the following car.

Cars will stop on signal only at farther corners, at car stations, transfer points and at points as provided in special orders.

Do not stop cars so as to block cross streets or crosswalks.

25. Churches and Hospitals—When passing a church during the hours of service, and at all times when passing a hospital, do not use the current and do not ring the gong, unless necessary.

26. Reversing Car—Never use the reversing lever to stop car except to avoid a collision or injuring a person or animal, or when the brake rigging is disabled.

Do not reverse the power when the brake is set, but release the brake and reverse the power simultaneously, and, when the reverse lever is thrown in position, apply the current one point at a time, otherwise the fuse will melt or the breaker will release. Sand should be used when making an emergency stop.

27. Passing Cars—Never run against the switch point of crossover when meeting a car, but slacken speed sufficiently to allow the car moving in the opposite direction to pass before striking switch point.

This rule refers particularly to all crossovers having switch points facing opposite to the direction in which the car is moving.

28. Leaving Car—Never leave platform of car without taking controller handle, throwing off the overhead switch and applying brake. Be careful to see that the hands point to the "off" mark before taking off controller handle.

29. Economical Use of Current—In order to effect an economical use of electric current, it is necessary that the continuous movements of starting and increasing speed should be made gradually.

In starting a car, let it run until the maximum speed of each notch has been obtained before moving handle to the next notch.

Do not apply brakes when the current is on.

Do not apply current when brakes are applied.



PLATE 3.—POSITION OF CONDUCTOR WHEN ABOUT TO GIVE "PROCEED" SIGNAL WITH LANTERN—SEE RULE I-6-b

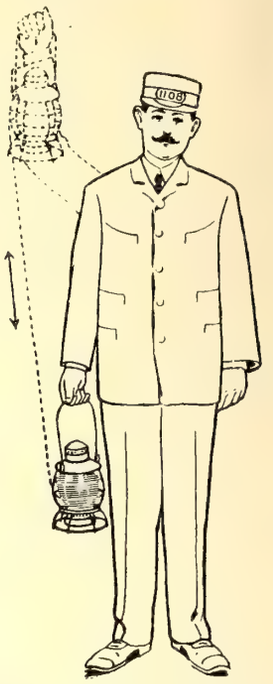


PLATE 4.—PROPER METHOD OF GIVING "PROCEED" SIGNAL WITH LANTERN—SEE RULE I-6-b

A great amount of power can be saved by using judgment and discretion in approaching stopping places and switches by shutting off the power so as to allow the car to drift to the stopping place or switch without a too vigorous use of the brake.

30. Throwing Overhead Switch—An overhead switch must never be thrown until power is turned entirely off, except in case controller cylinder fails to turn when power is on. It must be thrown by hand only.

31. Power off Line—When the power leaves the line the controller must be shut off, and the overhead switch thrown, the light switch turned on, and the car started only when the lamps burn brightly.

32. Release Brakes Before Stop—When brakes are set to make a stop they should always be released, or nearly so, just before the car comes to a standstill.

33. Water on Track—When there is water on the track run the car very slowly, drifting without use of power whenever possible, otherwise there is danger of burning out the motors.

34. Sanded Rails—Never run on freshly sanded rails with brakes full on, except to prevent an accident, as the wheels are liable to be flattened when this is done. On cars provided with sand boxes, in case of slippery rail, always sand the track for a short distance before applying the brakes.

35. "Spinning" of Wheels—Care must be taken, particularly during snowstorms, to avoid "spinning" of the wheels with no forward or back movement of the car.

36. Do Not Slide Wheels—On a slippery rail do not allow wheels to slide; as soon as wheels commence to slide the brake must be released and reset.

37. Do Not Oil Car—Do not oil or grease any part of a car.



PLATE 5.—POSITION OF CONDUCTOR WHEN ABOUT TO GIVE "BACK UP" SIGNAL, BY NIGHT, WITH LANTERN—SEE RULE I-6-c

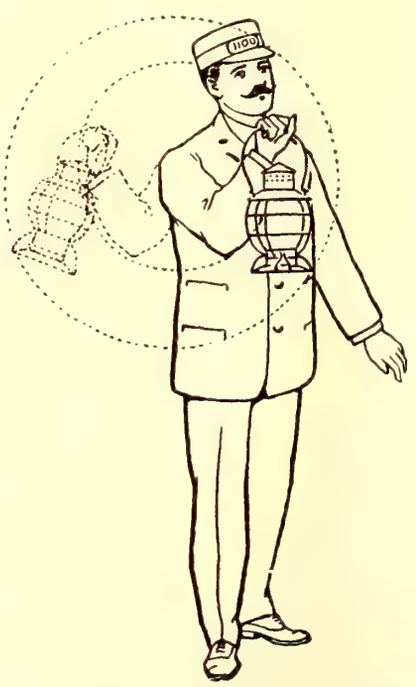


PLATE 6.—PROPER MANNER OF GIVING "BACK UP" SIGNAL, BY NIGHT, WITH LANTERN—SEE RULE I-6-c

Do not allow the current to remain on when car is going down grade, or when passing over section breakers. Endeavor to run car with the least amount of current, allowing the car to drift without the use of the current when it can be done without falling behind time.

SIGNALS AND THEIR APPLICATION

The following code of bell signals will be used in the operation of the car:

38. Bell Signals—From conductor to motorman, to be given on motorman's signal bell:

One Bell—"Stop at next crossing or station."
Two Bells—"Go ahead."
Three Bells—"Stop immediately."
Four Bells—Given when car is standing—"Back car slowly."
From motorman to conductor, given on conductor's signal bell.

One Bell—"Come ahead."

Two Bells—"Watch the trolley and danger signal to the conductor."

Three Bells—"Set rear brake."



PLATE 7.—POSITION OF CONDUCTOR WHEN ABOUT TO GIVE "TRAIN PARTED" SIGNAL, BY NIGHT, WITH LANTERN—SEE RULE I-6-d

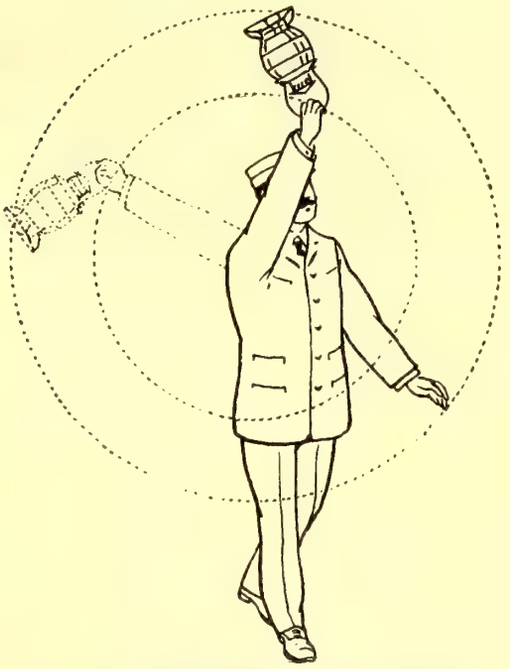


PLATE 8.—PROPER MANNER OF GIVING "TRAIN PARTED" SIGNAL, BY NIGHT, WITH LANTERN—SEE RULE I-6-d

Four Bells—Signal to conductor that motorman desires to back car.

*Five Bells—Warning—"Pull trolley down to roof."

Whenever a car in service is stopped, the motorman will, as soon as he is ready to go forward, give two taps of the gong, after which, if the conductor is ready to proceed, he will give the regular "go ahead" signal—two bells.

The motorman will answer the signal to stop from conductor by one loud tap of gong and two loud taps of gong after receiving the signal to go ahead. If unable to proceed immediately upon receipt of signal motorman will wait for for another "go ahead" signal before starting the car.

When the car is standing and motorman desires to back, for any reason, he will give the conductor four bells, but must not move the car until the conductor has answered with four bells to signify "all is clear behind."

39. Danger Signals—Red lights or flags indicate danger, and when they are placed alongside the track cars must be run slowly and with caution. When placed on the track cars must come to a full stop until such signal is removed.

40. Signals Before Passing Obstructions Near Track—Before passing any vehicle or obstruction close to the track, where passengers or conductor are liable to be injured while standing on the step of an open car, motorman must give two taps of signal bell as warning, reduce speed, and assure himself that all is clear before proceeding.

41. Starting—Motorman must never move car (whether stopped on signal or for any other reason) without signal from conductor, and then only when assured that no one is getting on or off front platform.

Conductor must never give signal to start when passengers are getting on or off.

Conductor must never give signal to back a car unless he is on rear platform and knows track is clear behind the car.

PRECAUTIONARY RULES—ACCIDENTS

42. Safety—The safety of passengers is the first consideration. All employees are required to exercise constant care to prevent injury to persons or property, and in all cases of doubt take the safe side.

43. Persons Between Cars—Cars moving in opposite directions must not pass at points where persons are standing between the tracks, but must be operated so as not to occupy both tracks at such points simultaneously.

44. Patrols—When any police or fire department vehicle is observed approaching (from any direction) cars must be stopped until such vehicle has passed.

45. Ambulances—Ambulances must be allowed the right of way, and when approaching or passing, cars must be kept under control to avoid collision.

46. Warning to Passengers—Conductors and motormen must (in a polite way) endeavor to keep people from jumping on and off the cars while in motion.

If such people attempt to get on or off the car while it is in motion, notify them politely to wait until the car stops. If passengers are leaving car while another car is approaching from the opposite direction notify them politely to look out for car on other track.

47. Standing on Steps—Do not allow any one to stand on the steps or buffers, and never, under any circumstances, permit a woman or child to ride on the steps. They should be fully inside of the car before the signal is given to start.



PLATE 9.—POSITION OF CONDUCTOR WHEN ABOUT TO GIVE "COME AHEAD" SIGNAL, BY DAY—SEE RULE I-9

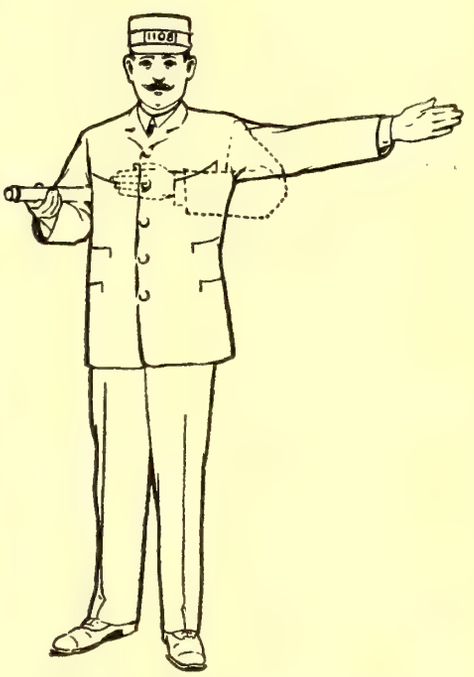


PLATE 10.—PROPER METHOD OF GIVING "COME AHEAD" SIGNAL, BY DAY—SEE RULE I-9

48. Leaving Car—When necessary for conductor to leave his car he must notify the motorman to protect passengers and car. Should passengers board car during absence of conductor, motorman will notify conductor of the number and location of such passengers upon his return.

Cars in commission must not be left unprotected, either conductor or motorman always remaining in charge.

* This applies to roads having overhead trolley.

49. Exercise Care—Motormen are cautioned to exercise great care when a vehicle is passing alongside of track ahead of car. Ring the gong vigorously to attract the attention of the person driving as a warning not to pull in ahead of car, and run cautiously until the vehicle is passed in safety.

50. Passing Cars—When passing standing cars gong must be rung and car brought to slow speed.

51. Render Assistance—In case of accident, however slight, to persons or property in connection with or near any car, the motorman and conductor in charge of the same will render all assistance necessary and practicable. In no case will they leave injured persons without first having seen that they are cared for.

52. Medical Attendance—Motormen or conductors are directed not to employ medical attendance to injured persons, except for the first visit, in cases of personal injury; nor will they visit such persons at any other time afterward, unless specially instructed so to do by an officer of the company.

53. Fatal Accidents—In the event of a fatal accident it will not be necessary to blockade the line awaiting the arrival of the coroner or any other official. If any accident occurs where it is impossible to carry the body to a place of shelter and security, motorman and conductor will put the body on the car and convey it to some suitable place.

54. Reports to be Full and Complete—A full and complete report of every accident, no matter how trivial, and whether occurring on or near the car, must be made by the conductor. Accidents sometimes considered as not worth reporting are often the most serious, troublesome and expensive.

The conductor will obtain the name and residence in full of all witnesses on or near the car.

The motorman will assist the conductor in securing the names of witnesses whenever practicable, and he will be held responsible for any neglect to render assistance.

In all cases full facts must be obtained and stated in the reports as follows:

The date, exact time, exact place, run and car number, and the direction in which the car was moving, the nature of the accident or collision, and the cause of its occurrence.

The full name and address of the party injured or whose vehicle was in collision (giving the name of both the driver and the owner of the vehicle).

Ascertain the extent of injuries or damage, if any, before leaving the spot.

In case there has been an accident on the car, and the conductors change ahead, the conductor taking car on which the accident happened must secure the names of witnesses as above.

In case a person is struck by a car after passing around the rear of a standing car, the numbers of both cars must be obtained, and both crews shall report accident.

If an accident is caused by any defect or damaged condition of car, conductor must report the same and its cause.

Accidents to employees will be reported the same as accidents to passengers.

Any trouble or disturbance of a boisterous or quarrelsome character which occurs on a car, or the ejectment of a person from a car, will be reported as an accident.

55. Telephone Information—In case of accident involving personal injury or serious damage to property, conductor will telephone at once to headquarters, giving notice and particulars of accident.

In case of a blockade, where assistance is required to get cars moving, conductor of car in block must perform this duty. Expense of telephone message will be refunded upon application at office.

56. Report Accidents to Inspectors—Conductors and motormen will make a verbal report to the first inspector or official of the company they meet of any accident, blockade or mishap of any kind.

57. Give Information to Proper Persons.—No employee shall, under any circumstances, give any information whatever concerning any accident, delay, blockade or mishap of any kind to any person except to a properly authorized representative of the company.

58. Responsibility for Damages—Employees will be held answerable for any damages caused by their neglect or carelessness or by disobedience of rules.

59. Disabled Cars—The motorman or conductor of any disabled car, withdrawn from the track, must remain with the car until relieved by proper authority or until car reaches depot.

EJECTMENTS

60. Ejectments—No passenger shall be forcibly ejected from a car for any cause whatsoever without order of an inspector, starter or official of the company, unless the conduct of the passenger is dangerous or grossly offensive. In such case the ejectment must be made by the conductor with the assistance of the motorman after the car has been brought to a stop, using "only such force as is sufficient to expel the offending passenger with a reasonable regard for his personal safety.

61. Refusing to Pay Fares—Transfers—When a passenger refuses to pay fare or presents a defective transfer, or ticket, upon which, in the judgment of the conductor, the passenger is not entitled to ride, the conductor must secure the names of as many witnesses to he fact as is possible, whereupon the car must be stopped and the passenger requested to leave. If the passenger fails to comply with such request, the facts of the case must be brought to the attention of the first inspector, starter or official. In all cases the passenger must be given the benefit of any doubt.

When a passenger who refuses to pay fare requests to be allowed to leave the car, the car must be stopped and the person permitted to alight.



PLATE 11.—POSITION OF CONDUCTOR WHEN ABOUT TO GIVE "DANGER" SIGNAL, WITH RED FLAG, FLAGGING TRAIN TO STOP, BY DAY—SEE RULE I-9

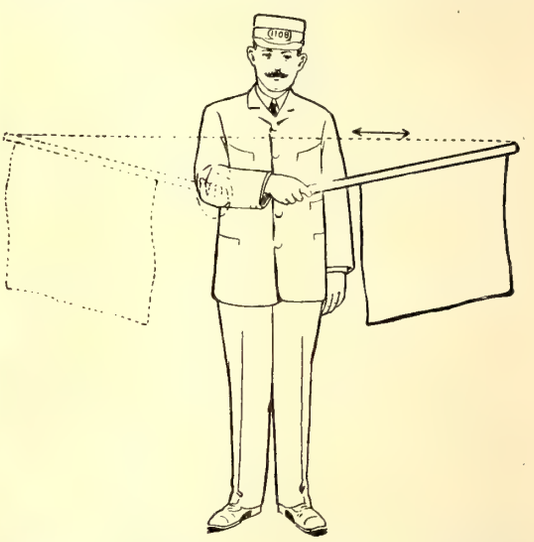


PLATE 12.—PROPER METHOD OF GIVING "STOP" SIGNAL, WITH RED FLAG, BY DAY—SEE RULE I-9

62. Intoxication—No passenger will be ejected from a car for mere intoxication, unless said passenger becomes dangerous or offensive; such passenger must be then ejected with great care and must be guided until free from probable injury.

63. Stealing Rides—Any person caught stealing a ride on a car must never be pushed therefrom while it is in motion.

64. Spitting on Floor—No passenger will be ejected from a car for spitting on the floor. If a passenger violates the rule of law prohibiting spitting, the conductor will call the attention of the passenger to the law prohibiting such conduct, and endeavor to persuade passenger to desist.

65. Get Witnesses—In case of ejectment, always get names of witnesses, and make report showing all the circumstances, the same as in case of accident.

66. Where to Eject—Any person ejected from a car must be put off at a regular stopping place.

No passenger will be put off at a point where likely to be exposed to danger.

Particular attention must be paid to this rule during bad and inclement weather, late at night, or when a passenger is intoxicated.

FARES AND TRANSFERS

67. Collection of Fares—Fares must be collected promptly after passenger has boarded car. When more than one passenger or

party boards car at a time the fares must be rung up on the register in the presence of the party who paid it before any more fares are collected. Conductor must ring each fare from the place where he collects it. Thus, a fare paid inside of car must be rung up from the inside, or from the platform if collected thereon.

68. Change—When necessary to give change, conductors must first register fare, and immediately thereafter give change.

69. Register Rings—Conductors must be careful to see that register rings each fare and that dial shows it.

70. Register Out of Order—In case the register gets out of order the conductor must stop using it, make report of fares on back of trip report or on blanks supplied for that purpose, and report the fact to the first inspector or starter met on the road, and subsequently report to superintendent.

71. Transfers in Blockades—In case any line is blocked it is the desire of the company to carry passengers to their destination on other lines. Under such circumstances conductors of parallel or intersecting lines will accept transfer tickets accordingly and will issue a transfer on a transfer if necessary. They will also accept transfer passengers without tickets on orders from any inspector or authorized representative of the company, making report of same on back of trip report.



PLATE 13.—FRONT END REGULAR TRAIN, WITH RED DASH SIGN, BY DAY—SEE RULE I-11



PLATE 15.—FRONT END REGULAR TRAIN, WITH RED LANTERN AND RED DASH SIGN, BY NIGHT—SEE RULE I-11



PLATE 17.—FRONT END REGULAR TRAIN, CARRYING SECOND SECTION SIGNALS, GREEN AND RED DASH SIGN, BY DAY—SEE RULE I-12

72. Transfer Point Meetings—Motormen and conductors will be held equally responsible for leaving a transfer point so quickly as to prevent the transfer of passengers from an approaching car on a connecting line.



PLATE 14.—REAR END REGULAR TRAIN, WITH RED DASH SIGN, BY DAY—SEE RULE I-11



PLATE 16.—REAR END REGULAR TRAIN, WITH RED LANTERN AND RED DASH SIGN, BY NIGHT—SEE RULE I-11



PLATE 18.—REAR END REGULAR TRAIN, CARYING SECOND SECTION SIGNALS, GREEN AND RED DASH SIGN, BY DAY—SEE RULE I-12

INTERURBAN RULES

In addition to the rules hereinbefore given the following rules will be observed by crews of interurban cars:

DEFINITIONS

Train. A car, or more than one car, coupled together, displaying signals.

Regular Train. A train represented on the time-table. It may consist of sections.

Section—One of two or more trains running on the same schedule displaying signals or for which signals are displayed.

Extra Train—A train not represented on the time-table. It may be designated as:

Extra for any extra train, except work extra.

Work Extra—For work train extra.

Superior Train—A train having precedence over other trains; a train may be made superior to another train by right, class or direction.

Right is conferred by train order; class and direction by time-table.

Right is superior to class or direction. Direction is superior as between trains of the same class.

Note—Superiority by direction is limited to single track.

Train of Superior Right—A train given precedence by train order.

Train of Superior Class—A train given precedence by time-table.

Train of Superior Direction—A train given precedence in the direction specified in the time-table as between trains of the same class.

Note—Superiority by direction is limited to single track.

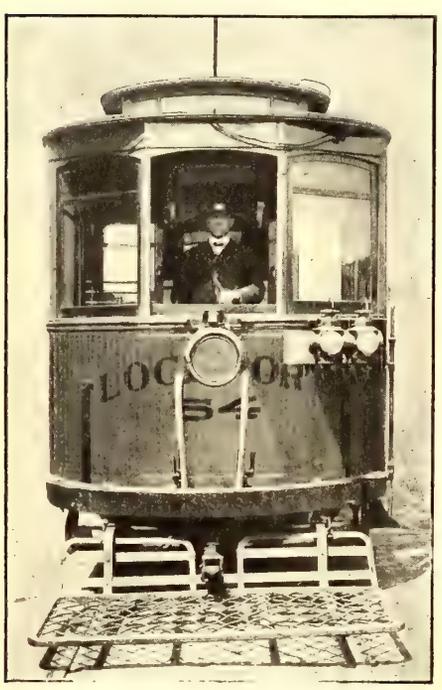


PLATE 19.—FRONT END REGULAR TRAIN, CARRYING SECOND SECTION SIGNALS, GREEN LANTERN, RED DASH SIGN AND LANTERN, BY NIGHT—SEE RULE I-12



PLATE 20.—REAR END REGULAR TRAIN, CARRYING SECOND SECTION SIGNALS, GREEN LANTERN, RED DASH SIGN AND LANTERN, BY NIGHT—SEE RULE I-12



PLATE 21.—FRONT END EXTRA TRAIN, CARRYING WHITE SIGN WITH BLACK X, BY DAY—SEE RULE I-13

Time-Table—The authority for the movement of regular trains subject to the rules. It contains the classified schedules of trains with special instructions relating thereto.

Schedule—That part of a time-table which prescribes the class, direction, number and movement of a regular train.

Main Track—A principal track upon which trains are operated by time-table, train orders or by block signals.

Single Track—A main track upon which trains are operated in both directions.

Double Track—Two main tracks, upon one of which the current of traffic is in a specified direction, and upon the other in the opposite direction.

Current of Traffic—The direction in which trains will move on a main track under the rules.

Station—A place designated on the time-table by name, at which a train may stop for traffic, or to enter or leave the main track, or from which fixed signals are operated.

Siding—A track auxiliary to the main track for meeting or passing trains, limited to the distance between two adjoining stations from which train orders may be received.

Fixed Signal—A signal of fixed location indicating a condition affecting the movement of a train.

Note to definition of fixed signal: The definition of a "fixed signal" covers such signals as slow boards, stop boards, yard limits, switch, train orders, block, interlocking, semaphore, disc, ball or other means for indicating stop, caution or proceed.

Yard—A system of tracks within defined limits provided for the making up of trains, storing of cars and other purposes, over which movements not authorized by time-table, or train order, may be made, subject to prescribed signals and regulations.

Pilot—A person assigned to a train when the motorman or conductor, or both, are not fully acquainted with the physical characteristics or running rules of the road, or portion of the road, over which the train is to be moved.

RULES

I-1. Employees whose duties may require them to give signals must provide themselves with the proper appliances, keep them in good order and ready for immediate use.

I-2. Motormen will be held responsible for the care and proper operation of the signal lamps and signals as well as the headlight on the front of the car.

Conductors will be held responsible for the care of the tail lights and signals on the rear of the car.

Motormen will see that their cars are provided with the following equipment, viz.:

Two regular run numbers.

Two "Car Following" signs.

Two "X" signs.

Four combination on classification lamps with oil.

One headlight.

One red lantern.

One red flag.

Conductors will see that their cars are provided with the following equipment, viz.:

One red flag to be carried on rear platform.

One red lantern in such a manner as to be available for immediate use.

I-3. Signs of the prescribed color must be used by day, and lamps of the prescribed color by night.

I-4. Night signals are to be displayed from sunset to sunrise. When weather or other conditions obscure day signals, night signals must be used in addition.

VISIBLE SIGNALS

I-5. Color signals.

	Color.	Indication.
(*a*)	Red.	Stop.
(*b*)	White.	Proceed, and for other uses prescribed by the rules.

I-6. Hand, flag and lamp signals.

Manner of Using.	Indication.
(*a*) Swung across the track.	Stop. (See plates Nos. 1 and 2.)
(*b*) Raised and lowered vertically.	Proceed. (See plates Nos. 3 and 4.)
(*c*) Swung vertically in a circle across the track, when the train is standing.	Back. (See plates Nos. 5 and 6.)
(*d*) Swung vertically in a circle at arm's length across the track when the train is running.	Train has parted. (See plates Nos. 7 and 8.)

A flag, or the hand, moved in any of the directions above will indicate the same signal as given by a lamp, except the "come ahead" signal, when used flagging railroad crossings, which shall be as provided for in Rule I-9. (See plates Nos. 9, 10, 11 and 12.)

I-7. Any object waved violently by any one on or near the track is a signal to stop.

AUDIBLE SIGNALS

I-8. Whistle signals.

Note—The signals prescribed are illustrated by "O" for short sounds; "—" for longer sounds. The sound of the whistle should be distinct, with intensity and duration proportionate to the distance signal is to be conveyed.

Sound.	Indication.
(*a*) — — —	Train has parted. (To be repeated until answered, as provided for in Rule I-6 (*d*.)
(*b*) — — — —	Flagman return from west or south.
(*c*) — — — — —	Flagman return from east or north.
(*d*) — O O	To call the attention of trains of the same or inferior class to signals displayed for a following section.
(*e*) — — O O	Approaching public crossings at grade.
(*f*) O O	An answer to any signal (except train parted).
(*g*) O O O O	Motorman's call for signals from switchtenders, watchmen, trainmen and others.
(*h*) — —	Approaching stations, junctions and railroad crossings at grade.

A succession of short sounds of the whistle is an alarm for persons or cattle on the track, and calls the attention of trainmen to danger ahead.

I-9. In addition to the instructions contained in Rule 9, which apply while cars are operating over city lines, conductors when flagging railroad crossings will use red lantern at night and red flag by day; both in manner prescribed in Rule I-6. The red flag to be carried, rolled up, under right arm, and used only as a signal that crossing is not clear and train may not proceed.

I-10. The headlight will be displayed to the front of every train by night.

I-11. All regular trains will display on outside of front and rear dash, in place provided, a red sign with designating run number signals thereon by day, and, in addition, a red signal light by night. (See plates Nos. 13, 14, 15 and 16.)

I-12. Each section of a train, except the last, will display on outside of front and rear dash in places provided, in addition to its red dash signs and its red signal lights, a green sign with the words "Car Following" thereon by day, and a green signal light at night. (See plates Nos. 17, 18, 19 and 20.)

I-13. Extra trains will display on outside of front and rear dash in place provided a white sign with black "X" thereon by day, and, in addition, a white signal light at night. (See plates Nos. 21, 22 and 23.)

An extra train at night will display on outside of rear dash in place provided, in addition to its other signals, a red signal light. (See plate No. 24.)



PLATE 22.—REAR END EXTRA TRAIN, CARRYING WHITE SIGN WITH BLACK X, BY DAY—SEE RULE I-13

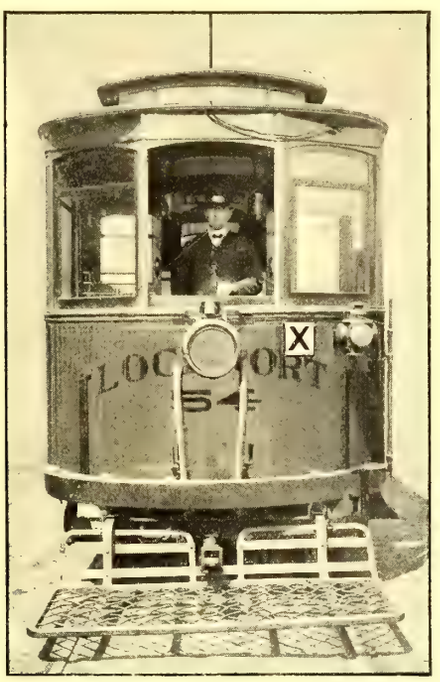


PLATE 23.—FRONT END EXTRA TRAIN, CARRYING WHITE SIGN WITH BLACK X AND WHITE LANTERN, BY NIGHT—SEE RULE I-13



PLATE 24.—REAR END EXTRA TRAIN, CARRYING WHITE SIGN WITH BLACK X, WHITE AND RED LANTERNS, BY NIGHT—SEE RULE I-13

USE OF SIGNALS.

I-14. A signal imperfectly displayed or the absence of a signal at a place where a signal is usually shown, must be regarded as a stop signal, and the fact reported to the despatcher.

I-15. The gong must be rung on approaching every public road crossing and until it is passed; and the whistle must be sounded 1000 ft. from the crossing.

I-16. The unnecessary use of either the whistle or the bell is prohibited. They will be used only as prescribed by rule or law, or to prevent accident.

I-17. Watchmen stationed at public road and street crossings must use red signals only when necessary to stop trains.

I-18. Express trains, work trains and extras must keep out of the way of a regular, and clear its time at least 5 minutes.

I-19. A train failing to clear the main track by the time required by rule, must be protected as prescribed by Rule No. I-23.

I-20. Unless some form of block signals is used, cars must keep at least 1 mile apart when running at speed.

I-21. Work extras will be assigned working limits. Within these limits such trains must move with the current of traffic.

I-22. Trains must approach the end of double track and junctions prepared to stop.

I-23. When a train stops or is delayed, under circumstances in which it may be overtaken by another train, the conductor must go back immediately with stop signals a sufficient distance to insure full protection. When recalled he may return to his car.

The front of a train must be protected in the same way when necessary.

I-24. Switches must be left in proper position after having been used. Conductors are responsible for the position of the switches used by them, except where switch tenders are stationed.

I-25. Both conductors and motormen are responsible for the safety of their trains and, under conditions not provided for by the rules, must take every precaution for their protection.

I-26. In all cases of doubt and uncertainty the safe course must be taken to guard against accident.

I-27. When a train crosses over to, or obstructs the other track, unless otherwise provided, it must first be protected as prescribed by Rule I-23 in both directions on that track.

I-28. Trains must use caution in passing a train receiving or discharging passengers, and must not pass between it and the platform at which the passengers are being received or discharged.

E. G. Connette,
T. E. Mitten,
W. E. Harrington,
Robt. McCulloch,

TRAIN ORDERS AND TRAIN SIGNALS FOR INTERURBAN ROADS.

BY CHARLES A. COONS

It is but stating a self-evident truth to say that the first and paramount consideration in the operation of any high-speed suburban or interurban electric road must be the safety of passengers and trains. To this element all others must be subserved even at the expense of the prescribed schedules, but it must be clearly borne in mind also that complete safety is dependent very largely upon the maintaining of schedules and the regularity and punctuality with which trains move. Rules and regulations that are drawn so conservatively as to interfere needlessly with the movement of trains may very easily introduce a new element of danger to say nothing of defeating the purpose for which the road is operated, namely, the moving of passengers and merchandise with promptness and despatch.

Inasmuch as the conditions under which electric interurban railways operate are beginning to approach very closely the conditions pertaining to steam railroad operations, and, taking into consideration that steam railroads have been running many years before electric traction was introduced, it would appear that electric railway managers could profit by studying and adopting many of the rules and methods of operation which have been adopted as standard on the steam roads and which may be considered the survival of the fittest after years of evolution. This is particularly true as regards methods of despatching trains. Years of study and experiment on the part of those responsible for the operation of steam roads in this country have resulted in the adoption by practically all of the prominent trunk systems of certain rules and methods, which, it is suggested, are in the main applicable to electric railway operation.

Time will not be taken here to review in detail the rules as commonly accepted by the prominent roads for the management of the operating department. The members of the convention are doubtless familiar with their general tenor, and to those who care to continue the study into details, it is suggested that copies of the book of rules as used by the Pennsylvania, New York Central, or any of the other large systems, can probably be obtained by application to the respective operating departments. Attention is also directed to the fact that the code of interurban rules presented to this convention by the committee on standard rules is patterned very closely after the rules in vogue on the best managed steam roads.

For the handling of train orders, the steam roads almost universally employ two blanks, known respectively as Form 19 and Form 31. Form 19 is a blank upon which the operator writes the order as he receives it from the despatcher, which is at once repeated back and the "O. K." of the despatcher is then given and proper notation, with time, noted thereon; a copy of this order is handed by the operator to the train crew to whom it is addressed. With order blank, Form 19, no receipt is obtained from the train crew and no means are provided for knowing absolutely that the order has been received and understood by those who are to execute it.

Form 31 is a blank upon which the operator writes the message as he receives it from the despatcher. After the message has been repeated back and the despatcher's "O. K." received, those to whom the order is addressed must sign their names to the blank, after which the operator must again repeat the message back to the despatcher in the presence of the waiting trainmen, and in addition must transmit the signatures of the trainmen and secure the despatcher's "complete" before the order becomes operative. The use of this form gives a considerable element of security, but it is not recommended for electric railway service owing to the delay caused by compelling the trainmen to wait at the station until their signatures have been transmitted and the "complete" response received. With a frequent service of many small units the delays from this source would be very considerable and render the method prohibitive.

As a compromise between Form 19 and Form 31 a modification of both is suggested for use on interurban electric roads. This blank is here designated as Form 21. With this blank the trainmen sign their names to the order at the operator's office; they then each take a carbon copy of the order and immediately proceed with their car, without the delay incident to the transmitting of their signatures as required with Form 31. In detail the method of using the form is as follows: Despatcher telegraphs order for trainmen to operator. The operator takes down the message on Form 21, making at the same time—by means of carbons—as many copies as may be necessary; the operator repeats the message back to despatcher; if correct, despatcher wires "complete" and operator marks the blank "complete." All this is done prior to the arrival of train. When the train arrives the crew thereof goes to the operator's office and fills in on the blank, in places provided, the following information: Number of section (if train is being operated in more than one section), number of run, number of train and time. The order is then signed for by both conductor and motorman, who must each take a copy of same, with their names thereon, in places provided (as a receipt therefor), before they depart. The operator retains one of the copies for file in his office. If one or more units are being operated as sections of a single train number the operator makes a sufficient number of copies to give each conductor and motorman of all the sections a copy thereof. This blank is being used with excellent results by the International Railway Company on its interurban lines, including one single track line 37 miles in length, on which cars are operated at a maximum speed of 55 m. p. h., with cars operating in each direction at intervals of 30 minutes, together with a large number of freight and express trains between regular cars.

It is not out of place to say here a few words concerning the relative merits of the telegraph and the telephone as the medium for transmitting messages from the despatcher to the operators along the line. It is true that most steam roads use the telegraph and most electric roads use the telephone for despatching purposes, and for electric railway operation opinion appears to be divided as regards the relative merits of the two systems. The management of the International Railway Company believes there is little to choose as between the two systems, and that either one will prove adequate if properly installed and properly maintained. The cost of wire and instruments of either system will be about the same, and either system is liable to disarrangement if not properly watched, although the telephone is perhaps more susceptible to disturbing influences than the telegraph. With either the telephone or telegraph system it is desirable to have operators at every regular meeting place to receive and record messages, or in lieu of operators, at least some method of recording the checking of messages as they are received by the train crew.

In further elucidation of the method of despatching with the use of Form 21 the following is added:

All orders issued by despatcher are copied in a book kept by him for that purpose in the following manner: Order when repeated back by operator is copied in this book word for word. All operators receiving an order repeat it back, the despatcher entering it in this book word for word as it comes back from the first operator, and underscoring each word as it comes back from the second operator and so on until all operators receiving the order have repeated it back.

Despatchers and operators are supplied with a form known as a train sheet to assist them in keeping track of the movement of all trains.

A daily register is kept at all single-track terminals for the purpose of trainmen registering their trains therein. On one page northbound trains are entered; on the opposite page southbound trains. Trainmen, in places provided, fill in the following information: Section number, run number, train number, signals carried, time, signature of conductor and motorman (or engineer).

All regular movements of trains are governed by the printed time-table, which is defined as "The authority for the movement of regular trains subject to the rules." The time-table contains the classified schedules of trains with special instructions relating

thereto. All movements of extra and special trains and of regular trains when off schedule are governed by special orders issued by despatcher in the regular way.

The system of train signals in use by the International Railway Company is practically the same as that presented to this convention by the committee on standard rules, and it is not necessary to repeat them in this connection.

In the matter of signals the International Railway Company adheres very closely to the methods accepted by steam railroads. In the adoption of signals, etc., we have considered the fact that steam railroad managements have been advancing in the science of railroading for many years, while the electric road is in its infancy. We naturally felt, therefore, in availing ourselves of their knowledge and experience, we were making a wise move in any event until something better and newer develops.

It should also be noted that the International Railway Company does not use flags as markers. It has been observed that when a train is running at speed the movement thereof causes the flags to hang straight to the rear, consequently, they are not plainly discernible by the crew of an opposing train; in place of flags for designating a car following, run numbers, etc., a metal dash sign is used, these signs being about 8 ins. x 8 ins. They have been found very satisfactory.

After all has been said and done, safety, together with regularity and punctuality in the operation of any electric railway system, do not depend so much upon the methods of despatching, or the rules adopted for the management of employees, as they do upon the way in which the rules are observed by every individual in the organization from the manager down to the switch boy. An indifferent set of rules rigidly and consistently enforced and observed is far better than the best code of regulations, half-heartedly or inconsistently enforced. The operating organization constitutes a huge and complicated machine, and the integrity of the whole depends solely upon the smoothness and accuracy with which each of the individual cogs fits into its allotted place and performs its allotted functions. A rigid, never ceasing, never relenting inspection of every cog is the first requisite to the efficient, economical and safe operation of the huge mechanism in the modern interurban electric railway.

RECENT STEAM TURBINE DEVELOPMENTS

BY W. L. R. EMMET, GENERAL ELECTRIC COMPANY

When the writer agreed, some months ago, to present a paper to this meeting, he fully expected that its subject matter would mainly consist in a record of practical results accomplished with commercially operating machines, and that such matter would be full enough to justify its presentation and discussion. Some months ago a paper was presented to the American Philosophical Society on this same subject, which has since gone the rounds of the press. This paper dealt at some length with our expectations concerning the new steam turbine developments now going on at Schenectady, and which is different in many respects from the machines now being built.

The scant array of established facts in this paper, and the rather liberal presentment of expectations have called forth some criticism, particularly from European turbine builders. Such criticisms are not unnatural under the circumstances, and we are naturally eager to demonstrate to the world the soundness of the claims upon which the General Electric Company and its customers have based such large undertakings.

The writer had confidently expected that before this date the 5000-kw turbine recently installed at Chicago would have been fully tested and verified, and that its results could be here presented to the members of this association who are so deeply interested in the success of developments of this kind. We have fallen a little short of this expectation, through such unforeseen delays as are usual in such cases, but still have produced results which are highly interesting and suggestive, although no complete tests have yet been made. The machine has been installed in the new station of the Commonwealth Electric Company, which is probably the finest and best equipped station in the world, and has been connected to its regular equipment of boilers and condensing facilities. It has been started without any hitch or delay, and has been operated repeatedly at full load, and under a variety of conditions to test its performance. It has operated with a wonderful steadiness and perfection, has governed perfectly from full load to no load with only 2 per cent speed variation, and has in every respect shown itself to be a thoroughly desirable operating machine. A test of steam economy was also very carefully conducted on this machine, very perfect facilities for weighing water and maintaining a steady and accurately measured load having been provided. Unfortunately, the results of these tests were found afterwards to be entirely indefinite, since a large leakage of circulating water, through a misplaced valve, into the steam space of condenser was discovered, which water had been weighed in connection with the condensed steam. When this was discovered it was too late to ascertain with certainty the amount of this leakage at the time of test. The flow with no load, however, indicated that this leakage was very large, and the general inference drawn from our test is that a very fine steam economy was shown. We will, however, refrain from making any positive statements on this subject until we have obtained tests which are absolutely unquestionable. All the conditions in connection with the running of this machine have given very favorable indications. The machine is connected so that the condensed water passes from the hot well through a heater, and is pumped directly back into the boiler. This whole system was in operation and worked perfectly. The water returned to boilers was, of course, entirely free from oil and quite clear, except at light load, when the leakage from the river appreciably discolored it. The plant operated at full load, with four 500-hp boilers fired out of the eight which have been provided for each machine. These boilers were fired with Illinois coal on chain grates, and their performance of the work is, in itself, an indication of good economy.

After this test run the machine was taken apart for the purpose of making a minor internal change, which was thought to be desirable. The machine will not be required for service for some months, and our desire is to get it in the best possible condition in advance of the time when it will be required to carry a large winter load. The machine will probably be ready to run again within about a week or ten days, and conclusive tests will then be made.

In order to properly understand the significance of the successful starting of this machine, it is necessary to review the history of its design, and to compare it with engines of other types: After the experiments with Mr. Curtis' steam turbine inventions had proceeded for several years, certain experimental results were obtained which seemed to justify the production of commercial machines, and it was decided to build a commercial machine for use in the Schenectady Works. A 600-kw machine, with horizontal shaft was designed, the mechanical arrangements being in most respects in accordance with the plans which Mr. Curtis had formed previous to that time for building the turbines. This machine was built and tested nearly two years ago.

These tests showed a high steam economy, and it was very soon after decided that the performance of this machine justified the building of other commercial machines, which could safely be relied upon to perform as good or better results. The question of mechanical design for these larger machines then became a matter of first importance. The steam economy could safely be expected to conform closely to that of the machine which had already been tested, but the whole question of cost and commercial desirability depended upon the mechanical construction adopted for accomplishing the desired results.

It was decided at this time to build a steam turbine unit as large as the largest engine-driven generating unit in the country, and as the result of this decision the design of the machine now in Chicago was made up after a great amount of thought and study. This design embodied many very radical features, as compared with other engines, turbines, or machines of any character. The shaft is vertical; the whole weight of the revolving part is borne by an oil film delivered by a pressure pump to the lower bearing; the delivery of steam to turbine is controlled through a system of electrically operated individual valves worked by a small controller something after the manner of multiple unit train control systems, the centrifugal governor moves the controller. The revolving field is mounted upon the same shaft with the turbine wheels, and the stationary portion of the generator is supported by the stationary portion of the turbine, the whole building up into the general form of a vertical cylinder about 25 ft. high, and about 14 ft. in diameter. The total weight of the turbine and generator is about 400,000 lbs., and its capacity is 5000 kw at full load. It is capable of running at about 75 per cent overload condensing, and at nearly full load non-condensing.

The question as to why the vertical shaft design was adopted for this unit has often been raised, and many doubts and criticisms concerning it have been expressed. It is not easy to explain all the reasons which lead up to its adoption, but it may be said that the compactness and simplicity of this unit, which are its most marked characteristics, are largely due to the merits of this design. With the vertical shaft arrangement all lateral strain is removed from the bearings which align the shaft and all deflection of the shaft is avoided with a minimum number and length of bearings. This matter of properly supporting shaft and keeping it exactly central

and in perfect alignment is an important one where small clearances are desirable with a large diameter in the revolving part. To carry such weights as are necessary in the revolving part of this large unit many very large bearings would be required if the shaft was in a horizontal position. An elaborate system of forced lubrication with artificial cooling would be necessary in connection with these bearings, and a failure of any of these bearings would occasion serious danger to the operation of the machine. If this machine were built in a horizontal position it would be very difficult to so support the wheels that their clearances would not be affected by sagging of shaft or looseness in bearings, and also, it might be difficult to place them with such a relation to each other that the clearance would not be affected by expansion of the shaft. In the vertical design the space between wheels is reduced to a minimum, the supporting structure is perfectly symmetrical and cannot be in any way distorted or put out of line, either by mechanical or steam pressure strains, or by the effects of expansion.

The oil pressure step bearing at the foot of shaft supports the whole revolving element in a balanced position by perfectly symmetrical suspension and preserves the exact relation of level between the stationary and revolving parts. As long as this step bearing fills its functions a multitude of mechanical difficulties and uncertainties are overcome.

At the time this design was adopted there was no good precedent for the support in this manner of such a weight operating at so high a speed, and there were many predictions of failure, examples being quoted where similar methods had failed with water wheels and other machines. It seemed clear, however, that with proper arrangements the operation of this bearing must be stable and reliable, and since forced lubrication was necessary to success in any case, it seemed advisable to put it where it would accomplish the greatest number of good results.

Experience with a number of machines has fully justified our decisions in this connection. The bearings have run perfectly with an inappreciable amount of friction and when properly supplied with oil operate with perfect steadiness and regularity. In one respect these bearings have agreeably surprised us, that is, tney have been much less injured by stoppages of oil than we expected. In the course of our experiments imperfect pumping arrangements have been used, and repeated failures of the oil flow have been experienced, but in no case has any damage to the machine resulted. Even the cast-iron blocks which constitute the step bearing, are as a rule not destroyed. Our experience has been that they cut and heat when the oil supply is removed, but in all cases the surfaces have ground themselves to an operating condition after the oil flow is renewed, so that the machine could be continued in operation. This might not always be the case, but it seems quite certain that the damage could never be as serious as that which would result from a failure of the lubrication system where heavy weights are carried on high-speed horizontal bearings.

In our newer machines we are providing a heavy stationary collar below the lowest wheel which can be used to support the wheels in case the step bearing is removed, and which would serve as a brake to bring the machine to rest in case the step bearing should cut enough to allow the wheels to settle to a dangerous degree. Our experience has been that there is very little tendency to settlement of the shaft in case of such cutting, and this latter function of the collar will presumably seldom be called into requisition.

The oil for step bearings and also for the upper bearings of machines is delivered by a small electrically driven pump which operates continuously from the exciter circuit. In most of the large plants where we are installing turbines, we have recommended in addition to these electrical pumps, a weighted accumulator, with steam pump arranged to keep it full automatically. This accumulator with its steam pump affords an automatic reserve for the lubricating system. Its capacity is such that there would be ample time to shut down the units, even if everything in the station should be stopped by the bursting of a boiler or steam pipe.

The 5000-kw machine in Chicago is the second of our vertical shaft turbines to be put into operation. The first machine of this type was one of 500-kw capacity installed by the Newport & Fall River Street Railway Company. This machine has been in daily operation since last June. During all this time its daily operation has been indispensable to the service of the plant, and there have only been two or three interruptions of a few minutes each which could be charged to its defects. It has, however, developed some minor troubles which have been the cause of some annoyance, and which it has been very difficult to correct, owing to the almost continuous operation of the machine. With new types of machinery which have to be put in service without any period of experimenting some such difficulties and delays can hardly be avoided.

The only serious troubles at Newport have been with parts of governor and with valves which have given out, owing to overstrain of springs or other mechanical causes which are easily corrected. These troubles have occurred as the result of continued service, and are being rectified as rapidly as it has been possible to analyze their causes and apply suitable remedies. Nothing has happened which suggests the possibility of a serious difficulty, and it can be safely predicted that a condition will very soon be reached in which the turbine can operate for an indefinite period with a very small expense for care and renewals.

Our machine at Newport has been tested and has shown results decidedly better than the reported tests of steam turbines of other makes, but the conditions have been such that we have reasons to believe that decidedly better results can be produced with slight changes in nozzles and adjustments of pressure. Up to the present time we have not been able to experiment with this machine or properly analyze its performances, owing to the almost constant requirements of service. We are, however, installing a second machine at Newport, and very soon expect to make a proper analysis of its performances and to bring both machines to a representative condition. All the experience which we can gain with these early experiments if, of course, available for the prevention of similar troubles and mistakes in other plants.

One important matter in connection with the introduction of our turbines has been the establishment of proper condensing facilities in order that the great benefits of high vacuum might be realized to the greatest possible extent. In turbines which we have tested the steam consumption has been reduced from six to seven per cent for every additional inch of vacuum above 25 ins. Such a reduction is, of course, very important and justifies large expenditures upon condensing apparatus. The fact that the turbine may be better than a condensing engine with equal vacuum must not be considered a reason for assuming that a condenser which is good enough for the engine is also good enough for the turbine. The selection of condensing facilities should be governed by the economic possibilities.

We have recently designed for some of our large new turbines surface condensers which themselves constitute the base and supporting structure of the machine. These condensers are of very ample cooling surface, and are so arranged that the maximum degree of vacuum is obtainable with a given amount of water. One feature of our turbine which is very advantageous in obtaining a high vacuum, is that it can be easily so arranged that the air leakage is reduced to zero. The two points where the shaft passes through the casing are fitted with packings which are kept sealed by steam. Another advantage is that there is no oil in the steam, and consequently that the exterior of condenser tubes is kept perfectly clean. Several turbines with condenser bases are now being built, and it is probable that there will be a large production of machines of this type.

I have mentioned above that no oil comes in contact with the steam in these turbines, and I need hardly call attention to the great importance of this fact. The condensed water can be delivered directly back to the boilers and all possibility of trouble in boilers from oil, dirt or scale is eliminated. Even in plants where feedwater is good and cheap, this constitutes a great advantage, since a considerable amount of heat is saved by using the condensed steam on account of its higher temperature. There is, however, no such a thing as perfectly pure and clean natural water, and there are few boilers that in their average working condition are perfectly clean. Cleanliness in boilers improves circulation and evaporation, prolongs life and constitutes, therefore, a very distinct and definite advantage.

The designs of these first machines, started at Chicago and Newport, are now about two years old. They were entered into upon the basis of a very limited experience with the turbine, and nothing to guide us other than the theoretical possibilities which previous tests had demonstrated. The period which has elapsed since the conception of these designs has been occupied in a battle with the innumerable difficulties attendant upon the production on a very large scale of radically new devices. When we became convinced of the practicability and the advantages of our designs, we determined that the possibilities could only be developed quickly through production on a large scale, and by a concentration of force upon the work. We consequently decided upon guarantees which we felt certain of fulfillment, and upon prices which would be attractive to our customers, and have taken a large number of orders for machines of several sizes. We now have on our books contracts aggregating more than 200,000 kw. in steam turbines generating units. A large proportion of these machines are now either finished or well under way.

This immense production has been introduced at a time when our regular manufacturing facilities were strained to the utmost, and when the difficulty of obtaining or sparing good men was very great. The trials and difficulties of such an undertaking are hard to describe. A vast amount of very expensive special machinery

has had to be assigned and built, and almost every step has required thought and experimenting. In such new work the average man cannot be made to advance with the same confidence that he does on established lines. He presupposes the possibility of difficulty or failure, and is constantly being brought to a halt and making mistakes that he would not make under different circumstances. Important processes are handled carelessly, and unimportant ones are unduly deliberated over. The strain is incessant, and an abundance of faith is required in those who would direct such work.

As the work of developing these designs has advanced, experience has shown the possibility of better and simpler methods, and the steady continuance of experiments has extended our knowledge of the theoretical possibilities. Consequently new designs have been proposed and developed, and we now have in production a large number of machines which we consider greatly superior to those which are now being put into service. This process of experimental development will continue, and the production and test of each new machine will extend our knowledge and make possible further advances.

Our machines at Newport and Chicago and other machines of about the same date, are of what we call the "two-stage" type. The Newport machine has two compartments, with three rows of moving buckets in each compartment, and the Chicago machine has two compartments with four rows of moving buckets in each compartment. Our later large condensing machine have four stages or compartments, with two rows of moving buckets in each. All the details of their design have been worked out in such a manner that their construction is greatly simplified, and the steam economy will presumably be much increased.

Thus, such successes as we may accomplish in the future will be the result of the large experience which responsibility for our existing work has entailed. We have been through long trials, and have combatted many predictions of failure, but the facts seem to indicate that we have succeeded, and to promise that we will in future accomplish greater successes.

THE EXCURSION TO SCHENECTADY

Upon invitation of the General Electric Company, an excursion was made from Saratoga on the afternon of Thursday to the Schenectady works. The excursion was one of the largest in which the Association has ever participated. The train of ten cars which left the Saratoga station at about one o'clock was filled with delegates and others, in all about 700. A large number of ladies participated in the trip. Schenectady was reached at two o'clock and the train was run on a siding into the yards of the General Electric Company. Here the party was met by a large number of representatives of the host, headed by Mr. J. R. Lovejoy, and conducted to the gallery of the new turbine building, where a bountiful repast had been prepared. The extent of the building can be realized from the fact that this large number of persons were seated at tables which occupied considerably less than one-half of the gallery area.

The dinner supplied by the General Electric Company consisted of a number of courses, and was heartily enjoyed. At the close of the repast Vice-President Ely expressed the appreciation of the Association to the representatives of the General Electric Company present for their hospitality in entertaining the Association. A trip was then made through a number of the departments of the works, including the motor department, assembly department, in which were several Baltimore & Ohio electric locomotives, and the turbine department, which latter received special attention. While the delegates were inspecting the machinery, the ladies in the party were given a trolley ride by E. F. Peck, general manager of the Schenectady Railway. The cars were decorated expressly for the occasion. The return was made by special train from Saratoga, where the party arrived about 6:30 p. m.

A pleasant incident of the occasion, and one which was known to only a few until after the return to Saratoga, was the presentation to Mr. Lovejoy, by the members of the staff of the railway department, of a handsome silver punch bowl. This occurred during the morning at a meeting held in the office of sales agents of the railway department, called by Mr. Lovejoy to discuss the coming entertainment. The presentation was decided upon, some time ago, as a testimonial of the high regard of the railway sales agents of the company for Mr. Lovejoy, and took place at the termination of the informal discussion on Thursday morning, much to the surprise of the recipient. The gift was greatly admired by those who had an opportunity to see it in Mr. Lovejoy's office during the trip to Schenectady.

Also upon the invitation of E. F. Peck, general manager of the Schenectady Railway Company, a number of those who took part in the General Electric trip to Schenectady made an inspection of the local trolley system in a private car provided for the purpose. This party was made up of about twenty-five delegates, and included Messrs. Vreeland, Ely, W. J. Clark, J. G. White, J. H. McGraw, John I. Beggs and others. A run was made first over the Troy division and the car then came back and made another run over the line which runs almost as the crow flies direct from Schenectady to Albany. Not only did this trip give an opportunity



SOME OF THE VETERANS OF "HORSE CAR DAYS" AT THE CONVENTION

to take a glance at the car houses and other plants of the company, but every opportunity was afforded to inspect the magnificent work that has been done in roadbed and line construction. It may, in fact, be questioned whether there is a better equipped system in the country, or one which is handled with greater ingenuity and progressiveness, the result being that the receipts of the company have been increasing with leaps and bounds. Refreshments were provided on the special car, and at the close of the trip Mr. Peck was most heartily and deservedly thanked by all who had enjoyed the Schenectady Company's hospitality.

OTHER EXCURSIONS

In addition to the trips to Schenectady and Lake George, a number of other trips were provided the visitors to Saratoga. Through the courtesy of the Hudson Valley Railway Company, an entertainment was provided Wednesday evening at Saratoga Lake, which was enjoyed by a number of attendants at the convention. The cars ran every 15 minutes throughout the evening, carrying pleasure seekers to the lake during the early part of the evening, and returning with them after the close of the entertainment.

On Friday afternoon a number of the delegates took advantage of an invitation from the Hudson Valley Power Transmission Company and were driven from Lake George to the immense new water-power plant of the company, located at Spier Falls. The features of this water-power development were described in the convention number of the STREET RAILWAY JOURNAL, and those who participated in the trip were well repaid for the excursion.

A number of delegates also made the occasion to take many of the attractive trips which are so numerous in the vicinity of Saratoga. Among these probably the most popular of the short excursions was that to Saratoga Lake, and the National Electric Company contributed to the pleasure of a number of the delegates by engaging several automobiles and making this run frequently during the convention.

STEAM TURBINES FOR LONG ISLAND CITY

The Westinghouse Machine Company has secured the order for the largest turbo-generators in the world. These will be installed in the Long Island City power house of the new Pennsylvania terminal, and will consist of three 5500-kw turbo-generator units.

EXHIBITS AND EXHIBITORS AT SARATOGA

The exhibition of apparatus in connection with the conventions was fairly representative, although the local conditions made it impossible to show heavy machinery in operation, and this detracted somewhat from the value of the display as a whole.



EXHIBIT OF THE INTERNATIONAL REGISTER COMPANY

There were many interesting individual exhibits, however, and these are illustrated and described in the following pages:

THE CONSOLIDATED CAR FENDER COMPANY, of New York, represented by Albert C. Woodworth, general manager; E. C. Hall, D. Bonenfaut, and G. H. Hollingsworth, exhibited the various types of the "Providence" fender, manufactured by this company. The company had, also, on exhibition the Campbell snow broom and the Millen car step lifter.

THE ST. LOUIS CAR COMPANY exhibited its car seats, arc headlights and interior arc lights for car lighting. G. J. Smith, assistant superintendent, was the company's representative. Mr. Smith found many old friends among master mechanics, to whose ranks he formerly belonged. In fact, Mr. Smith advocated the formation of a street railway master mechanics' association years ago, and is greatly gratified now at seeing his ideas carried out in the American Railway Mechanical and Electrical Association. This was the first appearance of the new interior arc lighting system at a convention. The company expected to have also exhibited one of the new cars built for the Fonda, Johnstown & Gloversville Railway, of Gloversville, N. Y., but was unable to complete them in time. These cars are of a very modern type, and were described in detail in the Souvenir edition of the STREET RAILWAY JOURNAL.

THE FRANKLIN ROLLING MILL & FOUNDRY COMPANY, of Franklin, Pa., manufacturer of the tripartite steel pole, had one of its three-part street poles on exhibition. These poles are made by rerolling old rails, and a given strength of pole can be made at less cost than in a tubular pole. G. V. A. Conger, superintendent of the pole department, was in charge of the exhibit, where sections of metal used in various weights of pole were shown, as well as one full-sized pole.

THE INTERNATIONAL REGISTER COMPANY, of Chicago, was represented by A. H. Woodward, president; John Benham, vice-president; W. H. Brown, secretary, and F. B. Hall, master mechanic. Neatly displayed were samples of the well-known standard types of New Haven and International fare registers. In cases were displayed lines of register fixtures, employees' badges, punches and trolley cords. An interesting feature of the exhibit were the original drawings for the numerous unique and timely advertisements published by the company in the STREET RAILWAY JOURNAL and other technical papers during the last year.

THE VAN DORN & DUTTON COMPANY, of Cleveland, showed samples of its well-known line of track scrapers, gears, pinions and armature lifts. The Van Dorn-Elliott Electric Company, an affiliated company, showed its armature coils, field coils and commutators. W. A. Dutton and J. N. Elliott were in charge.



EXHIBIT OF THE PECKHAM MANUFACTURING COMPANY



EXHIBIT OF THE MAGNETIC EQUIPMENT COMPANY

THE OHIO BRASS COMPANY, of Mansfield, undoubtedly had more visitors than any other exhibitor. The company had a large stand, devoted exclusively to entertainment. It was richly furnished and decorated with palms and flowers. The great attraction was the fact that the company took free photographs of every caller. Each day, from 8 a. m. to 6 p. m., there were in constant operation two photoscopes, furnished by the General Automatic Photograph Company, of New York. Photographs were turned out at the rate of better than one per minute. Each was encased in a frame appropriately inscribed with the company's name and line, and it proved a souvenir which was retained and worn. Over 7000 of these photographs were taken during the week. The company rented two cottages for the week, and several of the rooms were given up to entertainment. In cottage E were displayed sample cases showing the company's well-known

line of overhead material and rail-bonds. A new bond, known as Type F, was shown in several varieties. In this the wires come out at the sides instead of direct from the ends, giving better flexibility and more room where working close to a bolt. A new soldered bond, known as Type G, was also featured. The leaves are forged together at the end, and it is claimed there is no increased resistance at the ends. The representatives present were: C. K. King, secretary; N. M. Garland, New York manager; J. C. Warren, Jr., New York; A. L. Wilkinson, general sales manager; George A. Mead, chief engineer; E. F. Wickwire, traveling representative; F. Jameson, traveling representative; Max A. Berg and E. R. Mason, of Porter & Berg, Chicago representatives; Otto M. Uthoff, of Watts & Uthoff, St. Louis agents, and W. J. Keenan, of Lettingill, Andrews & Co., Boston, New England representatives.

THE ATLAS RAILWAY SUPPLY COMPANY, of Chicago, made an attractive exhibit of its well-known rail-joint, which is adapted for all types of rails. Those in attendance were: J. G. McMichael, president, Chicago; R. B. Kent, secretary; C. D. Porterfield, New York representative; Mrs. McMichael and Miss Rogers.

THE BRUCK SOLIDIFIED OIL COMPANY, of Boston, Mass., represented by J. W. Bruck, vice-president and general manager, exhibited, solidified in various forms, oil, both in a liquid and solid state. Mr. Bruck demonstrated by actual experiments right in his booth the process of turning liquid oil into a solid state. Liquid oil was turned into a solid mass in less than two minutes, and remained in a column 3 ft. high. This column withstood the rays of the sun without the least sign of melting or disintegrating.



EXHIBIT OF THE MYERS SAFETY CAR STRAP

EXHIBIT OF THE COLUMBUS STEEL ROLLING SHUTTER COMPANY

EXHIBIT OF THE CELLULOID COMPANY

EXHIBIT OF THE BRADY BRASS COMPANY

EXHIBIT OF THE PETER SMITH HEATER COMPANY

EXHIBIT OF THE DETROIT TROLLEY & MFG. COMPANY, MASSACHUSETTS CHEMICAL COMPANY AND THE ALLEN & MORRISON BRAKE SHOE & MFG. COMPANY

EXHIBIT OF THE LUDLOW SUPPLY COMPANY

EXHIBIT OF THE WHEEL TRUING BRAKE SHOE COMPANY

EXHIBIT OF THE STANDARD VITRIFIED CONDUIT COMPANY

This oil is meeting with great success in all parts of the United States. Some of the leading street railway companies in this country have adopted Bruck solidified oil for motor and journal lubrication, as well as power-house service.

THE MAGNETIC EQUIPMENT COMPANY, of Chicago, the concern which has the device for increasing the traction of



EXHIBIT OF THE STAR BRASS WORKS



EXHIBIT OF THE UNI SIGNAL COMPANY AND HOWE MANUFACTURING COMPANY

wheels on rails by means of magnetism, had a small model car equipped with the magnetic adhesion device, which demonstrated the principles covered by this company's patents. C. A. Ballard, treasurer; B. H. Honey, secretary; W. B. Frazier, chief engineer, and W. T. Davidson, general representative, were on hand explaining the apparatus.

THE LE VALLEY VITÆ CARBON BRUSH COMPANY, of New York, represented by J. V. Clarke, president, W. H. Ball, and L. Clarke, had on exhibition all styles of carbon brushes, in all shapes and sizes. The company gave away a sample set of carbon brushes for any style of motors made.

THE GARTON-DANIELS COMPANY, of Keokuk, Ia., was represented by its secretary, J. V. E. Titus, who was able to show to those interested a set of test recently conducted by D. C. and



EXHIBIT OF THE HEYWOOD BROS. & WAKEFIELD COMPANY



EXHIBIT OF THE MAYER & ENGLUND COMPANY AND THE PROTECTED RAIL BOND COMPANY

W. B. Jackson on cars equipped and non-equipped with the "automotoneer." The tests showed 7½ per cent saving in energy consumption in favor of the cars having the automotoneer, and a great reduction in maximum current used.

THE STERLING-MEAKER COMPANY, of Newark, N. J., represented by J. Albert Stowe, president, and H. E. Beach and E.

W. Hinman, exhibited all types of the Sterling-Meaker registers, Sterling brakes, trolley stands, and various fittings and appliances manufactured by this company. There was also on exhibition a model of a reversible seat fixture for open cars. Most reversible backs have the rubber tips, which strike against the seat. The objection to this arrangement is that, being on top of the back of the seat, mischievous passengers can cut off the rubber or mutilate it until it is useless. The Sterling-Meaker Company has reversed the position of the rubber; instead of having it on the top of the back support, it is placed on the seat itself.



EXHIBIT OF THE WEBER RAILWAY JOINT MANUFACTURING COMPANY

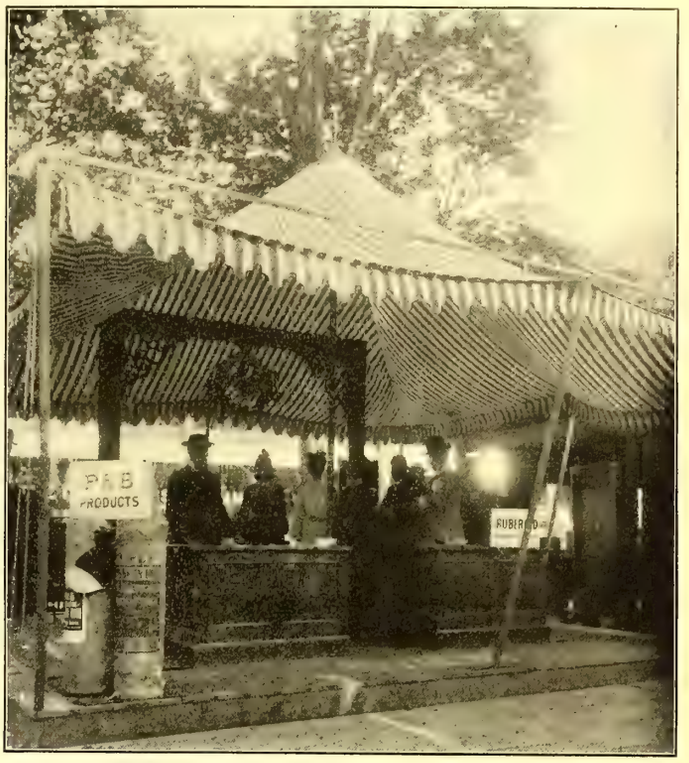


EXHIBIT OF THE STANDARD PAINT COMPANY

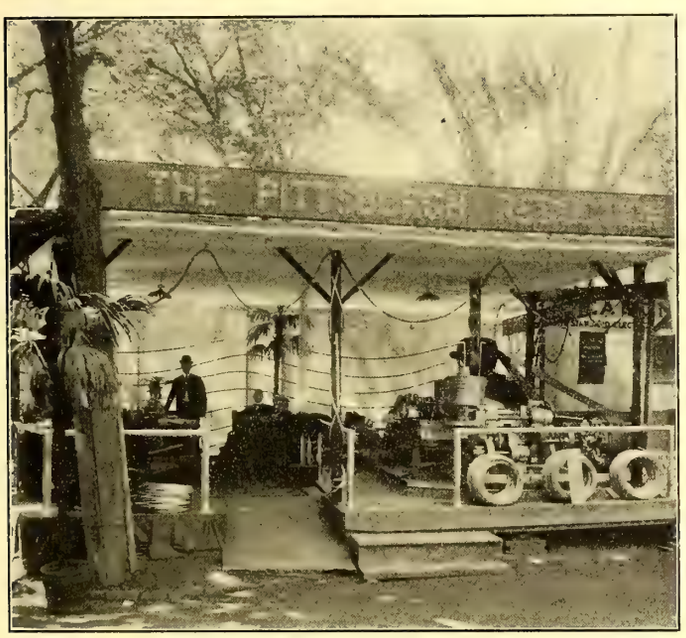


EXHIBIT OF THE PITTSBURG REDUCTION COMPANY



EXHIBIT OF THE ECLIPSE CAR FENDER COMPANY

THE RAILWAY JOURNAL LUBRICATING COMPANY, of Chicago, showed the new journal lubricator just put on the open market, and used for some time on the Aurora, Elgin & Chicago Railway, and on steam roads. This lubricates by means of ball-bearing lubricating wheels, which run in oil and carry the oil onto the journal. Stare Brothers, of Chicago, were both present in the interests of this company.

THE ARCHBOLD-BRADY COMPANY, and Fred M. Locke Manufacturing Company, of Syracuse, N. Y., made a joint exhibit of insulators, which was very interesting to the electrical man, because of the extremely high voltages for which some of the recent insulators are designed. As large as some of the 60,000-volt insulators of three years ago seemed, they are dwarfed by recent productions. For example, some of the three and four part Locke insulators now made are 15 ins. in diameter, umbrella-shaped, with two or three petticoat pin sleeves underneath. Besides the insulator exhibit a high-voltage testing plant, such as is used by insulator manufacturers, was in operation, and delegates were shown the effects of high voltage discharges. The transformer used in testing was one from the Worcester Polytechnic Institute in charge of Walter Goddard, of that institution. It is one of the highest voltage large transformers in the country, giving up to 175,000 volts. Fred M. Locke, W. K. Archbold, Paul T. Brady, M. A. Dunne, and J. R. McIntyre were in attendance.

THE BUCKEYE ELECTRIC COMPANY, of Cleveland, was represented by W. R. Bonham, of the Chicago office.

THE WALWORTH MANUFACTURING COMPANY, of Boston, had its interests looked after by H. L. Rideout.

THE POSITIVE RAILWAY SANDER COMPANY, of Lancaster, Pa., was one of the new concerns appearing at this conven-

tion for the first time. It has a sand box of truly remarkable construction and performance. No moving parts come in contact with the sand. The sand feeds simply by the rocking of the box, and yet the shape of the box is such that the sand never feeds, except when desired, although the opening is large and unobstructed, and consequently not clogged by sticks and stones, nor can such obstructions break the feeding mechanism. Besides the box the company has a valuable plan of supporting the spiral sand pipe so that it will feed onto the rail on curves on double-truck cars. Charles V. Rote, vice-president, and Park E. Shee, secretary, had the apparatus on exhibition.



EXHIBIT OF THE TAYLOR ELECTRIC TRUCK COMPANY



EXHIBIT OF THE FRANKLIN ROLLING MILL & FOUNDRY COMPANY

THE UNIVERSAL CAR BRAKE COMPANY, of Lancaster, Pa., made an exhibit of its combination track and wheel brake. This brake is operated by a solenoid magnet, taking power from the trolley. This company also has a sand box which is extremely simple in construction, which feeds the sand from a wheel somewhat similar to an undershot water wheel. The feed wheel forms the bottom of the hopper. Joseph Cullman, John F. Brimmer, I. Levi, William M. Deal and Richard Brimmer composed this company's representation.

JOHN A. ROEBLING'S SONS COMPANY, of Trenton, N. J., had Ulysses G. Tingley in attendance.



EXHIBIT OF THE ROBINS CONVEYING BELT COMPANY



EXHIBIT OF THE LORAIN STEEL COMPANY



EXHIBIT OF THE BULLOCK ELECTRIC MANUFACTURING COMPANY

THE BALTIMORE RAILWAY SPECIALTY COMPANY, of Baltimore, which makes ball-bearing center and side bearings for supporting car bodies on swivel trucks, and which does an extensive business on steam roads, showed its Norwood center and side bearings, and also a combination center and side bearing to be used under the center of the car, which practically does away with the necessity of extreme tilts. In the center bearing made for electric cars, the draft of the motors, as well as the load, comes upon the balls. Great saving in track wear at switches and curves is claimed when ball-bearing supports are used for the car body. In a test made by the M. C. B. Association committee in 1903 this was the only center bearing to turn under a load of 37 tons without cutting, the flange pressure in this case being only 58 lbs. It is used on 100 steam roads. John E. Norwood, the inventor, was in attendance.

R. W. CONANT, of Cambridge, Mass., exhibited his bond-testing and motor armature and field coil testing apparatus, and some samples of defects found by the use of his testing instruments. The Conant apparatus for locating weak motor fields is used by a number of companies, and was very well spoken of in some of the discussions that took place in the mechanical and electrical convention.

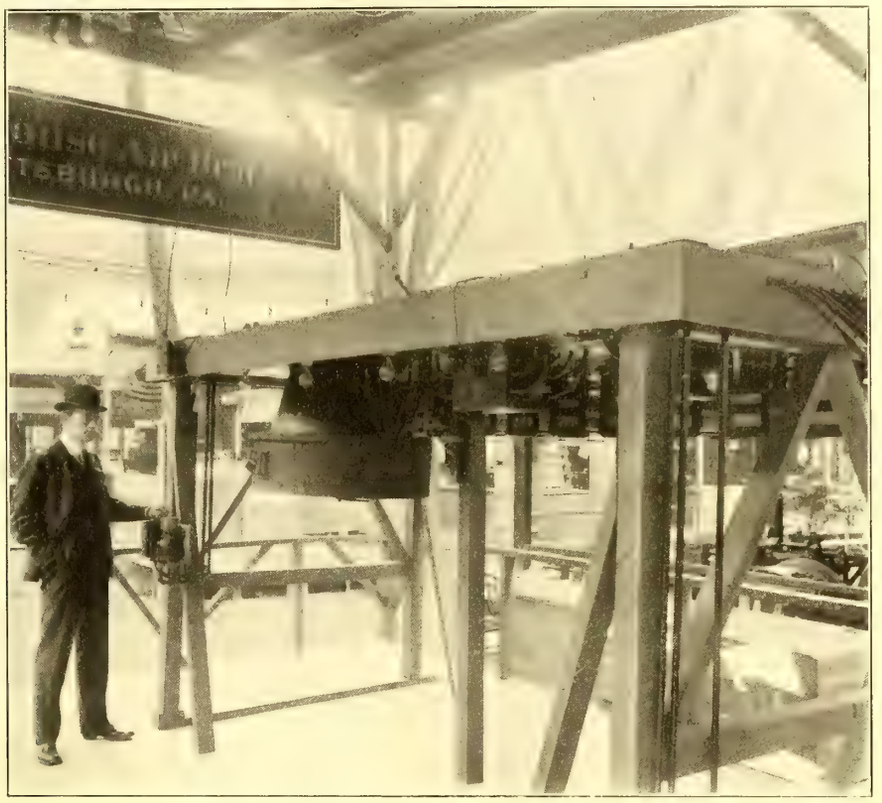
THE O. M. EDWARDS COMPANY, of Syracuse, N. Y., represented by O. M. Edwards, J. E. Simons and G. G. Norris, exhibited a disappearing window for street car service. The sill of the window is pulled horizontally outward, then the window is let down and the sill goes back to its original position, covering up the top of the window below the sill. When the window is to be closed the sill is again pulled outward and the window, operated by a Hartshorn roller, comes up of itself until it is closed. The tension of the spring on the roller can be regulated from the inside of the car by a small socket wrench.

HEYWOOD BROTHERS & WAKEFIELD COMPANY, of Wakefield, Mass., and New York city, showed their well-known



EXHIBIT OF THE WESTINGHOUSE AIR BRAKE COMPANY

Wheeler reversible seats, upholstered in rattan, plush and artificial leather. Their No. 4 S. F. has a high three-part back with head rest, and the seat cushion has spring edge, making a luxurious seat for interurban cars. It also has a mahogany arm rest, and a brass grab handle on the corner of back for use of standing passengers. They also show the shifting foot rest and pedestal base giving room



ELECTRO-PNEUMATIC TURRET CONTROLLER IN EXHIBIT OF THE WESTINGHOUSE AIR BRAKE COMPANY

under seat for small baggage. One of the seats that was shown had slat seat and back, similar to those furnished by this company for 120 Brooklyn semi-convertible cars. They were represented by Bertram Berry, of New York; F. H. Henry, of Wakefield, Mass.

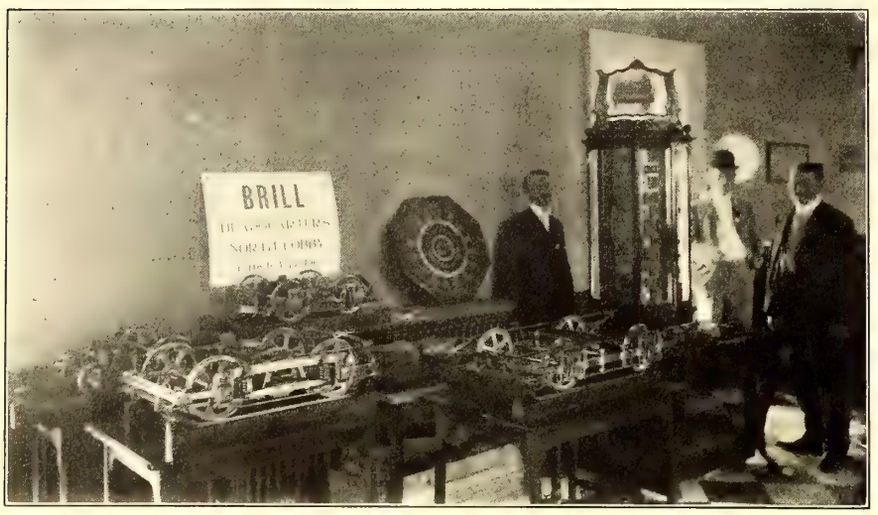
THE STUART-HOWLAND COMPANY, of Boston, Mass., in parlors of the Grand Union Hotel, made an elaborate exhibit of its specialties, featuring its varied lines of overhead material. Six types of bracket arms were shown, together with thirty-six types of trolley ears, several of which were hammered and bent to an extreme right angle, thereby demonstrating their wonderful plasticity, which in no wise injured their tensile strength. A constant flow of visitors were entertained by H. W. Smith, from headquarters in Boston, and H. De Steese, from the New York branch office. In addition there was shown the standard "III rib" wheel, Ham sand boxes, trolley catches and retriever, swivel trolley harp, bayonet trolley harp, signal bells, and S-H spiral brand trolley rope. It is interesting to note that this exhibit was the most elaborate ever made by this company, and the wonderful growth of its business during the past three years speaks volumes for the progressive policy and spirit which has been displayed.

THE HAM SAND-BOX COMPANY, of Troy, N. Y., represented by President A. W. Ham, exhibited its trolley catchers, and the well-known Ham sand box in the parlors of the Stuart-Howland Company on the second floor of the Grand Union. Mr. Ham had also on exhibition a new swivel trolley harp, which is a genuine novelty. The harp has a horizontal swivel adjustment through a radius of about 3 degs., thus enabling the wheel to follow curves with extreme ease. The wire at all times is in the center of the wheel, reducing the liability that the trolley will jump the wire. this point alone is one greatly appreciated by all who have had trouble with the wire cutting through the edges of the wheel.

THE CELLULOID COMPANY, New York, exhibited various styles of curtain material for open and closed cars. This curtain material is waterproof on both sides. The advantages of this fact can readily be appreciated in the use of this cloth for open car service. On rainy days, when the curtain is wet on the outside, it can be rolled up without affecting in the least the inside, or dry side, of the curtain. The company also had on exhibition several car seats, upholstered with "Texoderm," a form of artificial leather manufactured by the Celluloid Company. W. S. Sillcocks and W. C. Crosby were the company's representatives.

HAROLD P. BROWN, of New York, of course exhibited his various types of rail-bonds and track drill appliances, and also

his motorman's mirror, which has been recently adopted by a number of large roads in different parts of the country. Mr. Brown is also putting on the market a new fuel mixture, called "Brillium," which facilitates the burning of poor coal to such an extent that much better evaporation per pound of coal is obtained. In fact, the results said to be obtained would savor of Arabian Nights tales were not an engineer of Mr. Brown's reputation not behind the statements. Brillium fuel was being used under some of the boilers of the Grand Union Hotel during the convention. It is a powder which is mixed with coal and cinders, and gives most surprising evaporation results. Mr. Brown distributed an interesting circular showing the great saving effected by using "Brillium" at the Grand Union Hotel, Saratoga.



THE BRILL HEADQUARTERS

THE STANDARD POLE AND TIE COMPANY, New York, exhibited the round Southern cedar poles, octagon and square, and yellow pine; Florida heart pine cross-arms, and insulator pins. The exhibit was neatly and attractively arranged around the platform and exhibit booth of the Consolidated Car Fender Company. F. L. Merritt and E. G. Chamberlain were the representatives.



EXHIBIT OF WILLIAM WHARTON, JR., & COMPANY

THE GLOBE TICKET COMPANY, of Philadelphia, exhibited samples of its transfers and tickets. A feature was made of the Ham patent transfer, which has stubs for morning and afternoon. W. C. Pope, vice-president; P. C. Snow, Eastern representative; D. C. Griffith and Western representative were present. H. N. Brown, of the Duplicate Transfer & Rebate Company, of Norfolk, Va., held forth at this stand.

THE OHMER FARE REGISTER COMPANY, of Dayton, Ohio, featured its new No. 4 register, which is designed for interurban use, and has twelve classes of fare and transfer records. It registers and prints the date, the trip number and a record of cash and ticket fares, including mileage. A section of a car was shown, demonstrating the use of the device on summer cars, where it is desirable to enable the conductor to register fares from either running board. Samples of the other well-known types of registers were shown under operating conditions. These people are meeting with unusual success in introducing their goods on Western roads, and have recently sold the following equipments to coast systems: Oakland Transit Company, fifty; Los Angeles & Pacific Railway, seventy-seven; Los Angeles Street Railway, 350; Pacific Electric Railway, 140; Portland Railway, 200. The demand from all other sections of the country is also showing remarkable gains, and the company is preparing to enlarge its factory to twice the present capacity. John F. Ohmer, vice-president and general manager; J. H. Stedman, secretary; H. Tyler, Western representative; W. E. Hinman, Eastern representative; C. W. Kitteman, Southern representative, and H. A. Eckert, general representative, were present.

THE SPEER CARBON COMPANY, of St. Marys, Pa., displayed a large case containing samples of its large line of carbon brushes. An attractive paper knife was distributed to friends of the company. J. S. Speer and G. P. Tryling were present.

THE CONTINUOUS RAIL-JOINT COMPANY OF AMERICA, of Newark, N. J., exhibited samples of several styles of its well-known rail-joint. W. A. Chapman, of Boston; S. P. McGough, of Chicago; W. E. Clark, of Newark; B. M. Barr, of New York; L. F. Braine, of Newark, and W. J. Bradley, of Troy, were on hand.

THE LUDLOW SUPPLY COMPANY, of Cleveland, attracted considerable attention with its very efficient Cleveland track drill, which was arranged for electric motor drive. The device was shown in operation, and on numerous tests holes were drilled by one man in twenty-nine to thirty-five seconds. The device was fully described and illustrated in the Souvenir edition of Street Railway Journal. Col. W. E. Ludlow and James Ludlow were present. They also explained the features of the Garry pneumatic pit jack, and the Keeler curtain fixtures for which the company is agent. The Federal Manufacturing Company, of Cleveland, which manufactures the last-mentioned device, was represented by E. L. Ludlow and H. E. Keeler. The Keeler fixture has an eccentric fastener, by the use of which the two edges of the curtain remain constantly in parallel, no matter at what position the curtain may be gripped for raising or lowering. The company has recently taken a very nice order from the Metropolitan Street Railway, and another from the Rochester Railway.



EXHIBIT OF L. C. CHASE & COMPANY

THE AMERICAN STEEL & WIRE COMPANY made no exhibit, but it was well represented by H. G. Greenberg and C. S. Knight, Jr., of Chicago, and F. A. Keys, of New York.

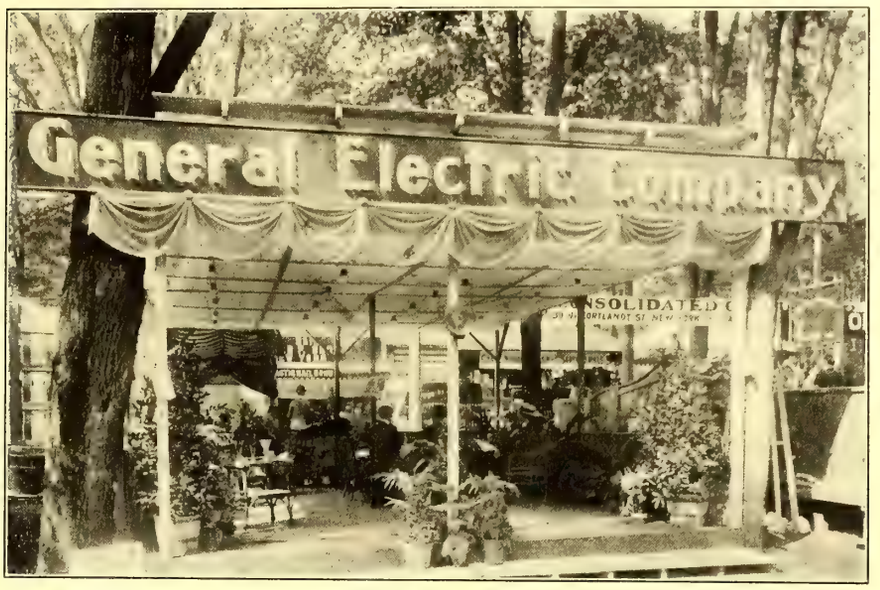
THE WHEEL TRUING BRAKE-SHOE COMPANY, of Detroit, displayed its "tried and true" brake-shoe, which is used by about 500 roads in this country. It is so well known that a detailed description is not necessary at this time. The company is

pleased at this time to announce that Judge Hazel, of the Western district of New York, has handed down a decision affirming the validity of its patent, and adjudging that a certain defendant has infringed the same, and ordering a decree for perpetual injunction, and accounting for damages. James M. Griffin and Mrs. Griffin were present. The latter had a fine souvenir deck of playing cards for the ladies.

JOHN C. DUNER, of Chicago, showed the Duner sand box. The former is well known through its use by all the Chicago elevated roads. The movement of the door is controlled by one pin projecting upward into a guiding track. Double wire gates for summer use can be operated by the same attachments. The Duner sand box is made in two types for either constant or intermittent discharge. A wire agitator moves up and down through the sand each time the hopper is tilted.

THE W. T. VAN DORN COMPANY, of Chicago, showed its well-known Van Dorn automatic couplers for elevated and surface cars. They are made in eleven sizes, and the company is bringing out a heavier draw-bar than heretofore made. W. T. Van Dorn was present.

THE ALLEN & MORRISON BRAKE-SHOE & MANUFACTURING COMPANY displayed its new steel back brake-shoe, the well-known Detroit insulating machine, and a new insulating compound known as "Thebest." This preparation is said to be free from acid, it dries quickly and the higher the temperature the greater the resistance. Donald Rawson, superintendent, was present.



HEADQUARTERS OF THE GENERAL ELECTRIC COMPANY

THE FEDERAL SUPPLY COMPANY, of Chicago, manufacturer of steel wool journal packing, the Miller car box receptacle, the Robertson ash and cinder conveyor and the Toltz automatic ash pan, was represented by W. B. Walker. The company is meeting with phenomenal success in introducing its steel wool packing, particularly in the foreign field, due, the company states, to the foreign circulation of the STREET RAILWAY JOURNAL. Recently the company shipped eight tons of packing to China, and has had orders from South Africa, France, Belgium and other foreign countries.

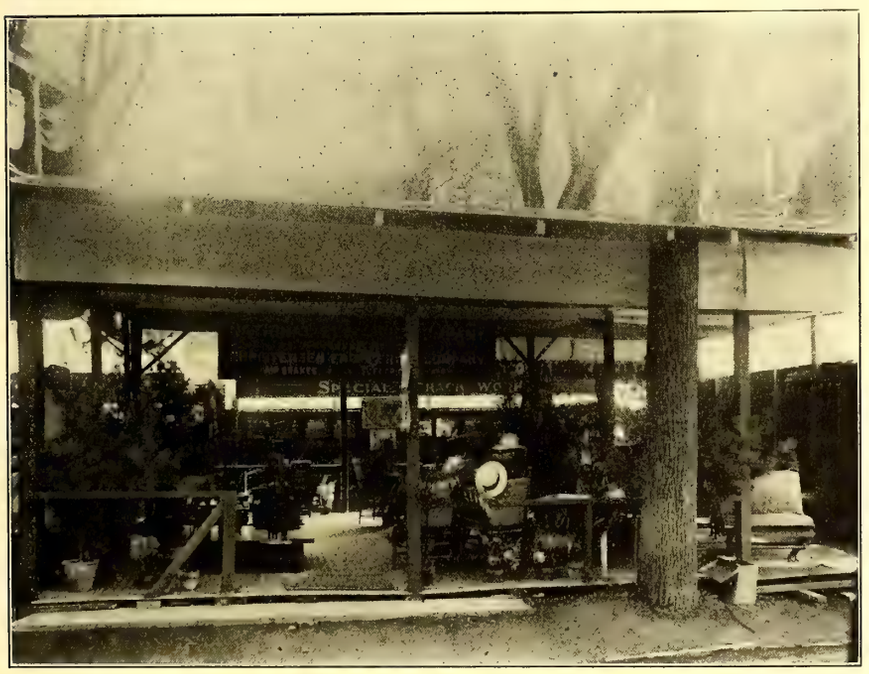


EXHIBIT OF THE NATIONAL ELECTRIC COMPANY

THE DETROIT TROLLEY & MANUFACTURING COMPANY, LTD., of Detroit, represented by W. S. McDonald, showed the Detroit ball-bearing trolley base, which was introduced at the Detroit convention last year, and which has since been adopted by a number of roads. Undoubtedly the plan of having a flexible trolley base goes a long way towards overcoming trolley difficulties.

THE STAR BRASS WORKS, of Kalamazoo, Mich., displayed numerous samples of its trolley wheels and harps. The company makes the statement that its wheels have been adopted as standard by a large majority of the leading roads in the country. The Star wheel is made of pure copper, especially treated, which gives it a softness combined with a high degree of toughness, making an extremely durable wheel. It is claimed that as high as 35,000 miles have been made with 6-in. wheels, and 23,000 miles with 4-in. wheels. O. P. Johnson was present, and distributed a neat paper cutter to friends.

THE NATIONAL TICKET COMPANY, of Cleveland, showed numerous styles of tickets, transfers and punches, and featured the National cash fare receipt, which has been adopted by a large number of interurban systems. H. C. Bates was present.

THE COLUMBUS STEEL ROLLING SHUTTER COMPANY, of Columbus, showed a steel rolling door as used in actual practice. The company has recently brought out a new form of slatting, which has a hinge, tubular in form, designed to produce great stiffness and reducing friction to a minimum. The shape is such that there are no pockets or recesses for the accumulation of water or dirt, which prevents rusting or clogging of joints. The doors are entirely fire proof, and take up a minimum amount of space, as they roll into a hood. Ray Lovell, manager, was present.

THE JOHNSON WRECKING FROG COMPANY, of Cleveland, showed the Johnson car replacer. Dr. X. Y. Scott was present.

THE ELECTRIC RAILWAY EQUIPMENT COMPANY, of Cincinnati, featured an hydraulic grooving press for placing recesses in wire for attaching ears. The strength of this method of attaching ears was shown by a test of 2500 lbs. on a single ear. The new Form M. ear, designed for all sizes and shapes of wire, was also featured. Various kinds of strain insulators made from a new composition were shown. Insulators of this composition have been tested to 16,000 volts and 360 deg. F. The company's well-known line of poles, brackets and other overhead material were displayed. P. F. Harten, of Cincinnati, and Elmer P. Morris, of New York, were in attendance.

THE TROLLEY SUPPLY COMPANY, of Canton, Ohio, showed its Knutson trolley retriever, designed for use on high-speed lines. The device is positive and quick of action, and has been adopted on such high-speed roads as the Stark Electric Railway, Western Ohio Railway, Cincinnati, Dayton & Toledo Traction Company, Columbus, London & Springfield Railway, Columbus, Buckeye Lake & Newark Railway and the Canton & Akron Railway, of Ohio; the Indiana Union Traction Company, the Indianapolis, Shelbyville & Southeastern Railway, and the Indianapolis & Martinsville Rapid Transit Company and the Lehigh Traction Company, of Pennsylvania. Equipments have

recently been shipped to Berlin, Paris, South America and Belgium. Robert K. Fast, secretary and treasurer, was present.

THE CLIMAX SUPPLY COMPANY, of Chicago, which has recently been formed to handle the lines of the Climax Stock Guard Company, of Canton, Ohio; the Climax Fence Post Company, of Chicago; the Union Drop Forge Company, of Chicago, and the Edgar Car Lock & Seal Company, of Iola, Kan., was represented by H. E. Overstreet, general manager, and J. H. Downs, Eastern representative. A crossing fitted with the Climax stock guard and fence post was shown. The company is going into the business of fencing railroads, utilizing its patent fence post in connection with plain or barbed wire. The new track tools furnished by the Union Drop Forge Company include tamping bars, claw hammers, driving hammers, picks, etc.

THE NATIONAL LEAD COMPANY, of Chicago,, showed babbitt metal journal bearings, and Phœnix metal armature bearings. Prominently displayed was a journal bearing which had seen continuous service for thirteen months under a car on the Detroit United Railway. It is claimed that this metal is used exclusively on bearings in all Detroit United cars. Arthur Benzel, St. Louis; J. R. Weithas, New York, and R. B. Pierson, Detroit, were present.

THE BENJAMIN EECTRIC MANUFACTURING COMPANY, of Chicago, had an attractive display of clusters of lamps arranged with the Benjamin wireless cluster. This cluster has an insulating base of porcelain, with two-piece contact plates attached thereto, each serving like terminals of all lamps in the cluster, and each provided with a binding screw, and a removable

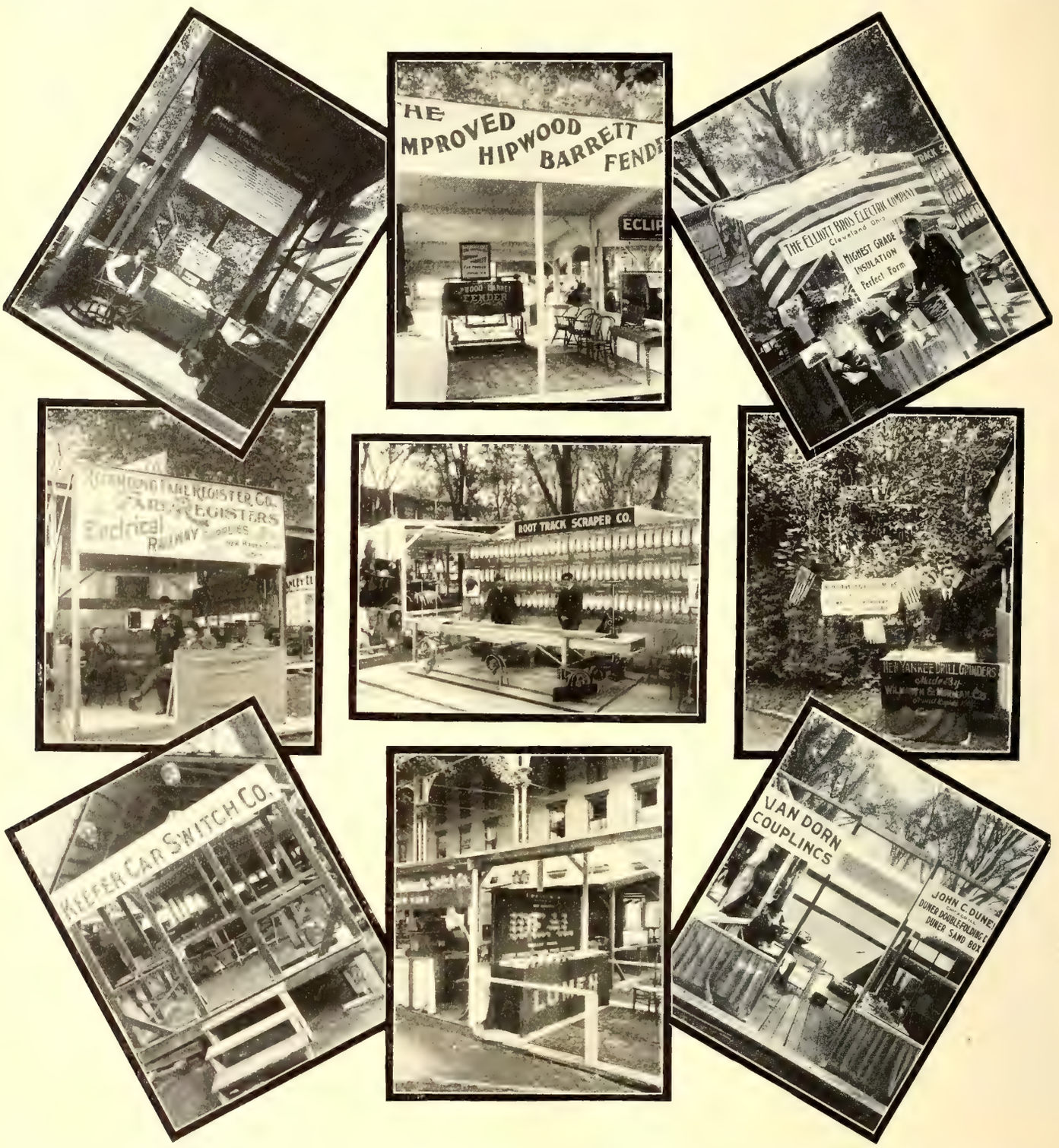


EXHIBIT OF THE KINNEAR MANUFACTURING COMPANY

EXHIBIT OF THE RECORDING FARE REGISTER COMPANY

EXHIBIT OF THE KEEFER CAR SWITCH COMPANY

EXHIBIT OF THE HIPWOOD-BARRETT CAR & VEHICLE FENDER COMPANY

EXHIBIT OF THE ROOT TRACK-SCRAPER COMPANY

EXHIBIT OF THE LUMEN BEARING COMPANY

EXHIBIT OF THE ELLIOTT BROS. ELECTRIC COMPANY

EXHIBIT OF THE WILMARTH & MORMAN COMPANY

EXHIBIT OF THE W. T. VAN DORN COMPANY AND JOHN C. DUNER

casing of brass or aluminum, protected by porcelain rings or bushings. In series clusters the contact plates are made in sections, each section serving two adjacent lamps, the inner and outer plates overlapping each other, thus connecting the lamps in series without wiring. The company states that these clusters have been adopted by the Interborough Rapid Transit Company, of New York, for the illumination of all underground cars. Basil G. Kodjbanoff, manager of the Eastern Department, was in charge.

THE AMERICAN CAR & FOUNDRY COMPANY, of Chicago, showed samples and sections of its new solid rolled steel wheel. The wheel is made from a cast-steel blank, which is heated and rolled by driven rolls, thereby compressing the steel of the tread and flange, and reducing the area of its cross section 20 per cent. The hub and ribbed plate remain as cast. The tire can be turned down as much as ordinary steel tire that is 2½ ins. thick, and, of course, the tire cannot work loose, as it is an integral part of the wheel. The low cost of this wheel forms one of its attractive features. The Fowler truck side bearing, a newly patented device, was also shown. The bearing consists of a gear wheel revolving between the body transom and the truck bolster. The bearing has but three parts. It cannot fail to revolve, as the truck bolster turns, and as the bearing surface in any position is from 3 ins. to 6 ins., the roller cannot flatten. The device can be supplied to any size or style of truck. William H. Fowler, of Chicago, was in charge of the booth.

THE PETER SMITH HEATER COMPANY, of Detroit, displayed three sizes of its widely used hot water heater for closed cars. The company is meeting with marked success in placing its device with leading city and interurban roads, and the advantages of this system of heating are rapidly becoming universally recognized. Peter Smith and E. J. Smith were in charge. George S. Hastings, general sales agent, was also present.



EXHIBIT OF THE CONTINUOUS RAIL JOINT COMPANY

THE KINNEAR MANUFACTURING COMPANY, of Columbus, manufacturer of the Kinnear rolling door, displayed a section of car house, with trolley wire and Kinnear door installed. The numerous self-evident advantages possessed by a rolling door which passes out of the way into a hood, are daily becoming more widely appreciated by electric railway people, and a very large proportion of the more modern car houses are being equipped with the Kinnear door. This fact is particularly true in the case of the roads in the vicinity of Albany and Saratoga. An important contract recently closed by the company was that of the Georgia Railway & Electric Company, of Atlanta, which calls for sixteen doors. F. H. Billheimer was in charge.



EXHIBIT OF ROSSITER, MACGOVERN & COMPANY

THE ECLIPSE CAR FENDER COMPANY, of Cleveland, had several methods of calling the attention of the public to the merits of its new life guard, and it is safe to say that no one who attended the Convention missed seeing the operation of the Eclipse fender in some manner or other. At the stand was displayed a fender attached to the dash of a car as in actual practice, and many hundreds of times the attendants allowed themselves to be pushed into the fender. Each morning and evening the company gave actual demonstrations of the fender on Hamilton Street, at the rear of the Grand Union Hotel. On no less than thirty occasions, not only employees of the company, but motormen and conductors of the Hudson Valley Railway, were picked up uninjured at speeds ranging from 5 miles to 15 miles an hour. On the last test two men were picked up at once. At one of the tests on Tuesday there was a "pick-up" which was not down on the programme. George Groman, a conductor on the Hudson Valley line, who had been instructed to keep back the crowd, failed to get out of the way of the car, and was picked up. He claimed it was a genuine accident, and that he had had no intention of getting in the way. These trials proved one of the greatest attractions of the week, and many thousand people witnessed them. Each evening the company gave a biograph exhibition of a trial made in Brooklyn

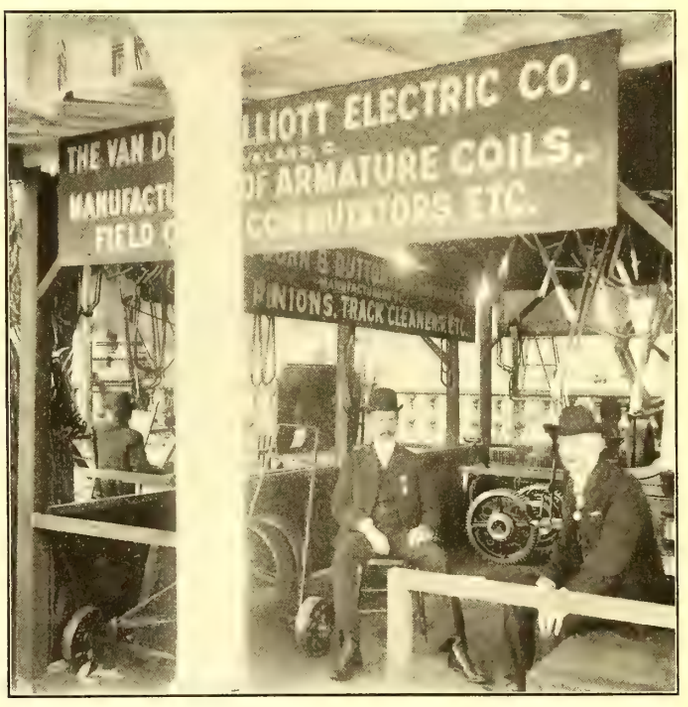


EXHIBIT OF THE VAN DORN & DUTTON COMPANY AND THE VAN DORN-ELLIOTT ELECTRIC COMPANY

at 22 miles an hour, while at the stand there was in constant operation a mutoscope showing the same tests. Each day thousands of small and attractive cards, calling attention to the various trials, were distributed throughout the grounds. On the whole, the new fender attracted widespread attention and comment, and its success seems assured. During the week many orders were taken for trial equipments. Those in attendance were Dr. C. B. Forward, Benjamin Lev, J. W. Range, Harry Brakeman, Charles F. Merseburg, S. M. White and S. C. Warr. Nearly all of the the above took part in the tests, and were picked up by fenders.



EXHIBIT OF THE H. W. JOHNS-MANVILLE COMPANY

THE CURTAIN SUPPLY COMPANY, of Chicago, had an artistically arranged booth on the veranda, half of which was fitted up as a Turkish cosy corner for entertainment. Three very fine revolving frames contained the various styles of the company's line of curtains in the various fabrics used in these goods. The leading feature to which attention was called was the Forsyth No. 86 roller tip fixture. The new device is self-aligning; it will not come out of grooves; it has a wide range of adjustment; it has a locking adjustment which can be operated only by barn men or others familiar with the device, these locks being capable of adjustment without removing from the window frame; there are no small parts; it is impossible to loose the tips or handles; the curtain will not creep up; and the device is made with or without handles. The fixture can be instantly removed from groove if desired, for cleaning, it will not disfigure the groove in removing, and it is reversible, so that an ignorant man cannot make an error in putting it in. Another feature was the Forsyth open car cable fixture. This device does not depend upon the cable for friction, and the cable is used simply to prevent the curtain from coming out of the groove. A simple pin and slot lock prevents the possibility of losing the cable tip. The fixture is designed for either open or convertible cars. W. H. Forsyth, general manager; A. L. Whipple, Eastern representative, and B. S. McClellan, Western representative, entertained.

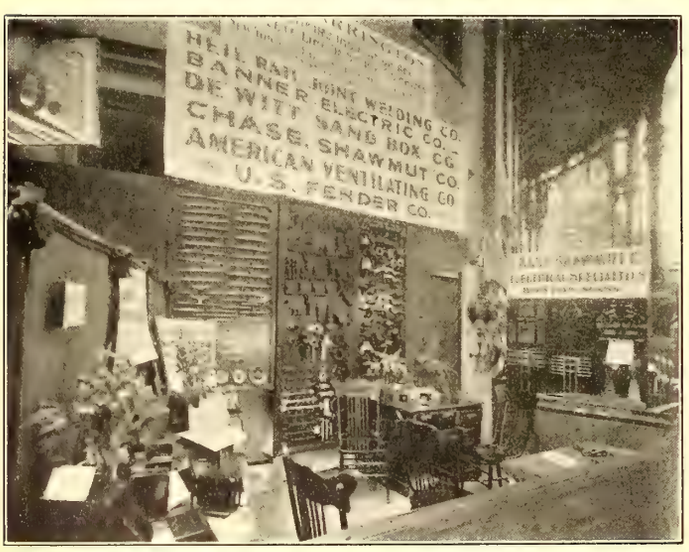


EXHIBIT OF C. J. HARRINGTON

THE CREAGHEAD ENGINEERING COMPANY, of Cincinnati, manufacturer of line material, flexible brackets, pole fittings, etc., was represented by Thomas J. Creaghead, president.

THE RAILWAY APPLIANCES COMPANY, of Chicago and New York, had a pagoda-shaped booth, in which it showed several of the appliances it is manufacturing. These included the Q. & C. portable rail drill, the Sampson rail bender, the Stanwood step, the Bryant portable rail saw, and the Fewing car replacer. The new drill is a very light and simple device, which sells at a very low price. It has clamps which hook on the rail above and below, and may be applied instantly. The drill proper is hinged so that it may be dropped back away from a passing car. There is a double handle, and the drill may be operated by either one or two men. The feed is automatic, and by means of a split gear in the driving mechanism, two speeds are available. Anthony T. Kalas, of Chicago, and Fred Brotherhood, of New York, were present.

THE GLOBE ELECTRIC MANUFACTURING COMPANY, of Cleveland, made a decided hit with its combination arc and incandescent headlight, designed to obviate the common objections to the arc headlight while on city tracks. A two-point switch, placed in the motorman's cab, does the trick, the same circuit being used. The company offers a thirty-day trial free of charge, and a number of sample orders were booked. William C. Egert, sales manager, was in charge, and a sample of the lamp was shown in operation.

THE NATIONAL CARBON COMPANY, of Cleveland, exhibited a line which is almost too well known to require detailing. It included carbons, brushes, dry cells, etc. R. K. Mickey, of the carbon brush department, was much in evidence. James Partridge, of the Partridge Carbon Works, Sandusky, was also present.



EXHIBIT OF THE STERLING-MEAKER COMPANY

F. H. NEWCOMB, of New York, known to the trade as the "Cap man," exhibited his usual line of uniform caps. A souvenir pocketbook was much sought for.

EUGENE MUNSELL & COMPANY and the Mica Insulator Company, of New York and Chicago, were represented by Charles E. Coleman, manager of the Chicago house. Their exhibit, which consisted of micanite rings, segments and empire cloth, and their other lines of insulation, was located at the left of the main cross

aisle in the booth with the National Carbon Company. Samples of their material were freely distributed among the visiting delegates, and at all the writing desks of the hotels very attractive blotters were very much in evidence.

GEORGE F. ROOKE, the inventor of the Rooke fare register, interviewed a good many railway managers who were interested in his device. The machine will not be placed on the market before the coming winter.

M. A. BERG, of Porter & Berg, electric railway supplies, represented the firm at the convention.

JOHN E. ELDRED, JR., represented N. A. Christensen, builder of air compressors at Milwaukee, Wis.

THE JEWETT CAR COMPANY, Newark, Ohio, had A. H. Sisson, general manager, and Mr. Gardner, treasurer, at the convention.

THE J. M. ATKINSON COMPANY, electric railway supplies, Chicago, was represented by J. M. Atkinson.

CHARLES K. KNICKERBOCKER, of the Griffin Wheel Company Chicago, was present.

THE W. R. GARTON COMPANY, electrical supplies, Chicago, was represented by the president, W. R. Garton.

L. E. MYERS, of the L. E. Myers Company, Chicago, was present.

E. F. KIRKPATRICK, of the McRoy Clay Works, Brazil, Ind., arrived with the "Wabash Special."

GEORGE S. BIGELOW, of the Railway Department, Chicago Varnish Company, was at the convention.

GEORGE WESTON, accompanied by Mrs. Weston, represented the Chicago Engineering & Constructing Company, of Chicago.

THE PAIGE IRON WORKS AND THE BUDA FOUNDRY COMPANY, Chicago, were well represented by E. S. Nethercut, who was accompanied by his wife.

THE HALE & KILBURN MANUFACTURING COMPANY, of Philadelphia, New York, Chicago and London, attracted universal attention with a novel and extensive display of car seats. The space, measuring 25 ft. front, was covered by a canopy, projecting about 6 ft. and supported by front columns. The entire rear wall of the exhibit, together with the inside of the canopy, was covered with canvas-lined woven rattan. The face of the canopy, as well as the columns supporting the same, were likewise covered with this material, which, taken as a whole, had a decidedly unique effect. Rolls of this material arranged in columns



EXHIBIT OF THE OHIO BRASS COMPANY

likewise added to the impressive effect. The entire space was surrounded by a solid brass railing. A uniformed colored attendant was present to act as a messenger and otherwise to provide for the comfort of the numerouse friends of this popular concern. The display of car seats included the famous walkover patterns, some ten or twelve in number, some of which never had been heretofore presented. The long experience of this concern in railroad car seating has led it to introduce numerous desirable features in electric car seats, which hitherto have only been used in steam car seating. This feature has been much appreciated by some of the foremost interurban electric lines of the country, including the Aurora, Elgin & Chicago line. Numerous other lines have likewise been fitted with the Hale & Kilburn interurban seats, and others now under construction will be equipped in the same manner, with high headroll backs, polished hardwood aisle ends, automatic foot rails, etc. The Hale & Kilburn Company was the first to introduce pressed steel car seats for first-



EXHIBIT OF THE CONSOLIDATED CAR FENDER COMPANY

class passenger coaches, and to-day this seat has become the exclusive standard of numerous leading railroads throughout the United States. The company has introduced this valuable feature into electric car seats, and showed the first samples in the Saratoga display. The absolute indestructibility, simplicity and lightness secured by this invention meets with unqualified approval on the part of all examiners. Among the samples shown were the high-back cross seats now being manufactured by this concern for the New York Interborough Rapid Transit, to be placed in 500 subway cars. The entire number of seats in this order is 26,000, the contract for which was awarded the Hale & Kilburn Company for the patented steel band construction after a close examination of every other seat manufactured in the country. The Hale & Kilburn Company is now rapidly finishing an immense new plant along the line of the Pennsylvania Railroad in Philadelphia, to enable it to meet the constantly increasing calls from home and foreign trade. The company will soon issue a catalogue of the leading styles of seating, which it will be pleased to forward to all inquirers. H. T. Bigelow, of Chicago, and Messrs. Walker and Old represented New York and Philadelphia interests.

THE LORAIN STEEL COMPANY had a handsomely decorated stand, and its exhibit included three large sample cases containing nickel-plated sections of all the types of rails built for city and interurban work. The staff present included: P. M. Boyd, secretary; D. J. Evans, Chicago office; Major H. C. Evans, and F. J. Drake, New York office; William W. Kingston, Atlanta office; Rudolph Clitz, Lorain; H. T. A. Kleinschmide, Johnstown, Pa., and L. P. S. Ellis, Pittsburg.

THE M'GUIRE MANUFACTURING COMPANY, of Chicago, had the only exhibit on the Delaware & Hudson tracks, at the rear of the hotel, which were supposed to have been the location of the rolling stock exhibits. The company showed a heavy vestibule rotary snow sweeper, one of a type which is used by many of the leading roads of the country. On the Hudson Valley tracks the company displayed in operation, a 4000-gal. sprinkler. The car was provided with a sprinkling head at each end, and sprayed water 45 ft. on each side of track. The width of the spray was regulated by

air pressure supplied the water compartment, controlled by a reducing regulating valve, and the variation in the spread of the water was governed by a lever, readily controlled for any distance from maximum to quick shut-off. The company states that many street railway systems are taking contracts for city sprinkling, and with a sprinkler of this kind, such a contract is likely to prove a most profitable arrangement. The sprinkler was equipped with the new 39-A truck, for heavy high-speed service. At Cottage P, W. J. Cooke, vice-president, and B. F. Stewart, sales manager, displayed a line of models of McGuire trucks. A new feature was the solid steel Columbian truck, 100 of which have just been supplied the Pittsburg Railways Company, making a total of 1000 McGuire trucks in use in the "Smoky City."



HEADQUARTERS OF THE "STREET RAILWAY JOURNAL"

THE STERLING VARNISH COMPANY, and the Pittsburg Insulating Company, of Pittsburg, were represented by H. Lee Bragg, general sales manager, Pittsburg, and S. C. Schenck, New York. They showed samples of varnish, armature coils, coated in varnish, insulating varnish and a new black plastic varnish for coil work. This is claimed to be absolutely oil proof and weather repellant, thus preventing the absorption of oils and moisture, and consequent lowering of insulation.

THE ELECTRIC STORAGE BATTERY COMPANY, of Philadelphia, had a very plain, yet effective exhibit, consisting of two Chloride type G-51 cells, having a capacity of 2000 amps., and two type F-11 cells of 200-amp. capacity. The stand was decorated with a number of photographs of Chloride installations in railway central station and isolated lighting plants, and there was a large map of the United States, showing the cities in which Chloride installations are located. All but two States were represented, the total including 286 railway batteries, 92 central station batteries, and 517 isolated plants, a total of 382,000 kw-hours. Business was reported to be increasing faster than ever before, and recent contracts include large batteries for the Northwestern Elevated Railway, Chicago; the Chicago Edison Company, Chicago; the Los Angeles Edison Company, Los Angeles, Cal., and the New York Edison Company, New York. This makes a total of 22 batteries in use by the latter company. The representatives present were: Charles Blizard, Philadelphia; J. L. Woodbridge, Pittsburg; Albert Taylor, New York; G. H. Atkins, Chicago; F. J. Stone, Boston, and H. B. Gay, Cleveland.



EXHIBIT OF THE OHMER FARE REGISTER COMPANY

THE DEARBORN DRUG & CHEMICAL COMPANY, of Chicago, was represented by William McVicker and J. Johnson, of New York, and G. W. Spier, of Chicago. They presented the merits of the various compounds manufactured by the company for obviating boiler flue troubles. Some remarkable samples of boiler scale were shown. As in previous years, this stand was constantly the Mecca of the souvenir-hunters, and fortunate ones were presented with tasty and valuable reminders of the company's products.

THE HEIL RAIL JOINT WELDING COMPANY, of Milwaukee, showed samples of its cast-welding in connection with the exhibit of C. J. Harrington.

ARTHUR S. PARTRIDGE, the St. Louis railway supply man, was a visitor to the convention. He made no exhibit.

THE PITTSBURG REDUCTION COMPANY, of Pittsburg, had a unique display. The booth was a large one, and one-half was occupied by an aluminum wire drawing machine in operation, reducing wire from No. 2 gage to No. 9 gage. The reception section was handsomely furnished with heavy antique and leather chairs and couches, and displayed on tables were aluminum splices, cables, insulated and bare wire. The railings were aluminum, and potted plants and handsome rugs were included in the decorations. The entertainment committee of the company was a large one, including: Arthur B. Davis, general manager; A. K. Laurie, general sales agent; J. A. Rutherford and Cyrus Harris, Cleveland; S. K. Colby and W. R. Darby, New York; E. H. Noyse, Chicago; William Hoopes, Pittsburg, and J. H. Finney, Washington, D. C.



EXHIBIT OF THE WATSON AUTOMATIC CAR FENDER

THE ADAMS & WESTLAKE COMPANY, of Chicago, was represented by J. A. Foster and W. H. Piersen. The exhibit consisted of headlights, lanterns, semaphores, and the gravity brake-handle. The arc headlight displayed included the Mosher, Wagenhals and Eureka. One of the signal lamps shown was of the non-sweating type, while another was of the long-time burning variety. It was claimed that with a good grade of oil this lamp would burn a week without refilling or touching wick.

EUGENE H. FARR, of the Farr & Foster Company, Chicago, manufacturers of railway tickets, ticket cases and supplies, was at the convention.

THE BALDWIN LOCOMOTIVE WORKS, of Philadelphia,

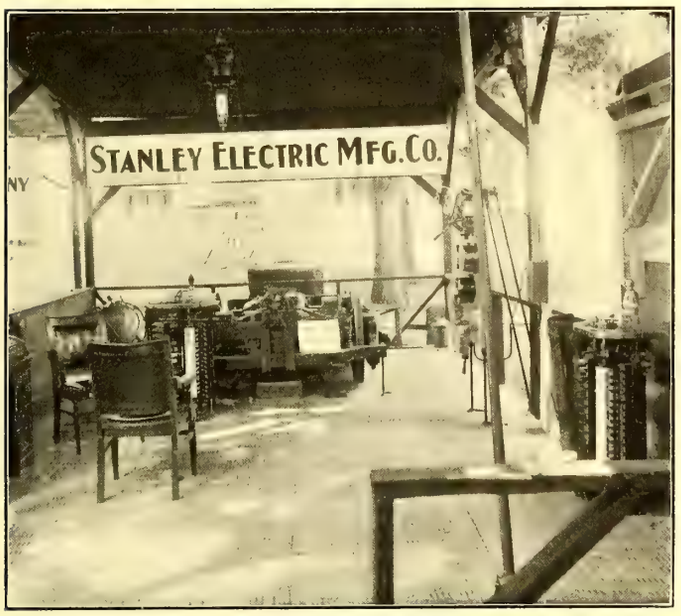


EXHIBIT OF THE STANLEY ELECTRIC MANUFACTURING COMPANY

exhibited one of the motor trucks it is building for the Interborough Rapid Transit Company, of New York, for the new subway lines. This truck is, of course, very massive in construction. It has been described in a recent issue of the STREET RAILWAY JOURNAL.

THE SHERWIN-WILLIAMS COMPANY, of Cleveland,



EXHIBIT OF THE ST. LOUIS CAR COMPANY

made a decided hit by placing its large "Covers the Earth" signs all over the rotunda. The booth was artistically arranged, and the exhibit included a line of paints and varnishes and insulating material. Two large panels demonstrated the various steps taken in finishing cars, both in light and dark colors. The company is meeting with excellent success in introducing its Ajax insulating varnish, a preparation for which many good qualities have been demonstrated. A brilliantly finished cast-iron chameleon, representing the company's trade mark, was a souvenir which was much sought after. E. M. Williams was in charge, assisted by F. A. Elmquist and L. W. Barney.

THE ALLIS-CHALMERS COMPANY, of Chicago and Milwaukee, had no exhibit, but was represented by John B. Allan, engine sales manager, Chicago; Jesse Vail, New York representative; James Lyons, Chicago; Edw. J. Meisenheimer, advertiser, Chicago.

THE MASSACHUSETTS CHEMICAL COMPANY, of Boston, distributed a unique souvenir, a rubber cuspidor mat, a useful article which was much in demand.

BERRY BROTHERS, of Detroit, showed highly varnished panels in light and dark finishes. The booth was tastefully fitted up for reception purposes, and the railway men who called were given a leather-covered memorandum book as a reminder of the company's line. Harry Frost was in charge of the exhibit.

THE ROOT TRACK SCRAPER COMPANY, of Kalamazoo, Mich., was late in completing its exhibits, as the goods were lost



EXHIBIT OF THE SECURITY REGISTER COMPANY AND GILES S. ALLISON

in transit. The line included several varieties of track scrapers. A new type, known as No. 5, is designed to clean all the snow from between the rails, and 9 ins. outside, throwing it away from the center, and at the same time cleans the top of the rail and the groove, being in fact a practical and inexpensive snow-plow, designed to clean the tracks of several inches of snow. The springs and plates are made of open hearth steel of the best quality, and will stand a great deal of heavy work and hard usage. The operation is by lever, giving a greater variation than the old plan of wheel operation. The double device is handled by one man as easily as the single machine. The arrangement and tension of the springs is such that it will operate satisfactorily on rough roads, as well as smooth pavement. Another new device was a third-rail ice cutter, which is claimed to be the best device yet brought out for removing ice and sleet from the contact rail. It first breaks the ice and then scrapes it off. Any desired pressure may be placed upon the springs, and no matter what the speed the ice is broken and removed uniformly. F. N. Root, general manger of the company, was in charge, assisted by Newton Root.

THE HOWE MANUFACTURING COMPANY, of Scranton, Pa., exhibited the Howe steam sand dryer. The device is a radical departure from the old hopper and stove combination. The chief feature comprises layers of steam pipes, so laid that all condensa-

tion immediately runs off. The device will handle a car load of sand at a time, and the entire operation of drying and screening is entirely automatic. The company makes a 10-ton machine of electric railway use. A. D. Blackinton, president of the company, explained the features of the device.

H. W. COVERT, of Waterford, N. Y., manufacturer of a new type of convertible car, was unable to exhibit, but delegates were of the Pennsylvania Street Railway Association, at Park Hotel, Williamsport, Pa., Sept. 23, a paper on the subject, "Fare Collection and Proper Protection of Same." This is the first time on record that a member of the trade has been asked to deliver a paper before this association, and the compliment was very gratifying to Mr. Ohmer.

THE HIPWOOD-BARRETT CAR & VEHICLE COM-



EXHIBIT OF SHERWIN-WILLIAMS COMPANY
EXHIBIT OF THE STANDARD AUTOMATIC LUBRICATOR COMPANY
EXHIBIT OF R. W. CONANT

EXHIBIT OF THE STERLING VARNISH COMPANY
EXHIBIT OF MERRITT & CO.
EXHIBIT OF THE AMERICAN CAR & FOUNDRY COMPANY
EXHIBIT OF THE AMERICAN DIESEL ENGINE COMPANY

EXHIBIT OF THE INGERSOLL CONSTRUCTION COMPANY
EXHIBIT OF THE UNIVERSAL BRAKE COMPANY
EXHIBIT OF THE SEAVY AUTOMATIC CAR FENDER COMPANY

extended an invitation to visit the factory and inspect a full-sized section.

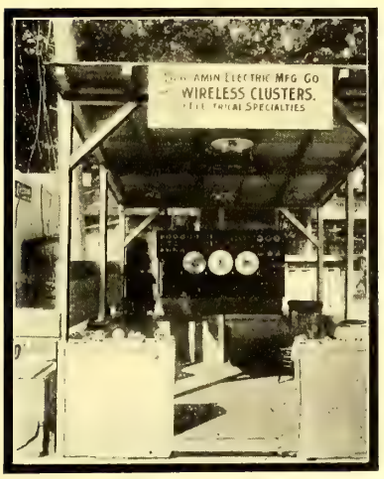
THE BANNER ELECTRIC COMPANY, of Youngstown, Ohio, exhibited a line of lamps and featured its special series burning lamp for electric railway service.

JOHN F. OHMER, of the Ohmer Fare Register Company, of Dayton, has accepted an invitation to deliver before the convention

PANY, of Boston, exhibited an improved type of their well-known fender, which is much lighter in construction than the old type. Mr. George Hipwood, Henry S. Jenkins, J. W. Barrett, A. B. Dalby, were present.

C. O. OBERG & COMPANY, of Boston, had an exhibit of their register handles. This concern states that its detachable register handles have been adopted as standard by the largest street

railways in the United States and Canada, and that every practical railway man who uses them finds that they will save his company both time and money. They are specified for new cars, and many order them for stock to replace old handles. The company believes it impossible to construct a more powerful and reliable gripping handle.



THE CHASE-SHAWMUT COMPANY exhibited in space 12, with C. J. Harrington, of New York, showing a full line of Shawmut soldered rail bonds attached to all makes of rail joints. In addition to exhibiting in the booth, a practical demonstration of the application was given on the tracks of the Hudson Valley Traction Company. They were represented by Harry P. Moore, Frank D. Masterson and E. P. Howe. C. S. Knowles, Boston, Mass.; W. J. Walther, J. S. Lapp, and C. H. Clark exhibited various specialties sold by this company.



EXHIBITS OF THE BENJAMIN ELECTRIC MANUFACTURING COMPANY AND THE O. M. EDWARDS COMPANY

THE F. H. SEAVEY AUTOMATIC FENDER COMPANY, Boston, Mass., exhibited the Seavey automatic fender. This is a new device recently patented and placed on the market by F. H. Seavey. Considerable interest was manifested in this life-saving device by all those who examined it.

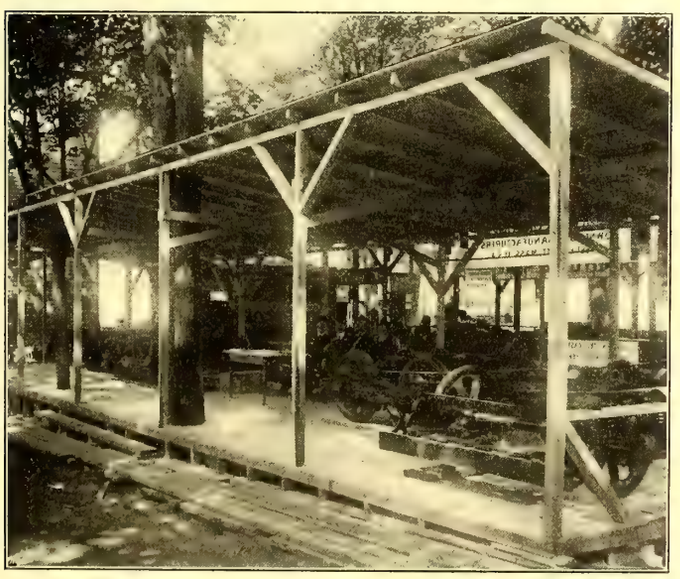


EXHIBIT OF THE BEMIS CAR TRUCK COMPANY

C. J. HARRINGTON, of New York, exhibited a complete line of Empire overhead material, cast-welded rail joints, lamps, rail bonds, car ventilators and various other street railway appliances which Mr. Harrington handles.

THE STANDARD VARNISH COMPANY, of New York, was represented by J. C. Dolph.

THE CONSOLIDATED CAR-HEATING COMPANY, of Albany, exhibited its new type of cross-seat heater, with lead wires coming out of the case at one end. This heater is shown under a cross seat, and other types are also shown in position under seats. A truss plank heater is shown under one end of a cross seat. This heater is very popular for interurban cars, as it is placed on the truss plank, near the floor, making it impossible to overheat the seats. Sufficient heaters are usually used to extend the full length of the car on both sides. The connecting wires are carried in a moulding underneath the heaters. These wires are connected to the heater coils inside of the heater case. There are, therefore, no exposed wires, and no joints outside of heater cases. The manner of bringing lead wires out at one end of heaters overcomes the objection to some heaters, where it is necessary to staple wires across the seat frame. The panel heater for New York Subway cars, for which an order for 12,680 heaters has been placed with this company, was also shown. The company was represented by Mr. Green, general manager, of Albany; Mr. Hawley and Mr. Keys from the New York office, and Mr. Hequembourg, of the Chicago office.



EXHIBIT OF THE UNITED STATES ELECTRIC SIGNAL COMPANY

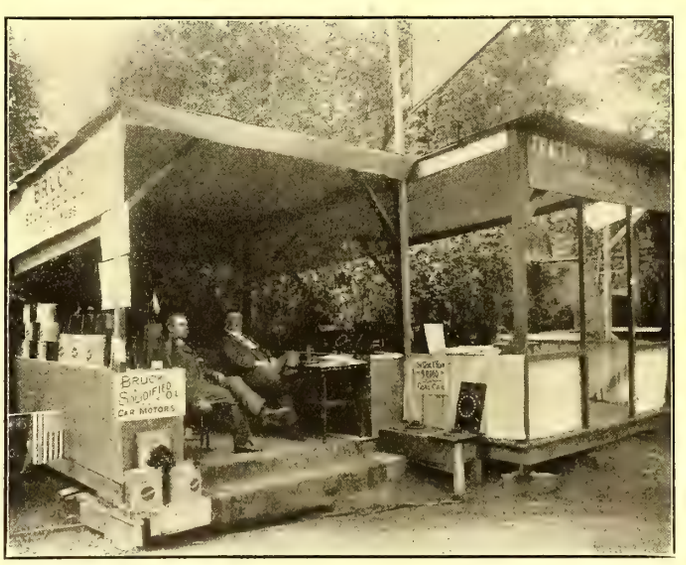


EXHIBIT OF THE BRUCK SOLIDIFIED OIL COMPANY AND THE TRACTION EQUIPMENT COMPANY

THE M'ROY CLAY WORKS, Brazil, Ind., had signs everywhere about the grounds, and Manager E. F. Kirkpatrick, of Chicago, was there.

GEORGE C. EWING, of Boston, was present at the convention in the interests of the McGuire Manufacturing Company, the Electric Railway Equipment Company, Nernst Lamp Company, and Cooper-Hewitt Electric Company, for which companies he is agent. He has recently been appointed New England agent for the Cooper-Hewitt mercury vapor lamp.

THE FRANK RIDLON COMPANY, of Boston, was, as usual,



EXHIBIT OF THE CROUSE-HINDS ELECTRIC COMPANY

represented by Charles N. Wood, and by Robert Mathias and David Stimon. The "Ridlon Representative" was very much in evidence at the convention. This house organ is now an estab-

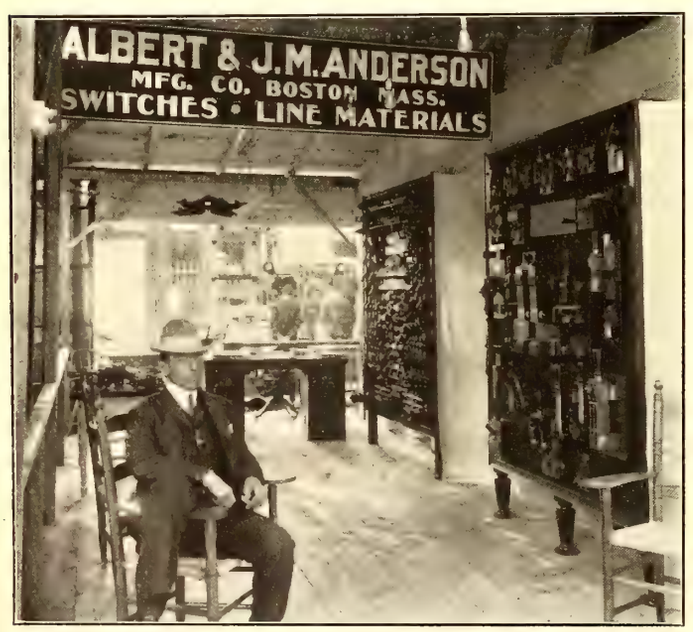


EXHIBIT OF THE ALBERT & J. M. ANDERSON MANUFACTURING COMPANY

lished and regular feature of the advertising department of the Frank Ridlon Company, and is a welcome guest to all street railway managers that it reaches. Newsy, epigrammatic, short and to the point is all the matter in it. It illustrates the progressive nature of the house it represents.

THE WEBER RAILWAY JOINT MANUFACTURING COMPANY, of New York, represented by Percy Holbrook, general manager; James C. Barr, general sales agent; Fred A. Poor, H. C. Holloway, Frederick P. Thompson, and James A. Greer, exhibited all types of its joints, including the one adopted as standard on the New York Subway.

THE CROUSE-HINDS ELECTRIC COMPANY, Syracuse, New York, exhibited the Crouse-Hinds arc headlight junction boxes, switchboards and switches, and Nesbitt specialties. Those present were A. F. Hills, Nathan Shute and H. B. Crouse, president. One of the best and most notable exhibits at the convention was the decoration of the pagoda of the Grand Union Hotel with miniature electric lamps, strung on Norbitt porcelain socket attachments. The lamps were surrounded by red decorative paper and strung in a very artistic way, making a brilliant and attractive effect. The Norbitt specialties are finding a ready sale for decora-



EXHIBIT OF THE ELECTRIC STORAGE BATTERY COMPANY

tive work in the hundreds of summer street railway parks now in operation all over the United States. They are also splendidly adapted for conduit construction work where temporary light is needed for working at night. The arc headlight manufactured by this company, and recently placed on the market, has also many excellent advantages over those now in use, and should be adopted by all street railway companies having interurban and suburban service.

THE SECURITY REGISTER COMPANY, St. Louis, Mo., regretted the absence, through serious illness, of its president, Giles



EXHIBIT OF ARCHBOLD-BRADY COMPANY AND LOCKE INSULATOR MANUFACTURING COMPANY

S. Allison, who, however, is expected to be out again shortly. The company was represented by H. C. Donecker, secretary, and D. J. Fitch, who report great interest in the self-recording registers. Six different types of registers were shown in the exhibit of this company, forming a most attractive and handsome display.

DICK HAM, Stockport, N. Y., was present at the convention in the interest of his trolley catcher attachment for retrieving the trolley pole when it jumps the wire.

THE R. D. NUTTALL COMPANY, of Pittsburg, was represented by President F. A. Estep.

THE T. H. SYMINGTON COMPANY, of Baltimore, Md., which has made a specialty of perfecting the steam railroad journal box in its various details, showed its boxes, both apart and assembled, and also two boxes with glass sides with a revolving journal inside them, to show the lubrication attained. The points of excellence of this box are, first, the placing of the metal where it is most needed to withstand the strains which most frequently break it in service; second, a dust proof lid, with a machined fit; third, a dust guard that protects the rear of the journal on all sides; fourth, arrangements to prevent the waste packing from becoming caked in the bottom of the box or from climbing up one side of the journal; fifth, a metal suited to the conditions. In other words, the company has simply applied good, conservative engineering to the regular journal box, with beneficial results. John F. Symington was present.

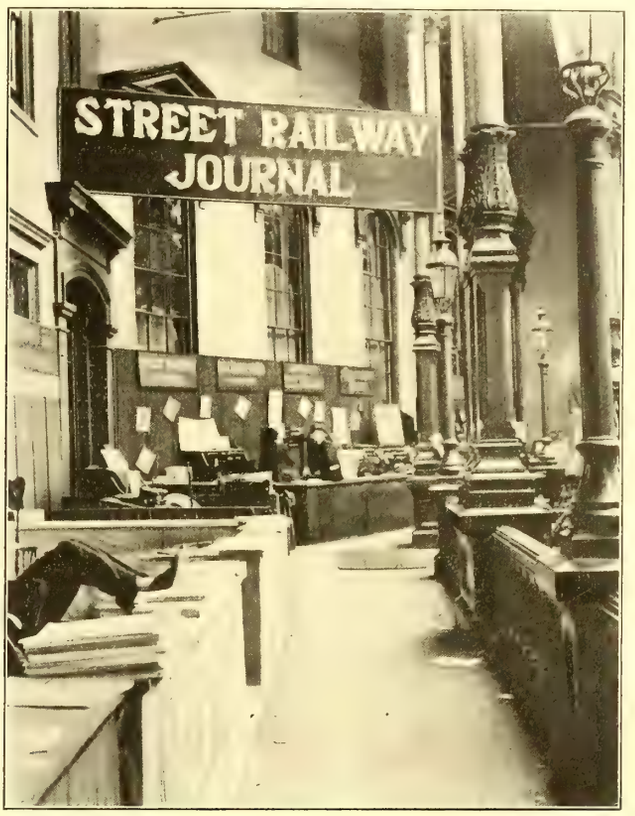


EXHIBIT OF THE CURTAIN SUPPLY COMPANY

THE MAYER & ENGLUND COMPANY, Philadelphia, had a tastefully arranged booth, containing all types of Protected rail-bonds. The Gonzenbach third-rail insulator used on the Aurora, Elgin & Chicago Railway and the Gonzenbach cable terminal for connecting the ends of third rails with lead covered cables at crossings and feeding in points was also shown. Charles J. Mayer, A. H. Englund, H. G. Lewis, William Armstrong, Jr., J. F. McCarthy, W. A. Cockley, J. M. Gallagher, Ed. Hammett and D. L. Crawford were in attendance.



EXHIBIT OF THE GOULD STORAGE BATTERY COMPANY



A SNAP SHOT ON THE PIAZZA OF THE GRAND UNION HOTEL

THE AMERICAN AUTOMATIC SWITCH & SIGNAL COMPANY, of Chicago, is a new company, just starting in the manufacture of automatic block signals for electric roads. Its signal was on exhibition. It is not an untried device, as signals on the same principles have been in operation for several years in East St. Louis. Robert Skeen, the inventor, was formerly connected with the East St. Louis interurban lines. Besides Mr. Skeen, those connected with this company who were present at the Convention were M. B. Madden, of Chicago, who is president, and V. W. Bergenthal. Mr. Bergenthal was, until Sept. 1, assistant manager of the Stanley Electric Manufacturing Company's Chicago office. He will be in charge of the sales of the company.

THE GOLD CAR HEATING & LIGHTING COMPANY, of New York, had a full line of electric car heaters on exhibition, and a set of heaters arranged to show method of regulation. Those representing this company at the Convention were E. E. Gold, J. E. Ward, W. H. Stocks and Chief Engineer Frank Cahill.

THE GENERAL RAILWAY SUPPLY COMPANY, of Pittsburg, was represented by George W. Provost, manager, and John P. Provost, treasurer.

THE KEEFER CAR SWITCH COMPANY, of Albany, N. Y., exhibited its automatic track switch, operated mechanically from an attachment on the car. This switch was fully described in the STREET RAILWAY JOURNAL, Aug. 29, 1903. D. H. Keefer, J. W. Keefer and Frank Bloomingdale were on hand explaining the device.

H. K. DOOLITTLE, Watertown, N. Y., showed his patented improved windows, which can be removed without removing stops or screws. The sashes are grooved, and slide up and down on a metallic rod.

CHARLES F. LUTHER, of Pawtucket, R. I., exhibited the "Rubaner" automatic switch for street railways. This is a track switch, operated mechanically by a car attachment. He also distributed samples of the new adjustable passenger strap, described elsewhere in this issue.

THE H. W. JOHNS-MANVILLE COMPANY, of New York, had on exhibition the most recently developed devices per-

taining to the Sachs "Noark" enclosed fuse apparatus. There were several fuse boxes of large capacity, a service box, and also some new designs of fuses. A complete line of the latest overhead line material, ears, clips, trolley wheels, insulated and metallic crossings and section insulators was on display, as well as a complete line of electric car heaters. Several new designs of heat-



EXHIBIT OF THE CONSOLIDATED CAR HEATING COMPANY

ers have been recently brought out. Those representing the Johns-Manville Company were J. W. Perry, manager electrical department, New York; J. E. Meek, New York; H. M. Voorhis, Philadelphia, and James Humphreys, of Boston. The Johns-

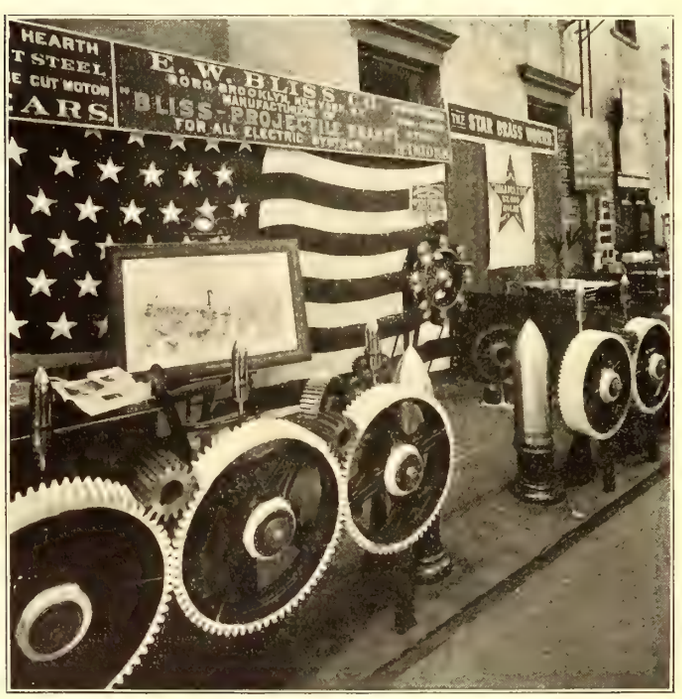


EXHIBIT OF E. W. BLISS COMPANY

Pratt Company, which manufactures the overhead line material and "Noark" fuses, of which the Johns-Manville Company is the sole selling agent, was represented by E. B. Hatch, president; Joseph Sachs, electrical engineer.

WILLIAM WHARTON, JR., & COMPANY, of Philadelphia, had, among other novelties, in their well-arranged exhibit, a 9-in. girder guard rail, made entirely of manganese steel. This was 20 ft. long, and curved to a sharp radius. Curves made entirely of these rails for places where the traffic is very heavy are now being used, where curves made of ordinary Bessemer steel rails wear out quickly. These manganese steel curves outlast the ordinary rails many times. A curved T-rail, also made of manganese steel, was shown. This was a sample of what this company has furnished for a number of places on the Boston Elevated Railway, where the curve wear has been most excessive. The remarkable wearing qualities of manganese steel were shown by a large photograph of a manganese steel frog, which was

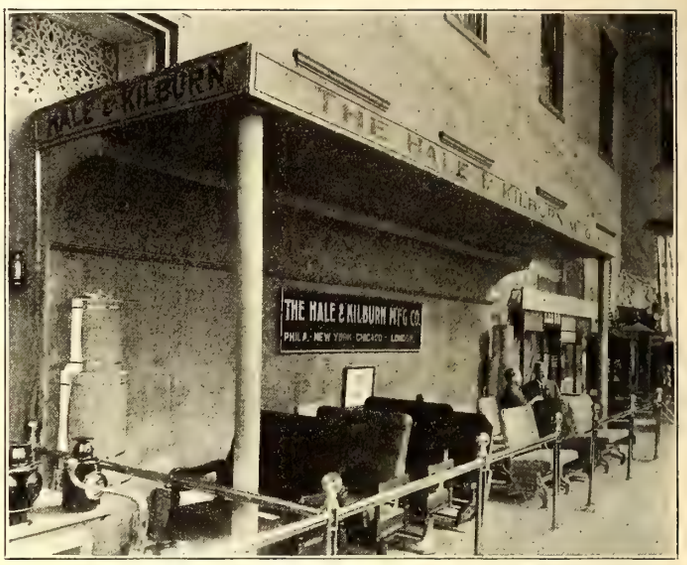


EXHIBIT OF THE HALE & KILBURN MANUFACTURING COMPANY

placed in the Philadelphia terminal of the Pennsylvania Railroad. This frog was the first of its kind put down by the Pennsylvania Railroad. It was induced to try this because of the fact that in this particular location frogs made of ordinary rails did not last more than three months. This manganese steel frog has now been in the tracks over three years, outlasting twelve ordinary frogs, and being still in good condition. Since this first frog was sold to the Pennsylvania Railroad, William Wharton, Jr., &



EXHIBIT OF THE CLIMAX FENCE POST COMPANY AND THE CLIMAX STOCK GUARD COMPANY

Company have sold over 2000 to the same company. In the exhibit a sample of this style of frog as usually supplied to steam or elevated roads was shown. A photograph of a manganese steel frog in one solid cast, as furnished to some of the crossings on the Boston Elevated Railway, was shown. Solid cast-steel manganese steel frogs and mates for surface railways laid with T-rail were exhibited. These are furnished regularly to such roads on calls for first-class work. The company is also prepared to furnish regular girder rail, switchboards, mates and frogs, cast

solidly of manganese steel, where the increased expense would warrant it; but no samples of this were shown, as the regular manganese steel center work has given such satisfaction. This was illustrated by a wornout frog, on which the entire head of the rail part had been worn away, while the manganese steel center was still in serviceable condition. Of course, the regular girder rail manganese steel center special work was exhibited. Unbroken main line work has undergone considerable improvement within the last year. All the parts subjected to the strain of wagon traffic are made of cast steel instead of cast iron, as heretofore. The movable tongue has a detachable device to hold the pivot and take up its wear. Attached to the girder rail-tongue switch is a novel spring-throwing device for the tongue, called the Dunham spring throw. By it the tongue can be turned, by means of an ordinary switching iron, and in either position it will act as a spring tongue. The spring at the same time keeps the tongue in position, so that it can be thrown between wheels.



EXHIBIT OF THE LE VALLEY VITÆ CARBON BRUSH COMPANY



EXHIBIT OF THE ATLAS RAILWAY SUPPLY COMPANY

The Nichols protected heel-tongue switch was another feature of the exhibit.

C. J. FIELD, of New York, made a small exhibit of his single and multiple-duct vitrified glazed clay conduits.

MERRITT & COMPANY, of Philadelphia, makers of the expanded metal lockers that are becoming so popular for use by street railway companies in shops and employees' rooms, made an exhibit of these lockers, in charge of George E. Morgan.

THE INDIANAPOLIS SWITCH & FROG COMPANY, of Springfield, Ohio, was represented by W. H. Thomas, the chief engineer.

THE MAGNETO ELECTRIC COMPANY, of Amsterdam, N. Y., exhibited a new form of graphite resistance box, which it is just putting on the market. This resistance is in the form of hollow graphite tubes, clamped between aluminum terminals. This company also makes variable-speed motors after the design of I. E. Story, assistant manager, who is so well known through his extended work in the way of the Storey variable-speed motors for machine tools. W. F. Dana and I. E. Storey were present.



EXHIBIT OF THE AMERICAN BRAKE SHOE & FOUNDRY COMPANY

THE AMERICAN DIESEL ENGINE COMPANY, of New York, which manufactures the Diesel gas engine, giving such fuel economy, and which has introduced its engines extensively in isolated plants in the East, is now preparing to enter the electric railway field. Norman McCarty represented the company at the convention, and a prominent sign was also displayed, containing a list of representative plants now using Diesel engines.

ALBERT B. HERRICK, consulting engineer, of New York, was at the convention, as usual, this year, and was able to give some of the details of his new autographic test car upon which he has been working for some time, and which has now reached a high state of perfection. With this car Mr. Herrick can go over a road and obtain a continuous graphic record of the condition of the ground return. The resistance of every joint is recorded by Weston instruments, in connection with a static spark recording device. The moving record sheet is on a scale of 1 in. to 100 ft. of track. The resistance of both rails and every joint is given in this record. A rotary converter is used to give a current of 200 amps., which is passed through the rails immediately under the car as the car passes along, and so gives an appreciable drop across each bonded joint. On interurban work paint is squirted on the defective joints, which is accomplished automatically, as the car moves at a rate of about 10 miles per hour. He also has his test car fitted up with appliances to make all line equipment and elec-

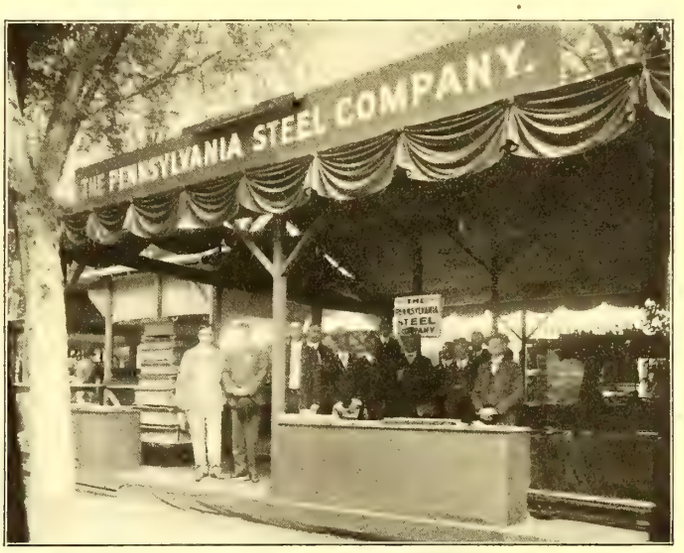


EXHIBIT OF THE PENNSYLVANIA STEEL COMPANY

trolysis tests, and apparatus for making station tests. Since Jan. 1 of this year he has gone over with his car and reported upon the systems of the following companies: Twin City Rapid Transit Company, the Milwaukee Electric Railway & Light Company, including the interurban lines; Toledo Railways & Light Company; Maumee Valley Railway & Light Company; Lake Shore Electric Railway Company; Lorain & Cleveland Railway Company; Sandusky, Norwalk & Southern Railway, and the New Haven roads operated by the Fair Haven & Westville Railroad Company. This includes over a thousand miles of track, forty-two power stations and 600 equipments. He has orders ahead of him for 1300 miles of track. With this car Mr. Herrick is, of course, able to make thorough tests much more cheaply than they could be done by the companies in any other way.



EXHIBIT OF THE AMERICAN CAR SEAT COMPANY

THE CHICAGO PNEUMATIC TOOL COMPANY had a large space, in which an air compressor supplied compressed air to various kinds of pneumatic tools useful in the shop or along the track. The tools shown included hydro-pneumatic punches and presses, using oil worked by compressed air for heavy punching and for pressing off pinions, compressed air jacks, drills, hammers, chisels and riveters. T. Alderson, of New York, together with W. P. Pressinger, Joe Parr and J. Caskey, made demonstrations of the work of the tools.



EXHIBIT OF HAROLD P. BROWN

THE STANDARD STEEL WORKS, of Philadelphia, had H. W. Sheldon as representative.

THE AMERICAN CAR SEAT COMPANY, of Brooklyn, exhibited various types of its push-over and stationary back cross seats, with rattan and plush upholstering. The stationary-back seat is creating interest among railroad officers now, as so many roads operate cars from one end only, that this type of seat is becoming more and more general. The push-over cross seats that were exhibited included several designs. One was a plush-covered seat, with high roll head rest and automatic movable foot rest with side arm. This style of seat is being adopted on high-speed interurban cars. Another type was the rattan upholstered seat, with corrugated back for ordinary street railway service. The principal aim in the construction of the reversible seat is to simplify the mechanical push-over action, and to have as few parts as possible. This seems to have been accomplished, as the action comprises simply a small tilting link or plate of malleable iron, on which the two levers connect, which are used to reverse the seat back. Consequently, the full mechanism consists of three metal parts, including a simple cam movement which locks the seat cushion forward and backward to give it slant. The maintenance cost of these few parts should be very small. This company makes its own canvas-lined rattan webbing for seat covering, which is carefully selected as to strength and color. It imports direct, sweeper rattan, which is furnished both in natural and cut lengths. President Joseph Salomon, who was in attendance, has just returned from a trip to Europe, where he has been looking after this company's export business, which has increased very much during the past year.



EXHIBIT OF THE DUFF MANUFACTURING COMPANY



EXHIBIT OF THE GOLD CAR HEATING & LIGHTING COMPANY

THE TAYLOR ELECTRIC TRUCK COMPANY, of Troy, N. Y., made one of the most extensive truck exhibits to be found on the grounds. The trucks shown were a swing bolster double truck, with 4½-ft. wheel base for outside-hung motors, an extra heavy swing bolster, swivel truck of M. C. B. type, on extra heavy 8-ft. wheel base single truck, a regular 7-ft. wheel base single truck, and an Empire State radial swivel truck. John Taylor, F. M. Nicholl and G. A. Tupper received the numerous delegates who visited this company's space.

THE U. S. CURTAIN COMPANY, of Newark, N. J., exhibited its curtains in the space of H, F. Sanville, of Philadelphia.

WILLIAM HALL & COMPANY, of Boston, manufacturers of brass car fixtures, were represented by J. F. Stout.

FRANCIS GRANGER, of New York, representing the Sterling Electrical Manufacturing Company, and other specialties which he handles, was very much in evidence at the convention. Mr. Granger's long experience in the street railway supply business and his many friends, make his attendance at the conventions a feature pleasant to all those acquainted with his genial and hospitable spirit.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, of Pittsburg, very sensibly confined its exhibit this year to the two things of most interest to electric railway men, namely, the new turret train control and the single-phase alternating-current railway motor. The turret controller, with two motors connected therewith, was here shown for the first time, and was described in a preliminary way in the issue of last week. The single-phase railway motor, it was stated, had been in service several months without sandpapering or turning down the commutator, as it was excellent. If this is a sample of what may be expected in service with this new motor there would seem to be nothing to fear from this heretofore most dreaded trouble with motors of this class. This motor was one built for the Washington, Baltimore & Annapolis Railway. A small army of Westinghouse representatives were present. Those connected with the Westinghouse Electric & Manufacturing Company were: L. M. Aspinwall, N. S. Braden, Paul T. Brady, J. L. Crouse, E. Dryer, H. P. Davis, D. E. Drake, A. F. Elers, T. C. Frenyear, J. R. Gordon, T. P. Gaylord, E. W. T. Gray, E. M. Herr, Arthur Hartwell, J. B. Ingersoll, W. W. Lovell, D. E. Manson, M. M. Murrill, E. D. Mills, W. M. McFarland, C. F. Nudbury, F. B. H. Paine, W. M. Probasco, George W. Pulver, W. S. Rugg, C. W. Register, S. B. Storer, N. W. Storer and Calvert Townley.

WILMARTH & MORMAN COMPANY, of Grand Rapids, Mich., manufacturers of the "New Yankee" twist drill grinder, had a model of one of these grinders on exhibition for the benefit of those master mechanics who have shops large enough to warrant the purchase of a twist drill grinder. Charles E. Meech, secretary of the company, was in charge of the exhibit.

THE PARMENTER FENDER & WHEEL GUARD COMPANY, Boston. George A. Parmenter was on hand at the convention to meet his many customers and friends, and incidentally talk the Parmenter fenders and wheel guards. Mr. Parmenter distributed a neat and handsome pocketbook as a souvenir of the convention.

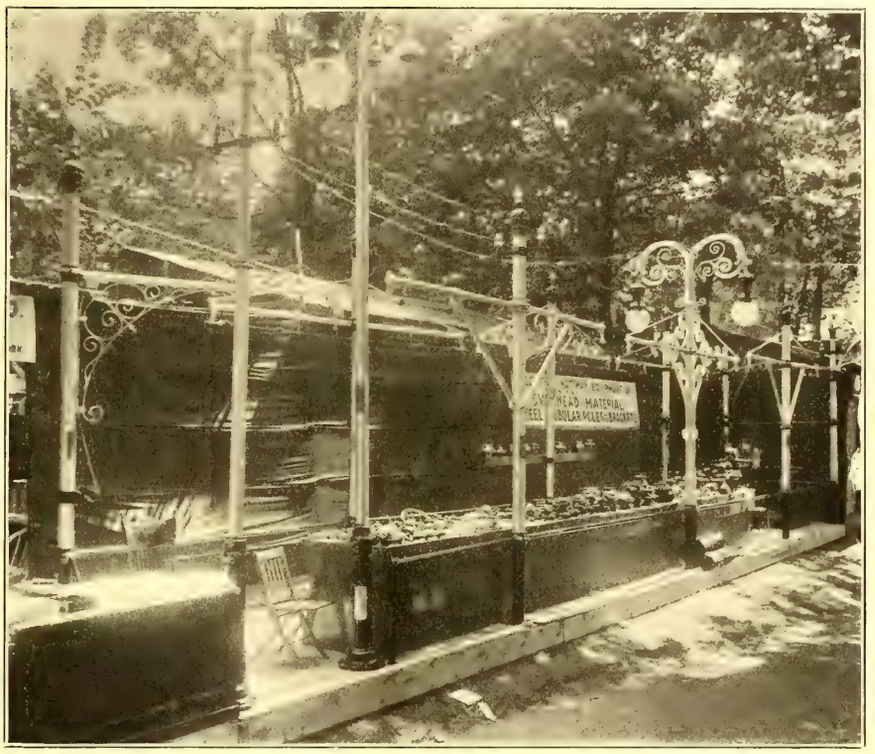


EXHIBIT OF THE ELECTRIC RAILWAY EQUIPMENT COMPANY AND THE ELMER P. MORRIS COMPANY

THE INGERSOLL CONSTRUCTION COMPANY, of Pittsburg, had undoubtedly the exhibit which attracted the most popular attention of any on the grounds. In fact it was the only one intended to attract the general public outside of street railway men, and the way this laughing gallery drew the people was the best recommendation it could have had in the eyes of delegates. The laughing gallery which this company set up had some of the funniest distortion mirrors that human eye ever gazed into. The laughing gallery is only one of the park attractions which this company makes. The figure 8 coaster, a model of which was on exhibition, is one of its most profitable products. The company keeps its amusements of all kinds fresh and up to date, so that the public has something new to look for from month to



EXHIBIT OF THE UNITED STATES STEEL COMPANY



EXHIBIT OF THE DEARBORN DRUG & CHEMICAL WORKS

month. Its attractions are found in parks all over the country, and it is almost as President Ingersoll says: "Time was when street railways made parks; now parks make street railways." The confidence that the Ingersoll Construction Company has in its amusement business is shown by the fact that it both builds and operates coasters, laughing galleries, etc., and is not simply a selling company. The way this exhibit accomplished the desired end of getting favorable attention from street railway presidents and managers is a matter on which the company is to be congratulated. Fred Ingersoll, president; E. E. Gregg, secretary; L. W. Hyde and J. T. Williams were present.

CHARLES F. JOHNSON, of Buffalo, was present in the interest of his large second-hand business.

J. M. JONES' SONS, Troy, N. Y.—This company was represented by J. H. Jones. Being one of the oldest car builders in the country, Mr. Jones naturally met many customers and friends of long standing.

THE MAGNET WIRE COMPANY, of New York, was represented by G. F. Valentine, who was also at the convention in the interest of the New York & Stamford Railway, in which he is largely interested.

THE BRADY BRASS COMPANY, of New York, exhibited a complete line of motor and journal bearings, babbitt metals, solder and trolley wheels. The company was represented by Daniel N. Brady, president; C. P. King and George C. Morse.

THE ROBINS CONVEYING BELT COMPANY, of New York, had in operation on the grounds a complete model outfit of the Robins conveyors, as they would be in a large power house, including Richardson automatic scales. This model used rice instead of coal, which was made feasible by the fact that bridal parties were not common at Saratoga this time of year. Some photographs of recent installations of Robins conveyors were shown by A. B. Proal, Jr., and John Fuller.

N. A. CHRISTENSEN, of Milwaukee, manufacturer of air compressors, was represented by J. E. Eldred, formerly one of the Christensen air-brake salesmen.

THE FALK COMPANY, of Milwaukee, made no exhibit this year, but Otto Falk was in attendance.

THE PENNSYLVANIA STEEL COMPANY showed several pieces of special work with hardened steel centers having cast joints. A frog, with hardened center, for steam railroad and interurban work, was an interesting feature. One decided novelty was the crossing with hardwood centers, which is the invention of C. A. Moreno, chief engineer of the St. Louis Transit Company. This crossing is to be tried at St. Louis, as mentioned in a previous issue of the Street Railway Journal. The "new century" adjustable switch stand, by which the switch point can be adjusted without the use of adjusting nuts by simply adding shims, is also arranged so that the motion of the handle and target to danger does not affect the switch point until the target has moved sufficiently to show red to an approaching car. The company was amply represented by George W. Parsons, superintendent of frog and switch department; Mason D. Pratt, C. W. Reinoehl, Charles A. Alden, R. E. Beiknap, C. E. Irwin, Charles S. Clark, Joseph A. Fitzpatrick and W. C. Cuntz.

THE NATIONAL ELECTRIC COMPANY, successor to the Christensen Engineering Company, was represented by a large corps of salesmen and engineers. It showed an air brake equipment on the exhibit grounds, and entertained in a nearby suite of rooms in the Grand Union. F. C. Randall, general manager of sales, headed the list of this company's entertaining force, assisted by the following salesmen and engineers: J. H. Denton, J. T. Cunningham, J. F. Dixon, Jr., and J. D. Maguire, of New York; W. W. Power and W. H. Goble, of Philadelphia; H. N. Ransom and C. N. Leet, of Cleveland; J. J. Nef, of Chicago; S. I. Wales, of Cincinnati, and J. S. Hamlin, of St. Louis territory; C. G. Burton, of Chicago; W. L. Waters, W. J. Richards and C. D. Knight represented the electrical end of the business.

THE DUFF MANUFACTURING COMPANY, of Allegheny, Pa., as usual, had a fairly representative line of Barrett jacks. Perhaps the most notable was the small, strong emergency jack, with which all the cars of the Pittsburg railways are equipped. A motor armature lift, mounted on wheels, for pit work, was the most prominent feature of the exhibit. A "traversing base," upon which any car jack could be mounted, was shown. By putting this under a jack considerable movement can be had in a horizontal direction. T. A. McGinley and G. A. Edgin formed this company's representation.

THE BEMIS CAR TRUCK COMPANY, of New York, had an extensive truck exhibit, consisting of a No. 51-M. C. B. extra heavy truck; No. 47 heavy interurban truck, No. 45 city and interurban truck and the standard single truck. Those present in this company's interests were D. Gallagher, president; W. S. De Hart, secretary and treasurer; S. A. Bemis, Charles Mead, Thomas F. Carey and George M. Hoadley.

THE G. P. MAGANN AIR BRAKE COMPANY, of Detroit, entertained visitors at its space. Manager E. C. Rutherford, W. K. Omick, superintendent, and J. C. Grace, vice-president, were in attendance.

THE AMERICAN RAILWAY SUPPLY COMPANY, of New York. Mr. Walter Chur was present entertaining the many friends of this company.

E. W. BLISS & COMPANY, Brooklyn, represented by Charles E. Porter and B. W. Stone, exhibited its Projectile-Bliss brand of high carbon steel gears and pinions.

THE STANDARD VITRIFIED CONDUIT COMPANY exhibited single and multiple-duct vitrified clay conduit and third-rail insulators, in charge of W. H. Barnard. B. S. Barnard, president of the company, was also in attendance.

THE PANTASOTE COMPANY, of New York, had an exhibit in the shape of a drawing-room car, equipped with Pantasote curtains, and two revolving seats and two cross seats, upholstered with Pantasote leather. The ceiling of the car was also made of embossed Pantasote, presenting a very handsome appearance.

THE E. P. MORRIS COMPANY made an exhibit of the goods for which it is agent. Mr. Morris himself was, of course, in attendance.

THE RECORDING FARE REGISTER COMPANY, of New Haven, exhibited its new recording fare register, which records on a strip of paper the number of fares collected on each trip. These trip sheets can be made in duplicate or triplicate if carbon copies are desired, and might be substituted for the usual reports entered on a conductor's trip sheet. The company also manufactures trolley wheels, conductors' punches, trolley catchers and cord. M. de Forest Yates, J. M. Hayes, Charles N. Yates and F. B. Kennedy were this company's delegation.

THE IMPERIAL MACHINE COMPANY, of Pittsburg, had a representative in the person of S. B. Whinery.

THE ALBERT & J. M. ANDERSON MANUFACTURING COMPANY, of Boston, exhibited its overhead material, and as a matter of historical interest, to show the progress that has been made since the early days of the electric railway, had some of the earliest overhead appliances used. Besides overhead appliances, several types of third-rail insulators, including one of reconstructed granite, were shown. E. Woltmann, J. R. Eckman and H. F. Sanville represented this company.

L. C. CHASE & COMPANY, of Boston, had a curtain novelty this year in the way of a curtain fixture which releases by pushing instead of pinching. Thus a person taking hold of the bottom of the shade in the most natural way would release the curtain so that it could be shoved up and down. This curtain fixture is very neat, and does not project far from the bottom rod of the curtain. The exhibit included also Chase leather for car seats and curtains. Frank P. Hopewell and William Walden had charge of the exhibit.

C. H. WHALL, of Boston, exhibited his metallic window-casing, which is dust and rattle proof, and reduces the tendency of window sashes to stick.

THE VOSE SPRING COMPANY, of New York, had General Manager Gus Suckow in attendance.

THE STANDARD PAINT COMPANY, of New York, which makes the P. & B. products, which are almost too well known to need comment, made an exhibit of its insulating paints, tape and varnish. P. & B. paint and tape are in use the world over, in all climates, and have a reputation for durability, elasticity and good insulating qualities. One secret of the success of this paint is that it retains its flexibility and does not dry out to the extent that many insulating paints do. One suggestion for master mechanics that this company is making is to insulate motor leads and car wires by wrapping with "Rubberoid" motor cloth and then wind with P. & B. insulating tape." F. F. Van de Water, Charles Ernshaw and N. D. King represented this company.

H. F. SANVILLE, of Philadelphia, dealer in street railway supplies and the agent of a number of prominent manufacturers, made an exhibit.

THE D. & W. FUSE COMPANY, of Providence, R. I., had Secretary W. S. Sisson on hand to meet the trade and agents of this company from various parts of the country.

THE AMERICAN BRAKE-SHOE & FOUNDRY COMPANY, of New York, exhibited its many types of brake-shoes, but gave special prominence to the cast-iron marginal protecting

strip for paving next to the rails in asphalt streets, and thereby cutting down the cost of paving maintenance. This marginal protecting strip has been laid in several cities with gratifying results. The brake-shoes exhibited were the Diamond S, Corning, Lappin, Streeter, and the steel back U shoe.

THE TRACTION EQUIPMENT COMPANY, of Brooklyn, has a new form of car resistance which it exhibited, in charge of George Best and C. V. Rapelje.

THE WESTINGHOUSE TRACTION BRAKE COMPANY exhibited an equipment on the porch of the Grand Union. A large number of its representatives were in attendance, including J. Brooks Clarke, A. J. Brislin, George E. Baker, J. B. Clark, E. H. Dewson, J. R. Ellicott, C. R. Ellicott, F. V. Green, E. M. Herr, G. A. Hagar, P. J. Miller, J. F. Miller, George H. Martin, William D. Ray and H. H. Westinghouse.

THE STANDARD AUTOMATIC LUBRICATOR COMPANY, of Philadelphia, makers of a lubricator which was very favorably spoken of in the discussions at the Mechanical Association conventions, showed its lubricators for motors and car journals. These lubricators feed oil to the bearing by virtue of the vibration of the car and stop feeding when the car stops. They can be applied so as to give oil lubrication on motors built originally for grease, as many companies now use oil instead of grease. G. B. Kirkbride, president, and J. P. Dirkin were in attendance.

THE BRYAN MARSH COMPANY, of New York, had J. P. Williams, special representative, and Guy V. Williams, of Minneapolis, looking after its interests.

THE STANDARD UNDERGROUND CABLE COMPANY made its usual parlor display of cable samples, and was well represented by C. J. Marsh, manager New York office, and Mr. Kimball, of that office; T. E. Hughes, Philadelphia manager; J. E. Pietzcker, of the Chicago office; F. C. Cosby, Boston manager, and T. J. McBride.

THE KEYSTONE CAR WHEEL COMPANY, of Pittsburg, was represented by John Howard Yardley, sales agent of the Philadelphia office.

BALDWIN & ROWLAND SWITCH COMPANY, of South Norwalk, Conn., exhibited their track switches.

W. T. WATSON, of Newark, N. J., had a very attractive exhibit, showing his 1903 type of fender and automatic wheel guard. Both of these devices attracted much favorable comment. As is now generally known, the Watson fender is furnished with two automatic releases and a foot-drop. An important feature of the Watson automatic wheel guard is that it is free from the spring movement or oscillating motion of the car, as it is fitted directly to the truck, being bolted to the pilot-board with four ½-in. bolts, and can be run closer to the rails or street surface than is possible when a gate type of drop or trip is used.

J. G. BRILL COMPANY exhibited several models of its latest trucks. The company was represented by W. H. Heulings, Jr., S. M. Curwen, George M. Haskell, George H. Tontrup, C. K. Pickles and J. E. Brill.

CROCKER-WHEELER COMPANY, Ampere, N. J., was represented by Charles W. Startsman, sales department, Ampere, N. J.; F. B. De Gress, manager New York office; S. Russell, manager Philadelphia office; R. N. C. Barnes, manager Boston office. The company distributed a special bulletin on street railway generators and gave away handsome souvenir match safes.

THE RAILWAY STEEL SPRING COMPANY, of New York, exhibited all classes of its springs. In the center of the booth was displayed a nickel-plated, full-size elliptical spring, which attracted a great deal of attention. There were also displayed nickel-plated spiral springs in small sizes and heavy spiral springs for truck construction. A. S. Henry, F. C. McLewee and D. S. Roche represented the company.

THE HAM SAND-BOX COMPANY, of Troy, N. Y., was represented by the Stuart-Howland Company, of Boston, the Sterling-Meaker Company, of Newark, N. J., and the Recording Fare Register Company. Its exhibits consisted of trolley-catchers, trolley retrievers and an adjustable trolley harp to prevent wear of trolley wheels and overhead wires on curves. This harp attracted much attention.

W. A. WOOD & COMPANY, of Boston, manufacturers of oil specialties, were represented by George W. Brown. This company is preparing to place on the market a new journal box, which will soon be heard from.

THE REVOLVING RAILWAY SANDER COMPANY, of Toronto, exhibited a sand box possessing novel and interesting features. The company was represented by B. B. Jenkins and G. Stevenson, who explained the merits of the device to many electric railway managers and master mechanics. The sander has been given a thorough trial in Toronto and other cities, and the success of the company seems assured.

THE FOREST CITY ELECTRIC COMPANY, of Manchester, England, was represented by W. A. Neff, whose many American friends were glad to welcome him. Mr. Neff is spending a few weeks in the United States and Canada, and reports the continued success of the Protected rail-bonds in Europe.

THE POWELL & TURNER TRUCK COMPANY, of Troy, N. Y., was present in the person of A. Fairweather, secretary. In addition to the Powell electric car truck, the company is putting on the market an emergency brake, and also a roller bearing possessing interesting features.

THE AMERICAN WOOD FIRE-PROOFING COMPANY, of New York, was a newcomer at the convention, being represented by Samuel A. Clark, treasurer. The obvious need of better protection against fire in the construction of car bodies should make an excellent market for the fire-proof wood which this company is now prepared to furnish.

PRATT & LAMBERT, the well-known varnish house, was represented by Joseph Maycock, of the Railroad Department. Through the excellent quality of its varnishes, and the enterprise of its officers in New York, Buffalo, Chicago, London, Paris and Hamburg, the name of Pratt & Lambert has attained an enviable international reputation.

THE UNI SIGNAL COMPANY, of Cambridge, Mass., exhibited its signal system. It had in actual operation a complete block, illustrating the workings in every detail. There are improvements in certain respects on this system over those of a like nature on the market, which ought to appeal to the progressive railway manager. The company was represented by C. F. Hopewell, general manager, and Professor Charles H. Morse, consulting engineer.

THE BARBOUR & STOCKWELL COMPANY, Boston, Mass., was represented at the convention by F. F. Stockwell. Mr. Stockwell entertained his many customers and friends with liberal hospitality. A neat souvenir in the shape of a measuring tape was distributed by Mr. Stockwell.

THE NATIONAL LOCK WASHER COMPANY, of Newark, N. J., exhibited its lock washers and the curtain fixtures manufactured by it.

THE WESTERN ELECTRIC COMPANY was represented by R. M. Campbell, of New York, and R. H. Harper, of Philadelphia, in the interest of Electrose overhead material. The Western Electric Company is exclusive selling agent of this well-known line of overhead material. It also handles in the East Stornbaugh guy anchors, manufactured by W. N. Matthews & Bro., St. Louis, Mo.

THE STANLEY ELECTRICAL MANUFACTURING COMPANY, of Pittsfield, Mass., showed a large interurban truck equipped with two S. K. C. 402 motors. One S. K. C. 401 motor was also exhibited, showing the careful and thorough construction in every detail employed by the Stanley Company. One improvement of great value is the thorough ventilation of the motor. Under the severest ordinary service this motor cannot get overheated. This fact has been thoroughly established by suburban roads in Pittsfield and vicinity which have used the Stanley motor for the past two years. The company also had on exhibition two S. K. C. 2 controllers, which are described in detail elsewhere in this issue, trolley stands, switchboards and car circuit breakers. S. T. Dodd, M. C. Canfield, H. R. Wilson, R. H. Hamlin and George C. Robb were present at the convention.

JOHN STEPHENSON COMPANY, of Elizabeth, N. J., was represented at the convention by E. J. Lawless, David Moffett, Thomas F. Carey and J. A. Hanna. The company made no exhibit.

THE WM. HALL COMPANY, of Boston, Mass., was represented at the convention by J. F. Stout.

NORMAN McCARTY attended the convention in the interest of the American Diesel Engine Company. This company is now prepared to bid for contracts in the street railway field for engines up to 500-hp. Considering the enormous economy and small cost of operating the Diesel engine, it ought to appeal to every railway manager who has the interest of his stockholders at heart.

THE force of habit brought to the convention John S. Bradley, F. C. Boyd and Willis Anthony, of the old New Haven Car Register Company, which recently sold out its business to the International Register Company, of Chicago, Ill.

THE ELECTRIC MOTOR & EQUIPMENT COMPANY, of Newark, N. J., furnished several electric signs, including the large STREET RAILWAY JOURNAL sign which was placed over the door leading into the convention hall, and adjoining the STREET RAILWAY JOURNAL booth. The Electric Motor & Equipment Company is to be congratulated on the artistic character of its work at the convention.

M. A. SINGER, of New York city, was the designer and builder of many of the booths in the court, and on the veranda of the Grand Union Hotel. Mr. Singer's long experience in work of this kind enabled him to handle this work in a manner which gave general satisfaction.

THE SAFETY CAR STRAP COMPANY, of New York, had on exhibition its recently patented Y-shaped safety strap. Judging from the interest displayed by the delegates at the convention this strap ought to find a ready sale on all progressive roads. The company was represented by Mr. Myers.

S. B. CONDIT, JR., & COMPANY, Boston, Mass, were represented by S. B. Condit, Jr., in the interest of his switches and oil circuit breakers and general heavy current switchboard work. Mr. Condit distributed a very handsome souvenir in the shape of a neat pocket knife.

THE LUMEN BEARING COMPANY, of Buffalo, N. Y., exhibited its motor, truck and journal bearings, ideal trolley wheels, and alpha bronze check plates. Considerable interest was manifest among the delegates in examining the goods displayed by this company, especially its special composition motor bearings, as well as the neatness and general appearance of the devices on exhibition. The company was represented by E. P. Sharp, manager of sales.

THE ELECTRIC CABLE JOINT & APPLIANCE COMPANY, New York, distributed neat folders describing its electric cable joint. The company was represented by W. M. Murphy.

EUGENE MUNSELL & COMPANY AND THE MICA INSULATOR COMPANY, of New York and Chicago, were represented by Charles E. Coleman, the energetic and enterprising manager of the Chicago house. The exhibit, which consisted of micanite rings, segments and empire cloth, and their other lines of installation was located at the left of the main cross aisle in the booth with the National Carbon Company. Samples of their material was freely distributed among the visiting delegates, and at all the writing desks of the hotels very attractive blotters were very much in evidence.

THE UNITED STATES ELECTRIC SIGNAL COMPANY, of West Newton, Mass., exhibited its signal system, which has been in use for several years. A complete block of the system was shown illustrating the workings of the system in detail. It is interesting to note that a great many street railway systems are equipped with this system, and that it has so far done most of the block-signal business in the street railway field. J. H. Nickerson, H. G. Root and J. J. Ruddick represented the company at the convention.

THE CLEVELAND FROG & CROSSING COMPANY, of Cleveland, Ohio, was in evidence through G. C. Lucas, general manager.

THE AMERICAN ELECTRICAL WORKS, of Providence, R. I., was represented by W. J. Watson, the New York sales agent of the company. The general hospitality of Mr. Watson was much enjoyed by his many friends.

THE GOULD STORAGE BATTERY COMPANY, New York, had on exhibition plates of the Gould storage battery. The booth was attractively decorated with large, clear photographs of some of the many large installations for street railways which it has recently made in various parts of the United States. Some of the largest and most important street railway installations in this country have recently been furnished by the Gould Storage Battery Company. The photographs displayed by this company were carefully examined by railway men at the convention, and judging from expressions made by some of them who are not users of storage batteries, they evidently gave them food for thought. The company was represented at the convention by W. W. Donaldson, sales manager, and E. L. Draffen.

THE AMERICAN AUTOMATIC SWITCH COMPANY, of New York, exhibited an automatic switch.

THOMAS F. CAREY, of Boston, Mass., was present at the convention in the interest of his varied business. Mr. Carey represents the John Stephenson Company, Bemis Car Truck Company, and the snow plow department of the Wason Manufacturing Company, in Boston and the East. Mr. Carey also deals in all classes of heavy second-hand equipments for street railways.

GILES S. ALLISON, 57 Broadway, N. Y., unfortunately, was not able to be present at the convention, owing to serious illness. He was, however, well represented by H. C. Donecker, of St. Louis, and D. J. Fitch, of New York. A street railway convention without the presence of Colonel Allison is an unusual occurrence, and the absence of the "genial Colonel" was widely commented upon.

THE GEORGE W. KNOWLTON RUBBER COMPANY, of Boston, had an interesting display of its rubber specialties. The company was ably represented by D. B. Wakelee.

BULLOCK ELECTRIC MANUFACTURING COMPANY, of Cincinnati, had the largest single electrical exhibit at the convention, this being one of five rotaries for the Scioto Valley Railway Company's power plant at Columbus, Ohio. It is a handsome machine, receiving three-phase current and delivering 400-kw direct current at 600 volts. It is six-pole, about 9 ft. high, and slightly over 10 ft. square at base. The order for these includes three 1000-kw, three-phase generators, as well as step-up and step-down transformers. The exhibit was in charge of R. T. Lozier, general sales agent; G. B. Foster, W. S. Arnold, A. E. Foote and C. Van Deventer.

ROSSITER, MACGOVERN & COMPANY had a large space on the lawn fitted up with a booth and replete with electrical apparatus, and occupied also one of the cottages in the annex, where a hospitable welcome was extended to all comers. A number of motors were shown, open for inspection, as well as armature and field coils, and commutators, including one of 750 kw, just finished for the Brooklyn Rapid Transit Company. The exhibit was directed by Frank MacGovern, vice-president and general manager, whose staff comprised Messrs. R. J. Randolph, J. A. Peirce, C. J. Macdonald, J. W. Archer and several other efficient men. A neat pamphlet of Rossiter-MacGovern plants was distributed and was in great demand.

THE COLUMBIA MACHINE WORKS & MALLEABLE IRON COMPANY, of Brooklyn, was represented at the convention by its president, J. G. Buehler. Mr. Buehler, with his original and genial ways, is always a welcome guest among his hosts of friends from all parts of the country. W. R. Kerschner, second vice-president, from Allentown, Pa., was also present at the convention.

THE PECKHAM MANUFACTURING COMPANY, of Kingston and New York, had one of the largest and most tasteful booths at the Saratoga Convention. As its exhibit was located on the main walk from the hotel to the convention hall, and as the apparatus shown was of great interest, the exhibit attracted wide attention. Mr. Peckham this year devoted his exhibit principally to his new line of M. C. B. trucks, of which three types were shown. The first of these was the No. 36B, which is intended for high-speed service with medium weight of cars. The second type of M. C. B. trucks in the Peckham exhibit was the No. 40, called by Mr. Peckham his "standard" high-speed truck, while the third type was the No. 46, or "extra strong." All three of these trucks are equipped with the patent combination side frames, double roller side bearings, flexible motor suspension, Taylor's patent non-chattering brake hangers, and other features which made these trucks popular in interurban railway work. Mr. Peckham also showed his No. 14 B 3 X short-wheel base truck, which has been adopted on a large number of city and suburban roads, and which is well known to railway managers and delegates to the conventions. The Peckham Company had a large number of representatives present, who were kept busy explaining the special merits of the different trucks to those in attendance. They included Mr. Peckham, president of the company; E. G. Long, G. H. Bowers and Wm. M. Wampler, of the New York office; Messrs. Hanna and Richards, of the Cleveland office; Arthur W. Field, of the Boston office, and Messrs. Wilkinson and Riley, from the works at Kingston. The company also had at the convention its new catalogue, which describes the full line of Peckham trucks, and which was one of the most complete, as well as tasteful, catalogues at the convention. All of the typographical work issued by this company is of a superior grade, and the catalogue this year forms no exception to the rule.

E. P. ROBERTS & COMPANY, of Cleveland, Ohio, were represented by William C. Andrews, of New York, their Eastern representative. This well-known firm of consulting engineers has recently completed work on the Northern Texas Traction Company now operating between Fort Worth and Dallas, and is now building the Dayton & Muncie and Muncie, Hartford & Fort Wayne roads, and is acting as engineers for a number of other properties. Mr. Andrews states that the company has a number of prospective enterprises in its office for which it will do the entire electrical, mechanical and civil engineering.

THE ELLIOTT BROTHERS ELECTRIC COMPANY, of Cleveland, made an attractive exhibit, and was represented by W H. Elliott, manager, who explained his company's facilities for handling dynamo and motor repairs, including armature and field rewinding, commutator building, etc.

MR. E. F. DE WITT was on deck as usual, making new converts to the De Witt sand box.

MESSRS. GEORGE S. HASTINGS & COMPANY, of Cleveland, who are doing such an enviable business in electric railway supplies, were represented by Mr. Hastings himself.

THE many friends of W. R. Kerschner, of Allentown, were glad to welcome him on his return from a sojourn in Europe. They were also glad to learn that Mr. Kerschner's trip abroad has resulted in a considerable improvement in his health.

THE ELECTRIC RAILWAY EQUIPMENT COMPANY, of Philadelphia, was represented by A. S. Vane, president; M. Herman Brill, vice-president, and W. H. Heulings, Jr., secretary and treasurer.

MESSRS. WENDELL & MacDUFFIE were present in the persons of Jacob Wendell, R. L. MacDuffie and C. A. Hayden.

THE UNITED STATES STEEL COMPANY, of Everett, Mass., exhibited the Neal duplex brake and Jupiter steel castings. The advantages of the brake and castings were explained by William E. Reid, mechanical engineer, and L. H. Miller, of the steel department.

THE ST. LOUIS CAR WHEEL COMPANY was ably represented by J. L. Butterfield, general sales agent, and John Jay Morse, treasurer.

WARREN M. POORMAN, of Boston, through whose efforts the varnishes manufactured by McCaskill, Dougall & Company, of Montreal, are being so extensively introduced on street railway systems in the United States, was present in person, and distributed cards setting forth the merits of his goods.

MESSRS. J. G. WHITE & COMPANY, of New York and London, were represented by J. G. White himself.

THE CHICAGO CAR WHEEL & FOUNDRY COMPANY was represented by A. A. Hilton, vice-president and manager.

THE GENERAL ELECTRIC COMPANY, of Schenectady, made no regular exhibit, as its works at Schenectady were so near, and were made particularly available through the special excursion to the works which the company tendered to the Associations on Thursday afternoon. The company had, however, headquarters on the grounds in a spacious booth, which was attractively decorated by palms and other plants, and illuminated at night.

T. G. SEIXAS, of the Philadelphia Electric Company, Philadelphia, Pa., was a guest at the convention of the American Street Railway Association. Mr. Seixas greatly enjoyed a visit to the works of the General Electric Company, at which place he had the pleasure of seeing many of his old friends and associates, he having been with the original Edison Machine Works at Schenectady in the early days.

H. A. NEALLY, of the paint department of the Joseph Dixon Crucible Company, looked after the interests of his company at the Saratoga Convention. Mr. Nealley was sought after by a great many people, who desired to secure one of the very unique pencils given away by him as a souvenir. The pencil contained lead at one end, and rubber at the other, which was a perfect imitation of a pencil, and fooled every one who tried it. Mr. Nealley also distributed among the railway men a circular descriptive of the colored paints made by his company. It is needless to say that if Mr. Nealley attends future street railway conventions, and gives away souvenirs that will be appreciated as much as the above-mentioned pencil, he will always be a center of attraction.

THE STANLEY NO. 2 CONTROLLER

The Stanley No. 2 controller, which was shown for the first time at the Saratoga Convention, differs radically from the other controllers on the market both in details of construction and in the combinations which it effects with the motors.

The interlocking arrangement between the main cylinder and the reverser cylinder does not depend upon the usual cam movement. Instead each cylinder carries a flanged disc with slots cut in its flanges. These flanges intermesh so that the main cylinder can be revolved only when the reversing cylinder is in the proper position, and vice versa. The arrangement of the magnetic blow-out is also novel. The magnet for the blow-out is provided with long pole pieces which are within the stationary horizontal partitions separating the controller contacts. These pole pieces produce a perpendicular magnetic field at each contact piece, with the result that the arc is always blown out horizontally. The separating partitions are removable and, in fact, are supported on the pole pieces of the magnetic blow-outs and are also held by spring clips.

An ingenious attachment to the controller prevents the necessity of opening the casing in order to cut out one motor. The motors are cut out by means of a switch connected with a short horizontal shaft projecting through the side of the controller casing. This shaft is turned by the reverser handle, which has to be removed for this purpose. As it can be taken off the reverser cylinder only when the latter is in the right position and the main controller is off, there is no danger of throwing either motor cut-out switch with the current on.

The connections of the motors effected by the controller are not the same as those of the ordinary series parallel controller, and instead of two, as in the latter, the new controller has five running points. This is secured by running a lead to the middle of each motor field and thus securing combinations between half fields on each motor. The actual combinations used are as follows: In the first position, the current is led first through a resistance, then through armature No. 1, field No. 1, field No. 2 and armature No. 2 to ground. In the second and third positions the resistance is cut out until at the fourth position the motors are running in series with the fields connected directly to each other, in the order stated above. In position 5 the end terminals of each field farthest away from its armature are connected to the mid-lead of the other field, so that each motor runs on a three-quarter field. In position 6 there is only one connection between the motors, that between the middles of the two fields, so that each motor runs on a half field. In position 7 the mid-field lead of each motor is connected to the outside brush of the armature of the other motor so that the two armatures are in parallel together with half of their respective fields, while the other halves of the fields are in series with this combination. This gives a three-quarter field strength for each motor, with armatures in parallel. In position 8 the two motors are in straight parallel.

The special feature of the connections is that the motors are very easy in acceleration, as there is no cutting out of blocks of resistance, but rather a shifting of the motor equipment from one characteristic curve to another until the required speed is attained. Although, as described, the combinations seem somewhat complicated, a small amount of wiring only is required, consisting of five wires to each motor, viz., two armature wires, two field wires and one mid-wire. The controller was shown at Saratoga applied to two S. K. C. 402 48-hp motors mounted on a truck, and the motors were started and run on the different position points and different motors were cut out to illustrate the combinations possible.

PROPOSED ASSOCIATION OF SUPPLY MEN

A meeting of the street railway supply men exhibiting at the Saratoga Convention was held on Friday, Sept. 4, in the meeting room of the Street Railway Accountants' Association at the Grand Union Hotel. The meeting was called to order at about 1 o'clock by O. W. Johnson, general manager of the Johnson Wrecking Frog Company, who explained that the object was to form an organization of the manufacturers of and dealers in street railway equipment and supplies who attend the annual meetings of the American Street Railway Association and its allied associations. Daniel M. Brady, president of the Brady Brass Company, then made a short speech, in which he described the organization and methods of a similar association which conducts entertainments and arranges for exhibits in connection with the conventions of the American Railway Master Mechanics' Association and the Master Car Builders' Association. After discussion as to the best method of proceeding, W. J. Cooke, vice-president and general manager of the McGuire Manufacturing Company, of Chicago, was by motion appointed temporary chairman, and Cornell S. Hawley, of the Consolidated Car Heating Company, of New York, temporary secretary.

J. G. White, of J. G. White & Co., then moved that an organization of electric railway supply men be formed and that W. J. Cooke, vice-president and general manager of the McGuire Manufacturing Company, Chicago, chairman; Daniel M. Brady, president of the Brady Brass Company, New York; Scott Blewett, of the American Car & Foundry Company, St. Louis, Mo.; James H. McGraw, president of the STREET RAILWAY JOURNAL, New York, and F. S. Kenfield, president of the Street Railway

Review, Chicago, be constituted an executive committee, to which they shall add four other representative supply men; that the full committee of nine as thus appointed confer with the executive committee of the American Street Railway Association and other committees representing those who may have interest in this question, and that the executive committee have full power to establish a permanent organization, to decide upon the name of the association and to arrange for all such matters affecting the interest of the association as may seem desirable. The motion was carried unanimously. There was some discussion on the name of the association, but decision on this point was left to the discretion of the executive committee.

TWENTY-FIRST ANNUAL MEETING OF THE NEW YORK STATE STREET RAILWAY ASSOCIATION

The twenty-first annual meeting of the New York State Street Railway Association will be held at the Yates Hotel, Syracuse, Tuesday and Wednesday, Oct. 6 and 7, 1903. This meeting has been called a month later than usual because the American Street Railway Association held its convention this year during the early part of September, which is the time when the New York Association usually convenes. In view of the change of date and the large attendance and great interest manifested in the American Street Railway Association, the executive committee of the State Association appreciates the necessity of an even more determined effort than it has put forth heretofore to secure the desired large and representative attendance of both street railway and supply men.

An unusually interesting meeting is anticipated. Numerous papers upon important street railway subjects will be presented and topics of general interest and profit to street railway men will be thoroughly discussed. In addition to the interesting and profitable features of the meeting a splendid programme of entertainment (including the annual dinner on Tuesday evening, Oct. 6), has been arranged by the local committee.

The Association is very desirous to have a large attendance, and wishes to have it plainly understood that supply men are particularly invited and will be tendered a cordial welcome.

The following list of topics for papers and discussion speaks well for the activity of the committee, and should help to make the coming meeting very successful:

"Care of Dynamos."
"Street Railway Taxation."
"Electrically Welded Joints."
"Street Railroads vs. State."
"Receipts from Other Sources."
"Transfers—Their Use and Abuse."
"Points on Overhead Construction."
"Long Distance Power Transmission."
"The Care and Maintenance of Fenders."
"Suggestions on Financial Organization."
"The Inspection and Care of Brakes."
"Reading and Club Rooms for Employees."
"Care and Inspection of Wheels and Axles."
"Signal Systems for Single Track Roads."
"Maintenance and Repair of Car Bodies."
"Pleasure Resorts as Traffic Stimulators."
"Suggestions for Report Blanks and Forms."
"The Selection and Management of Employees."
"Effect of Interurban Service on Small Towns."
"Track Bonding."
"Car Mileage Record."
"Rotary Transformers."
"The Modern Power-House."
"Power Brakes for Electric Cars."
"Employees' Benefit Associations."
"Low Joints—How to Prevent Them."
"Prevention of Accidents."
"Electrolysis."
"Care and Inspection of Motors."
"Municipalities vs. Street Railroads."
"Economical Maintenance of Boiler Room."
"How Can We Increase the Efficiency of Employees?"
"Hints on Making Small Electric Railroads Profitable."
"Store-Room Accounting and the Distribution of Supplies."
"How Can We Enlarge the Field and Scope of the Association?"
"Practical Experience with Double-Deck and Semi-convertible Cars."
"Economical Production of Steam."
"Electric Lighting by Street Railways."
"Steam Railroad Crossings or Right Angle Crossings of Electric Lines" (Allotted).
"Repair Shop Methods" (Allotted).
"Hydraulics in Connection with Street Railway Operation" (Allotted).
"Track Construction and Maintenance" (Allotted).
"Accounting and Way-billing on Trolley Express Lines" (Allotted).
"Despatchers' Duties and Electric Signals" (Allotted).
"Methods of Discovering Fraudulent Claims for Injury" (Allotted).
"Physical Examinations in Accident Cases" (Allotted).
"Track Drainage—Interurban Roads."
"Steam Turbines."
"Single and Double Trucks—Their Advantages and Disadvantages."
"The Sub-station."
"Physical Examinations as Aid for Trial Counsel" (Allotted).

In addition to the papers allotted and selected from above list of topics, there will be an allotment of sub-topics and ensuing general discussion upon the following practical subjects suggested by H. H. Vreeland:

"Interurban Service" (divided into three heads), (a) Standard Equipment, (b) Car Despatching, (c) Standard Methods of Fare Collection and Ticket Taking.

"Extra Freight and Baggage Service on Interurban Lines" (divided into three heads), (a) Traffic Arrangements with Steam Roads and Boats, (b) Traffic Arrangements with Other Interurban Lines, (c) Development of Freight and Express Service.

In pursuance of the suggestion of the Board of Railroad Commissioners of the State of New York, there will be a general discussion of the following timely topics:

"The Advantages and Disadvantages of Oil Tail Lights for Interurban Cars."

"Street Car Controllers—Their Proper and Improper Operation."

All street railway representatives are earnestly urged to come prepared to participate in the discussion of the above important subjects as outlined.

DEVELOPMENT OF ENCLOSED FUSE PROTECTIVE DEVICES

Probably no recent development in electrical construction devices has met with more rapid advancement and success than the so-called enclosed fuse, which is to-day supplanting nearly all forms of open fuse protective devices. Actual commercial exploitation was begun but five years ago; yet to-day the enclosed fuse has been accepted almost universally and is to-day being demanded by the Underwriters,—and in fact it finds a place in almost every new plant. At first it was thought that the increased cost of the necessarily more expensively constructed enclosed fuse device would to a great extent prohibit the universal application of this meritorious protective device, yet it was soon found that the many advantages accruing from the use of enclosed fuses warranted the additional expenditure.

The development of enclosed fuse protective devices is somewhat noteworthy, as their application has been almost universal, not only to ordinary interior work, but for street railway motor protection, transformer protection, switchboard work, and a multitude of other service. The Sachs "Noark" enclosed fuse, marketed by the H. W. Johns-Manville Company, sole agents, was one of the pioneers in the enclosed fuse field. The basis for the development of this now well known protective device began more than a dozen years ago. The original Sachs patent of 1894 is claimed to be the first showing the modern form of constructing enclosed fuses.

The variety of styles and types of enclosed fuse protective devices marketed by the above-mentioned concern is exceedingly extensive and covers almost every branch of electrical service. It is also of interest to note the large ampere sizes to which these fuses have been developed on the various voltages in common use. Recent tests made of Sachs "Noark" fuses on a 4000 amp. hour storage battery at 250 volts have demonstrated the entire efficacy of fuses whose normal carrying capacity was 400 amps. at 250 volts (100,000 watts). These fuses were short-circuited dead on the terminals of the battery and operated absolutely without smoke, flash or any demonstration whatever, yet indicating upon the exterior of the tube their interior condition. Larger sizes are also being developed, and it is expected that they will be furnished up to 1000 amps. in the near future. As a circuit-rupturing performance, the opening of an enclosed fuse capable of carrying 500 or 600 amps. at 250 volts absolutely without any external demonstration or explosion whatever, and without in any way affecting the integrity of the tube or external structure, is certainly noteworthy.

FINANCIAL INTELLIGENCE

WALL STREET, Sept. 9, 1903.

The Money Market

The recent incident of the greatest interest for the money market was the official announcement from Washington that Secretary Shaw would use, in case of need this autumn, the surplus treasury moneys, amounting to about $40,000,000, to add to the bank deposit fund. Various interpretations have been placed upon this proposal, but in banking circles only one opinion is expressed. The Secretary clearly means to come to the relief of the market only in case there is no other way to prevent a serious money stringency. He does not propose to make the treasury surplus available for a fresh Wall Street speculation, but, on the contrary, Wall Street liquidation on a more or less extensive scale would probably have to be tried before the treasury funds would be placed at the market's disposal. What the Washington authorities particularly want to be sure of is that there will be plenty of money this autumn for all legitimate needs. The present bank surplus reserve—$17,000,000—may be adequate, but if it is not, and if gold cannot be imported readily from abroad then the treasury proposes to stand by and help out the mercantile community. That this action is felt to have a practical significance is made clear by the quick decline in rates for time money, which followed the first news of the treasury offer two weeks ago. Previous to then it was difficult to obtain five and six months' loans at 6 per cent; now 5½ per cent is the ruling figure on this class of business, and loans are comparatively easy to negotiate. Rates for call money and for the short-time options continue rather low, the same as they have been for some time past. The average call rate is 2 per cent, and for sixty-day money 4½ per cent. Regarding the likelihood of gold imports this season the chances have been diminished somewhat by recent developments. A heavy and protracted drain from Egypt, Germany and other parts of Continental Europe has caused the holdings of the leading foreign banks to fall below what is considered a prudent average at this period of the year. Partly under this pressure and partly with a view to future demands from America the London market has taken some sharp measures to protect itself, and to make the process of withdrawing gold a difficult one. The price of the metal has been forced up by successive stages, thereby raising the premiums which the foreigner must pay for it. More to the point still, the Bank of England last Thursday took the unusual course of jumping its discount rate from 3 per cent to 4 per cent, a month at least ahead of similar moves in former autumns. The Bank is following up this step by borrowing heavily, with a view to diminishing the outside supply of lendable capital, and thereby bringing the market within its control. All this means, so far as our money situation is concerned, that drawing gold from Europe this fall will be a much more difficult operation than seemed probable a month ago. The exchange market has already reflected the altered condition rather notably by advancing 1¼ cents in the pound above the August low level. To sum up the most obvious facts of our money market in one conclusion, the Treasury tender of relief and the foreign exchange position promise either separately or combined to prevent any real stringency during the next few months. But neither of these palliatives would come into operation soon enough to prevent a fairly considerable rise in interest rates from the present level.

The Stock Market

The course of the general stock market from day to day confirms the opinion expressed some time ago that the larger financial interests are content that Wall Street speculation should be left to take a good rest. The market is intensely dull, with prices moving in a narrow range, and with nine-tenths of the business supplied by the professional operations on the floor of the Stock Exchange. Indeed, what has been witnessed for the past two weeks has been simply a succession of petty movements, first in one direction, then in another, with the advantage possibly in favor of a rise, but with certainly no settled upward tendency. Speculative circles are simply enjoying a breathing space. Liquidation is over, many people believe for good, but investment buyers are so extremely cautious, what between the unsettled crop outlook and the money market uncertainties, that there is no substantial support for any operations designed to effect a higher price level. The best news that has come to hand recently was the Government report, issued last week on cotton. It showed that not only is the area under cultivation the largest on record, but that the condition of the crop is far above the average for the season. These circumstances have suggested so forcibly the probability of a record-breaking cotton harvest this autumn that it is small wonder that they have completely knocked out the underpinnings of the recent bull speculation in the staple, causing a severe reaction in prices. These events have a large meaning for the general financial situation. But, like other favorable factors, such as the excellent statements of railway traffic, their influence seems likely to be postponed until the corn crop is out of danger, and until a better measure can be taken of the season's requirements in the money market. Continuation of the present dullness and narrow price fluctuations for a while longer at least seem to be the most logical course of things.

The transfer of the Kuhn-Loeb holdings in the Metropolitan Securities Company to what is known as the Ryan-Whitney syndicate caused quite a stir in the local traction share market when the news was first published, ten days ago. Various opinions have been expressed as to the motive beneath this transaction, but the latest statement issued by Mr. Ryan seems to make it clear that the exchange of holdings was purely voluntary, and that there is no basis for the sinister talk that Kuhn-Loeb & Company forced the sale by claiming that the situation in the Metropolitan Street Railway Company had been misrepresented to them. On the Stock Exchange both Metropolitan Street Railway and Metropolitan Securities shares advanced rapidly when the operation was first announced. A sympathetic rise also took place in Brooklyn Rapid Transit and Manhattan on the idea that the Metropolitan stock transfer might be one of the parts in a grand scheme of traction consolidation. The several movements, however, proved to be entirely speculative, and when the trouble became known the stocks concerned quickly receded to their former level.

Philadelphia

Prices have altered very little in the Philadelphia market for some time past. The undertone continues strong in all classes of securities, but in the absence of developments affecting individual properties and in the apathetic state of the general market, there is little business doing. Philadelphia Company common has been the most active stock on the list, but for a fortnight past it has not swung beyond a one point range, from 40 to 41. The preferred stock is unchanged, at 43¾. Union Traction sold down from 44⅞ as low as 43½ at one time, then recovered to 44. Philadelphia Traction was strong, at an advance from 95¾ to 96. Rapid Transit on a renewal of pool operations rose as high as 14½, then fell back to 14. Other recent sales of note include Consolidated Traction, of New Jersey, at 60, Railways General at 3, American Railways at 46, Reading Traction at 30, Chicago Union Traction at 5½, and Union Passenger Railway, of Philadelphia, from 235 to 238.

Chicago

This is a very stupid time in the market for Chicago traction stocks. Announcement has already been made of the fact that the so-called minority committee of Lake Street Elevated appointed by the stockholders last June, now has an actual majority of the stock in hand. It is expected that a reorganization plan will be drawn up some time this month, with a fair chance that all the various interests in the property will come together on a harmonious basis. In this hope the stock has held well in the market, but with few trades between 6 and 6¾. The only other transactions reported during the last two weeks include Northwestern Elevated common at 22, City Railway at 170, West Chicago 5 per cent bonds at 97, Metropolitan Elevated common at 21, the preferred from 61½ to 59½, and South Side at 96. All lines are making good traffic returns. The Metropolitan has about completed its new coaling station on the Belt Line and Forty-Sixth Street, and the only remaining construction work is the downtown terminal, which, owing to the difficulty in obtaining structural material promptly, will probably not be completed during the present calendar year.

Other Traction Securities

Trading is practically at a standstill in Boston, so far as traction securities are concerned. As an instance of the prevailing dullness less than a thousand shares of Massachusetts Electric

common—ordinarily a very active stock—have changed hands during the past week. Prices are barely changed at all from what they were a fortnight ago. Massachusetts Electric common has sold between 22 and 21½, the preferred from 81 to 79¾, Elevated from 137½ to 138, West End common from 89½ to 89, and the preferred at 110. In Baltimore only one or two transactions have occurred in the traction department, outside of United Railways issues, which have held their prices well, but which have shown no tendency to advance. Recent sales of the stock are recorded between 10¾ and 11, the income bonds at 63½, and general 4s "ex" semi-annual interest of 2 per cent at 90¾. Sales are also reported in Lexington Street Railway 5s at 100 and Atlanta Street Railway 5s at 104¾. On the New York curb the traction sales during the last ten days might be enumerated on the fingers of both hands. Interborough Rapid Transit, after selling at 98⅛, fell to 96½. New Orleans common sold at 11⅛ for 200 shares. Three hundred St. Louis Transit went at 18¼ to 18. Washington Traction & Electric common sold at 11 for 100 shares, while the general 4s changed hands at 73.

Security Quotations

The following table shows the present bid quotations for the leading traction stock, and the active bonds, as compared with last week:

	Closing Bid	
	Aug. 18	Sept. 8
American Railways	46½	45
Aurora, Elgin & Chicago	b17½	a20
Boston Elevated	137	137
Brooklyn Rapid Transit	47¾	43¾
Chicago City	160	170
Chicago Union Traction (common)	5	4½
Chicago Union Traction (preferred)	25	30
Cleveland Electric	b72	a73
Columbus (preferred)	—	100
Consolidated Traction of New Jersey	61	58
Consolidated Traction of New Jersey 5s	103	104¾
Detroit United	69¾	68¾
Elgin, Aurora & Southern	b52	a42
Lake Shore Electric	b10½	—
Lake Street Elevated	5¾	6
Manhattan Railway	135	134¾
Massachusetts Electric Cos. (common)	24	21½
Massachusetts Electric Cos. (preferred)	80	79
Metropolitan Elevated, Chicago (common)	22	21
Metropolitan Elevated, Chicago (preferred)	60	59
Metropolitan Street	116	112½
New Orleans (common)	11⅛	10⅝
New Orleans Railways (preferred)	35	31
North American	79⅜	77⅜
Northern Ohio Traction & Light	18	18
Philadelphia Rapid Transit	12¾	13¾
Philadelphia Traction	95½	96
St. Louis Transit (common)	19	18⅜
South Side Elevated (Chicago)	96	96¼
Syracuse Rapid Transit	25	—
Syracuse Rapid Transit (preferred)	73	—
Third Avenue	114	110
Toledo Railway & Light	22	20
Twin City, Minneapolis (common)	95	93¼
Union Traction (Philadelphia)	43⅝	43⅝
United Railways, St. Louis (preferred)	68⅝	67

a Asked. b Last sale. * Ex-dividend. † $10 paid.

Iron and Steel

A more hopeful feeling prevails in the iron trade than has appeared in some time past. It is generally felt that the decline in prices for pig iron, which began six months ago, and has continued without interruption up to the present, has now about run its course, and that with the usual autumn requirements close at hand, the market is in a better position to raise prices and increase business than it has been at all since the culmination of the boom last autumn. Already the lower prices have compelled a number of the less profitable mills to shut down, and this, of course, has benefited the technical situation. Along with the improvement in the lower branches of the industry a better demand is reported for the manufactured iron and steel products generally. This is in part due to the belief that a great deal of the business hitherto deferred on account of labor troubles will shortly come upon the market. Quotations are as follows: Bessemer pig iron, $17.35; Bessemer steel, $27, and steel rails, $28.

Metals

Quotations for the leading metals are as follows: Copper, 13¾ to 13⅞ cents; tin, 27¼ cents; lead, 4¼ cents, and spelter, 6 cents.

AFFAIRS IN CHICAGO

The proposed modifications of the leases from the West Chicago and North Chicago companies and of the tripartite agreement have been approved by over 70 per cent of the stock of each company. The leases and agreement therefore take effect Sept. 1, 1903. The position of North Chicago stock as to dividends under the amended lease is that on Oct. 15 (the next dividend day) the Traction Company shall pay to the Railroad Company $88,800 which shall be taken as a payment generally on account of rent to accrue and be credited against any deficit of the cumulative rental should there be such deficit. The rent for the quarter beginning Sept. 1 is payable Jan. 15, and, for successive quarters, on the 15th days of April, July and October. This rental shall consist of the entire net earnings of the lines up to $237,600 per quarter (at the rate of 12 per cent a year), but if the net earnings so paid as rental fall below $118,400 per quarter (or at the rate of 8 per cent a year on the outstanding stock, extending that owned by the Traction Company), then the deficit shall be cumulative and be a charge against the future net earnings of the Traction Company and be paid without interest out of such future earnings before any dividend is paid on Traction stock. Beginning Oct. 15, 1908, the minimum 8 per cent rental becomes an absolute guaranteed charge, failure to pay which constitutes default. The position of West Chicago stock is the same except that the cumulative rental, guaranteed after five years, is 4 per cent.

Receiver Sampsell, of the Union Traction Company, recently made a statement indicating a consolidation of all the companies. The central idea is that a concrete organization, offering universal transfers, could obtain better concessions from the municipality in the matter of franchises than could Union Traction, West Chicago and North Chicago acting individually. It is pointed out that a company in position to offer a service first-class in every respect, with universal transfers, might be able to obtain such favorable conditions in the matter of renewal of franchises as would make it desirable for all interests to accept the scheme. From an operating standpoint it is urged that, with the companies consolidated, by a rearrangement of routes, passenger traffic could be diverted into new channels. This would get rid of the congestion and enable the company to operate cars according to the natural avenues of travel, rather than within the limits of separate franchises.

FLOOR FRAMING FOR MILWAUKEE CARS—A CORRECTION

In the article on "Improvements in Interurban Cars and Motors by the Milwaukee Electric Railway & Light Company," which appeared in the Street Railway Journal of Sept. 5, 1903, an engraving entitled "Floor Framing" was, by mistake, inserted in the article. The engraving referred to is the channel bottom construction supplied by the same builders to the Chicago City Railway, and a number of other companies, for city cars. The Milwaukee cars do not have this channel bottom type of construction, as can be seen from the engraving of the exterior of the car, which appeared in the article.

AMERICANS TO BUILD ELECTRIC RAILROAD ACROSS NICARAGUA

An American syndicate has been formed for the purpose of building an electric railway system across Nicaragua, Central America. Pittsburgers are primarily interested in the project. T. M. Latimer, president of the Lindmore Land Company and the Anglo-American Potteries Company, of Pittsburg, is the chief party concerned in the enterprise. Others largely interested are Isham Sedgwick, of the United Coffee Company, and C. T. Manning, who is the Nicaraguan representative of R. G. Dun & Company. The Nicaraguan steam railroad, which was built about a year ago by British capitalists and is now owned and operated by the Nicaraguan government, will be acquired by the syndicate. The line runs from Port of Corinto, on the Pacific Ocean, to Granada, on the Lake of Nicaragua, via Chinandega. Its length is 161 miles. The road will be electrically converted, and is to be operated in connection with the new electric road which will join the existing one at Managua and extend to the Atlantic Ocean, having terminals at Monkey Point and Perlas. The third-rail system will be employed. The present Nicaragua road is narrow gage. It will be standardized as well as the new line. The length of the system will be about 500 miles. The power house will be constructed at Matagalpa, where water power is available. It will take about five years to complete the work.

AN ADJUSTABLE CAR STRAP

The Adjustable Passenger Strap Company, of Pawtucket, R. I., is putting on the market the new type of car strap illustrated herewith. This strap possesses several points of superiority over the ordinary leather strap which is in general use. A unique and advantageous feature is that the new strap is instantly adjustable to two lengths, differing from 2 ins. to 5 ins. or 6 ins., as the company purchasing the strap may desire. This arrangement thus provides for the comfort of standing passengers, whether they are tall or short. Another great advantage possessed by this style is that in replacing a strap it is not necessary to remove the strap-rod, as is the case with the ordinary strap, but the strap may be removed and a new one substituted by a simple fold in the strap through one of the buckles. The strap is made of strongly webbed material and is very durable. As the strap is very easily removed and replaced, it can be easily cleaned and kept free from disease germs. The manufacturer is prepared to fit one or more cars of any street railway company with these straps for a thirty or sixty-day trial, with the understanding that the straps shall be paid for only if entirely satisfactory.



ADJUSTABLE CAR STRAP

ANNUAL MEETING OF THE PENNSYLVANIA STREET RAILWAY ASSOCIATION

At a meeting of the executive committee of the Pennsylvania Street Railway Association, held in Harrisburg, on Aug. 24, it was unanimously resolved that the twelfth annual meeting of the association be held in Williamsport, Sept. 23 and 24. The convention will be called on Wednesday, Sept. 23, at 11 a. m., at the Park Hotel, and continued during the day. Papers on subjects of general interest will be read and discussed. On Thursday, Sept. 24, there will be an excursion to Eagles Mere, to be followed by a banquet at the Crestmont Inn. The association is anxious to have the attendance at the coming convention exceed any heretofore held, and all persons interested in street railways in Pennsylvania, whether members of the association or not, are invited and urged to be present, and participate in the deliberations.

THE WORCESTER SUBURBAN COMPANIES' TROUBLE

The Worcester & Southbridge Street Railway Company and the Worcester, Rochdale & Charlton Depot Street Railway Company, of Worcester, Mass., two companies which were closely allied, have gone into the hands of receivers. The properties at Pinehurst Park, Auburn, and Hotel Overlook, Charlton, which were built up by the Worcester & Southbridge Development Company, have been put in the hands of another receiver. Wilford A. Bailey has retired from the general management of these properties, a position he has occupied since they began to be built.

Charles M. Thayer, of Worcester, and John A. Hall, of Southbridge, were appointed receivers of the two street railway properties Aug. 29 by Chief Justice Albert Mason, of the Superior Court. The appointment of receivers was on the petition of Arthur P. Rugg, of Worcester, representing the Trust Company of the Republic, of New York, the city of Worcester and Horace S. Pike, of Worcester. Other creditors were represented by Rufus B. Dodge, of Worcester, and L. R. Eastman, of Boston. Charles M. Thayer appeared for the two street railway companies. The Trust Company of the Republic had a demand note of $25,000 which it has tried to collect, and the failure to secure payment on this led to the appointment of receivers. On the allegation that money of the street railway companies had been used for the development of the properties at Pinehurst and Overlook, Rufus B. Dodge, of Worcester, was appointed receiver of these properties.

Since the appointment the receivers have been going over the books of the various companies to learn their exact standing. There is some uncertainty as to the relations between the two street railway corporations and the development company. Both were under Mr. Bailey's personal management.

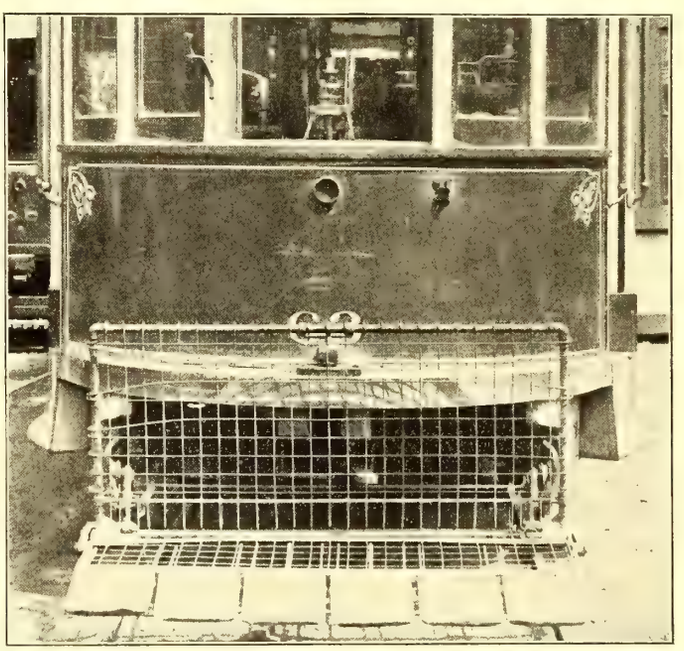
The failure of the roads is ascribed to the large expenditures that were made for construction. Large amounts of money were spent in building up the development company's property, but how far this has affected the finances of the roads is to be determined. From the start the expenditures on the construction of the properties, both of the street railway companies and the development company, have been lavish. The stock of the Worcester & Southbridge Street Railway Company and of the Worcester, Rochdale & Charlton Depot Street Railway Company is held by the same people. The latter company owns tracks and rights, but all cars are operated over its property by the Worcester & Southbridge road. Because of the great expenditures the companies have been unable for some time to raise the money for necessary current expenses.

The failure of the street railway company has involved Frank D. Perry, of the American Car Sprinkler Company, who underwrote some of the Worcester & Southbridge paper, in financial difficulties. Contractors who worked for the companies have been unable for some time to make collections. The failure of the Worcester & Southbridge has attracted a great deal of attention in financial as well as street railway circles because of the amount of money involved, said to reach between $2,000,000 and $3,000,000. Steps were being taken to consolidate the companies which are now in receivers' hands.

A NON-RIGID CAR FENDER

For several years inventors have endeavored to design a fender that would obviate the great force of impact exerted by a moving car when colliding. Efficient safe-guarding by fenders can be accomplished only when this shock is eliminated. A rigid fender imparts the velocity of the car, producing a blow, and favors an object passing under.

The Hipwood-Barrett Car & Vehicle Fender Company, of Lakeport, N. H., has embodied in the fender shown herewith the principle of receding action, which gradually imparts momentum, easing and lifting an object from the roadbed, and which has for the moment the effect of a car coming to a stop. This fender is designed to conform to uneven surfaces and to offset the effects of car oscillation.



NON-RIGID FENDER

By the simple receding and conforming principles, combined with a receptacle sufficient to contain a person, and a resilient bunter guard to prevent forceful contact and rebounding, the required fender protection is attained.

A blow that seriously distorts a rigid fender causes little or no damage to the receding front sections of this fender, each of which may, if necessary, be replaced at slight cost.

The fender may be quickly adjusted and instantly controlled in emergencies. Its simple construction enables the quick removal of fenders when repairing cars. The projection of the fender is very moderate when in use, but when not in use it can be instantly placed beneath the car, thus giving full space in car houses without interference by fenders.

A DARING CAR-HOUSE ROBBERY IN CHICAGO

There was a most daring car-house robbery in Chicago Sunday morning, Aug. 30. Protected by darkness, masked thugs secured entrance to the Sixty-First Street car-house of the Chicago City Railway Company, and deliberately shot down the three men working in the brilliantly lighted office. When all had fallen, one of the robbers forced an entrance to the office, seized the cash at hand, and vanished with his pals. One of the employees shot was killed outright, another was left dying, and the third was seriously wounded. The robbery was carried out some twenty minutes after the last conductor had made his returns, and just when the returns were all before the receiver, who was busily engaged in sorting the money. It is said that the robbers secured $4,000, but this estimate is unofficial. The company has offered a reward of $1,000 for the apprehension of the robbers, and its own detectives and a detail of Central Office men are at work on the case.

STREET RAILWAY PATENTS

[This department is conducted by W. A. Rosenbaum, patent attorney, Room No. 1203-7 Nassau-Beekman Building, New York.]

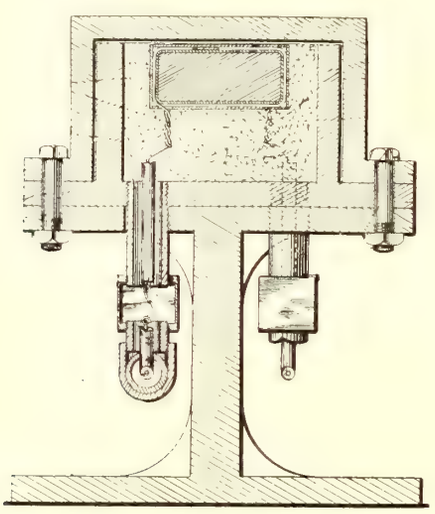
UNITED STATES PATENTS ISSUED SEPTEMBER 1, 1903.

737,582. Resilient Multiple Contact Trolley Wheel; Edward S. Cobb, Los Angeles, Cal. App. filed April 14, 1903. The trolley wheel flange and tread are made up of a series of segmental spring plates against which the wire bears.

737,596. Safety Mechanism for Motor Cars; Carrell J. Eckroad, Cleveland, Ohio. App. filed Feb. 16, 1903. Details of construction of a fender.

737,624. Emergency Car Brake; John M. Hedrick, Flourtown, Pa. App. filed Jan. 22, 1903. A brake-shoe or drag pivoted under the front platform and adapted to trail under the car is brought into contact with the roadway or ground by an operating rod, which extends through the platform, having a threaded connection therewith.

737,630. Vehicle Life Guard or Obstruction Remover; Arthur Hudson and Joseph Bowring, Manchester, England. Automatic means for causing the fender to fall to operative position when the feeler or swing gate, mounted in advance, strikes an obstruction.



PATENT NO. 737,935

737,748. Single Rail Railway Wagon; Albert Lehmann, Vienna, Austria-Hungary. App. filed May 20, 1902. An arch-shaped halter projecting laterally in the central line of the wagon-frame and adapted to pass over the back of the hauling animal, said halter being provided with means for attaching the animal thereto.

737,806. Car Fender; William J. Westgate, Glenville, and Chubb E. Herrick, Cleveland, Ohio. App. filed Sept. 23, 1902. A guard is mounted in advance of the fender which, when moved rearward or upward by contact with an obstruction, causes the fender to make a downward scoop.

737,885. Switch Operating Mechanism; Ambrose A. Tripold, New York, N. Y. App. filed June 9, 1903. Relates to that class of switch operated by the momentary interruption of the electric circuit which takes place when the car approaches a switch.

737,896. Railroad Bond; Horace M. Bellows, Huntingdon Valley, Pa. App. filed May 18, 1903. The abutting ends of the rails have aligned recesses in which is placed a coiled spring forming the bond.

737,914. Life Saving Guard for Tram Cars of the Like; William T. G. Ellis, Glasgow, Scotland. App. filed Dec. 15, 1902. Comprises a scoop, a tripping frame adapted to be suspended in advance of the scoop, and a spring catch pivoted to the base of the tripping frame and detachably connecting the tripping frame with the scoop to uphold the scoop by the tripping frame.

737,935. Third Rail for Electric Railways; Lloyd G. Johnstone, New York, N. Y. App. filed June 9, 1903. An electric heater applied to the third rail to melt ice or snow.

737,936. Contact Device for Electric Railways; Henry F. Kellogg, Wellesley, Mass. App. filed Oct. 15, 1902. Comprises a number of independent laterally movable contact pieces grooved for the reception of the wire and taking the place of a trolley wheel.

738,005. Railway Brake; David W. Davis, Detroit, Mich. App. filed March 11, 1903. A movable brake-hanger carrying an auxiliary braking wheel, a brake-shoe interposed between the auxiliary wheel and the adjacent car wheel and means for moving the auxiliary wheel against the brake-shoe and also the rail.

738,029. Abrading Shoe; Judson M. Griffin, Detroit, Mich. App. filed Jan. 15, 1903. A case adapted to hold abrading blocks, each block having one part thereof made abrasive and the other part non-abrasive.

738,056. Trolley; Moses Nicholls and Clark J. Smith, Ottumwa, Iowa. App. filed Dec. 15, 1902. Details.

PERSONAL MENTION

MR. GUY K. JEFFRIES, formerly chief despatcher of the Erie Railroad, at Huntington, Ind., has been appointed superintendent of the Indianapolis & Northwestern Electric Railway.

MR. L. F. MAHLER, formerly district manager of the De Laval Steam Turbine Company at Chicago, has taken charge of the St. Louis office of the Bullock Electric Manufacturing Company, with offices at 1505 Chemical Building, St. Louis.

MR. HOWARD S. KNOWLTON has resigned from the engineering force of Stone & Webster, of Boston. He is planning to visit Colorado and California, and will probably remain in one of those States. Mr. Knowlton has been a frequent contributor to these columns on topics of street railway and engineering interest.

MR. V. W. BERGENTHAL, formerly assistant manager of the Chicago office of the Stanley Electric Manufacturing Company, on Sept. 1 became actively connected with the American Automatic Switch & Signal Company. This is a new company, well backed by prominent Chicago men, which will make block signals for electric railways under fundamental patents granted to Mr. Robert Skeen, formerly of East St. Louis. Mr. Bergenthal will have charge of the sales business of the company, and will become vice-president, for which his previous experience as engineer and salesman make him well fitted.

MR. GEORGE M. TOMPSON, member American Society Civil Engineers, has recently opened an office in the Beacon Building, Boston, and is making a specialty of the appraisements of and reports upon the physical and commercial value of railway properties, and as consulting engineering expert in the separation of grade crossing problems. Equipped with an exceptional education, Mr. Tompson at the opening period of his career entered the office of the late Thomas Doane, C. E., of Boston, and a short time later became the division engineer of construction of the Troy & Greenfield Railroad, in which position he served two years. He left to accept the position of assistant chief engineer of the Philadelphia, Wilmington & Baltimore Railroad. Later Mr. Tompson was made locating engineer of the Texas-Mexican Railroad, and under his able supervision 250 miles of this railroad in Southwestern Texas were located. Attracted by his high qualifications the Mexican Central Railroad obtained his services, and during construction he was engineer and superintendent of the road department of that road. Owing to the failure of his health Mr. Tompson was obliged to return to New England, where he has held a number of responsible positions. One of his latest achievements was the construction of an electric railway at Portsmouth, Rye and North Hampton, N. H. Recently Mr. Tompson has been engaged in the appraisal of a number of the largest railroad properties in New England and in the Middle West and Western States also, and he is frequently consulted by the Massachusetts Railroad Commissioners. With the technical knowledge Mr. Tompson possesses is combined a practical experience that makes him peculiarly fitted in the most minute details of his profession.

INDEXED

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EDITORIAL NOTICE

Street railway news, and all information regarding changes of officers, new equipments, extensions, financial changes and new enterprises will be greatly appreciated for use in these columns.

All matter intended for publication must be received at our office not later than Tuesday morning of each week, in order to secure insertion in the current issue.

Address all communications to

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Our Convention Report

In the last two issues of the STREET RAILWAY JOURNAL our readers have received a more complete and comprehensive report of the meetings of the three associations and of the exhibits than it would have been possible for any one person to have gathered by actual attendance at Saratoga. While this fact should in no sense be construed as an argument for non-attendance at the conventions, we refer to it from a sense of pride of the service supplied to the subscribers of the STREET RAILWAY JOURNAL. This paper had representatives detailed to report each special feature of the convention, and their work is represented by the 150 or more pages devoted to the proceedings in the two weekly numbers which have just been issued. These numbers, together with our convention number for Aug. 29, comprise some 300 readings pages, all of which have been published within the space of three weeks. This number of pages is more than that contained in the entire annual volume of this paper during 1887, and practically as many as in that of 1888. These three issues contain more reading matter than a great many expensive technical books which take months to compile, but have been published promptly on the day of issue, with all reports and news notes brought up to date.

To those who have occasion to look over the back files of technical journals, even of this paper, the difference in general construction, typographical appearance and character of articles as compared with the leading technical papers of to-day is apparent. Standards have changed in this field as rapidly and as completely as in the electric railway or any other industry. The illustrations and articles are fresher and better, and the papers are striving to give their subscribers the very best possible service. The 1903 volume of the STREET RAILWAY JOURNAL, for example, will contain in the neighborhood of 6000 reading and advertising pages. This is twice as many as in 1898, and twelve times as many as in 1888. Like the street railway industry which it represents, the STREET RAILWAY JOURNAL is constantly expanding, and each year is furnishing its readers more for their subscription price than ever before.

Statistics and Street Railway Service

An example of the danger of statistics in the hands of a man who does not know what they mean is presented in the case of Mayor Rodenbeck, of Rochester, N. Y., who has undertaken to prove that the transportation facilities afforded by the Rochester Railway Company are inadequate, and who uses for this purpose a compilation of data representing the equipments employed in other cities and their performances. In support of his argument the Mayor prepared a table, giving the number of cars and the number of miles of track in several cities, and the number of passengers carried, also the number of cars Rochester should have to be on an equal footing with her neighbors, based upon these considerations alone.

The Mayor says that the data presented was compiled from the STREET RAILWAY JOURNAL, which only goes to show that very good material may be put to base uses. The statistics, if taken from the STREET RAILWAY JOURNAL, are undoubtedly reliable, but they do not prove anything in this case for the simple reason that they of themselves cannot furnish grounds from which to draw any such conclusions. Any street railway manager, or any one else of mature judgment, it seems to us, should know that many important factors enter into the transportation problem of every city, large or small, which have been entirely overlooked by Mayor Rodenbeck. Local conditions, the density of population, the size of the cars, the industries of the city, the lay-out of the territory served and the routing of cars are not common elements; they differ materially in each individual case, and yet these are the factors which must be given the greatest consideration by the intelligent manager if the problem is to be satisfactorily solved. Evidently none of them entered into the calculations of Mayor Rodenbeck. His method is entirely original, and we venture to say that he will be left to the complete enjoyment of it.

Crowding Motorman's Platform

One of the charges made against the indicted trolley officials in connection with the Newark tragedy was that the front platform of the car which was demolished was crowded with passengers so that the motorman was unable to work freely. Fortunately for the company this charge was not supported by the evidence, and, as it was shown that the company's rules prohibited passengers from riding on the front platform, the officials under indictment were relieved of all moral as well as legal responsibility. The regulation cited is an excellent rule, and should be strictly enforced, especially on lines where heavy cars are operated and a high rate of speed maintained. Motormen should be perfectly free and unhampered, and their at-

tention should not be diverted for a moment from their duties. There should be no possibility of physical interference with them by passengers crowding the front platform so as to prevent their unrestricted movement in controlling the car. It is often difficult to enforce this rule, and in many cases it has been found necessary to use gates on the front platform to keep passengers off. This is done on the open cars of the Interurban Company in New York and in many other large cities where the danger is recognized, but on the closed cars it is often difficult to keep this platform entirely clear, as the front as well as the back door is used by passengers entering and leaving the car. It would seem as if the passengers themselves, for whose protection the rule was made, would co-operate with the management, but it is a matter of common knowledge that even when there is plenty of room inside the car many persons persist in standing on the front platform until they are compelled by the conductor to enter under penalty of ejectment. In the Newark case the company had established a rule of this kind for the purpose of preventing the crowding of the platform, and it proved a valuable defense for the indicted officials.

An Almost Untouched Field

There are few functions of the railway in general that have not been assumed by the electric car, and yet so busy have we Americans been in the ordinary line of street railway work, varied by interurban excursions, that we have been, and are, prone to overlook side issues, even if interesting and profitable ones. Hence it has come about that the portable, or semi-portable tramway, has been left quite exclusively to the steam engine builder, in spite of the singular adaptability of the trolley system to this class of work. It is largely an export business at present, which may account for our lack of interest in it, but its extent is really far more than the average person realizes. We, in this country, are generally remiss in looking after export business, except along certain conventional lines, and as a people our business methods are such as repel rather than attract trade with countries other than European. In particular, the American makes the effort to sell his regular standard line irrespective of the customer's demand, and makes that line following a system of weights and measures unfamiliar save in English-speaking countries. Nevertheless, in the way of portable light railways there is good business to be had, which ought to be developed along electrical lines, and practically nothing has yet been done about it. All through tropical America there is a demand for light tramways that can be easily and cheaply installed and operated. For such work the electric motor, worked from a semi-portable generating station, possesses especial advantages. It is about as nearly fool-proof as a machine can ever be, highly efficient, remarkably free from danger of breakdowns, and exceedingly convenient in every way. Yet it has been hardly even given a trial in light tramway work.

The engineer dealing with this particular problem may seek and seek in vain for suitable electrical equipment among American makers. He can find, indeed, railway motors, not of the latest design, which will go upon, by close fitting, trucks of a meter gage, and special running equipment at high prices for trucks somewhat narrower, but nothing that would come anywhere near filling the bill, for, by way of example, a plantation railroad of 6-10-m gage (23⅝ ins.), a common standard for light work. Nor can he find any more easily the equipment of such a road outside of the motors.

The time has come when American manufacturers must look to export business more and more. Our facilities are unequalled, the world's trade is ours if we will but go out and gather it in. But there is need of a wider view and more flexible methods to work foreign trade for what it is worth, and this instance in tramway manufactures is typical of many others. American engineers are prowling all over the world, and will bring trade home whenever they can, but they must be met half way by the manufacturer. In some instances the manufacturer has done his duty, and American electrical machinery is in use pretty nearly all over the world, but the particular corner of tramway work which we are considering seems to have been passed by and left for others to exploit.

Stopping at Far or Near Side of Street Crossings

In the discussion on rules at Saratoga Mr. Beggs called attention to the provision in rule 24 relating to points at which cars stop on signal, and he questioned the advisability of assuming that street railways generally would continue to stop on the "far side" of the street. He mentioned the fact that some municipalities had enacted ordinances requiring street cars to stop on the "near side" of the street, and that others were seriously contemplating similar action. Cincinnati was prominent as one of the latter class, and other cities might have been added to the list, especially those on the Pacific Coast, where, we understand, the subject is receiving a good deal of attention at present. In Los Angeles, for instance, the local street railway men are securing an expression of opinion from other companies, especially those in that section of the country, as it is recognized that any rule made for governing the operation of cars should be made general for the part of the country at least in which it is introduced. This is partly because the American public travels so much that every city has at all times a large percentage of visitors, and these strangers patronize the street cars freely. Moreover, there is a constant shifting of population, and confusion would result if regulations of this kind were not made universal. This explanation has been offered for the failure of the plan where it has been attempted heretofore. In the great majority of cities cars stop on the far side of the street only, except in the case of intersecting streets upon which there are car lines, and there the cars are obliged to stop on the near side, and then if there are passengers to be taken on at the far side another stop is necessary. Mr. Beggs referred to this feature of the case in the discussion before the American Street Railway Association, and pointed out the advantage of having a universal rule by which cars would stop at the near side only. This would do away with the double stop, a point that has been emphasized by advocates of the proposed measure. Probably the strongest argument in favor of the proposed rule is that a car in starting up is under better control than in slowing down, especially on slippery tracks or where there is a down grade; the danger at street crossings is thus minimized when the stop is made at the near side.

There are a great many influential street railway managers who favor the proposed change, and some of them, including Mr. Beggs, of Milwaukee, Mr. Beeler, of Denver, and other practical men, are earnestly advocating its general adoption, and they would welcome the enactment of ordinances embodying this rule. The subject has been a topic of discussion in different parts of the country for several years, and in some places where it has been tried it has been found difficult to get the people to depart from their established custom. That seems to be the greatest, although not the only, trouble, and we venture to say that it will remain a serious obstacle to the general adoption of the rule.

Report of the Merchants' Association

The Merchants' Association of New York has published a report by its "committee on engineering and sanitation" upon the "Passenger Transportation Service in the City of New York," embodying the results of the investigation which was made by the committee at the time of the hearing before the State Railroad Commissioners. The findings and recommendations correspond with those advocated in the preliminary report, published on page 183 of our issue of Jan. 31, and the report in question is an elaboration and defense of this preliminary statement.

The preface to the document is signed by William F. King, chairman of the committee on franchises and transportation, and we are sorry to see that it partakes of those acrimonious characteristics which pervaded his utterances during the agitation last winter. While Mr. King advocates co-operation between the city, the companies and the patrons of the railways, his attitude makes it clear that harmonious action can only be obtained by accepting his views unreservedly. A perusal of his introductory message cannot fail to prepare the reader for what follows. With charming frankness Mr. King declares that the work of his organization, as presented in this document, embodies the only reliable and trustworthy data on the subject, and that "all official reports have rested upon data supplied by the railway companies, and, therefore, from an interested source."

To the average business man it would seem that the State Railroad Commission, which has access to the records of the railway companies, is in much better position to present an accurate, comprehensive and reliable statement of facts than any unofficial committee, no matter what its character or composition. Yet, Mr. King places his personal opinion and that of the committee above the records of the railway companies, even those which have been compiled on such important subjects as the obstructions to the movement of surface cars in Manhattan.

Commenting upon the contention of the Interurban Company, for instance, that it is impossible under existing conditions to move more cars or attain higher speed on congested streets, the committee admits that it "is not prepared to deny this statement unreservedly;" in other words, "the only comprehensive and reliable data thus far gathered" does not disprove the assertion of the railway company, but the committee will not graciously admit its accuracy. It refers in another place to a statement of the same company as "plausible and difficult to disprove," thus indicating that the principal object of the investigation was to discredit the records of the railway companies, as well as, incidentally, the official reports of the Railroad Commissioners themselves.

This of itself would be enough to disqualify the committee, but the report elsewhere shows a lack of practical knowledge which should be possessed by any body of "experts" assuming to regulate traffic in New York. Thus a considerable portion of the report is given to a discussion of the subject of double-deck cars. If there was any value in double-deck cars for American conditions, certainly some one company in this country would have adopted them as a result of the trials to which they have been subjected in this country. But although this subject has been threshed out repeatedly by transportation companies from Maine to California, the committee clings to the hope that some plan may be found to permit of their introduction in this city. The report reluctantly admits that conditions do not seem to favor their operation in New York, but recommends, nevertheless, that a fair trial be given this type of cars.

Another important point upon which the conclusions in the report differ radically from those of practical railway men is in the division of responsibility for the operation of cars. The committee sees no theoretical reason why this cannot be done, and recommends the employment of two conductors on all closed cars, 28 ft. in length and over, so that when fares are being collected in the body of the car there may be a man on the rear platform to give the signal to start and stop the car. We so fully considered this proposition in an editorial in our issue of Jan. 31 that we shall not again discuss it here. It is sufficient to say that this proposition will always be opposed by practical railway men, on the ground that it would result in a division of responsibility, confusion and friction, which would prove detrimental to the service.

Generally speaking, it may be said that the report presents little information of practical value, and that it is made up principally of expressions of opinion on the recommendations already discussed. Much disappointment was felt by the Merchants' Association because of the failure of its bill providing for the appointment of Railroad Commissioners representing the city of New York, but the explanation may be found in the report itself. The association's representatives found it "difficult to disprove" the assertion that the railway companies and the present commission were fully competent to handle the situation.

Responsibility of Directors

What is the measure of responsibility of a director of a corporation, so far as accidents are concerned? This question came up for consideration in Newark upon the trial of the directors of the North Jersey Street Railway Company, under the indictment returned by the Essex County Grand Jury, as a result of the investigation into the grade crossing tragedy of last February. That the management of a railway company is accountable in civil actions for injuries resulting from the negligence of the company's servants and insufficiency of its equipment or other remediable fault is well understood and established, but to charge the directors with criminal responsibility was a new proceeding, and, as the case developed, was shown to be wholly unwarranted and indefensible. For all practical purposes the men charged with manslaughter had no more to do with the fatalities than any other half a dozen men holding the securities of the company. The charge against them was something new in law and criminal procedure, and it is scarcely necessary to point out that if it had been possible to find them guilty of manslaughter for an event that happened many miles away from them and without their knowledge, and by reason of an infraction of the rules made by the practical managers hired by the directors, it would have been difficult to ever again secure the services of financiers to manage the business of trolley companies or of any industrial company whose operations might involve casualties through inadvertence of employees. It was contended on behalf of the indicted officials, and the position was sustained by the court, that the officers under trial had not neglected their plain duty in a felonious manner, and that they had not shown an evil disregard of duty, or a reckless disregard of the lives of passengers. It is a matter of much importance that the decision in this case was reached without a dissenting opinion. Chief Justice Gummere had invited Justices Dixon and Van Syckle to sit with him, and they concurred in his decision directing the jury to return a verdict of acquittal.

SHOPS OF THE AURORA, ELGIN & CHICAGO RAILWAY

The shops of the Aurora, Elgin & Chicago Railway, at Wheaton, Ill., are regarded as model equipments for interurban electric railways. They are notable for the completeness of their organization and a number of features which greatly facilitate repairs rather than for their size, as the road is not large. The equipment comprises thirty cars, only a small number of which are required for the ordinary schedule.

Fig. 1 shows a general view of the repair shop, and Fig. 2 the ground plan of the repair shop and adjoining parts of the buildings. The repair shop is spanned by a crane of 10 tons capacity, furnished by the Whiting Foundry Equipment Company. This travels the entire length of the repair shop. A traveling crane of this kind is unusual in such a small shop, but it greatly facilitates repairs. The rolling stock of the company is very heavy, and, consequently, repair work would be very slow were it not for this traveling crane, as the motor cars are each equipped with four 125-hp General Electric motors.

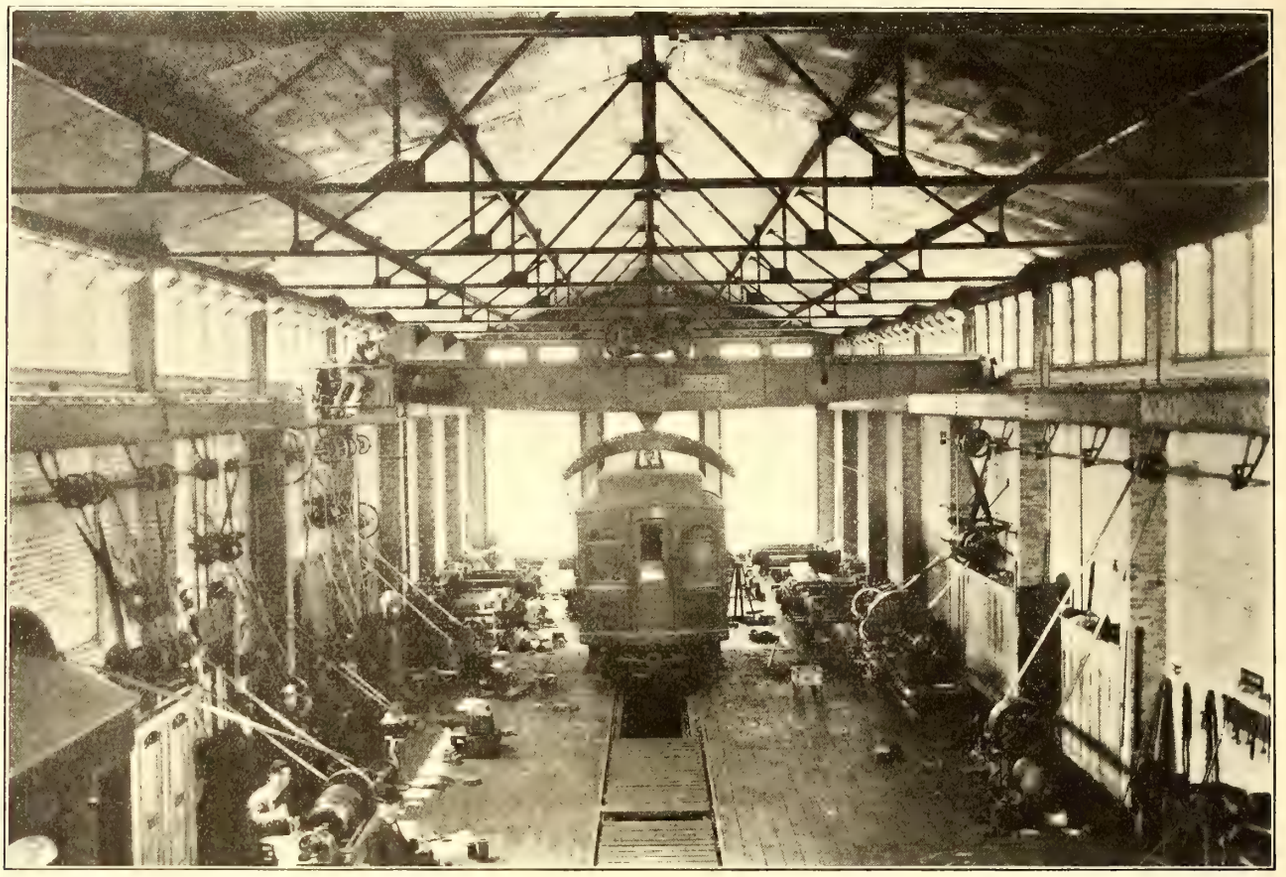


FIG. 1.—GENERAL VIEW OF SHOPS, SHOWING CRANE READY FOR RAISING CARS

Next after the traveling crane the feature which will attract visitors' attention is the arrangement of the tracks and pits. One track runs directly through the repair shop from end to end, as seen in Fig. 2. This track makes it possible to enter the shop at either end, from the yards at the east of the building or from those west of the building. At each end of the building there are two tracks in addition to the middle track. These tracks hold one car each and have pits. The space

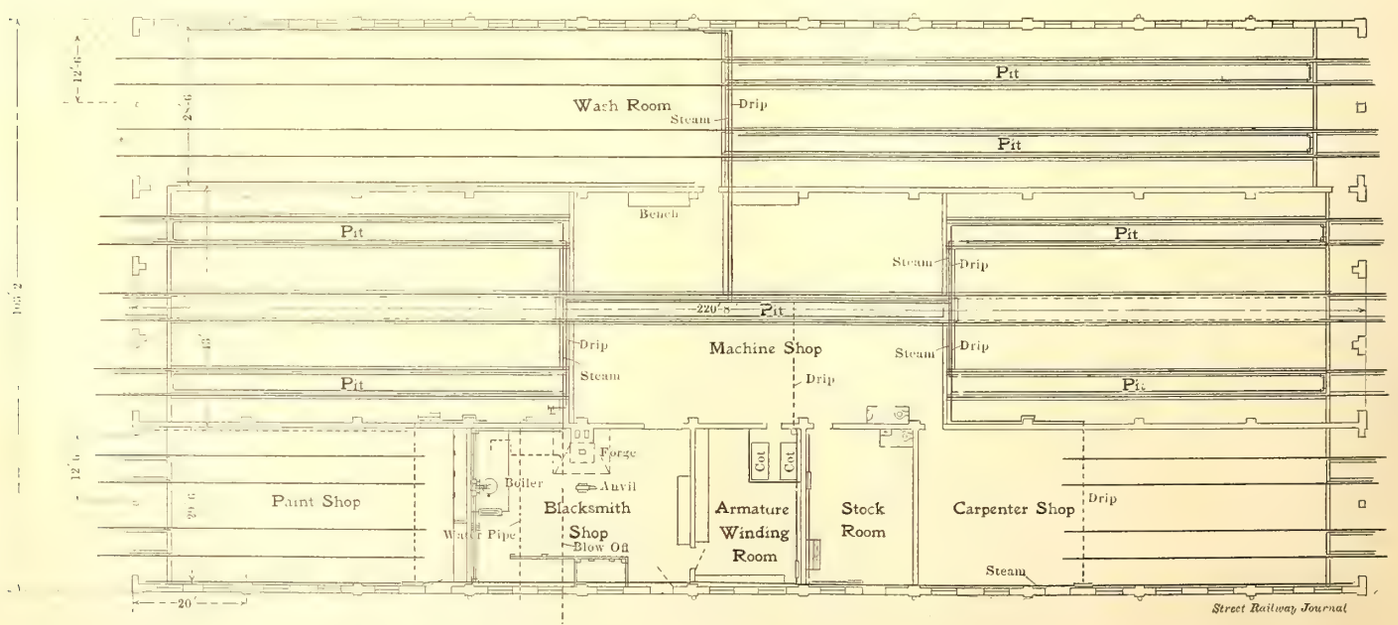


FIG. 2.—PLAN OF CAR HOUSE AND SHOPS

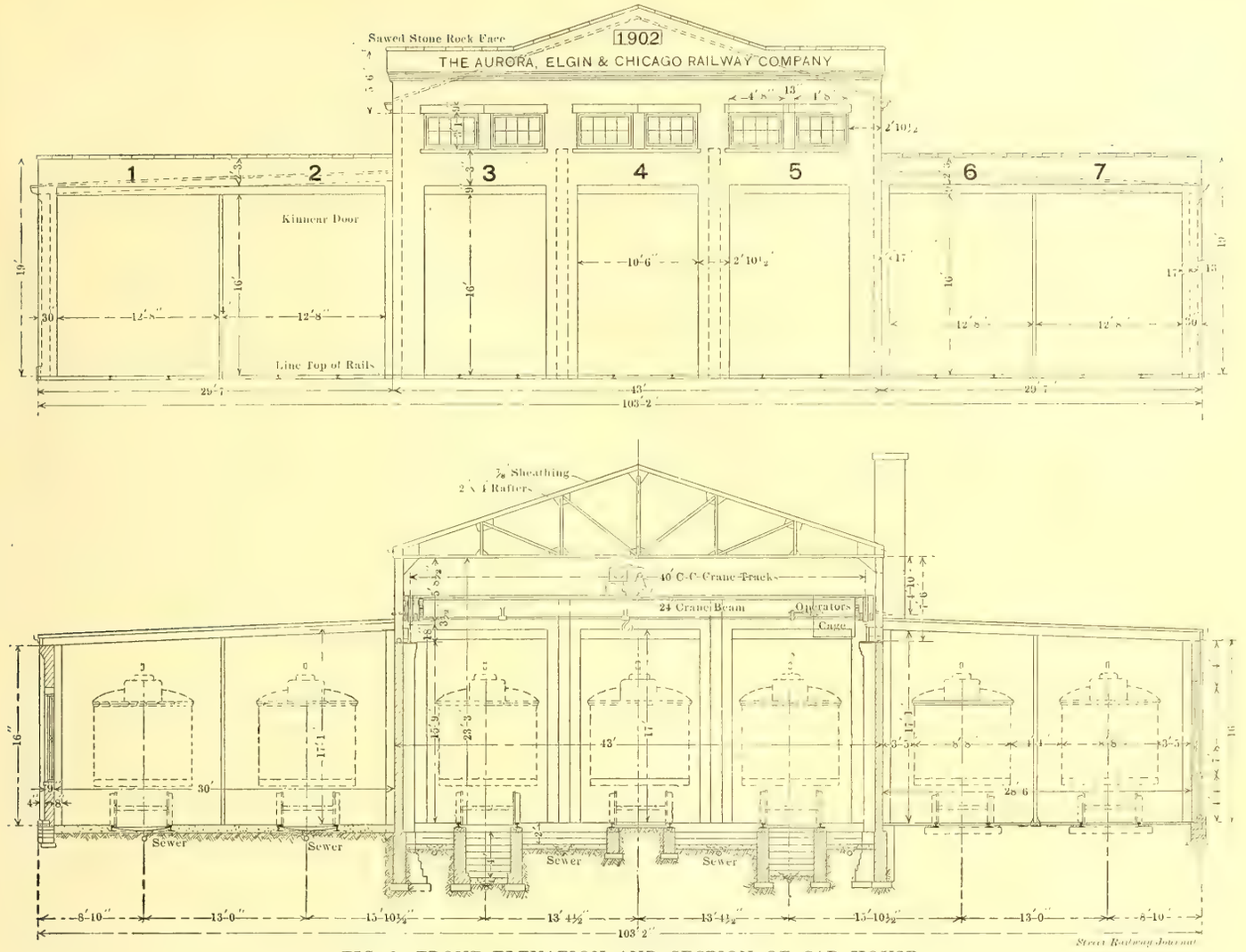


FIG. 3.—FRONT ELEVATION AND SECTION OF CAR HOUSE

between the tracks is lower than the level of the tracks by 20 ins. to 24 ins. The pits are 4 ft. 8 ins. deep. The object of having the floor lower than the track instead of flush with it as is usual is to facilitate work on the sides of the trucks. With this arrangement it is not necessary for a man to lie down to work at the side of a truck. It is a commendable feature and one which could be adopted with profit more generally than it is. The arrangement of pits can be seen both from the sectional elevation, Fig. 3, and from the view taken in one end of the repair shop, Fig. 4.

The central part of the shop is devoted to machine tools, which are arranged on the wall on either side of the track running through the middle. The general arrangement is shown clearly, both in Fig. 1, which gives a general view, and in Fig. 5, which is a view of the central portion of the shop, with the machine tools and the central track given especial prominence. The central track, although provided with a pit, ordinarily has its pit covered, as seen in Fig. 5. In case of emergency the planks covering this pit can be removed so that work can be done under a car if placed in the middle of the shop. Ordinarily this middle space is kept clear. It will be seen from the plan that there is room in the shop for seven cars—three at each end and one in the middle. The space alloted to each car is 70 ft., so that there is in every case room to roll a truck out from under the car, in addition to the room provided for the length of the car body. The width of the shop which is spanned by the crane is 40 ft.; a view taken in the yards approaching the shop is shown in Fig. 6. In this connection it is to be noted that the company follows the practice of the steam roads of storing cars in yards instead of in a car house. There are yards at both front and rear of this repair shop. Both of these yards join a main line, so that the yards are in reality on a loop-off of the main line. The arrangement is a very convenient one, as cars can be passed through the shops and set out on the tracks in the yards in regular order, or can be run past the shop on the outside without entering it, and there is

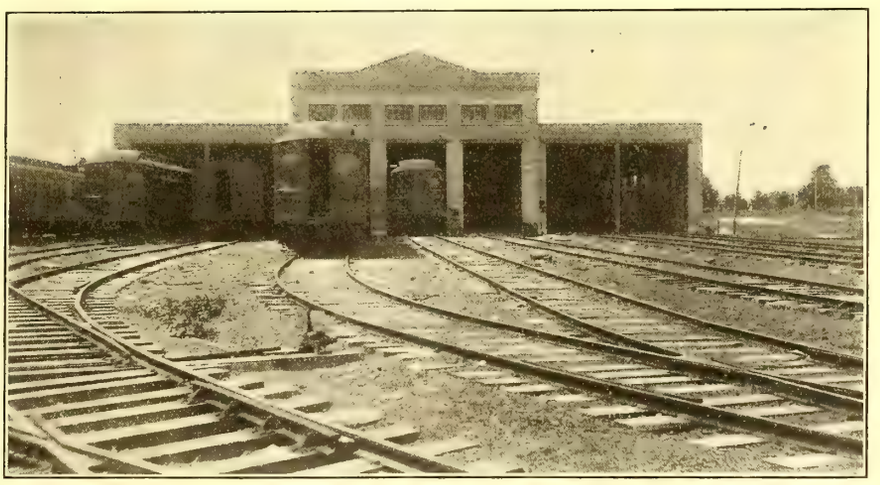


FIG. 6.—SHOPS AND YARDS

very little switching to be done to get a car from the main line to the shop and from the shop back to the main line.

Fig. 8 is a view in the shops in which is shown one of the



FIG. 9.—BLACKSMITH SHOP

channel-iron horses for supporting the car body after it has been lifted for the removal of a truck. In Fig. 1 the traveling crane is preparing to lift the end of a car body for the removal of the truck. For this purpose the yoke seen is attached to the hook of the traveling crane. and from this yoke log chains with grappling irons hook under the I-beams, forming part of the subframe of the car. To remove the armatures from

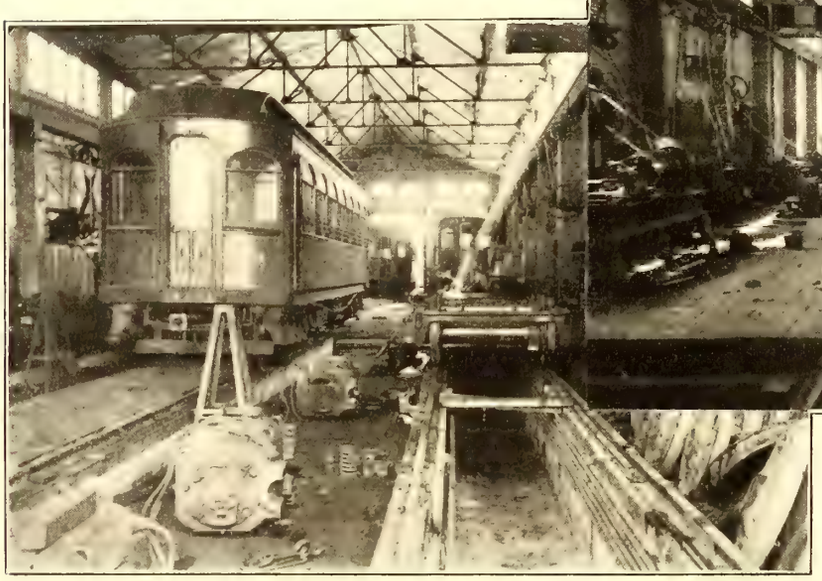


FIG. 4.—RAISED TRACKS AND PIT

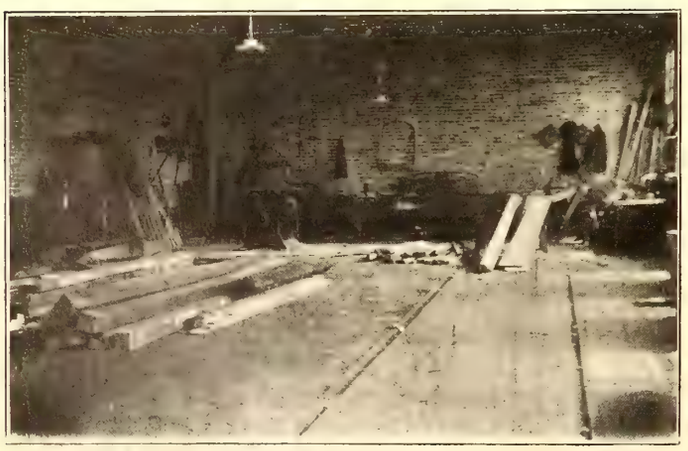


FIG. 10.—CARPENTER SHOP

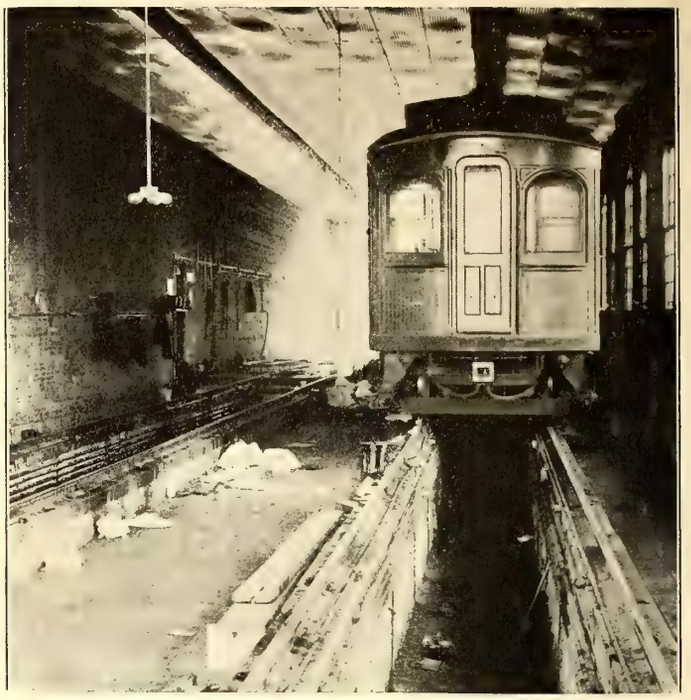


FIG. 8—INSPECTION AND WASH ROOM.



FIG. 5.—MACHINE TOOLS AND COVERED PITS

these motors they are lifted out of the trucks by the traveling crane and set on the floor with the pinion up. A hook is then put over the pinion, to which the hook of the traveling crane is attached, and the armature is lifted endwise out of the motor case.

The machine tool equipment seen in Figs. 1 and 5 consists of 3 lathes, 1 shaper, 1 drill press and 1 wheel press. The large lathe for turning down and boring steel wheels and axles, is seen at the right. The hydraulic wheel press is also seen at the right. At the left is a lathe with 8-ft. bed and 24-in. swing, the size suited to the handling of armatures for turning down commutators. Next, to the left, is an emery wheel grinder, and beyond this is the shaper. In the background, at the left, is a small lathe for cutting threads on bolts and similar work.

On one side of the repair shop building is a room for motor inspection and car washing. One end of this room has pits for motor inspection, arranged like the pits in the repair shop. Fig. 8 shows this.

All wiring of the building is in iron pipe conduits, and is shown most plainly in Fig. 8. This conduit is run along both sides of the pit, and combination outlets and sockets are placed

at regular intervals. The other end of this room has a brick floor, well drained, over which the car washing is done.

On the other side of the repair shop building are the paint shop, carpenter shop, blacksmith shop, armature winding room and stock room. In the blacksmith shop is a boiler which furnishes steam to heat the building in winter. The paint shop and carpenter shop each have room for two cars. The carpenter shop is provided with a band-saw. Toilet rooms are provided in a building and also place for some employees to sleep. Fig. 9 is a view of the blacksmith shop, and Fig. 10 shows the carpenter shop.

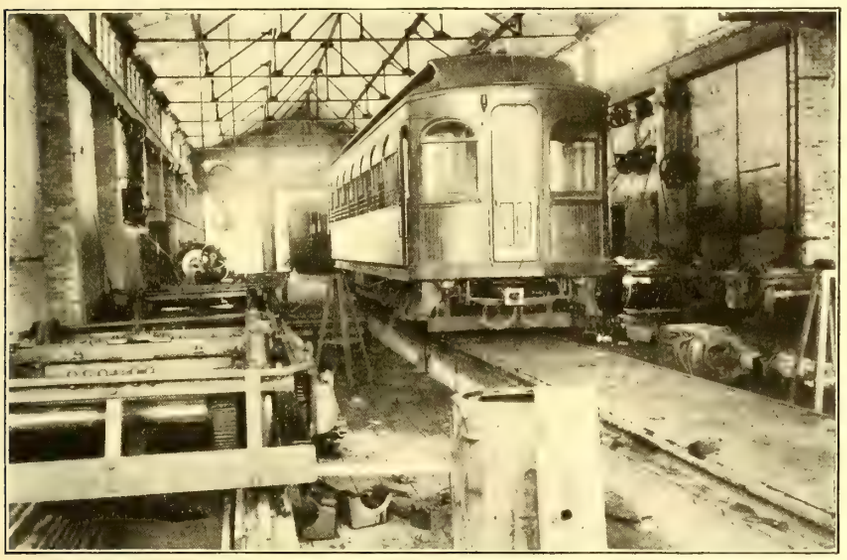


FIG. 7.—EQUIPMENT FOR REMOVING TRUCKS AND MOTORS

From this description it will be seen that the details of these shops were carefully worked out; that the building is well designed for the purposes to which it is devoted; that the equipment is complete and practicable, and that every facility is offered for ordinary repairs, such as will commonly need to be made on interurban equipments.

Those chiefly responsible for the excellence of these shops are Will Christy, Akron, Ohio, who was general manager of the road during construction, and W. L. Morris, mechanical engineer during construction. The road is at present under the general management of E. C. Faber, and the shops are under the immediate charge of Master Mechanic Miles.

NETWORK OF WESTERN INTERURBANS

. Special press despatches a few days ago announced that plans were forming for a network of electric railways to extend from Chicago to Louisville, Ky. That no systematic effort is being made to complete a line of this kind is well known. However, the despatches are suggestive, and to one going over the routes of the lines now in operation and of projected lines, through travel between these cities looms up as a possibility of the near future. As is well known the objective point of the Indiana Union Traction Company is Chicago, so that between Chicago and Indianapolis, with the exception of a few small breaks, there is more than a paper line. From Indianapolis the Indianapolis, Greenwood & Franklin Company now operates to Franklin, and is rapidly completing its line to Columbus. A line is projected between Columbus and Jeffersonville, which is opposite, and connected with Louisville by several bridges. The last-mentioned gap, therefore, appears to be the only serious one encountered.

The Cleveland Electric Railway Company has removed its city touring car, as it is believed it would not be a paying institution during the winter months.

THE WORCESTER & HOLDEN STREET RAILWAY

One of the most recent electric roads to be placed in operation in Massachusetts began to carry passengers this summer between the city of Worcester and the village of Jeffersonville, via the town of Holden. When completed the line will connect Worcester with the town of Princeton, at the foot of Mt. Wachusett, thereby making this beautiful Bay State landmark easily accessible to some 125,000 inhabitants of the "Heart of the Commonwealth," about 16 miles away. In addition to the through connection with Princeton, the line will bind together the cities of Fitchburg and Worcester by an additional route over the tracks of the Gardner, Westminster & Fitchburg Street Railway through Westminster.

Cars from Worcester for Jeffersonville start from the City Hall in the former place, and are run by Worcester Consolidated crews over the lines of the latter company through Main Street, northward to Lincoln Square, whence they follow Salisbury Street and Grove Street past the Washburn & Moen North Works of the American Steel & Wire Company, to Chadwick Square. At this point the Worcester & Holden track begins and the crews are changed. The line follows Grove Street around the south shore of North Pond, strikes Holden Street and follows the highway to North Worcester, where it passes beneath the Fitchburg division of the Boston & Maine Railroad and crosses the Holden line not far from Chaffin's Station. From Chaffin's to Holden the line runs for the most part either at the side of the highway or on a semi-private right of way, and after passing through Holden Center again crosses the Boston & Maine tracks, this time on an overhead bridge, coming to an end in Jeffersonville at the power station on the east shore of Eagle Lake. Jeffersonville is becoming well known as a restful country summer resort, and four hotels are now established in the vicinity of the lake.

At present there are twelve scheduled steam trains per day between Worcester and Holden, and nine between Worcester and Chaffin's. At the latter place is located the hydraulic testing laboratory of the Worcester Polytechnic Institute, which has hitherto been relatively inaccesible for students who wished to put in a full afternoon's work on the apparatus, because of the inconvenient distribution of trains. The new electric line will change all this and create a new value to an already useful feature of the Institute's equipment. There are but four Sunday trains between Worcester and Holden, or two in each direction. The country is exceedingly attractive and offers many desirable features for suburban or rural residences. If the experience of other electric roads radiating from Worcester is suggestive, there is little doubt that this hitherto inaccessible region will be extensively developed by the building of the new line.

The length of track operated between Chadwick Square, Worcester, and the Jeffersonville power station is 7.65 miles. From Chadwick Square to the City Hall is about 1.5 miles. The time required to make the run from the City Hall to points along the road is as follows:

City Hall to—	Minutes
Lincoln Square	4
Chadwick Square	11
North Pond Spring	18
North Worcester	20
City Line	23
Chaffin's	27
Holden	33
Car Houses	37
Jeffersonville P. S.	41

Both 90-lb girder and 70-lb. T-rails are employed in the track construction. Gravel ballast and chestnut ties are used, with six bolts per joint at the fish-plates. The riding is remarkably smooth for so new a road, and the track appears as well laid as that on many a steam line, although nothing in the way of very high speed has been attempted so far. Maximum speeds of 35 miles to 40 m. p. h. are easily within the capacity of the equipment, however, and there is no doubt that real rapid transit will be furnished from Worcester through to Mt. Wachusett when the line is completed. Speeds are necessarily limited on the side of the highway, which accounts, to a considerable extent, for the moderate schedule speed of 13.4 m. p. h. in the run from Worcester to Jeffersonville. It is probable that the run from Worcester to Mt. Wachusett will take about 1¼ hours. The fare from any point in Worcester to the city line is 5 cents, and from Holden to Jeffersonville 5 cents. Southbound, the fares are the same, with free transfer to any point on the Worcester Consolidated Company's city lines. Three turnouts have been built between Chadwick Square and Jeffersonville. No fencing of any consequence has been set up, and the maximum grade is 6 per cent. The line is single track throughout, excepting the Worcester Consolidated tracks, and it is bonded with No. 0000 "Crown" bonds, furnished by the American Steel & Wire Company. Several sharp cuts and heavy fills were required, the embankment being especially steep near the Boston & Maine bridge crossing in North Worcester. The track switches are of steam railway pattern, and are opened and closed by hand levers mounted on regular switch stands. The rails are laid in 30-ft.



TYPICAL TRACK CONSTRUCTION



EAGLE LAKE

lengths. Special attention has been paid to careful drainage of the track and roadbed. Ties are placed on 24-in. centers. The only bridge which the track passes over is a steel truss structure at Holden, approaching Jeffersonville, which crosses the Boston & Maine tracks.

The overhead system is in the main side suspension, although bracket construction is used in various places. Two trolley wires are installed in parallel over the center of the track, each being a No. 0000 B. & S., figure 8, in section. The poles are of chestnut, 30 ft. to 35 ft. in length. There are two cross-arms to each pole, with space for feeder, telephone and signal wires. No signal system is as yet installed, but it is stated that the company is planning to adopt one. Glass insulators are used throughout. The line is at present supplied with power under the most disadvantageous conditions so far as the location of the power house is concerned, as it is at the extreme end of the road, but when the Princeton section is completed the plant will be practically in the middle of the line.

The power station at Eagle Lake is a one-story brick building, with a sloping slate roof, terminating in a monitor which runs its entire length. A brick stack, 100 ft. high, and about 12 ft. in diameter at the base, stands at the north side of the building, and is connected directly to the boiler flues without the medium of an economizer. The station floor is some 30 ft. below the level of the highway on which the track runs, and a large coal pocket is being built just south of the building, and at the side of the roadway. This is bounded by a solid masonry wall, and when it is completed a narrow-gage track and coal car will probably be installed to connect the pocket directly with the boiler room. It will then be a simple matter for coal cars to discharge their product directly over the embankment into the pocket. Inside, the building is divided into an engine and a boiler room, separated by a brick partition wall. The roof is supported by heavy wooden trusses.

The boiler room is located next to the railway embankment, and contains two 100-hp boilers, furnished by the Stewart Boiler Works, of Worcester, each 6 ft. in diameter by 20 ft. long. There is room for an additional boiler of the same capacity. The boiler room also contains two American exhaust



BRIDGE OVER BOSTON & MAINE TRACKS

heaters, a Spencer damper regulator, and a Blake duplex feed pump, cylinders 5-in. x 3½-in. x 6-in. stroke. The boiler steam pressure is 120 lbs. per square inch. The room is lighted by five 16-cp lamps on the railway circuit, and it will be equipped with scales as soon as possible, in order that records of fuel consumption may be kept. There is also an injector for supplying the feed water, which, with the condensing water, comes from Eagle Lake. A large double door in the south wall facilitates the entrance of machinery and supplies. There is no provision for automatic firing. Ashes will probably be handled by a car and narrow-gage track scheme. Practically no duplication of piping exists, the steam being carried through the plant to the engines in a single main pipe.

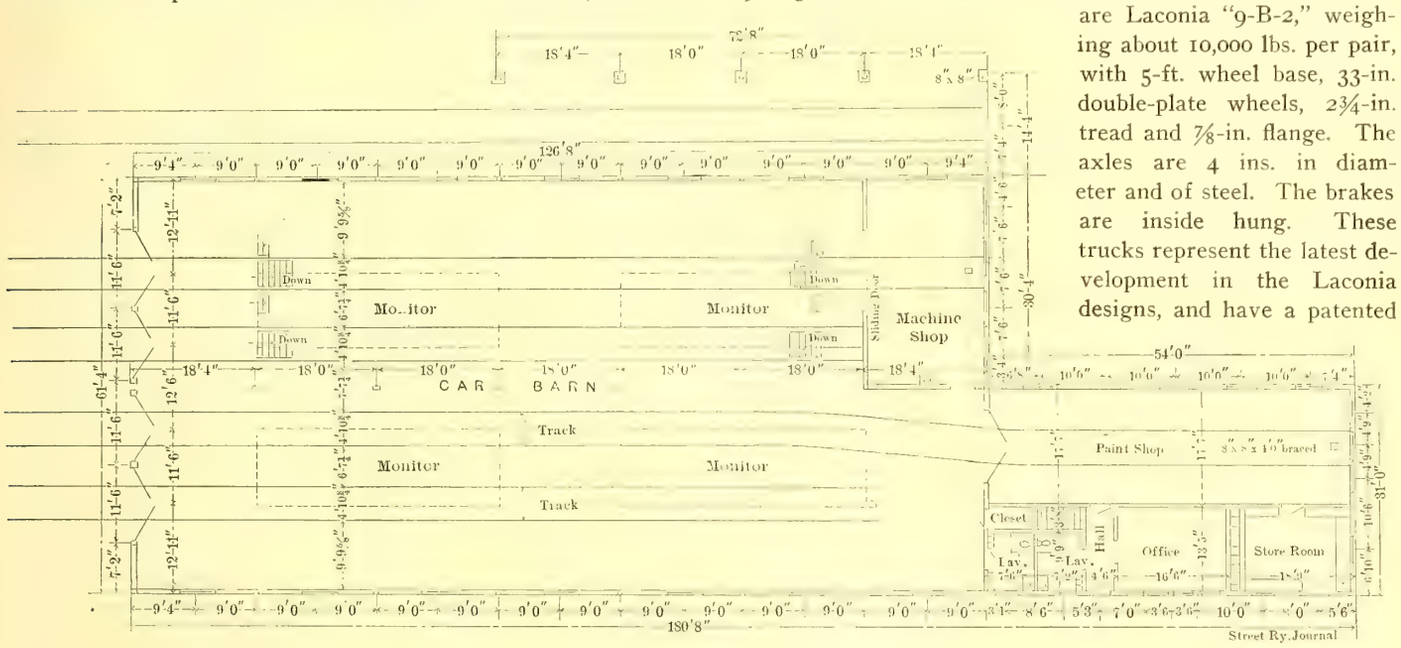
The engine room is extremely well lighted, especially on the western side nearest the lake, and is also provided with a double door for the ingress or exit of machinery. The walls are whitewashed, and fifteen windows are set in the sides, exclusive of the monitor windows at the top. Artificial lighting is furnished by seven clusters of 16-cp incandescent lamps, which depend in groups of five from the wooden beams overhead. At present there are in use two 250-hp Armington & Sims horizontal tandem-compound engines, with cylinders 13 ins. x 18 ins. diameter and 24-in. stroke, belt-connected to four 90-kw

T. H. railway generators, installed on account of the desire of the owners to see the road in operation as early in the season as possible. The switchboard is of the wooden frame type, and there is little doubt that the near future will witness the replacement of this temporary apparatus by engines, generators and a switchboard of more modern design. The condensers and pumps are of the Knowles pattern, the suction pipe being 8 ins. in diameter. Eagle Lake supplies the condensing water, and the boiler supply pipe is 3 ins. in diameter. The machinery was installed by the aid of tackle rigged around the wooden truss beams.

The rolling stock is one of the strongest points in the road's favor with the public. The cars are seven in number, and are

	ft.	ins.
Wheel base	4	6
Wheel diameter		33
Wheel Tread		2½
Wheel Flange		⅞
Weight of trucks per pair	9500 lbs.	

The open cars were made by the Laconia Car Company. Each has thirteen benches, closed ends and three drop sashes; nine of the seats are reversible. The length over dashers is 37 ft. 4¼ ins., and the width over posts 7 ft. 6 ins. The over-all width over the running boards comes to 8 ft. 11¼ ins., and the height from the bottom of the sill to the top of the trolley board is 9 ft. 3 ins. The weight of the car body is 11,000 lbs. Trucks are Laconia "9-B-2," weighing about 10,000 lbs. per pair, with 5-ft. wheel base, 33-in. double-plate wheels, 2¾-in. tread and ⅞-in. flange. The axles are 4 ins. in diameter and of steel. The brakes are inside hung. These trucks represent the latest development in the Laconia designs, and have a patented



CAR HOUSE AT JEFFERSONVILLE

very attractive in design and finish. Three are closed and four open. The former were supplied by the Bradley Car Works, of Worcester, and their principal dimensions are:

	Ft.	Ins.
Length of car body	30	0
Length of car over all	40	4
Width of car over all	8	½
Height inside, floor to roof	7	10
Width of aisle, between cross-seats		17
Width of aisle, between longitudinal seats	3	4
Width of vestibule inside	6	3
Length of vestibule inside	4	2
Weight of body	16,000 lbs.	

The inside finish is of cherry. Plate-glass, 3-16 in. thick, is used on the windows, which are eleven in number on each side, with compound sashes, the lower sash being raised when desired. There are ten cross seats, upholstered in crimson plush, and four longitudinal seats, supplied by the Heywood Brothers & Wakefield Company, the total seating capacity being forty-four. Consolidated car heaters are installed, with the switches in the vestibule. The hand brakes are of the wheel pattern. Inside each of the closed cars are fourteen 16-cp lamps, eight being installed in the monitor roof and three on each side. The air brakes are Christensen, running at 70 lbs. pressure per square inch in the gage, and there are two trolleys per car. Pfingst fenders are in regular use, and the registers are of the International type. The cars are painted an attractive blue color. Kilbourn sanders and Wilson trolley catchers are used.

These closed cars are to be equipped, as are the open, with Mosher arc headlights. The signs are of the four-sided pattern, reading "Worcester," "Jeffersonville," "Holden" and "Special." The closed cars are each mounted on two Taylor trucks. The principal truck data is:

swing bolster which is especially arranged to enable curves to be run at high speeds. The elliptic springs which formerly rested near the jaws of the truck have now been arched higher and the ends brought nearer together so as to rest on spiral springs attached to the truck frame proper. The arrangement practically constitutes an equalizer bar.

The floors of the open cars are finished in hard pine, slatted between the seats. The running boards fold up when desired, and drop side-guard rails have been furnished, divided into two sections per side for the conductor's convenience in raising and lowering. Double trolley and Pfingst brake handles were supplied, and solid bronze trimmings used throughout. The monitor roof extends over the vestibules, and is of steam car pattern. The ceilings are of white birch, decorated, and the seats are of white maple. Side curtains run to the floor and are of waterproof duck.

All of the cars are equipped with General Electric "67," 38-hp motors, there being four per car, outside hung with nose suspension; K-6 controllers are used and the gear ratio is 65 to 19, or 3.42.

The car house is now being built at Jeffersonville. Its capacity will be eight cars, and it contains four spur tracks. The length of the car house proper is 126 ft. 8 ins., and its width 61 ft. 4 ins., while the total length is 180 ft. 8 ins. The building will also contain a paint shop, a machine and repair shop, toilet room, general offices of the company, and a store room. On the west side will be an open shed, and in the yard an extra spur track for car storage.

The company's offices are at present located at 452 Main Street, Worcester. The line was built under the supervision of Albion R. Clapp, of Wellesley Hills, a director of the Boston & Worcester Street Railway. A. W. Woods, of Worcester, was

the civil engineer. The present officers are: President, General Augustus B. R. Sprague, of Worcester, who is also president of the Worcester Electric Light Company, and the Mechanics' Savings Bank, of that city; vice-president, H. W. Warren, of Holden; clerk and superintendent, E. S. Douglas, of Worcester; purchasing agent, A. R. Clapp, of Wellesley Hills; electrical engineer, E. B. Nichols. The chief engineer of the power station is E. A. Cross. James T. Rood, of Worcester, acted in the capacity of advisiory electrical engineer in the early stages of the road's development.

Taken as a whole, the Worcester & Holden Street Railway stands as an interesting example of modern trolley construction in track, rolling stock, roadbed and overhead system. While it is a straight direct-current road and has no interesting complications of alternating apparatus to exhibit, it is particularly noteworthy as the latest spoke in the traffic wheel which is fast turning Worcester into one of the most prominent electric railway centers of New England. The reflection of its operating results will be analyzed with care in the reports of the State Railroad Commission of Massachusetts from year to year, and if a progressive policy is followed by the management in regard to the reduction of operating expenses by the improvement of the power station equipment, there is good reason to expect that the new line will become an important and useful link in the chain of electric roads covering Northern Massachusetts.

PROTECTIVE DEVICE FOR TROLLEY AND FEEDER WIRES

Cleveland, Sept. 5, 1903.

Editors Street Railway Journal:

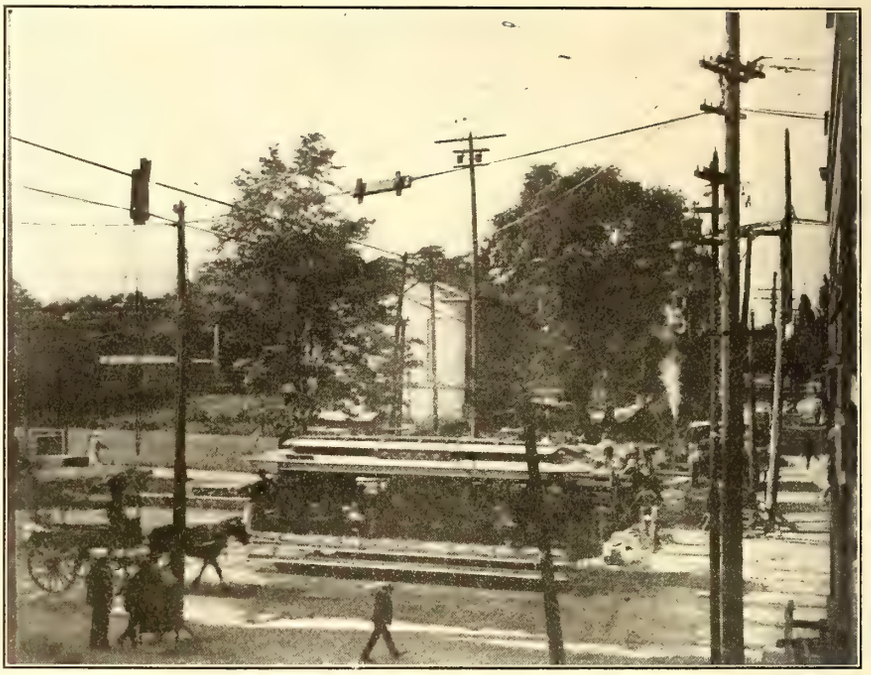
Interruptions to electric car service are avoided by street railway managers as far as possible at all times, every precaution being taken to prevent short circuits from wires and cables crossing above the trolley wire. Of course, the fewer of these the better for all concerned, especially in sleety weather.

In almost every instance a street railway could be operated uninterruptedly during sleet storms and heavy snow storms were it not for the falling of telephone and other small wires across the trolley lines. Such cases as these are not under the control of the street railway company, but a systematic raid against poor construction, and a little oversight and lookout for old wires will reduce to a minimum troubles incident to falling wires.

However, there are occasions where the linemen can make provision for what would otherwise cause delays and entail costly repairs, and possibly loss of life. The accompanying photograph illustrates a case in hand.

A sewer is to be run beneath the car tracks; the construction equipment being provided with overhead wire cables and traveling buckets, with the wire cables of the sewer construction company dangerously close to the telephone cables and the street railway feeders. To protect these circular loom or some similar material is placed over each cable. These are then clamped together with bolts passed through a piece of 2-in. x 4-in., near each end of the boards, which are of ⅞-in. pine. The necessity for protection at this point is the swinging upward of the wire cables of the construction company as the bucket passes. The clamping together is shown in the upper central portion of the illustration. Circuit breakers are also placed in each trolley wire, one over each side of the street, allowing plenty of room for the swinging of the bucket or of the chains.

Track cross-overs are also brought into use. While one of the tracks is undermined the cross-over enables the cars to go around the obstruction. During the days of "dinky" cars run



PROTECTING TROLLEY AND FEEDER WIRES

by horse and mule power, track cross-overs were hardly essential to a well-regulated road. The writer recalls a case in a Southern city where a load of hay broke down on the car tracks. The driver scarcely slowed up; but with a "gee!" and a pull, drove his car around the obstruction and came out upon the track again as if nothing had occurred.

In the spring of '99, when the tracks of the street car lines of Covington, Ky., were in some places under a foot of water, after trying vainly to find the tongue of a switch at a certain corner, a driver was helpless, when an assistant superintendent, from his post of observation on the sidewalk, took in the situation and waded to the car, starting the team, and with lines in hand directed its progress around the corner, the car bumping up and down over the uneven block-paved street.

These cross-overs are sometimes very inconvenient and annoying, especially so when the motorman, from some cause, stops between circuit breakers in the dead section. The conductor may at the time be very busy; but must dismount and swing the trolley across to the other track, or swing to the opposite end of the car—a very troublesome proceeding with double-truck cars, when he is obliged to climb upon the car to put the trolley in place upon the wire. This all takes time, and the resulting mix-up is anything but agreeable.

The illustration given shows the work of a sewer construction company in progress at the intersection of Euclid Avenue and Doan Street, in the city of Cleveland, Ohio.

A. B. Weeks.

"A slow service bringeth forth slow dividends." No, that isn't a quotation from the Bible, nor an aphorism from Poor Richard's philosophy in the "Saturday Evening Post." It is merely the result of a paroxysm of pain suffered by a good resident of one of the cities in Western New York, where the Mayor and the local street railway manager are at odds. But that isn't nearly as interesting as the poem written by a local man in the city referred to, which begins: "The street car man, with his lively pen." But why inflict unnecessary pain on the reader?

PREDICTION AS TO THE COMPLETION OF PHILADELPHIA'S UNDERGROUND AND ELEVATED SYSTEMS

A prominent officer of the Philadelphia Rapid Transit Company declared that the underground railroad from City Hall to Twenty-Third Street and the elevated road from the latter point to Sixty-Third Street, will be in operation within the next two years. The task upon which the company is engaged is a gigantic one. In addition to the underground and elevated road 75 miles of surface roads are to be built. These lines are being built with two objects in view—the better accommodation of the public and to increase the earnings of the company. Consequently, parts of the system will be put into operation as rapidly as they are completed.

PROGRESS BEING MADE

Rapid progress is now being made on the line between Twenty-Third Street and City Hall. This portion of the system will be four-tracked. Two of the tracks will connect directly with the elevated road, which will be a double-track structure, and two will connect with the surface lines, which will use the present Market Street Bridge, the latter gradually descending to the underground after leaving the bridge.

The four underground tracks will be continued to City Hall, at which point they will separate, one passing north to Filbert Street, south on Juniper to Market, then down Market to Front. A second track will pass south on Broad to Penn Square, east to Juniper, north to Market, and down Market to Front. Thus, the Market Street underground east of City Hall will only be double-tracked, against four tracks west of City Hall to Twenty-Third Street.

In addition, another line (underground) will run from a point on Market Street, just west of City Hall, north on Broad to Arch, down Arch to Fifth, south on Fifth to Walnut, west on Walnut to Broad, north on Broad to Penn Square, and thence to a connection with the four tracks on Market Street. The object of this "loop" is to enlarge the shopping district—that is, to make Arch Street and Walnut Street as easy of access as Chestnut or Market, and cars will be so run as to carry out this object. The present plan is to run the surface cars—those which now come over the Market Street Bridge, and which will enter the tunnel at Twenty-Third Street—all the way down to Front Street. But some of these cars, like those from the elevated, may be diverted at Broad Street and Market Street to the "loop," already described.

THE PLANS FOR STATIONS

The company has already purchased the properties between Front Street and Water Street and Arch Street and Market Street, and on this location the elevated road again forms a part of the system, and an important part of it, too, for a double-track structure will extend from this point down to South Street, the underground lines coming to the surface at Front Street and Market, and gradually ascending to the elevated road. Thus, the system will pass every important ferry in the city.

The cars which now turn from the cross-town streets into Market Street east of Twenty-Third Street, will be operated as at present. That is, they will continue on down Market Street as surface lines, their tracks passing over the underground road.

Stations for the underground have already been selected in a number of cases. The western terminal will be at Sixty-Third Street and Market Street, where property has already been acquired for the purpose. A second station will be located at Thirty-Second and Market, at the Pennsylvania's station at that point; another at Twenty-Third and Market, at the City Hall, on the south side of Market, just below Eighth, the property for which was purchased some time ago, and at Front Street and Market Street. The largest station, however, will be at the City Hall, and will extend entirely around that building.

The Pennsylvania Railroad will build an underground tunnel or passageway from the Broad Street Station to the underground road, so that passengers from the Pennsylvania trains desiring to take a car for other parts of the city need not leave the railroad station to do so. The Reading, it is expected, will make similar arrangements, although nothing in that direction has yet been done by that company. In addition, it is not unlikely that several of the principal department stores will ask for this privilege—that is, of connecting their stores with the underground road; in fact, such permission has already been asked. These connections, by the way, are made at the expense of the railroads and stores.

INSURING IMPROVED HYGIENIC CONDITIONS IN ST. LOUIS CARS

The St. Louis Transit Company, of St. Louis, Mo., has changed the plans of construction of 450 new cars now building at the works of the St. Louis Car Company, so as to insure almost perfect hygienic appointments. The carving or fancy finish, liable to catch dirt, has been eliminated, and instead of wooden beams and sills steel will be used. The claim of advantage in using the latter is that it can be more readily cleaned, will be smaller and present shallower crevices than the wood. The cars, according to the specifications, will be models of neatness and comfort. They are to be finished in mahogany like the new Pullman cars, which are comparatively plain. In general appearance they are to be similar to the new coaches on the St. Louis & Suburban road, except that only one (the front) platform will be a closed vestibule. The rear platform will be a broad double arrangement like that on the Olive Street cars. This platform was designed by Mr. Dupont, vice-president of the company, and is commonly known as the "Detroit" platform. A feature of the window sockets or grooves on the sides of the new coaches will be a panel which remains closed whether the sash is up or down. At the bottom of the groove, under the car, will be an opening through which any dirt that sifts in may be dropped. The seats are to be so arranged that dirt cannot accumulate. In accordance with the regulation passed recently by the city authorities, the new cars are to be equipped with power brakes. The brake to be used is that made by the Westinghouse Company, and consignments of it are already being received. All of these cars will be ready for service before the Louisiana Purchase Exposition.

THE RECONSTRUCTION OF THE RHODE ISLAND COMPANY'S LINES AT PAWTUCKET

The Commissioner of Public Works of Pawtucket, R. I., has just granted the first of the necessary consents to the Rhode Island Company for the reconstruction of part of its system in that city. As will be remembered, it was but a few months ago that the differences between the company and the city officials were adjusted so as to permit the rehabilitation of the system to conform with that operated by the company in Providence. The system, as at present operated in Pawtucket, is over a narrow-gage line laid with light-weight rails, and the cars are very antiquated, even the old method of rheostat control being still in use. The permission which has just been granted provides for the construction of the Prairie Avenue road and also for changing of the gage of the line on Prospect Street. The latter work is being done from Main Street Bridge to the terminus of the present line, and the line will probably be connected with the new Phillipsdale extension. The plan of the company, it is said, is to push the work on the two improvements, so as to have them completed this winter. Then, with the beginning of spring, the complete reconstruction of all the lines will be begun in earnest. At the present time the Prospect Street line from the Phillipsdale end to the Pawtucket

city line is completed, and cars are running as far as the standard gage tracks are laid. However, it is necessary for passengers to change cars and walk a considerable distance in order to board the Prospect Street cars and go toward the city. The Prairie Avenue route will run from Prospect Street to Division Street, to Arch Avenue, Pond Street, South Bend Street, to the railroad track. This is an entirely new line and will be the means of opening up a section that has never had railroad facilities. In reconstructing its lines at Pawtucket the company will, of course, do away with the small cars now in use, and probably substitute for them modern double-truck cars, such as it operates in Providence. An unofficial estimate of the cost of the work to be carried out places it at more than $1,000,000.

GASOLENE CARS FOR INTERURBAN SERVICE

Mention has previously been made in these columns of the probability that experiments would soon be tried on some roads in the Middle West with gasolene motor cars. This statement was based on the knowledge that the Chicago Motor Vehicle Company had been experimenting with a gasolene railway car of the same general type as the brakes, busses and auto coaches which are such familiar sights in Chicago streets, and which have been in regular service there for a number of months.

The company has had one of these gasolene street cars in switching service in the railroad yards at its factory, Harvey, Ill., for some time. The first railroad company to adopt these cars is the Tabor & Northern Railway, of Southwestern Iowa, of which Robert McClelland is general manager. This is a road 9 miles long, connecting the college town of Tabor, which has a population of about 1000, with the main line of the Chicago, Burlington & Quincy Railroad at Malvern, Ia. The passenger service to be provided for on this line is similar to a number of other places where the investment necessary to put in an electric railway would not be justified, because of the light traffic, while a gasolene motor car, in comparison, is practicable, is believed to be cheaper in operation and maintenance and may fill a hitherto neglected place in the transportation field. The gasolene motor car illustrated herewith has been found to be practicable, and is similar to the gasolene auto coaches which have been used so extensively in Chicago, except that flanged wheels have been substituted for rubber-tired wheels, while the steering and differential gears have been omitted.

The weight of this car is 7500 lbs. and seats are provided for comfortably seating twenty people. The entrance is at the front, so that all passengers in and out of the car pass the motorman, who collects the fares as well as operates the car, thus dispensing with the services of a conductor. As this car is considerably lighter than a light electric car it can be operated over a much lighter track without excessive track deterioration.

The cost of gasolene per mile for coaches of this kind running on paved streets in Chicago is given as about 1 cent. For cars operating on rails and making fewer stops the cost would probably be less, unless the maximum speed was increased so as to compensate for the fewer stops.

The gasolene engine used on this car has two cylinders opposite each other, so that they counterbalance and reduce vibration. The capacity of this gasolene engine, when run at a maximum speed of 500 r. p. m., is upward of 25 hp on a brake test. The engine can be speeded up to give more power, although the manufacturing company does not recommend high-speed engines for ordinary service, and, in fact, with the engine running at 500 r. p. m., as high a speed as desired with a light single-truck car can be attained, namely, about 20 m. p. h., to 25 m. p. h.

The application of power is by what is known as the "Worth Traction Drive." This mechanism for starting the car from a state of rest is much simpler than any of the changeable speed clutch mechanisms with speed gears used on automobiles, and for this reason it is especially adapted for railway service.

The gasolene motors are mounted on a tubular steel frame which rests on the springs of the car. The car body rests on this frame, and is independent of the engine and driving mechanism. The motors are of the four-cycle type, and are provided with a governor to prevent racing when the load is thrown off. This governor also regulates a mechanical sparking and igniting device automatically controlled to conform with the speed at which it is desired to have the motors run. The governor can be set for any engine speed desired, although the required variation of the car speed is obtained by the traction disc driving arrangement, which is at all times under the direct control of the operator.

The motor drives a pump for keeping the water in circulation around the jackets of the engine cylinders and through the cooling coils. It is arranged so that the circulation of the cooling water is through pipes in the car, which may be regulated to make the desired temperature within the car body.

Taking into consideration the fact that a lighter track can be



GASOLENE CAR FOR INTERURBAN SERVICE

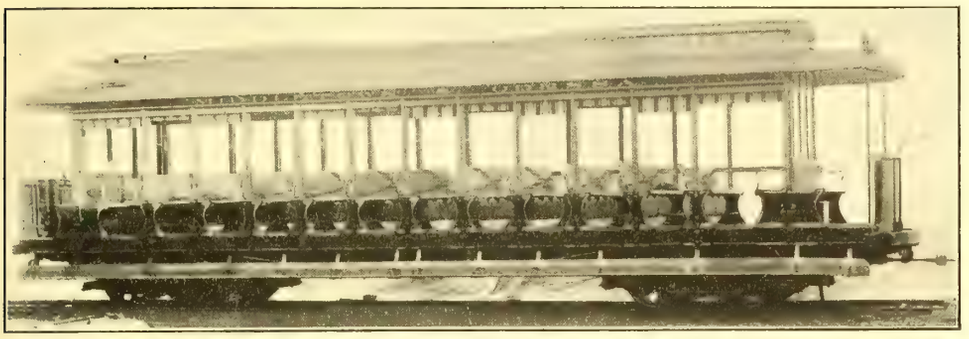
employed under cars of this kind than under the usual electric or steam interurban cars, the designers of this system believe that gasolene-motor roads should be built and equipped for about one-half to one-third the cost of an ordinary electric or steam railway; and reduction of fixed charges should be from one-half to two-thirds less, which is a very important factor in the possibilities of gasolene-motor railway building to serve rural districts. Roads equipped with this system may go a long way toward solving the problem confronting so many railway companies operating interurban and suburban lines, and it is expected that this system, on account of the comparatively small amount of capital required to equip and maintain it, will show good profits from the start.

The gasolene automobile has reached a state where there can no longer be any question as to its commercial success, although the time will probably never come when the gasolene engine will not need some skilled supervision; but this skilled supervision, as the simplicity of gasolene engines become better known and understood, will be easier to obtain from year to year as they come into more general use. Furthermore, improvements are constantly being made in details which increase the reliability and reduce their cost of maintenance. Just what the cost of maintenance will be will depend very much on the condition of the roadway and the supervision and care given the equipment.

The natural growth of traffic on the Metropolitan West Side Elevated Railway, of Chicago, is being retarded by the introduction of universal transfers on the Union Traction Company's lines.

NARRAGANSETT TYPE OF CAR FOR DELAWARE

The type of car shown in the accompanying illustration



NARRAGANSETT TYPE OPEN CAR

built by the J. G. Brill Company, has recently been put on the line of the Odessa & Middletown Street Railway Company, Middletown, Del., to handle crowds of excursionists on this line during the summer months. As is generally known this type has double steps with the upper step on the lower flange of the Z-bar sill, making an easy pair of steps to mount and dismount, and at the same time the width over all does not exceed the usual single-step open car width. It is practically impossible to have the floor of a car mounted on double trucks lower than 36½ ins., consequently a single step would be inconvenient and unsafe. As the illustration shows, the posts are bracketed to the sills, and Brill patented round-corner seat-end panels are set upon the brackets and inclose the posts. It will be seen, therefore, that both panels and sills are arranged to economize space without detracting from the valuable features of standard construction. The seats are a trifle longer than usual, and will accommodate six passengers of average size.

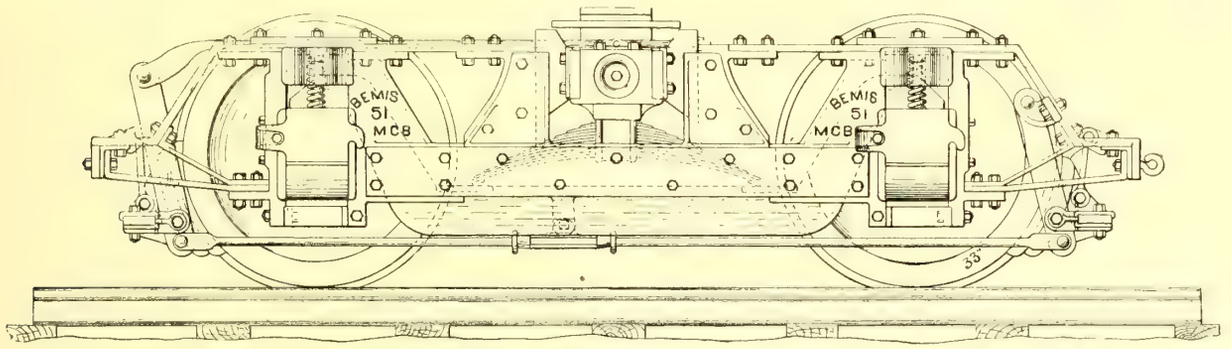
The length of the car over crown pieces is 40 ft. 4⅜ ins., the width over sills 8 ft. 2 ins., and over posts at belt 8 ft. 7 ins., from center to center of side posts 2 ft. 6 ins., sweep of posts 2¾ ins. The inside finish is of cherry and ash, with birch ceilings, decorated with a neat pattern. Dumpit sand-boxes, radial draw-bars, angle-iron bumpers, ratchet brake handles and Dedenda gongs are included in the equipment.

The trucks are Brill No. 27-G with 4-ft. wheel base, 33-in. wheels and 4-in. axles; they are equipped with two motors, each 25 ft. Weight of car and trucks, with motors, 35,260 lbs.

THE BEMIS NO. 51 TRUCK

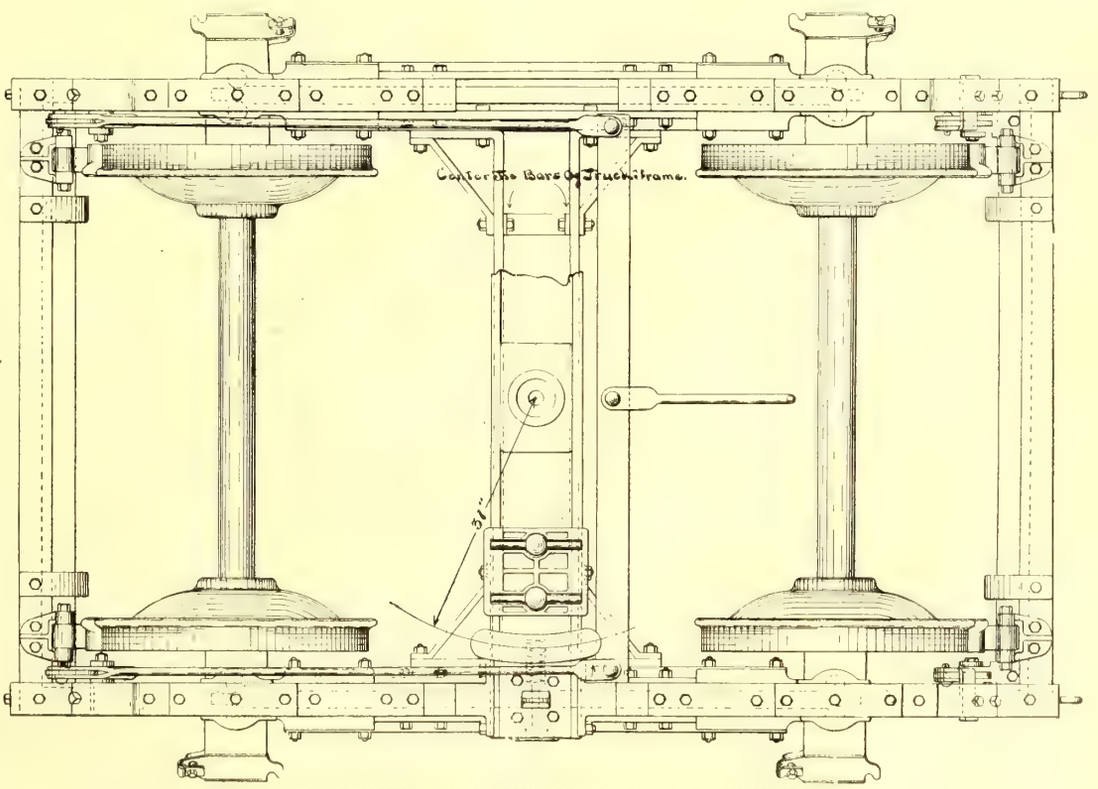
This new M. C. B. type of truck, which was the subject of so many favorable comments at the recent Saratoga Convention, has been especially designed for the very heaviest electric high-speed service. This truck possesses all the M. C. B. standard equalizing bar features, combined with some of the best recognized ideas of regular electric truck construction. It is designed to carry inside suspended motors of the heaviest types made.

The method of distributing or dividing the weight of car bodies upon the trucks in this class of service is in the No. 51 truck somewhat novel, where high acceleration of speed is attained, and where frequent and quick stops are required.



SIDE VIEW OF BEMIS NO. 51 M. C. B. TRUCK

The frame construction is of the built-up type, in conformity

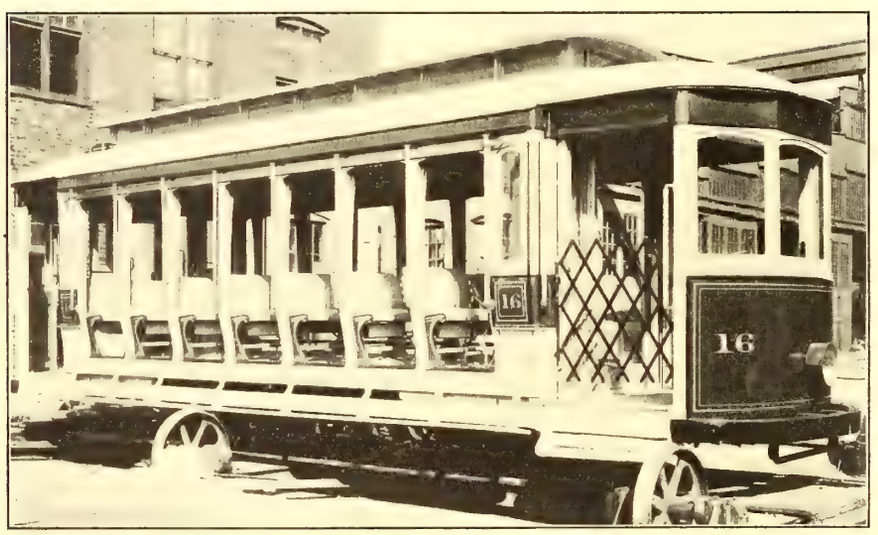


TOP VIEW OF BEMIS NO. 51 M. C. B. TRUCK

with the regular standard M. C. B. equalizing bar methods. The inside or pivotal bolster is suspended to the outside or transom bolster, which latter rests upon long semi-elliptical springs. These springs are supported by the equalizing bar, the ends of which rest directly on the journal boxes, and carry the entire weight of the car body, relieving the truck frame proper from this strain. The work that then devolves upon the truck frame is to hold the wheels in alignment and to carry the weight of the motors, which are spring suspended. In general, the construction of this truck is extra heavy and strongly built, weighing from 10,000 lbs. to 12,000 lbs., and accommodating the heaviest wheels and axles.

CONVERTIBLE CARS FOR MARQUETTE, MICH.

The city of Marquette, Mich., on the southern shores of Lake Superior, is an excellent place to test the weather qualities of the Brill type of convertible car. In winter the city is exposed to the intensely cold winds from the lake, and it is, therefore, necessary to have cars which are capable of retaining heat. This type of car is used in several of the cities of this State on the shores of Lake Michigan and Lake Huron, and has already demonstrated its ability to retain heat quite as well as cars of standard construction. The Marquette & Presque Isle Electric Railway has lately received four semi-convertible and two convertible cars from the American Car Company, of St. Louis, both types of cars being practically the same in length and width. The cuts show the convertible car,



CONVERTIBLE CAR OPEN

which is 20 ft. 7 ins. over end panels, and 30 ft. 7 ins. over crown pieces; width over side sills 7 ft. 9 ins., and over posts at belt 8 ft. 5 ins., thickness of corner posts 3¾ ins., of side posts 3⅜ ins. From center to first side post over corner post 15 ins. These posts are connected with solid panels, from center to center of side posts 2 ft. 7 ins., sweep of posts 4 ins. Panels and sashes are stored in roof pockets when not in use by the well-known method used in this type of car. The inside finish is ash, with ceilings of decorated birch. The seats are reversible, made of spring cane, and afford seating capacity for thirty-two. The length of seats is 34¾ ins. Cars are vestibuled at either end, with dashers wainscoted and arranged with pockets for vestibule windows. Sizes of side sills 5¼ ins. x 6 ins., plated on the outside with ⅝-in. x 6-in. steel; end sills 4½ ins. x 6 ins., from rail to platform steps 14½ ins., from step to platform 13 ins.

The six cars are mounted on Brill No. 21-E trucks, with



INTERIOR OF CONVERTIBLE CAR

7-ft. 6-in. wheel base, and 33-in. wheels, and equipped with 38-hp motors; weight of a car and truck without motors about 18,000 lbs.

The illustrations show the appearance of the car open and closed, and a general view of the interior.

VISIT OF THE ROYAL TRAFFIC COMMISSION

The Royal Commission on London Street Traffic, appointed to investigate traffic conditions of the United States, is expected to arrive in New York Sept. 26, on the White Star steamship "Arabic." The party consists of Sir David Barbour, K. C. M. G., K. C. S. I.; Lord Ribblesdale, Sir John Dickinson-Poynder, Bart., D. S. O., M. P.; Sir Francis Hopwood, K. C. B., C. M. G. (permanent secretary of the British Board of Trade); Sir George Bartley, K. C. B., M. P.; George S. Gibb, manager North-Eastern Railway, and Lynden Macassey.

The committee will commence its hearings in New York soon after arriving and will probably visit other cities in the United States before returning to London.



CONVERTIBLE CAR CLOSED

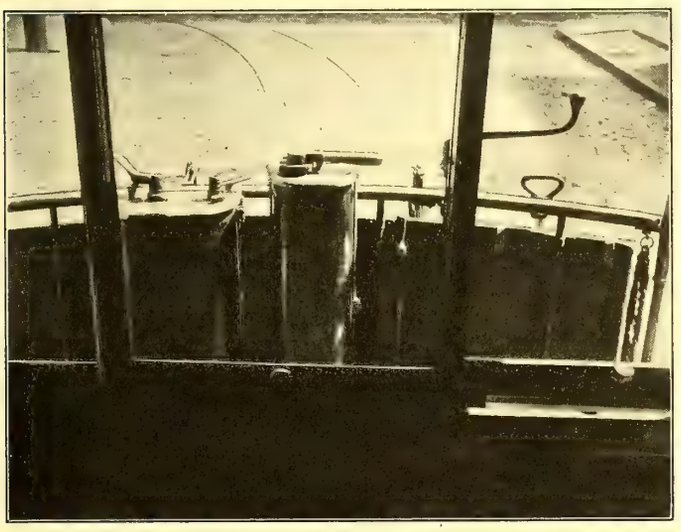
A NEW ELECTRIC BRAKE

For the past two months an electric brake, made by Price, Darling & Company, of New York, has been in operation on the system of the Brooklyn Rapid Transit Company, Brooklyn, N. Y. As this brake possesses some novel features a description of its parts and operation may be of interest.

Car No. 601, on which this brake is now in service, is used on the Southern Division of the Brooklyn Rapid Transit system. The route traversed is an exceptionally good one for testing braking apparatus, as the cars on this line run not only through crowded city streets, which necessitate slow running and frequent stops, but also travel at high speeds over miles of somewhat hilly country on the way to Coney Island. As many as 2000 stops per day are sometimes made under the varied conditions on this line.

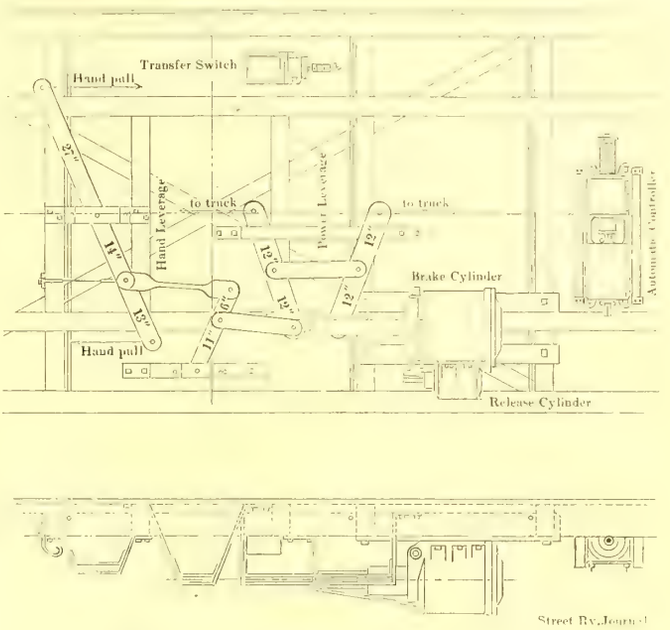
The car is of the twelve-bench open type and is mounted on Brill "Eureka" maximum traction trucks, fitted with 33-in. drivers and 20-in. pony wheels. The operating equipment consists of two No. 68 Westinghouse motors geared 14:68, and two K-11 controllers; the braking equipment of two C-7 Price-Darling controllers mounted on platforms, together with an electromagnetic brake cylinder, automatic controller and transfer switch under the car and a regular hand brake outfit. The total weight of the car when empty is about 13 tons, and of the electric braking equipment approximately 1350 lbs.

As shown in the accompanying cut the brake controller is



VIEW OF CAR PLATFORM

somewhat narrower than the K-11 controller, being about 10 ins. wide. The one illustrated herewith projects above the dashboard, but this is exceptional, as this braking equipment was originally designed for a car having a higher dashboard. The brake controller has six notches, one for the general operation of the car, four braking positions for several rates of retardation and one for releasing the brake. Moving the brake controller from the running position to any of the braking positions cuts off the trolley current from the motors, applies it to the brake and converts the motors into generators for supplying current to the electromagnetic brake cylinder. When the generators deliver current in sufficient quantity the trolley circuit is automatically cut out by the transfer switch and the braking current is derived from the momentum of the car. If, however, the car is moving very slowly the trolley current remains in the circuit and furnishes the braking current, which in this case never exceeds 10 amps. at 500 volts. It has been found that with the present equipment the maximum current used to make a high-speed stop does not exceed 125 amps. at 125 volts, which is but a small portion of the total capacity of the motors, and, therefore, does not increase their heating appreciably. By an electric interlocking device in the brake controller the



BRAKING APPARATUS UNDER CAR BODY

latter is prevented from being returned to running position until the power controller is returned to "off" position, preventing any injury to the apparatus due to a sudden and unexpected start. As the car approaches a stop, when using this brake, a locking device in the brake cylinder holds the shoes on without using any power until the motorman releases them in the "release" position of the controller.

As the action of the brake is entirely automatic it is not dependent on the motorman for operation at its greatest efficiency. Owing to its retaining mechanism the car, when the current is cut off and the brake applied, will remain standing on any grade until the motorman turns the handle to "release" position. The position of the power or reverse handle does not affect the operation of this brake in any way.

The brake-shoe pressure varies in correct proportion with the speed to get the maximum retardation obtainable by the friction between car wheels and rails. An inspection of the wheels on the testing car after using this brake on it two months failed to show any signs of flat-wheel trouble. The makers also state they have found that brake-shoe adjustment is reduced to a minimum.

It will be seen, by reference by the accompanying diagram, that the braking apparatus under the car takes very little space. When installing this system it is not necessary to displace any braking equipment already on the car, the same brake-shoes and levers on the trucks being used as with the hand brake. The brake wiring is connected with the regular car wiring so as to make the running and braking apparatus completely interlocking. Some representative stops are presented in the following table:

REPRESENTATIVE STOPS

Miles Per Hour	Distance Run, in Feet	Equivalent Constant Rate of Retardation M. P. H. P. S.
28.4	141.5	4.2
24.4	117.5	3.7
19.0	89.0	3.0
12.0	31.0	3.52
7.75	16.0	2.83

This braking apparatus possesses few parts, is substantially built and operates almost noiselessly. On a recent trip many stops were made up and down grades at all speeds up to 33

miles an hour, and in every instance the car was quickly stopped without causing any appreciable shocks or jarring.

This brake can be adapted to all classes of electric railway service, including systems using multiple-unit control, and is arranged to go into action automatically on the rear section of a broken train.

RAPID SURVEYING ON THE SOUTHERN ILLINOIS

The Southern Illinois Electric Railway is one of the interurban electric routes which is pushing its way across the lower portion of that State. The engineers have recently completed the survey from Mt. Vernon to Belleville and the branch line from Irvington to Salem, and as the work was quickly and efficiently done, some particulars of it may be of interest especially to promoters of interurban electric railway projects.

The survey party consisted of a chief engineer, one transitman, two chainmen, one back flagman, one stake marker, two axemen, one leveler, one rodman, one topographer, one tapeman, one teamster and one cook, also one team of good horses with a covered wagon. The party also had a team of horses and a surrey, which were found very useful, as the line was for the greater part of its length parallel or adjacent to public highways.

Excepting the chief engineer none of the party had ever been on a railroad survey before, consequently they had to be "broken in," but they were apt and willing, so that it was not much trouble to teach them their respective duties. The line had been "gone over" and approximately located before the survey began, so the chief engineer knew pretty well where he was going.

The party began July 6, at the Chicago & Eastern Illinois depot, which is on the east side of Mt. Vernon, Ill., and ran west, partly over highways and partly across fields and stubble to Boyd, 12 miles distant, which was reached in six days. The next Saturday night found them at Okawville 42 miles on the way, and at noon the following Saturday they were at Belleville, 67 miles. The party rested for a week, and the following Monday began at Irvington, and at noon the following Friday were at Salem, 23 miles.

The party put a stake in at every 100 ft., took levels over all the line and noted the topographical features, including the names of all property owners over whose land they passed. They also measured to the nearest section corners of every section line they crossed, so as to tie in their work to the land lines. As a rule, they followed the lines of population, and made it a point to cross farm lands on property lines, if possible, so as to avoid land damages arising from cutting farms diagonally. Observing all these conditions 90 miles of complete survey was accomplished in twenty-seven days.

The cost of the survey was as follows:

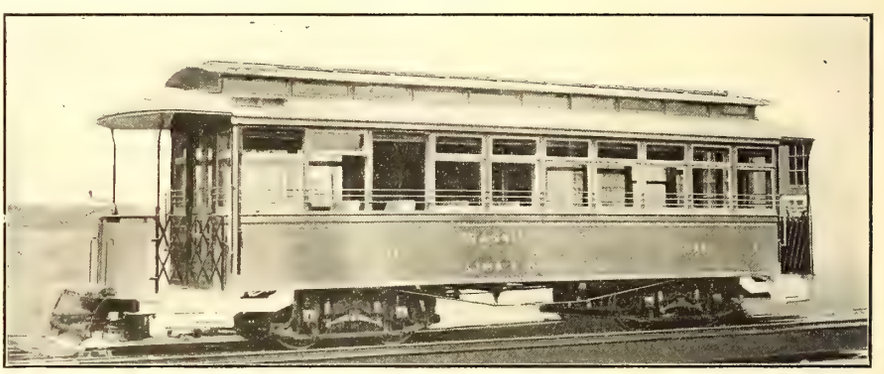
	Per Day
Chief engineer	$5.00
Transitman	3.00
Leveler	2.50
Rodman	2.00
Team	2.50
All others (each)	1.50

Adding to this maintenance, 50 cents per day per man and team, $7, gave a total of $38 per day, or $1,026 for the field work of the survey, an average of $11.40 per mile. This is, of course, a very low average per mile, and was only possible by a constant hustle of the party. On one day the party made 11 miles over the level lands between Sandoval and Salem, which, perhaps, comes close to the record for a preliminary survey.

When it came to plotting the notes very few errors were found. The level rodman checked the stake marker and "called him down" on all his errors of numbering stakes. The levelman set bench marks every half mile, and pegged back to them so as to check his levels, and the transitman checked his deflections by needle readings of the compass, so the field work was thoroughly and carefully done. The party was in charge of Isaac A. Smith, chief engineer.

SEMI-CONVERTIBLES FOR SOUTH AMERICA

The advantages of semi-convertible cars for tropical countries are beginning to be appreciated, as is shown by the interest that has lately been manifested in this subject. This type of car is particularly adapted to service in countries where there are sudden and severe climatic changes, as it enables patrons to enjoy what is practically an open car when desired and yet furnishes shelter from rain and wind or sudden drop in temperature, such as these regions experience. The John Stephenson Company, of Elizabeth, N. J., is turning out several orders of this kind, including one of ten cars for the Lima-Chorillos Tramway Company, of Peru.



AMERICAN CARS FOR PERU

These cars differ materially in their interior arrangement from those employed on American railways. A partition extends across the center of the car dividing it equally into two compartments, one of which is for first-class passengers and the other for second class. The first-class compartment is finished in white ash with mahogany panels, and contains eight reversible seats. The second-class compartment is finished in dark ash with plain ash panels, which are uniform in color throughout and finished in a gloss. This part of the car has longitudinal seats, the backs of which are made of ash slats. In the center of the partitions is a sliding door finished with mahogany panels on the side facing the first-class compartment and in ash on the other side. There are double end doors opening on each platform.

These cars have 28-ft. bodies, are 8 ft. 4 ins. wide and 36 ft. over dashes. They will be mounted on Peckham trucks having a wheel base of 4 ft. 1 in., and will be equipped with two General Electric No. 57 railway motors.

The side sills and center sills are of yellow pine, and the flooring is of 1⅛-in. yellow pine. The end sills and braces are of oak. The bolsters are framed into the body so that only a single step is required. Each end of the car has an open platform 4 ft. long.

As will be appreciated from the accompanying illustration, the car is of handsome design with a monitor roof, the formation of which is not affected by the pockets for the storage of the upper sashes. The semi-convertible feature is that adopted by the John Stephenson Company.

It is stated that the Law and Order League of Brooklyn is to be chartered. It was organized to protect defenseless women and children from the insults of the rowdies who frequent the beaches and amusement resorts in summer. Each member is provided with a deputy sheriff's badge and revolver.

FINANCIAL INTELLIGENCE

WALL STREET, Sept. 16, 1903.

The Money Market

Matters in the money market are taking the course they usually do at this season. Certain salient points of difference stand forth when the situation is compared with a year ago. Borrowings from Europe have been paid off extensively, and bank loans, outside of the local clearing-house institutions, have undoubtedly decreased. But in its routine features the money movement bids fair to follow a close parallel with previous years. Currency demands from the West and South, already begun in a small way, will continue for another six weeks or two months at the least to draw down New York's cash supply. The Treasury, partly by reason of heavy payments for customs, is a large creditor also upon the local institutions, and under our present financial system will most likely continue to press its claims for some time further. Another cause regularly present at this season contributes toward the diminution of the available surplus reserve. This is the withdrawal of funds which interior banks have been lending in the New York market, and which are now needed for crop-moving purposes. The practical effect is, of course, that the clearing-house banks of this city in supplying a substitute for these interior credits, increase their own liabilities and consequently decrease the margin of the legal surplus. Saturday's bank statement, like those of the preceding weeks, showed the workings of these several factors in another addition to that loan account, in another decrease in cash holdings, and in further lowering of the available reserve. It is true that the present surplus of $17,000,000 compares with barely any surplus at all at this time last year, and is far above the average for the period. Yet this circumstance appears to mean, under the present circumstances, that exhaustion of lendable capital is only a question of a somewhat longer time than usual. The promise of the Secretary of the Treasury to increase government deposits holds good, but it is obviously meant to apply only after a real money stringency has become imminent. It must, therefore, be left out of the reckoning in all immediate calculations. As for the prospect of relief through gold imports, the latest developments in the foreign money markets show this to be an increasingly uncertain dependence. Sterling exchange is lower now than it was a week ago; it may decline further if the movement of grain and cotton enlarges in the manner hoped for and expected. But, on the other hand, the markets abroad are engaged in a keen competition for the surplus gold supply. London discounts under the manipulation of the Bank of England have risen sharply during the week. Money on the Continent is hardening in expectation that the Imperial Bank of Germany will raise its discount rate and make a strenuous effort to outbid the English market. Should this happen, as now seems probable, Paris would be the only logical source where American demands could be filled. Remembering from past experience the arbitrary measures which the Bank of France is apt to adopt when a call for gold is impending, help from this quarter must likewise be accounted as exceedingly doubtful. Our market must either raise its rates a good deal above the present, or it must be content to work out its own salvation without importing gold from the other side. These are the plain alternatives of the present situation. Meanwhile, in the absence of a new speculative demand, call money continues to rule at nominal figures on the local stock exchange, the prevailing quotation being 2 per cent to 2½ per cent. Time money is unchanged at 4½ per cent for sixty days, and 5½ per cent from five to six months.

The Stock Market

After another period of dullness lasting up to the close of last week, dealings on the stock exchange have become more active again. The activity, however, as Wall Street writers are fond of putting it, has occurred at the "expense of values." A partial recovery yesterday afternoon took away somewhat from the unpleasant impression left by Monday's really severe declines. Nevertheless the market is disposed to consider rather seriously again the question whether another interval of liquidation is not confronting it. Ostensibly prices broke the day before yesterday because of alarming reports of frost in the corn belt, and recovered yesterday when these reports proved to be unfounded. Still, it may be doubted whether the real trouble, after all, lay in misgivings owing to the crop outlook. The season, of course, is very late, and in the remaining two or three weeks before harvest, frosts have an opportunity to work a great deal of harm. But against this must be set the truly remarkable estimates on the corn crop made by the government in last Thursday's report for September. The government figures show that on the first of the present month corn promised to yield between 2,250,000,000 and 2,300,000,000 bushels, which would make it the third, if not the second, largest crop on record. No one expects this promise to be realized, owing to the lateness of the season, but there is a very liberal margin for frost damage to occur and still leave an average crop. It seems to many thoughtful observers that the crop uncertainties are only one of a number of influences in the latest disturbance in the stock market. The difficulties and limitations already pointed out in the money situation are quite as important, if not a more important cause. So, too, are the evidences of mysterious but persistent liquidation going on in many quarters of the market. The suspicion naturally arises in view of the summer's experiences that this special selling may represent further unloading of marketable securities on the part of capitalists, who are called upon to meet syndicate obligations of one sort or another. This, perhaps, is the most disquieting possibility in the immediate market situation, because it means that securities are being sold regardless of their merits, and consequently that prices may be forced down below intrinsic values. As yet investment buying is discouragingly small. Capital is timid at home; abroad it is perplexed by the new uncertainties which have arisen within the last month in the foreign money and political situations. Our market can hardly count for such ready assistance from foreign investment purchases as it received during the trying days of July and August. The best face that can be put upon existing conditions is that stocks have passed into more secure hands than held them two months ago, and that this, with the low level of prices, should make any further liquidation a less unpleasant matter than it has been on former occasions this year.

Brooklyn Rapid Transit has attracted the most attention among the local traction stocks during the past week. It sold on Monday at the lowest price recorded since the spring of 1898. This movement, occuring simultaneously with the publication of the annual earnings report of the company, has been ascribed to a feeling of disappointment that the property is making no faster progress toward a dividend-paying basis. Although surplus earnings increased $756,000 during the year, it is pointed out that the great proportion of the gain fell within the first six months, and that the record of the last six months failed to bear out previous promises. Attention has also been given to the prospect that more bonds will have to be sold before the extensive improvements now under way on the system are completed. But whether or not these are the entire influences at work, there has certainly been some heavy liquidation of important speculative holdings in the stock. The other traction stocks have declined in sympathy with the rest of the market, but have shown no particular weakness.

Philadelphia

In the absence of anything really important in the Philadelphia traction stocks, the speculative community tried to make a stir over the supposed reconciliation of two well-known street railway magnates who some time ago had a falling out. These gentlemen, at a friendly luncheon, were supposed to have buried the hatchet, and out of this circumstance ingenious gossip wove an interesting story of how some new and great plans had been set on foot by which all the local traction companies were duly to benefit. The story served to break into the monotony of a tedious week, causing some fractional advances among the leading shares. Union Traction advanced from 43½ to 44⅛, and Philadelphia Traction from 96 to 96½. Even this little spark of life soon flickered out, however, and business came to a standstill again. Philadelphia Company common stock has shown the effects of moderate liquidation, declining from 40½ to 39; the preferred remained stationary at 43¾. Other transactions for the week were confined to scattering lots of American Railways at 45, Chicago Union Traction at 5½, New Jersey Consolidated from 60 to 61, and Union Passenger Railway at 235.

Chicago

Everything has been very quiet in Chicago street railway circles during the past week. No new developments have taken place with regard to franchise matters, as far as can be learned, but it is expected both sides will have the matter up again within a short

time, and that all concerned are about ready to come to some sort of agreement. Prices of the various securities have changed very little, and transactions for the week have been too small to have any significance. City Railway sold at 177, and later at 175, ex-dividend. A small lot of Metropolitan Elevated common sold at 21, then the price broke to 19, the lowest of the year. The preferred also reached a new low record at 57½. Northwestern Elevated sold at 20, South Side from 96½ to 96, and Lake Street at 6½.

Other Traction Securities

The feature of the week in Boston has been renewed weakness in Massachusetts Electric securities. Both common and preferred sold down to almost the lowest prices of six weeks ago, the former going to 19¼, the latter to 78. No significance attaches to this decline, except as a part of the general market liquidation. Selling in both stocks was light. Scarcely anything has been done in Boston Elevated; a few sales were reported between 137 and 137½. West End common rose a point from 89½ to 90½, and one sale of the preferred occurred at 108. In Baltimore the only incident of note was the further decline in United Railway securities, the common stock selling down to 10⅝, the income bonds to 62¼, and the general mortgage 4s to 90½. All these represent very nearly the lowest prices for the season. A few sales were reported in Baltimore Traction 5s on a scale down from 104¾ to 104. This ended the week's dealings so far as traction securities were concerned. On the New York curb scarcely any week that we remember in recent years has contained so little of interest for holders of street railway securities. One hunded shares of Interborough Rapid Transit sold at 97, 300 New Orleans common sold at 10¾ and 10½, a few sales were made in the 4½ per cent bonds of the latter company from 82 to 81¼, and 100 shares of St. Louis Transit was reported yesterday at 17⅞.

There was practically nothing doing on the Cincinnati exchange last week. The announcement that Cincinnati interest had gained control of the Cincinnati, Dayton & Toledo Traction Company caused that stock to make slight advance in the figures asked, but there were few sales; these were made at around 28 and 29. Detroit United sagged considerably and several hundred shares sold at between 68⅞ and 70. Cincinnati Street Railway declined to 130, with a few small sales at 130½. Cincinnati, Dayton & Toledo bonds sold at 81½ for a small lot. Columbus, Delaware & Marion 5s and Mansfield Railway, Light & Power 5s held at 101.

On the Cleveland market, Northern Ohio Traction & Light led in the selling. It held at 18¼ during the greater part of the week, but selling orders developed late in the week with little buying to meet it. At the close of the week the price sagged to 17⅞. There were several sales at 20 for delivery six months hence. In view of the fact that the earnings of this road are showing an increase of almost 50 per cent, the purchase at 20 for delivery six months hence is looked upon as a good one. Northern Texas Traction sold at 35 and 35¼, its high mark for the week previous being 34½. Cincinnati, Dayton & Toledo sold at 26¾, a decline of two points since it was announced that Cincinnati interests controlled the road. Western Ohio receipts sold for 15½, which was 1¼ below last sale. A small block of Aurora, Elgin & Chicago 5s receipts sold at 80.

Security Quotations

The following table shows the present bid quotations for the leading traction stocks, and the active bonds, as compared with last week:

	Closing Bid	
	Sept. 8	Sept. 15
American Railways	45	43½
Aurora, Elgin & Chicago	a20	a20
Boston Elevated	137	137
Brooklyn Rapid Transit	43¾	38¾
Chicago City	170	*170
Chicago Union Traction (common)	4½	5
Chicago Union Traction (preferred)	30	32
Cleveland Electric	a73	t9
Columbus (preferred)	100	—
Consolidated Traction of New Jersey	58	59
Consolidated Traction of New Jersey 5s	104¾	104¾
Detroit United	68¾	68
Elgin, Aurora & Southern	a42	a42
Lake Shore Electric	—	—
Lake Street Elevated	6	5¾
Manhattan Railway	134¾	133
Massachusetts Electric Cos. (common)	21½	20
Massachusetts Electric Cos. (preferred)	79	78
Metropolitan Elevated, Chicago (common)	21	18
Metropolitan Elevated, Chicago (preferred)	59	55
Metropolitan Street	112½	113¾
New Orleans (common)	10⅝	10¼
New Orleans Railways (preferred)	31	30
North American	77⅜	75
Northern Ohio Traction & Light	18	17¾
Philadelphia Rapid Transit	13¾	13½
Philadelphia Traction	96	96¼
St. Louis Transit (common)	18⅜	18
South Side Elevated (Chicago)	96¼	95
Syracuse Rapid Transit	—	a30⅝
Syracuse Rapid Transit (preferred)	—	a76½
Third Avenue	110	108
Toledo Railway & Light	20	20
Twin City, Minneapolis (common)	93¼	91¾
Union Traction (Philadelphia)	43⅝	43⅝
United Railways, St. Louis (preferred)	67	68

a Asked. b Last sale. * Ex-dividend. † $10 paid.

Iron and Steel

No fresh cuts in pig iron have occurred since the date of our last writing. Prices, however, are between 25 cents and 50 cents a ton lower than they were on the first of the month, and about a dollar less than five weeks ago. A contributory explanation for the recent decline now appears in the regular monthly statistics compiled by the Iron Age. This authority reports that pig iron production increased some 27,400 tons in August, as compared with July, the increase being attributable to the blowing in of furnaces which had been shut down for some time previous on account of the Southern miners' strike. It is true that stocks of iron on hand have increased only moderately, indicating a very high rate of consumption. Still the fact of there being any over-production at all helps to explain the downward tendency of prices. In the higher branches of the trade the only developments during the week are a somewhat better inquiry for steel rails for next year's delivery, a larger volume of business in sheet steel, and the refusal of makers of steel bars to reduce their previous schedule of prices. Quotations are as follows: Bessemer pig iron $17.35 per ton, Bessemer steel $27, and steel rails $28.

Metals

Quotations for the leading metals are as follows: Copper 13¾ to 13⅞ cents, tin 27⅛ cents, lead 4⅜ cents, spelter 6 cents.

LOW-FARE ORDINANCE PASSED IN CLEVELAND

The City Council has railroaded through the ordinance granting to Albert E. Green and associates the right to build an electric railway on Dennison Avenue. This is the first of the new grants for the People's Street Railway, which is supposed to be promoted by John B. Hoefgen, an understudy of Mayor Johnson. The rate of fare on the line is to be 3 cents, with tickets at the rate of five for 15 cents, nine for 25 cents, and forty-four for $1. The city reserves the right to purchase the road whenever it is vested with the proper power. Work on the line must start within six months, and the line must be placed in operation within one year. As an alleged start on the construction of the line, two wagon loads of rails and a wagon load of ties have been dumped in front of the residence of a citizen who fought the project of placing a line on the street. The promoters state that at the present time an effort will be made to build only the line in question, instead of the eleven lines which were proposed a year ago, when Mayor Johnson's plans were frustrated by a change in the city government.

FRANCHISE RENEWAL ORDINANCE VETOED IN TOLEDO

Mayor Jones, of Toledo, has vetoed the ordinance granting a renewal of franchises to the Toledo Railways & Light Company. He assigned a large number of reasons for his veto, among them being that the city had no right to renew or extend a grant except on the expiration of the franchise. The ordinance provided for the sale of eight tickets for 25 cents, and universal transfers, and was one of the most liberal franchises, so far as the city is concerned, ever presented to a municipality. Had the Mayor signed the ordinance it would have been promptly turned down by the company, as it is claimed the company could not operate under it and pay interest on its bonds. As a matter of fact, the company is in excellent condition to continue business without a franchise extension, since but 18 per cent of its franchises expire within seven years, and no franchise expires before that time. The majority of its franchises have a much longer time to run.

THE ANNUAL REPORT OF THE BROOKLYN RAPID TRANSIT COMPANY

The annual report of the Brooklyn Rapid Transit Company for the year ending June 30, 1903, was made public Saturday, Sept. 12.

The detailed statement shows an increase in gross earnings of $769,699, with an increase in net earnings of $1,022,517. The increase in total income was $1,047,964. The net income increased $777,890, while the increase in the surplus was $737,503. The earning capacity is not fully shown by the net income, however. In spite of the economical operation which resulted in curtailing unnecessary expenses in many directions, operating expenses were swollen by several unusual items. The cost of operation of power plants, which increased over $418,000, includes $109,337 paid for power rented, which item could hardly occur again in view of the completion of the company's new power plant. The coal strike was also responsible for $283,979. These two items added to the income would give total income of nearly $1,400,000, which would be more than 3 per cent of the outstanding capital stock of the company. Economy was introduced in many ways, equipment being fully maintained, although expenditures in that line were reduced nearly $350,000. Damages and legal expenses, one of the heaviest items in the road's cost, were $956,730, a decrease of $138,015 as compared with 1902.

The operating statement, with the figures for 1902, follows:

	1903	1902
Gross earnings	$13,280,321	$12,510,622
Operating expenses	7,931,079	8,183,897
Net earnings	$5,349,242	$4,326,725
Other income	277,493	252,046
Total income	$5,626,735	$4,578,771
Taxes, fixed charges	4,661,857	4,475,450
Net income	$964,878	$103,321
Special appropriation	168,095	84,428
Surplus for year	$796,783	$18,893
Charged off	40,386	.....
Surplus	$756,397	$18,893

A comparative detailed summary of operations follows:

Gross earnings:	1903	1902
Passenger	$13,086,840	$12,321,265
Freight, mail and express	75,658	64,902
Advertising	117,823	124,455
Total earnings from operation	$13,280,321	$12,510,622
Operating expenses:		
Maintenance of way and structure	$495,188	$567,059
Maintenance of equipment	812,600	1,160,999
Operation of power plant (a)	1,680,751	1,262,429
Operation of cars—trainsmen's wages	2,542,214	2,605,330
Operation of cars—other expenses	908,310	975,561
Damages and legal expenses	956,730	1,094,745
General expenses	535,286	517,774
Total operating expenses	$7,931,079	$8,183,897
Net earnings from operation	5,349,242	4,326,725
Income from other sources:		
Rent of land and buildings	$81,877	$67,963
Rent of tracks and structure	99,054	99,051
Miscellaneous	96,562	85,032
Total income	$5,626,735	$4,578,771
Deductions:		
Taxes (b)	$757,789	$742,817
Interest and rentals—net	3,904,068	3,732,633
Total deductions	$4,661,857	$4,475,450
Net income	$964,878	$103,321
Special appropriations	168,095	84,428
Surplus for the year	$796,783	$18,893
Sundry accounts from previous years charged off	40,386	.....
Balance to credit of surplus	$756,397	$18,893

(a) Included in the cost of "operation of power plant" is $109,337 paid for hired power, and $283,979 increase in the cost of coal due to the coal strike.

(b) Included in taxes is $16,931 paid under protest and now in litigation.

The general balance sheet as of June 30 shows:

ASSETS

Cost of road, equipment, etc., of properties owned in whole or in part by the Brooklyn Rapid Transit Company		$92,488,400
Advances—Account, construction for leased companies		10,361,578
Brooklyn City Railroad Company	$5,479,787	
Nassau Electric Railroad Company	1,948,930	
Prospect Park & Coney Island Railroad Company	214,574	
Brooklyn Union Elevated Railroad Company	1,681,267	
Additions and betterments not yet distributed	1,037,019	
Guaranty fund (securities and cash)		4,005,755
Total permanent investments		$106,855,733
Current assets		1,842,620
Cash on hand	598,721	
Due from companies and individuals	185,275	
Material and supplies on hand	416,547	
Prepaid accounts	386,849	
Bonds and stock in treasury	255,228	
Accounts to be adjusted		16,187
Total assets		$108,714,540

LIABILITIES

Capital stock		$45,985,655
Brooklyn Rapid Transit Company	$45,000,000	
Outstanding capital stock underlying companies	985,655	
Bonded debt and real estate mortgages		57,861,140
Brooklyn Rapid Transit Company	12,000,000	
Bonded debt of constituent companies:		
The Brooklyn Heights Railroad Company	250,000	
Sea Beach Railway Company	650,000	
Brooklyn, Queens County & Suburban Railroad Company	6,624,000	
Nassau Electric Railroad Company	15,000,000	
Brooklyn Union Elevated Railroad Company	23,000,000	
Real estate mortgages	337,140	
Total capital stock, bonded debt and real estate mortgage		$103,846,795
Current liabilities		3,119,905
Audited vouchers	$1,041,799	
Due companies and individuals	53,665	
Taxes accrued and not due	1,095,974	
Interest and rentals accrued and not due	866,386	
Interest accrued on real estate mortgages and not due	4,700	
Sundry charges accrued	9,381	
Insurance	48,000	
Surplus account—balance		1,747,840
Total liabilities		$108,714,540

The report says that substantial additions to and improvements of the properties were made during the year. There were added to car equipment 120 open elevated cars, 16 open surface cars, 34 combination surface cars, 10 freight gondola cars and 2 snowplows. The new central power station is progressing toward completion and is expected to be fully in operation with its equipment of eight 4000-hp engines in the spring of 1904. Four of the eight engines are in service and work is generally well advanced, with the exception of boiler and steam-fitting work, which is much behind the time set for completion. There were installed and are in operation in the eastern power station one new 4000-hp engine, with 2700-kw generator, and at various sub-stations six 1000-kw rotary converters and eighteen static transformers.

REPORT OF NEW ORLEANS RAILWAYS COMPANY FOR SIX MONTHS

The report of the New Orleans Railways Company for the six months ending June 30, 1903, which was noted in the STREET RAILWAY JOURNAL of Sept. 5, as being in preparation, has just been issued. It gives the income, charges and surplus of the company, details the earnings of the constituent companies, details the holdings of stock by the new company, and toches on the betterments and improvements that have been made. Figures are also given of unexpected extra charges that the company was called upon to meet.

The result of the operations of the company, also of the constituent companies, follows:

NEW ORLEANS COMPANY

Income—		
Dividends, interest and undivided surplus on account of securities of constituent companies owned by the Railway Company		$424,229
Charges—		
Taxes	$3,705	
General expenses	9,595	
Interest on bonds	400,703	
Total		$414,003
Surplus for six months		$10,226

COMPARATIVE STATEMENT OF CONSTITUENT COMPANIES

	Gross Earnings		Operating Expenses		Net Earnings		Taxes and Licenses and Other Deductions		Bond Interest		Surplus	
	1903	1902	1903	1902	1903	1902	1903	1902	1903	1902	1903	1902
N. O. Railways Co., Lessee	$832,288	$801,967	$492,295	$481,609	$339,993	$320,357	$70,540	$58,891	$146,970	$149,592	$122,483	$111,873
N. O. & C. R. R. L. & P. Co.:												
Railroad Department	390,850	402,558	206,120	206,921	184,730	195,637	35,395	31,541	74,695	75,145	74,640	88,950
Electric Department	396,795	375,347	195,094	161,668	201,700	213,678	34,709	17,203	70,000	70,000	96,901	126,474
St. Charles St. R. R. Co	179,722	166,019	108,514	105,342	71,208	60,677	14,534	9,556	7,500	6,000	49,174	45,121
Orleans Railroad Co	65,387	63,701	44,701	44,718	20,687	18,984	5,343	4,504	12,000	12,000	3,344	2,479
N. O. Lighting Co., Lessee	323,303	300,084	148,108	128,405	175,194	171,679	31,290	33,056	*1,900	*1,900	142,004	136,723
	$2,188,345	$2,109,676	$1,194,832	$1,128,663	$993,512	$981,012	$191,901	$154,751	$313,065	$314,637	$488,546	$511,623

* Not including the interest on the New Orleans Lighting Company's bonds, the most of which are already owned by the Railways Company, and all of which are provided for in the plan of consolidation.

The New Orleans & Pontchartrain Railway Company is still in process of construction and is expected to be completed some time during the coming fall. The Railway Company has already expended on account of this road $243,938.

The Railways Company now owns (as of July 1, 1903) the following stocks of the constituent companies:

Name of Company.	Shares Outstanding	Shares Owned by Railways Company	Per Cent. Owned
New Orleans City R.R. Co.:			
Preferred stock	24,995	24,044	96
Common stock	49,792	47,308	95
Orleans Railroad Company	4,694	4,694	100
New Orleans & Carrollton L. and P. Co.:			
Preferred stock	46,000	45,112	99
Common stock	25,000	24,916¼	99
St. Charles Street Railroad Co	9,533	9,359½	98
New Orleans Gas Light Company	37,500	14,579	*39
New Orleans Lighting Company	20,000	20,000	100

* In addition to the stock of New Orleans Gas Light Company owned, the Railways Company also has an option on 20,212 shares, making a total of 93 per cent. owned and under option.

Since July 1, 1903, the company has acquired in addition to the stocks mentioned above:

110 shares New Orleans City Railroad Company preferred stock.
187 shares New Orleans City Railroad Company common stock.
568 shares New Orleans & Carrollton Railroad, Light & Power Company preferred stock.
33¾ shares New Orleans & Carrollton Railroad, Light & Power Company common stock.
17 shares St. Charles Street Railroad Company stock.

The company also owns all the stock rights of the New Orleans & Pontchartrain Railroad Company.

The company, in addition to the ownership of the stocks, as above mentioned, of the New Orleans City Railroad Company, also has a lease of the properties of said company, and is, therefore, entitled to all surplus earnings of said company over and above the guaranteed dividends.

The New Orleans Gas Light Company is leased to the New Orleans Lighting Company on a guaranteed dividend of 6 per cent on the stock of the Gas Light Company. The Railways Company owns all the stock of the lighting company.

OUTSTANDING STOCKS AND BONDS OF THE NEW ORLEANS RAILWAYS COMPANY, AS OF JULY 1, 1903

Common stock	$27,588,900
Preferred stock	8,792,400
Four and one-half (4½) per cent bonds	17,809,000

In connection with the above statement of the income, operating expenses and interest charges of the company, special attention is called to the fact that while over $240,000 has been expended on the New Orleans & Pontchartrain Railroad, the railroad is still in process of construction, so that the company has received no appreciable income or benefit from the money expended.

Since the organization of the company there has been expended approximately $1,500,000 in betterments and improvements to the various properties, from which the expected benefits are only now commencing to be realized. In the electric light and power department one unit of 1050-kw capacity has been installed complete, and a second unit of 1000-kw capacity is expected to be brought into operation by the end of this month, thus increasing the capacity of this plant from 3200 kw to 5250 kw, an increase of 64 per cent. In the new power house a new 1500-kw unit was put into operation February, 1903. A second new unit of 2250-kw capacity is expected to be installed, ready for operation about Dec. 1, 1903, and a third new unit of 2250 kw, now under order, is expected to be installed, ready for operation in time for use during the Mardi Gras season of 1904, making a total of 6000 kw of new and most modern electric equipment installed in the new power house. Upon the completion of these new units, operated with the present boiler plant, it is expected that there will be an annual net saving in cost of operation of more than $20,000, due to economies to be obtained by shutting down several of the plants now operated under adverse conditions as to location and apparatus. With the installation of a proposed new boiler plant, the estimated annual saving will amount to approximately $60,000.

For the purpose of increasing the output of the gas company the price of gas for both light and fuel was, on May 1, 1902, reduced to $1.25 per 1000 cu. ft. Previously it had been $1.75 per 1000 cu. ft. for lighting gas and $1.25 for fuel gas. The company, in order to take care of the increased demand under the reduced price, has expended for extensions, betterments and improvements about $300,000. The reduction in the price of gas has, as anticipated, stimulated the consumption, the amount of gas sold in the six months ending June 30, 1903, having been 258,300,000 cu. ft., as compared with 203,900,000 cu. ft. in the corresponding period last year, an increase of 26.6 per cent, thus fully justifying the reduction in price.

During the past six months the company has been called upon to meet large unexpected charges and diminution of income, which are approximately as follows:

Increase in taxes for six months	$40,507
Increase in operating expenses, due to increase in wages of motormen and conductors	37,944
Increased cost of fuel	45,588
Reduction in price for municipal lighting	26,473
Total	$150,512

Henry A. Everett's new private car, the "Josephine," which was described in a recent isssue of the STREET RAILWAY JOURNAL, has been delivered in Cleveland. It was given a trial spin over the Cleveland, Painesville & Eastern Railway a few days ago.

THE BIG TRACTIONS

The "Wall Street Journal" recently presented some interesting comparisons of the operating results of the street railway companies in New York, Philadelphia, Boston, Brooklyn and Chicago. Results for the fiscal year ending in 1903 not being available, recourse was had to the fiscal year 1902, for the purpose of comparison. The figures of the Metropolitan Company, of New York, comprise three months of the Interurban Company, and nine months of the old Metropolitan Street Railway Company. Metropolitan Securities, despite the competition of Manhattan Elevated, shows the largest gross earnings, and Philadelphia Rapid Transit comes second, with Brooklyn Rapid Transit a close third. Boston Elevated, which operates 395 miles of surface road, under the name of the West End Street Railway, and about 16 miles of elevated road, stands in the same class, with earnings running upward of $11,500,000. Chicago Union Traction does not include the elevated lines of that city, and, although Chicago is the second largest city in the country, this company comes fifth in point of gross earnings. Pittsburg would naturally, perhaps, be the sixth city to include in this comparison, but any such comparison is impracticable from the fact that the separate trolley operations are covered up, being combined with the gas business in the Philadelphia Company's report. Baltimore United Railways & Electric, in a comparatively small city, does within $3,000,000 of the amount of gross business done by Chicago Union Traction.

The comparison of earnings follows:

Fiscal year 1902.	Phila. R. T.	Met. S. N. Y.	B. R. T.
Track mileage	475	196	522
Gross earnings	$13,969,232	$14,501,568	$12,321,265
Operating expenses	6,402,338	6,739,275	8,952,214
Net	$7,566,894	$7,762,293	$3,369,051
Total income	*7,715,820	8,343,962	3,835,954
Fixed charges	7,597,780	†8,281,940	3,732,633
Surplus	$118,040	$62,022	$103,321
Capital stock	‡$6,000,000	‡$15,000,000	$45,000,000
Earn. per share stock	$0.19	$0.20	$0.23
Present market price	$14	$27 (77%)	$45
	Chicago U. T.	Boston Elev.	Balt. U. R.
Mileage	486	409	363
Gross earnings	$7,825,119	$11,321,030	$5,041,275
Operating expenses	4,570,719	7,862,572	2,252,133
Net	$3,254,400	$3,458,458	$2,789,142
Total income	3,371,750	3,458,458	2,789,142
Fixed charges	3,619,278	2,836,560	a 2,637,115
Surplus	def. $247,528	$621,898	$152,027
Capital stock common and preferred	$32,000,000	$13,300,000	$15,069,308
Earn. per share stock	$0.00	$4.67	$0.50
Present market price stk.	b$5	$138	*$11

*Includes present Union Traction rental of $900,000 per annum and $60,000 interest on Hestonville collateral trust 4s.
†Includes 7 per cent guarantee on Metropolitan Street Railway stock.
‡Cash paid in; assessable up to $30,000,000.
a Includes preferred dividend.
b Common.

Philadelphia Rapid Transit for the 1903 fiscal year will show about $15,400,000 gross and about $400,000 surplus, or 66 cents per share for the stock as against $118,040 for the latter item shown in the table above. Metropolitan, Brooklyn Rapid Transit, and Boston Elevated will probably report increases, though scarcely as large as those of Philadelphia Rapid Transit. Chicago Union Traction earned about $8,000,000 and made, it is said, about $250,000, or substantially the same as in 1902.

With its relatively lesser net earning power on the amount of gross business done, Brooklyn carries much tighter fixed charges than Metropolitan or Philadelphia Rapid Transit, and with $1,000,000 more gross business than Boston Elevated the fixed charges are only about $300,000 larger. Thus it is that Brooklyn is able to earn a surplus, although its operating expense item is from $2,000,000 to $2,500,000 higher than that of Philadelphia Rapid Transit or Metropolitan.

Metropolitan, of the larger roads, bears the heaviest fixed charges in proportion to gross business, and the operating results suggest at present a narrow margin of earnings over the 7 per cent guarantee.

Boston Elevated has the lightest capitalization based on gross earnings, hence its ability to pay dividends of 6 per cent and to have its stock sell at a handsome premium, while classed as an investment dividend-paying stock.

OUTING OF BROOKLYN STREET RAILWAY MEN

On Sept. 14, 15, 16, 17 and 18 a seaside festival was given at Luna Park, Coney Island, in aid of the Brooklyn Rapid Transit Employees' Sick and Death Benefit Association. A percentage of the returns from the sale of tickets, which were on sale by all of the Brooklyn Rapid Transit Company's employees, went to swell the coffers of the treasury, which is in readiness for the wives and children of those members needing assistance in time of sickness or distress. What greatly helped the sale of these tickets was the fact that the outing occurred during the entire week of Sept. 14, up to and including Friday, combining with a number of the principal attractions the special features arranged for the Indian Summer Carnivals which began on Labor Day, to continue until Oct. 1. Two kinds of tickets were sold, one for 50 cents and the other for 25 cents. For 50 cents the holder was entitled to admission to Luna Park, "A Trip to the Moon," "20,000 Leagues Under the Sea" and to Hagenbeck's Trained Wild Animal Show, which, under ordinary circumstances, would cost 85 cents, without considering the extra Indian Summer Carnival features. Twenty-five cents included admission to the Park, a ride on the Chute the Chutes, the Old Mill, the Laughing Mirrors and the Midnight Express, the total cost of which is usually 40 cents.

The carnival was in charge of the following members of the Association, who constituted the arrangement committee: George Wolfram, D. S. Smith, G. W. Edwards, D. R. Collin, H. Pistor E. Gilchrist, T. Moylett, C. E. Roehl, J. M. Dudley. This committee is to award prizes to all who sell fifty or more tickets. Much of the success enjoyed was due to the conscientious work of the committee and to the liberal reduction in price made by the owners of Luna Park.

PLAN TO CONNECT NEW YORK'S BRIDGES

Mayor Low, of New York, has made public a letter from Bridge Commissioner Lindenthal containing recommendations for the connection of the four bridges over the East River with the transportation companies on both sides of the East River. The Mayor said that he would submit the letter to the Rapid Transit Commissioners. Mr. Lindenthal says that the Brooklyn Bridge was constructed before the present demands upon the structure were foreseen, and for that reason he is of the opinion that the floor system of the bridge must be replaced so that there will be separate decks for the trolley tracks and for the elevated railway tracks. This will require a general strengthening of the structure, which is not now adequate to carry much more weight.

He added that provision will be made in the plan of the new City Hall station for a loop terminal, with a space of 40 ft. between each loop, that will probably give ample room for all the trolley cars of the future. He also wishes to remove the present elevated terminal structure in Brooklyn and use the cleared space for a park. He proposes an extension of the elevated lines over the Brooklyn Bridge, along Park Row and Division Street, which will allow the construction of a loop between the new Manhattan and the Brooklyn Bridge.

Mr. Lindenthal suggest that the Second Avenue elevated structure in Manhattan be removed and deflected from Delancey Street into the Bowery. The Williamsburg bridge will have six tracks, two in the middle for the elevated road, and two on each side for the trolley lines. The elevated trains from Brooklyn, in reaching the Elm Street station, will have to cross over the tracks of the Manhattan Elevated road at Allen Street and the Bowery, and the Brooklyn roads will have their Manhattan ends within two blocks of Broadway.

The Elm Street Station, Mr. Lindenthal says, should have four tracks and five platforms, which would permit the separation of incoming and outgoing passengers. One six-car train, he says, could depart from the station every sixty seconds, which means a seating capacity for 15,000 passengers and 15,000 standing passengers every hour. It would also transfer passengers from Brooklyn and Williamsburg to the subway at this point and to the Manhattan Elevated Railway trains, both north and south.

The southern two blocks on the Williamsburg bridge, Mr. Lindenthal says, can be used for the moving platform. This moving platform would descend on a 12 per cent grade into a subway in Manhattan under Delancey Street to the Bowery, to Park Row, to Nassau Street, according to the plan now before the Rapid Transit Commission. The Commissioner believes that the moving platform, with a capacity of 70,000 passengers per hour, should suffice for the traffic between lower Manhattan and Williamsburg for a long time to come. Mr. Lindenthal concluded by reviewing his plans for the Blackwell's Island bridge.

PROGRAMME OF THE VIENNA MEETING OF THE INTERNATIONAL TRAMWAYS AND LIGHT RAILWAYS UNION

The list of papers and questions to be followed at the next convention of the Union Internationale de Tramways et de Chemins der fer d'Intérêt local (Internationaler Strassenbahn-und Kleinbahn-Verein), has just been issued by the secretary. This meeting is to be held in Vienna some time during the first two weeks of September, 1904. The exact date is to be announced later. The subjects to be discussed and the questions which each member-company of the association is requested to answer before October 30, 1903, are given below. Replies to these questions should be sent directly to the secretary of the association at Brussels, and will be referred by him to the member who has been selected to present a report on each topic.

(1) RENEWAL ACCOUNTS.

1. Do you have a regular renewal account independent of the operation, repair and sinking fund accounts, to cover the renewal of your equipment? The purpose of this fund is based on the theory that a large part of the equipment of a street railway undergoes a certain depreciation, which, independent of repairs, makes it antiquated and requires its renewal one or more times before the expiration of the franchise.

2. Is the establishment of such a renewal fund prescribed either by law or by the charter or by-laws of your company? If in the affirmative, what are the regulations?

3. Upon what should the payments to such a renewal account be based, in your opinion? Is it desirable to divide it into the following sub-divisions: (a) track construction, (b) rolling stock and equipment, (c) buildings and structures, (d) power station and equipment, (e) overhead lines and feeder conduits, (f) other parts of the equipment which are subject to deterioration?

4. What is the total amount of the sum charged to this account annually in each of the different sub-divisions?

5. Are these different accounts credited with the sums realized from the sale of old material, or are these credits carried into the receipts from operation?

6. What expenses in repairs and renewals from the standpoint of their importance do you charge into ordinary operating expenses instead of against the renewal account? If you have a limit, how is it fixed?

(2) TRANSFER TICKETS.

1. Do you use transfer tickets?

2. Are they valid on your own line only or do you transfer with other lines?

3. What are your fares with and without transfers?

4. Have you introduced the system of transfers of your own volition or have they been required by the authorities?

5. Give the results of the use of transfers, and the reasons for any opinions you may express in regard to it.

6. What methods do you recommend for preventing the abuse of transfer tickets?

7. Do you, to avoid fraud, differentiate the tickets in any way, or do you employ some other method of checking? In this connection please send one of your tickets and indicate the identification marking.

8. Has the system which you employ of preventing frauds given satisfactory results?

9. Does this system cost more than the frauds which it is intended to prevent?

10. What amount, in percentage of your receipts, do you estimate as the loss from frauds in connection with your transfer system?

(3) ECONOMY IN THE CONSUMPTION OF CURRENT BY CARS.

1. What is the gage of your tracks? Give the percentage of your lines on a grade of 0 to 1 per cent, from 1 per cent to 3 per cent, of 3 per cent to 5 per cent, of 5 per cent to 7 per cent, of 7 per cent to 9 per cent, above 9 per cent.

2. What is the maximum grade?

3. Give in percentages of the total length of your lines, the length on curves as follows: Curves up to 15 meters radius, between 15 and 20 meters radius, between 20 and 40 meters radius, between 40 and 60 meters radius, between 60 and 100 meters radius, curves of over 100 meters radius, and straight line.

4. What is the total length of your line?

5. What is the number and weight of the different types of motor cars used by you as follows: Single-truck cars, three-axle cars, double-truck cars?

6. What is the number and weight of your trail cars?

7. What is the average number of stops per kilometer of track?

8. Do you produce your own power or is it purchased?

9. How do you measure the consumption of current?

10. What make of wattmeters do you use?

11. Do you measure the current from a main wattmeter or by several wattmeters? Give a schematic diagram of the arrangement of the feeders and the position of the wattmeters. Also state how you determine any errors in reading these wattmeters.

12. Give the number during the last year of operation of car kilometers, number of car kilometers per kilometer of track, the number of motor car kilometers calculated on the basis of one trail-car kilometer equals one-third of a motor car kilometer; the actual number of motor car kilometers, and the number of tonne kilometers run.

13. Give the consumption of current per car kilometer as follows per motor per car kilometer calculated as above, per motor kilometer, actual, and per tonne kilometer.

14. Do you think the consumption of current, as determined in question 13, can be reduced?

15. Have you taken any steps to accomplish this? If so, indicate what you have done, and what results have been obtained.

16. Do you consider that, by a good course of technical instruction to the motorman, a material reduction can be made in the amount of current required to operate the cars? If so, in what direction should this instruction be given, and what would be its cost?

17. To what extent do you check up the consumption of current by motormen, either by inspectors or by individual watt meters? What results have been obtained? What is the additional cost of operation?

18. Have you instituted any system by which the employees who are economical of current participate in the economy realized? If so, do the motormen alone participate, and what is the plan followed?

19. Have you attempted in employing wattmeters on your cars to determine the average consumption of cars of the same type on lines of the same class of traffic?

20. Who are the manufacturers of the wattmeters used on your cars? How many did you order, and what was the price?

21. Give your opinion as to their use.

22. How often are these wattmeters regulated or repaired? What troubles have you observed in them, and what errors have you noticed in their reading?

23. Where are the wattmeters mounted in the car?

24. How long have they been in use?

25. When and how often are these wattmeters read?

26. Who reads them?

27. Do the motormen receive prizes for economical use of current?

28. What percentage of the total number receive such prizes?

29. How often do you distribute such prizes?

30. How do you proceed to determine these prizes? If according to a certain scale, please give particulars.

31. What is the total cost of installing this system?

32. How much is the cost of maintenance and other expenses increased by its use?

33. How do you determine the saving realized by the company?

34. What proportion of this saving is given to the motorman, and what to the conductors?

35. Is the consumption of current constant for all lines and for the different types of cars?

36. If not, how do you determine the relative efficiency of the motorman?

37. How do you calculate the current taken by trail cars?

(4) BRAKES.

1. What system of brakes do you use for motor cars and for trains? Please indicate, in the case of trains, how the brakes on the trail cars are applied, and if they are operated by the motorman of the motor car.

2. Point out the advantages and disadvantages of the different types of brakes, especially compressed air, electric and electromagnetic.

3. Have you made any tests on brakes? If so, state what have been the results.

4. Give the cost of maintenance and renewal of brakes employed by the year and per car kilometer.

5. What are the weights of your motor cars and your trail cars?

6. What is the gage?

7. What is the percentage, in total length, of your line (on track) of the following grades: From 0 to 1 per cent, from 1 per cent to 3 per cent, from 3 per cent to 5 per cent, and above 5 per cent?

8. In case you have several systems of brakes, state which are for regular service and which are for emergency use.

N. B.—Also note the discussion relating to brakes at the meetings at Paris in 1900 and London in 1902, and also the re-

port presented to the 1902 convention by Mr. Poetz, chief engineer of the Hamburg Tramway Company.

(5) PROTECTION OF THE TROLLEY WIRE AGAINST ACCIDENTAL CONTACT WITH TELEPHONE AND OTHER AERIAL WIRES.

1. What system of protection of this kind do you employ?
2. Have you employed other systems? If any have been abandoned, give the reasons.
3. Is the system, which you are now using, one required by the authorities?
4. Is it satisfactory (a) for the object for which it is intended; that is, to prevent accidents, (b) from the standpoint of operation?
5. What is the cost of maintenance of this system, both per km of trolley wire and per motor car km?
6. Have you been obliged to install any safety precautions in the other ærial wires themselves, such as the introduction of a complete metallic circuit, fuses, etc.?
7. To what accounts have you charged these expenses?
8. What trolley system do you use; trolley wheels or trolley bows?

(6) OPERATION OF TRAIL CARS IN CITY SERVICE.

1. Under what conditions do you consider the operation of trail cars, in city service, desirable?
2. Do you operate trains composed of one or several trail cars? Are you permitted to employ any number of trail cars in a train? In case there are any restrictions, please state what these are, and for what reasons they were introduced.
3. To what extent does the operation of trail cars depend on the local conditions on your line, such as single or double track, and the intensity of the traffic? If your lines are single track, are trail cars sometimes desirable, and are you permitted to run them? If double track, give all the reasons which have led you to use trail cars, and the number of cars per train.
4. To what extent does the operation of trail cars on your system depend on the street traffic and on the length and character of the streets and squares?
5. To what extent does the braking of the trains depend upon the grades and other topographical conditions in the streets occupied by your lines? What system of braking do you employ, and is it satisfactory for trains?
6 To what extent is the employment of trail cars on your system determined by other local conditions, such as crossings and terminal facilities?
7. What is your opinion as to the relative advantages and disadvantages of trains composed of one motor car and one or more trail cars?

(7) ADVANTAGES AND DISADVANTAGES OF ELECTRIC TRACTION ON INTERURBAN RAILWAYS.

1. What, in general, are the advantages and disadvantages of electric traction on such lines?
2. Was electric traction originally installed on your line, or has it replaced steam traction?
3. What were your reasons for introducing electric traction?
4. Describe the influence of the length of your line in km, density of traffic, etc., on the position of your central station?
5. Give the amount of traffic and freight carried per kilometer of track and per year.
6. Are your tracks standard or narrow gage?
7. What gage would you recommend when electric traction is used, and give your reasons?
8. Does your operation include trains composed exclusively of passenger trains, or of freight trains, or of mixed trains; that is to say, are the trains ever made up of both passenger and freight cars?
9. Describe the composition of trains made up, giving number of cars, weight empty and loaded, average speed, whether drawn by special locomotives or motor cars.
10. What is the expense of operation per train kilometer and per tonne kilometer? In making up this report kindly employ the standard system of accounting adopted at London in 1902.
11. Give the average price, per ton, of coal delivered, and the average wages of the employees.
12. Would you recommend any changes in your equipment as it exists to-day?

(8) CHARACTER OF CURRENT FOR INTERURBAN LINES.

1. What is the most desirable character of current to use on interurban lines whose length does not permit the use of direct current from one central station? Divide this answer according to the following points: (1) Cost of transportation of power, (2) installation of transmission lines and the apparatus for taking the current, (3) the motors and (4) the effect on other neighboring installations.
2. What limit of voltage should be used on the transmission line and in the cars?

(9) TRACK CONSTRUCTION FOR INTERURBAN STEAM LINES.

1. Give section of rails employed on your interurban lines.
2. What is the weight of your rail, per meter?
3. What joint do you use, and is it attached to the tie? Please give full description, with plans.
4. What guarantees do you require from the manufacturers of the rails?
5. State what ties are being used, viz., wood or metal, length, width, spacing, and spacing at joints.
6. State what ballast is being used.
7. Have you made any investigation into the relative merits of different kinds of ballasts? If in the affirmative, state what.
8. What is the weight of your locomotives and your trains, per axle? What is the admissible weight, per wheel, of your locomotive cars?
9. What is the average and maximum speed of your trains?
10. What are the advantages of different kinds of track construction, and what changes would you make if you were to rebuild your track?

(12) LEGISLATION ON TRAMWAYS AND INTERURBAN ROADS IN DIFFERENT COUNTRIES IN EUROPE

Communications relative to this subject in the different countries in Europe should be sent to the secretary, according to the plan suggested at the London meeting by Mr. R. H. Scotter.

(13) STANDARD FORM OF OPERATING REPORT.

Communications relative to the subject of the standard form of report adopted at the London meeting in 1902 are requested, as well as a copy of the report of each company made out on this basis. The members of the association are requested to indicate in what form they recommend the division of expenses between motor car kilometer and trail car kilometer; in other words, if they estimate the expense of trail car kilometers at one-half or one-third, or any other fraction, of a motor car kilometer.

N. B.—The operating expenses should be separated under the nine primary headings defined in the standard system of classification.

(14) CONTROL OF ELECTRICAL INSTALLATIONS AND MAINTENANCE OF TROLLEY WIRE

1. Have you established any system of inspection in regard to faults of insulation on your overhead system, or the stability of the trolley wire? If so, please give full information, especially on the following points:
2. Describe the methods which you employ for testing the insulation of the system as a whole, measured from the switchboard.
3. Tests of insulation, individually, of the feeders, trolley wire and the return circuit.
4. Measurement of the electrical resistance of the joints.
5. Measurements of currents which would cause electrolysis.
6. What importance do you attach to this inspection?
7. After what periods do you consider it necessary to test the insulation of the line and track?
8. Have you, in spite of this method of inspection, suffered important losses due to bad insulation of the line in general?
9. Have you had any instances of trolley-wire breakage?
10. What was the cause?
11. What precautionary measures have you adopted in this respect?
12. How often do you renew the trolley wire?
13. Complete your reply by giving the following data: Profile of line, headway of cars at different hours of the day, form and section of the trolley wire, type of suspension used, length of spans and tension of wire at 0 degree cent; type of trolley, viz., center under-running trolley, Dickinson trolley, and bow.

(13) USE OF MOTOR CARS AND LOCOMOTIVES ON RAILWAY AND TRAMWAY LINES

Motor cars in this connection will be understood to be cars not sufficiently powerful to haul trailers; locomotives as cars capable of hauling one or more trailers.

1. Are you using motor cars, with steam, gas or electric power? If so, describe the system, gage of your tracks, the form of motor employed.
2. How many and what kind of locomotive are you using?
3. What kind of service do these cars supply? Are they used for passengers, post, freight or baggage service, or all together, or for one or more of them alone? Is this service carried on on tramway lines, or purely on lines which operate outside the city limits?
4. Do you divide the cars into classes? How many seated and how many standing? What is the capacity of the compartments reserved for baggage, and what for passenger service? What is the tonnage of the cars or locomotives used in freight business? What is the maximum speed, in kilometers, per hour? What is the maximum grade and minimum curve? What is the maximum

weight, net and gross, which can be transported in or by these cars?

5. Do these cars have to be turned at the ends of the line?

6. When not operated as motor cars or locomotives, can they, without inconvenience, be used as ordinary cars, and be made up in trains?

7. How many employees are required to operate a train?

8. Give a description of these cars; in particular, their construction, wheels, motors, boiler, etc., principal dimensions, weight loaded, empty, the system of braking, method of lighting and heating, consumption of fuel per car kilometer, total expense per car kilometer, per train kilometer and per tonne kilometer. These expenses of operation should not include interest and sinking fund.

9. What are the average car kilometers and train kilometers run by these cars?

10. What is their initial cost?

11. If electric traction is used, indicate if it is by accumulators, trolley system or third rail.

12. If by accumulators, indicate the system, connections employed, number of cells, method of disposing the batteries in the car, the capacity of the batteries, the maximum run per charge.

13. What is the cost of current?

14. What changes would you recommend in the construction of your cars?

15. What are the advantages and disadvantages of a road of this character?

16. What other information can you give on this system of traction?

17. What are the results of your operation since you employed this type of car, especially from the standpoint of cost of operation and net receipts?

WHERE IS THE DISHONESTY?

Officials of the Pacific Electric Railway Company, of Los Angeles, Cal., are wondering whether the trainmen or the traveling public have the better opportunity to pilfer articles that are left on cars by passengers, and their conclusion is that far more unrecovered articles are wrongfully taken by passengers than by trainmen. The motorman and conductor, it is argued, have little time to note bundles left behind by passengers, while a dishonest passenger can readily take possession of property that is not his. Of course anything left in the car until the end of the trip falls into the hands of the trainmen, and then their honesty is on test.

Of late a large number of passengers walking away with packages or other property picked up in cars have been intercepted by officials of the road. To keep better tab on the trainmen the company hereafter will assign to one of its employees the duty of watching cars to gather up everything left behind by passengers. To each article that is found will be attached full particulars of when, where and by whom, and a duplicate of these particulars will be forwarded to the general manager's office. Then at the end of ninety days or six months all property not reclaimed will be sold at auction.

The "found" department of the Los Angeles Railway Company is worked on a different plan. All articles not reclaimed after a certain period are returned to the trainmen turning them in. It is argued, however, that the system may serve as an inducement to a trainman to keep back a "found" article until all inquiry about it has passed. Then when he turns it in he may be pretty sure that he will get it back again. In the case of valuable finds it is urged this might prove a serious temptation.

The Los Angeles Railway Company has cut down the number of passes, because the privileges restricted to policemen and firemen were abused. Badges were transferred, and scores of people were found to be enjoying free rides. Trainmen have been ordered not to honor fire department badges, and now men regularly employed in that department are furnished with pass books, which are renewable. Police stars are honored only when carried by the chief, the captain of police, captain of detectives, police sergeants with stars from one to eight, detectives with stars from one to twenty, and patrolmen with stars from one to one hundred and three. As heretofore, mail carriers, special delivery messengers from the postoffice, and the sanitary police continue to ride free, and, to show good faith in the matter, the management has issued free transportation to all municipal boards and commissions, including the Board of Library Trustees, the Civil Service Commissioners, the Park and Water Commissions, and the members of the Board of Education, to all of whom the courtesy has not heretofore been extended.

LONDON LETTER.

(From Our Regular Correspondent.)

At the half-yearly meeting of the Metropolitan District Railway Company shareholders interesting figures were given, especially with relation to the probable adoption, after the electrification of the line, of a uniform fare of 2d., instead of the graduated fares with first, second and third-class, which prevail at present. The District Railway reduced its fares considerably about a year ago, but it would appear that if it decreases its rates very considerably for the short-distance runs round about London that its traffic would very largely increase. The company's first-class fares are very high when compared with bus competition, and especially with the tube competition. The difficulties of overcoming the various causes of the graduated fares have been great, though it is quite evident, from the apparent tenor of the remarks at the meeting, that a uniform fare will be adopted when electrical trains are placed in service. The electrification of the railway is proceeding most satisfactorily, and there are, at present, engaged on the work about 1000 men. The work, of course, is mainly done at night after the trains stop, so that very little of it is visible to the ordinary traveler. The large generating station is making excellent progress. The docks in which the barges will be received for delivering coal are also being rapidly completed, and the whole power house will soon be a very interesting place to visit. It is said that the turbines which are being made at Trafford Park are also making good progress.

Considerable excitement in tramway circles has recently existed in Leeds, where a warm discussion has been proceeding concerning the salary of J. B. Hamilton, general manager of the tramways. As is well known, Mr. Hamilton came from Glasgow about eighteen months ago, and has done remarkably well for Leeds since being established there; in fact, he has established such a reputation for himself that when Birmingham was in the throes of its negotiations with the British Electric Traction Company as to whether it should operate the tramways itself or lease them to the latter company, Mr. Hamilton was called in as an expert by the Corporation to advise it of the value of the tramways, and to give a report on the whole situation. Recently, Mr. Hamilton, who has been enjoying a salary in Leeds of £900, to be raised to £1,000 in two years, was offered by the Birmingham Corporation the position of general manager of its tramways, with a salary of £1,500 a year. Mr. Hamilton very promptly laid the whole matter before his committee, of which Councilor Smithson is the chairman, who strongly urged Mr. Hamilton to stay in Leeds, when they would recommend the council to advance his salary to £1,500 a year. With this understanding, Mr. Hamilton declined the invitation of the Birmingham Corporation, but the Leeds City Council has refused to ratify the agreement made by the tramways committee, and positively refuses to increase Mr. Hamilton's salary in any way. Following this action, on the part of the Council, Councilor Smithson, as chairman of the committee, has sent in his formal resignation, as it was strongly on his recommendation that the increased salary was promised, he being one of the few members of tramways committees who seem to appreciate what a good tramway manager is worth.

In moving the adoption of the tenth annual report, at a meeting of the Electric Construction Company, Ltd., J. W. Barclay said the net profit of £20,736 was the same as last year, and the dividend of 5 per cent was also the same, while the amount carried forward (£4,394) was somewhat larger. As to the new fiscal policy, it was said that its industry was doomed, if some change was not made. It survived in spite of competition, which was as strong as they need expect. The Germans had secured orders from some corporations who believed more in cheapness than quality, but it was the depression at home which had led the Germans to compete with us, and when trade improved in Germany he did not think there would be much to apprehend from German competition. Then, again, the American manufacturer did not seem to derive much advantage from the protection he enjoyed at home, because two of the largest electrical manufacturers in the United States had set up works in this country. P. E. Beachcroft seconded the adoption of the report, which was agreed to.

At the ordinary meeting of the Electrical Power Storage Company, Ltd., held at the offices, 4 Great Winchester street, J. I. Courtenay, who presided, moved the adoption of the report. He congratulated the shareholders on the position of the company, and said the directors felt justified, by the steady improvement in the business, in recommending an increase of 1 per cent in the dividend, making it 6 per cent, while continuing the cautious policy of again transferring £5,000 to reserve and £1,000 to con-

tingent fund. In addition to its usual business in smaller batteries for lighting and traction, it had completed, during the year under review, more than twenty large installations in connection with lighting and power stations in various parts of the Kingdom; and it had in course of erection, or on its books, at the beginning of the year, orders for thirteen similar installations. The competition had been quite as severe as in previous years, and the company had also had an American invasion, as the largest storage battery company on the other side of the water had acquired the controlling interest in one of the competing companies in this country.

During the past month the last horse car ceased to run on the Liverpool Corporation tramways. The route from which it was withdrawn is situated in Litherland, and is about a mile in length from Bridgeroad to the Bootle boundary at Linacreroad. This is now the only portion of the tramway system unelectrified, and the work of reconstruction will be carried out with all possible speed by the city engineer's department. Meanwhile, the locality in question will be devoid of tramway facilities. When this section is completed 106 miles of track will then have been transformed from horse haulage to electric traction since the municipality took control in 1898.

The report of the Dublin United Tramway Company (1896), Ltd., for the half-year ended June 30, last, states that the amount available for division is £36,882, out of which a dividend for the half-year is recommended at the rate of 5 per cent per annum on the ordinary shares, and a sum of £2,000 has been set aside to reserve fund, leaving £2,857 to be carried forward. The amount charged against revenue of the half-year for rates and taxes again shows an increase of £2,125, as compared with the corresponding period of 1902.

At one of the meetings of the Royal Commission, now sitting in London, to inquire into the question of London street traffic, Harry Edwin Haward, comptroller of the L. C. C., gave evidence with regard to the tube railway schemes in London. The capital involved in the tubes now in operation was £7,518,000. Of those in course of construction, the amount involved was £18,493,000, and of those authorized, but not commenced, the amount involved was £3,680,000. Of new railways, including the extension of existing ones, proposed by bills introduced into Parliament this session, the amount involved was £20,586,000, the whole giving a total capital in question of £50,257,000. J. Williams Benn, L.C.C., made the statement that there were, approximately, 15,000 tramcars and 4000 omnibuses running daily in London, carrying something like 17,000 passengers. The length of the horse tram was 35 ft. 6 ins., and of an omnibus, 20 ft. These vehicles would extend a distance of 27½ miles, and would carry 170,000 passengers, whereas an electric car carrying 65 passengers was only 35 ft. 6 ins. in length, and 2615 of these vehicles, covering only 16 1-3 miles, would be sufficient, in his opinion, to carry the same number of passengers which now took 5500 horse vehicles. There would thus be a saving, in the streets, of nearly 3000 vehicles. If they packed 5500 horse cars and omnibuses close together, an area of 24½ acres would be covered, whereas 2615 electric cars, carrying the same number of passengers, would only cover fourteen acres. Consequently, there would be a saving of street room of 10½ acres, without any prejudice to the public service, and relieving the streets of an immense amount of dirt.

At the last meeting of the electricity committee of the Accrington Town Council a letter was read from the secretary of the tramway company, asking for an interview with the committee to discuss matters with reference to possible arrangements as to a conversion of the tramways to electrical traction.

The annual report of the Glasgow Corporation Tramway to May 31 states that the result of the year's working shows that the revenue amounted to £656,572 and the working expenses, including depreciation, to £431,870, leaving a balance of £224,702. The revenue of the previous year was £614,413 and the working expenses, including depreciation, £405,103, leaving a balance of £209,310. This year's balance of £224,702 has been applied to meeting interest and sinking fund, etc., on cost of Govan and Ibox tramways, interest on capital, sinking fund, and annual payment to the common good, these payments amounting, in all, to £124,425. The net balance remaining amounts to £100,276, out of which an extra payment of £10,000 has been made to the common good. On account of the high rates prevailing for electrical material during the period of construction, £40,000 has been written off the cost of feeder cables and overhead equipment; £25,000 has also been written off the cost of buildings originally constructed for horse traction. The balance, amounting to £25,276, has been added to the general reserve fund.

The London County Council is anxious to proceed with the construction of a tramway extension on the electrical conduit system along Tottenham Courtroad, and it has again asked the consent of the St. Pancras Borough Council as the road authority concerned. The latter has decided to adhere to its resolution only to sanction the scheme as part of the general plan of linking up the tramways of north and south of the Thames, via Charing-cross and Northumberland Avenue.

For some time past there has been a feeling among the members of the Sunderland Tramways Company that the electricity and lighting committee should allow it to have current at a cheaper rate. This view forced itself to the front recently, when the Corporation contemplated supplying electric power to manufacturers at less than the price paid by the tramways. The tramways committee applied for a reduction, and the matter was referred to the engineer, Mr. Snell. Mr. Snell has just issued a report on the subject, and suggests, upon the condition that coal does not increase in price during the period, that the charge to the tramways department should be reduced from 2d. per unit to 1⅞d. during the current year, which will make a difference in revenue to the electricity committee and a saving to the tramway department of £711. Mr. Snell also hopes to be able, from the first of March, 1904, to advise a further reduction to 1¾d.

The old-fashioned horse trams at Reading have been superseded by an extended service of electric trams. The routes embrace all the attractive suburbs of the town, including the favorite Thamesside resort of Caversham. The expenditure sanctioned was £214,000, and the route is about 7½ miles in length. The inauguration was signalized by a luncheon given in the town hall. The mayor presided, and was supported by Lords Saye and Sele, Sir Albert Rollit, M.P., Mr. George W. Palmer, M.P., and others.

Lowestoft Corporation has also inaugurated its electric tram undertaking, which has involved an outlay of some £80,000. Six and a half miles of track have been laid, and overhead equipment completed within the short period of three months, the contractors having been stimulated to expedition by the offer of a bonus of £1,500.

Mr. R. A. Chattuck, at present electrical engineer to the Bradford Corporation, has recently been appointed to a similar position with the Birmingham Corporation, which is about to electrify all of its existing tramway lines.

The first section of the Mid-Yorkshire tramways has been formally inspected and is now open for traffic. This is the section in the Shipley township, extending from the boundary of the township at the Bingley end of Nab Wood to the Thackley boundary. The line has a length of rather more than 2½ miles, and the whole of that section, in addition to a good deal of the Otley road section, has been constructed since March 9 last.

A. C. S.

EQUIPMENT CONTRACTS AWARDED IN CHICAGO

Contracts for 100 new electric cars and motors have been awarded by Receivers Eckels and Sampsell for the Union Traction Company, of Chicago. The St. Louis Car Company will construct the cars for $2,535 each, and the General Electric Company will furnish the motors. The total cost of the new equipment is placed at $493,500. The cars will be 40 ft. long, with six large windows on each side, reversible cross seats and large platforms with rolling doors. They are to be delivered by Dec. 15. The first delivery will be made about Nov. 1.

President Roach says the company will begin the construction of the elecctric railways as soon as permits are received from the city. He says he applied for permits three or four weeks ago, but has heard nothing from the public works department in response to his application. The assurance is given by Commissioner Blocki that the permits will be granted at once.

The city authorities refuse to issue permits for the change in motor power on the ground that the company's franchise has expired, and it has no right in the streets, and because an ordinance is necessary to authorize the change from cable to trolley. The City Council, they say, must act on Mr. Roach's application for permits. Mr. Roach claims that the company's ordinances allow a change of power upon a permit to be issued by the commissioner of public works.

The members of the local transportation committee say they probably will not grant authority to the Union Traction Company to change its power until a new franchise ordinance has been passed.

An extensive network of electric lines is to be constructed and operated by the municipality of Moscow, Russia. New lines will be built and then the existing horse roads will be electrically converted. Before the system is completed, which will take about three years, fully 175 miles of lines will be electrically operated. Vladimir F. Gnesin, a well-known Russian electrical expert, Morris Building, New York, can give further particulars to interested parties.

LOCOMOTIVE FOR HAULING COAL IN OHIO

The Youngstown & Southern Railway Company is negotiating with builders of electric locomotives for three engines of the heaviest type. It is the aim to haul twenty coal cars, each loaded with 50 tons of coal. The new company will build a low-grade road from Youngstown to East Liverpool, touching important coal fields in the East Liverpool district heretofore undeveloped through lack of railroad facilities. The promoters of the company own 5300 acres of coal land, which will furnish the best grade of North Lima coal, a fuel equal to that produced in the Massillon district. The coal will be marketed in Youngstown, and the company will have a private right of way into the city, which will connect with the belt line around the city. As already outlined in these columns, it will be built a third-rail road, and will be designed by Ernest Gonzenbach, who engineered several of the leading third-rail roads in this country.

DOUBLE TRACK LEGISLATION IN INDIANA

The increasing number of collisions between interurban cars in Indiana has re-emphasised the urgent necessity of double tracks on these lines for two reasons—first, for safety, and, second, to afford facilities for the rapidly increasing business. The general demand of the time, reinforced by competition, requires that fast time be made by interurban cars, which naturally increases the complications in operating cars. Switches for passing purposes are all right where the need of speed is not urgent, but under present conditions such close connections at meeting points are necessary that the margin of safety is not only extremely narrow, but the possibility of error and misunderstanding is considerable. This is evidenced by three very recent and serious collisions resulting from the above causes. The only remedy for this condition is double tracks from terminal to terminal, and the necessity is so apparent that legislation requiring roads to be constructed with double tracks is sure to be enacted in Indiana.

THE NEW YORK AND BOSTON RUMOR REVIVED

A special press despatch from Stamford, Conn., dated Sept. 19, says that plans are being completed for the operation of electric parlor and sleeping cars from New York to Boston, and quotes those back of the scheme as stating that the service will be begun within two years. The dispatch further says that several electric railways now in operation between these two points may be absorbed by the new company. The identity of those behind the project, however, is not disclosed. The line is to run by way of Worcester, Hartford and New Haven. According to the scheme of traffic which has been worked out, residents in New York and Boston will be able to take the trip between these two cities in only twice the running time of the present steam railroads, and at half the expense. It will be possible for the new company to operate between Boston and Worcester over the Boston & Worcester Street Railway, if a traffic arrangement with that company can be made, and to operate between Worcester and Hartford over the Worcester & Hartford Street Railway, now under construction. Between Hartford and New Haven, however, there appears to be a serious break in the line, and the information at hand does not tell how this is to be overcome. Between New Haven and New York there is at present a series of lines. From Port Chester, of course, it might be possible for the company to operate into New York over the New York & Port Chester Railway, when that road is completed.

In "Cassier's Magazine" for September there is an article entitled "Electric Shocks from Fire Streams." After discussing the hazards of fighting fires amid live wires, the danger to firemen from electric shocks due to current carried to the nozzle of the hose by the stream of water when it comes in contact with a live wire, is discussed. So far as is known no fatalities due to this cause have occurred, but shocks that resulted in disablement are recorded. Some results ars given of a series of experiments made recently in Germany. They were made with pressures of 6000 volts alternating current and 550 volts direct current, and the stream of water was directed against a portion of the wires from which the insulation had been previously removed. On the whole the results of the experiments showed that the danger is not ordinarily so great as has been generally supposed hitherto.

NEW PUBLICATIONS

The "Engineering" and Electrical Traction Pocket Book. Third Edition, 1903, revised and enlarged, by Philip Dawson. 16 mo.; XIV + 1411 pages; morocco; price, $5.00. Published by John Wiley & Sons, New York.

This book needs no introduction to our readers. The first two editions have established it as an important adjunct to the library of every electrical engineer, and especially to those engaged in the traction field. The present edition has been completely revised, and a large number of sections have been entirely rewritten and brought up to date. Considerable new matter has also been added.

Manual of Statistics Supplement, Vol. 1, No. 1. Published by the Manual of Statistics Company, 220 Broadway, New York. Price, $5.00 per year.

The value of financial information and statistics depends largely upon the promptness with which they are given to the reader, so that the monthly supplement which the publishers of the well-known Manual of Statistics have just commenced to issue will be appreciated by investors. The size of page and general make-up of the monthly is the same as that of the manual itself, and it is paged with the latter publication, so that it forms practically a supplement. In the first number statements are given of some of the most important late incorporations, as well as some recent annual reports, directors' changes, etc. The publication has an editorial department, also tables showing quotations, high and low, for the last two years, and for the last month, of the principal securities dealt in on the Boston, New York and Philadelphia exchanges, as well as other financial tables. To annual subscribers the publishers furnish a handy binder.

LONG NARROW GAGE RAILWAY FOR SOUTHWESTERN AFRICA

The firm of Arthur Koppel has been awarded the contract for the building and equipping of a narrow gage railroad, about 400 miles long, by the Otavi Mining & Railroad Company. The railroad is to be used in the service of the copper mines in the districts of Octavi and Tsumeh in Southwestern Africa. The total cost of building the road is approximately $4,500,000.

The contracting firm has formed a company with several prominent German banks to build this road, which has to be finished within two and one-half years.

The firm of Arthur Koppel will build and equip the road complete, including rails, steel ties, rolling stock and all other equipment. By one of the last steamers fifteen engineers of the firm left Hamburg for Southwestern Africa to begin the work.

OPENING THE ROCHESTER & EASTERN RAILWAY

It is expected that the Rochester & Eastern Rapid Railway will be formally opened this month. The route will be from Canandaigua to Geneva and thence to Rochester, a distance of 41 miles, through a prosperous farming country, touching many villages. The new road connects with the Rochester Railway at the end of the Monroe Avenue line, and cars will be run over the Monroe Avenue route of the Rochester Company to Main Street, and will turn through State, Church and Sophia Streets in the same manner as the Sodus Bay cars do at present, thus giving the new company admission to the heart of the business district. A few cars are now running in Canandaigua. Two power houses have been constructed, one at Canandaigua and the other at Geneva. A large car house has also been built at Canandaigua, where the offices of the company will be established. The company is controlled by the Comstock-Haigh-Walker interests, of Detroit, Mich.

The Sheffield Company, which is to construct a plant at Sheffield, Ala., for lighting the towns of Florence, Sheffield and Tuscumbia, and operating an electric railway, both freight and passenger, to be built by the company between those places, has just placed contracts through its New York office for cars, etc. The American Car & Foundry Company, Jackson & Sharp, Wilmington, Del., branch, has taken an order for eight cars—five open, fifteen-bench type, and three closed 44 ft. 2 ins. The trucks will be Peckham. The motors—No. 68—of each car will be of Westinghouse build. The power house, whose initial capacity will be about 850 hp, will be equipped with Wickes boilers, Brown Corliss engines, and Westinghouse generators. A 325 kw, three-phase, alternating-current machine will take care of the railway work, while a 250-kw generator will furnish the lighting power.

TRUCKS FOR ELECTRIC AND STEAM RAILWAY CARS

Raymond R. Frazier, United States Consul at Copenhagen, Denmark, writes to the Department of Commerce and Labor at Washington, that a well-known firm of agents in Copenhagen desires to correspond with firms in the United States which are in a position to furnish trucks for street cars and steam cars in a country where the government will undertake the construction of new lines of railway, electric and steam. Trucks for passenger cars will be required for the electric lines, and trucks for passenger and freight cars for the steam railways. Letters forwarded to the office of the Consul will be promptly delivered.

PARIS SUBWAY REFORMS

The municipal committee, which has been investigating the recent tunnel disaster on the Metropolitan Railroad, has drawn up a report, which has been approved by the prefecture, indicating the reforms which should immediately be made in the underground railroad system of Paris.

The principal proposals are as follows:

The present system of a motor at each end of the train should be abandoned; the motor must be capable of isolation from the train. In case of the slightest fire the train must be stopped and the motors cut out. Telephones and speaking tubes must be provided at reasonable intervals along the line. The number of employees at the stations must be increased. The platforms must be cleared of every obstruction, and lighted by an electric current independent of the current supplying the traction and the lighting of the tunnels. Numerous lamps must be placed to indicate the direction of the exit, at which a powerful inextinguishable lamp must be lighted. An alarm must be sounded when it is necessary to clear a station.

The report says that it is proposed later to insist on the use of incombustible rolling stock, and the construction of refuges in the tunnel walls.

PAPERS FOR THE WESTERN SOCIETY OF ENGINEERS

The Western Society of Engineers, headquarters of which are at No. 1734-41 Monadnock Block, Chicago, where most of the meetings are held, has announced the following programme for meetings during the remainder of the fall and winter up to Jan. 20, 1904:

Sept. 16.—"A Combination Steel and Concrete Railway Cross-Tie," G. W. Kimball, of New York.

Sept. 30.—"Hydro-electric Power Development at Joliet, Ill," T. T. Johnston, M. W. S. E.

Oct. 7.—"Sewage Disposal in Iowa," Prof. A. Marston, M. W. S. E.

Oct. 21.—"The Use of Superheated Steam," Prof. Bull, M. W. S. E.

Nov. 4.—"The Haskell Self-registering Water Gauge," G. A. M. Liljencrantz, M. W. S. E.

Nov. 18.—"Asphalt and Bitumen, and Their Use in Structural Work," H. Wiederhold, of Philadelphia.

Dec. 2.—"The Movement of Iron Ore on the Great Lakes," A. J. Mason, M. W. S. E.

Dec. 16.—"Heating from a Central Station," W. H. Pearce, M. W. S. E.

Jan. 5.—Annual meeting and dinner.

Jan. 20.—"Railroad Signaling," E. E. Ellis, M. W. S. E.

The first meeting of the season was held on Sept. 2.

SOUTHWESTERN ELECTRICAL ASSOCIATION

The Southwestern Electrical Association, of Oklahoma and Indian Territory, has been organized in Oklahoma City, as an association embracing the varied electrical interests of the two Territories and the Southwest. The object of the association is to bring together at semi-annual conventions, the representatives of the various electrical interests in the Southwest. It has been decided to hold the first semi-annual convention in Oklahoma City on Oct. 9 and 10. Papers on telephone, electric light and street railway work are to be read, and there will be social features, embracing inspection trips to different plants and street railway systems and a banquet. The full programme will be published later. The initiation fee of the association has been placed at $10, but it has been decided to reduce this to $5 for charter members, good until the October convention. The initiation fee also includes the current year's dues, which means the fiscal year ending in May.

A CAR TRUST ASSOCIATION FOR STREET RAILWAYS

The Virginia Passenger Car Trust Association has been formed for the purpose of supplying and leasing cars to the Virginia Passenger & Power Company, of Richmond, Va. There are three managers, viz., E. T. Jeffrey, Jasper Bayne and B. H. Harned, all of New York, and the trustee is the Bowling Green Trust Company. The organization of associations of this kind is common in steam railway work, but is a novel departure in street railway practice.

The Series "A" stock of the new company has been sold, and twenty-two cars have been ordered from the St. Louis Car Company, which are to be equipped with Christensen air brakes and Bemis trucks. This equipment will reach Richmond about Oct. 1, when it will immediately be put in operation.

BRITISH WESTINGHOUSE WORKS

The British Westinghouse Electric & Manufacturing Company, Ltd., has had reprinted in magazine form an article recently written by G. R. Dunnell for Traction and Transmission, describing the company's great Trafford Park Works. Mr. Dunnell has done full justice to the importance of the subject, his article being very thorough in every respect.

It is stated in this article that the chief work of the company will be the manufacture of electric generators, motors, steam engines, steam turbines, gas engines, magnetic brakes, switch gear, Westinghouse-Bremer arc lamps and other Westinghouse products.

The publication just issued contains a detailed description of every department, a plan and section of the works, and numerous illustrations which serve to make clear even better than verbal description the vast extent of this undertaking, and the great scale on which the whole scheme has been carried out.

BLOCK SIGNAL CONTRACT FOR NEW YORK SUBWAY

A contract for the equipment of its line with a block signal system has recently been awarded the Union Switch & Signal Company, by the Interborough Rapid Transit Company (subway), of New York.

The Westinghouse electro-pneumatic system is to be installed, but a new feature is to be introduced, that of using alternating current. It is obvious that the use of track circuits on third-rail roads, where the rails are used for the return circuit, and at the same time for the signalling circuit, introduces what may be serious complications. In order to avoid these difficulties, the signals will be controlled by alternating current, through relays that are sensitive to alternating current only, and which will not be affected by the direct current used for train service in the subway.

A similar system is being installed by the Union Switch & Signal Company on the North Shore Railway, of California, which runs about 30 miles north from Sausilito, across the bay from San Francisco. This being a high tension third-rail electric road, alternating current will be used for operating the signal system, in connection with a track circuit.

CLEVELAND & SOUTHWESTERN TRACTION COMPANY ELECTS NEW OFFICERS

Owing to his poor health A. H. Pomeroy has resigned the presidency of the Cleveland & Southwestern Traction Company. His son, F. T. Pomeroy, has been elected in his stead.

F. T. Pomeroy has been general manager and treasurer, and he now relinquishes the latter office for that of president, holding at the same time the position of general manager.

The vacant treasurership has been filled by the election of F. L. Fuller. Mr. Fuller is a broker in the Garfield Building and has been interested in the company since its organization. In addition the position of assistant treasurer has been created, and J. O. Wilson has been elected to fill it. He has been general passenger agent of the road for some time, which position he will continue to hold.

A. H. Pomeroy, who now retires from the presidency of the company, has been associated with the line largely in an executive and advisory capacity. His business has been that of a banker. The active duties of promoting and constructing the lines which have been joined under the name of the Cleveland & Southwestern Traction Company, have been the work of F. T. Pomeroy, who now takes up the reins of control.

FROM INDIANAPOLIS TO PITTSBURG BY TROLLEY

A trip by trolley from Indianapolis to Pittsburg looms up as a possibility of the not far distant future. The opening of the road from Pittsburg to Wheeling, W. Va., and the contemplated extension to Bellaire, Ohio, are the beginning of the line connecting the two cities. The lines from Indianapolis to Bellaire will be 364 miles long, and if the line is extended to Wheeling and Pittsburg it will make the latter city the hub of a vast system extending in all directions. The plan is regarded as feasible, even where the electric lines come into sharp competition with the steam roads. The longest continuous electric road thus far running is from Indianapolis eastward, via Richmond, Dayton, Springfield and Columbus to Newark, Ohio, a distance of 226 miles. Another line, 26 miles long, now nearing completion, will extend from Newark to Zanesville, where there will be a connection with the Ohio River & Western. A road is in operation from Zanesville to Bellaire, 112 miles, making the total distance from Indianapolis to Bellaire 264 miles.

STREET RAILWAY PATENTS

[This department is conducted by W. A. Rosenbaum, patent attorney, Room No. 1203-7 Nassau-Beekman Building, New York.]

UNITED STATES PATENTS ALLOWED SEPT. 8, 1903

738,170. Means for Bridging Over Fire Hose; William L. Doughty, Oshkosh, Wis. App. filed Nov. 28, 1902. Relates to means for attaching a supplemental rail having recesses for the fire hose, to the main rail.

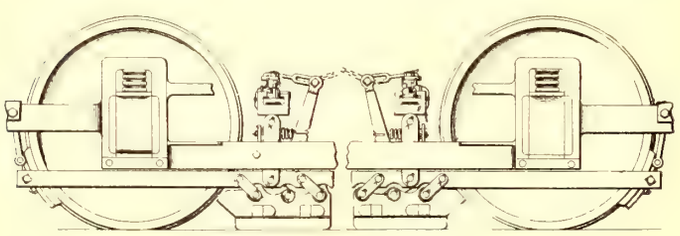
738,172. Fluid Operated Sander; Frank H. Edwards, McKees Rocks, Pa. App. filed Jan. 2, 1903. A fluid operated sander having an air-conducting tube provided with one or more holes, which direct the air into the sand to agitate the same, and with another hole which directs the sand so as to expel it from the sander.

738,195. Switch-Operating Mechanism; William J. Hynes, Utica, N. Y. App. filed Sept. 27, 1902. A star-wheel set in the road-bed is adapted to throw the switch, when engaged by a projection on the car, by means of a system of gears and levers.

738,205. Switch Throw; Clarence C. Korns, Johnstown, Pa. App. filed Oct. 15, 1902. The combination with an operating lever and a switch rod to be operated thereby, of a short intermediate lever, parallel with the operating lever, and fulcrumed eccentrically thereon, one arm of the intermediate lever being connected with the short arm of the operating lever, and its other arm with the switch rod.

738,297. Automatic Derailer for Drawbridges; John P. Cowing, Cleveland, Ohio. App. filed Aug. 27, 1901. Details.

738,299. Combined Rail and Wheel Car Brake; William M. Deal, Philadelphia, Pa. App. filed July 16, 1902. Consists of a



PATENT NO. 738,299

brake frame embracing a wheel, a rail brake-shoe supported by one end of the brake frame, and a wheel brake-shoe supported by the other end.

738,305. Trolley for Electric Railways Having Overhead Wires for Supply of Current; Amedee Fayol, Bordeoux, France. App. filed June 28, 1902. A fork pivoted near the trolley wheel adapted to be thrown upward by pulling on a rope, to thereby guide the wire into the groove of the wheel.

738,602. Trolley Stand; John J. Bouchard and William F. Ensor, Bradford, Pa. App. filed Dec. 18, 1902. Relates to details of the horizontal pivot of the pole to avoid friction and exclude dust and dirt.

738,606. Switch Operating Mechanism; Bertram J. Delzeit and William J. Saker, Philadelphia, Pa. App. filed Feb. 18, 1903. Shifting rails arranged at each side of the truck of the car, are adapted when lowered to contact with arms extending upward from the switch tongue and thereby move the switch.

738,637. Switch Operating Device; Wilber K. Smith, Denver, Col. App. filed Feb. 10, 1903. Comprises a frame having swinging connection with a car, two rollers mounted in the frame, one forwardly of the other, having beveled flanges at opposite ends thereof and means operated from the car platform for tilting said frame to bring either one of said flanges into operative position.

738,638. Railway Switch; Wilber K. Smith, Denver, Col. App. filed Feb. 11, 1903. Details of construction of a plate set in the roadbed and adapted to be engaged by the switch operating device described in the preceding patent.

738,647. Car Fender; John A. Williams and Lester B. Britton, Seattle, Wash. App. filed April 29, 1903. Details.

738,649. Contact-Shoe for Electric Railways; Walter D. Young, Baltimore, Md. App. filed Jan. 21, 1903. The shoe is so mounted that it will constantly maintain a square contact with the third rail.

738,651. Preventing Leakage of Current to Studs in Surface Contact Systems of Electric Traction; Benjamin H. Bedell, London, Eng. App. filed March 17, 1903. A conducting shield is interposed between the live rail or wire and the surface stud, so that any leakage current will be grounded before it reaches the stud.

738,676. Trolley Retractor; Richard H. Ham, Stockport, N. Y. App. filed Jan. 16, 1903. Details.

738,721. Third-Rail System; John H. Hughes, Greenwich, Conn. App. filed April 30, 1903. Angle-brackets supporting the third rail are clamped between, but insulated from, two inverted T-rails.

PERSONAL MENTION

MR. GLENN E. PLUMB, of Dixon, Ill., has been appointed general manager for the receiver of the Chicago General Railway Company.

MR. H. W. GINAVAN has been appointed electrical engineer of the main power station of the Appleyard system of roads to succeed H. C. Regan, resigned.

MR. RALPH D. MERSHON, the well known consulting engineer, sails for Europe Sept. 23, on a business trip of about six weeks. Mr. Mershon expects to visit London, Paris and Berlin.

MR. HOWARD E. HUNTINGTON, formerly assistant general manager of the Pacific Electric Railway Company, of Los Angeles, Cal., has been appointed superintendent of electrical construction.

MR. H. A. FRAZER, formerly master mechanic of the Montgomery Street Railway, of Montgomery, Ala., has resigned, and now has a similar position with the New Hampshire Traction Company, with headquarters at Salem, N. H.

MR. WALTER MATTINGLY, superintendent of the Vicksburg Electric Railway Company, of Vicksburg, Miss., has resigned to accept the management of the Mississippi territory for a soap company. His successor has not yet been named.

MR. WILLIAM RABER, for the past ten years superintendent of light and power for the Mansfield Railway, Light & Power Company of Mansfield, O., has been appointed general manager of the company. Mr. Raber was first connected with the construction department of the company.

MR. J. D. HOUSEMAN, JR., general manager of the St. Louis, St. Charles & Western Electric Railroad, of St. Louis, Mo., was presented, Sept. 4, with a handsome silver loving cup by the employees of the company. The presentation was made at a banquet given in celebration of the second anniversary of the completion of the road to the Missouri River.

MR. J. BOIES POTTER has been appointed general superintendent of the Worcester & Connecticut Eastern Street Railway, which operates between Worcester, Mass., and Moosup, Conn., and is soon to have a line through to Norwich, Conn. Mr. Potter formerly was superintendent of the northern division of the company. Mr. J. E. S. Kane has retired as superintendent of the southern division.

MR. ARTHUR A. ANDERSON has resigned as general superintendent of the Indiana Union Traction Company, and will be succeeded by Mr. C. A. Baldwin, general passenger agent of the company. Mr. Anderson will go to Kansas to perfect the organization of a company that proposes to build a system of electric railways connecting Independence, Coffyville and Parsons. It is generally believed the Indiana Union Traction Company is back of the Kansas project.

MR. F. G. DANIELL, formerly with the Appleyard system of roads in Ohio, has been appointed general superintendent of the Cleveland, Painesville & Ashtabula Railway, of Cleveland, Ohio. This road is now nearing completion, and it is expected it will be placed in operation between Painesville and Ashtabula before Oct. 1. The cars will enter Cleveland under a traffic arrangement with the Cleveland, Painesville & Eastern Railway, and the line will form another link in the rapidly completing chain of lines between Buffalo and Chicago.

TABLE OF OPERATING STATISTICS

Notice.—These statistics will be carefully revised from month to month, upon information received from the companies direct, or from official sources. The table should be used in connection with our Financial Supplement "American Street Railway Investments," which contains the annual operating reports to the ends of the various financial years. Similar statistics in regard to roads not reporting are solicited by the editors. * Including taxes. † Deficit. *a* Including earnings of Pan-American exposition period. ncluding all properties.

Company	Period	Total Gross Earnings	Operating Expenses	Net Earnings	Deductions From Income	Net Income, Amount Available for Dividends
AKRON, O.						
Northern Ohio Tr. & Light Co	1 m., July '03	95,765	47,970	47,795	22,806	24,989
	1 " " '02	81,130	40,588	40,542	16,765	23,777
	6 " June '03	388,281	211,733	167,189	132,024	36,164
	6 " " '02	318,937	185,362	133,575	98,390	35,185
ALBANY, N. Y.						
United Traction Co.	1 m., July '03	------	------	63,182	25,382	37,800
	1 " " '02	------	------	51,197	23,866	27,331
	6 m., June '03	1,590,357	1,083,171	507,186	------	------
	6 " " '02	1,471,516	1,011,263	460,253	------	------
AURORA, ILL.						
Elgin, Aurora & Southern Traction Co.	2 m., July '03	92,956	37,808	55,147	40,000	15,147
BINGHAMTON, N. Y.						
Binghamton St. Ry. Co.	1 m., July '03	26,202	11,289	14,913	------	------
	1 " " '02	23,269	11,198	12,071	------	------
	2 " " '03	48,976	22,311	26,665	------	------
	2 " " '02	43,512	21,843	21,669	------	------
BROOKLYN, N. Y.						
Brooklyn Heights R. R. Co	3 m., June '03	3,394,490	1,981,983	1,412,507	1,099,639	312,869
	3 " " '02	3,133,993	1,851,119	1,282,874	1,072,879	209,995
Brooklyn, Queens Co'ty & Suburban Ry. Co	3 m., June '03	229,840	207,704	22,136	------	------
Coney Island & Brooklyn R. R. Co	3 m., June '03	438,874	255,685	183,189	67,934	115,255
	3 " " '02	426,123	229,210	196,913	53,638	143,275
BUFFALO, N. Y.						
International Tr. Co.	1 m., June '03	323,098	176,935	146,163	130,528	15,635
	1 " " '02	271,246	147,614	123,632	126,141	† 2,509
	3 " " '03	945,556	519,062	426,494	389,394	37,100
	3 " " '02	786,281	436,915	349,366	375,039	† 25,673
	12 " " '03	3,728,173	2,013,624	1,714,549	1,538,484	176,065
	12 " " '02	*a* 4566,503	2,254,084	2,312,418	1,548,960	763,458
CHICAGO, ILL.						
Chicago & Milwaukee Elec. Ry. Co.	1 m., July '03	29,529	8,523	21,006	------	------
	1 " " '02	23,591	7,586	16,005	------	------
	7 " " '03	123,250	48,370	74,880	------	------
	7 " " '02	102,531	45,638	56,892	------	------
CINCINNATI, O.						
Cincinnati, Newport & Covington Light & Traction Co	6 m., June '03	573,384	338,965	234,419	126,254	108,164
	6 " " '02	519,241	296,985	222,256	125,966	96,290
CLEVELAND, O.						
Cleveland & Southwestern Traction Co	1 m., July '03	43,692	22,539	21,153	------	------
	7 " " '03	240,538	143,419	97,119	------	------
DETROIT, MICH.						
Detroit United Ry *b*	1 m., July '03	455,432	251 212	204,220	84,621	119,599
	1 " " '02	391,205	212,645	178,560	79.287	99,273
	7 " " '03	2,489,622	1,468,701	1,020,921	575,386	445,535
	7 " " '02	2,211,551	1,251,643	959,908	542,950	416,958
DULUTH, MINN.						
Duluth Superior Traction Co	1 m., July '03	61 412	28.107	33,305	15,876	17,429
	1 " " '02	52 632	24,985	27,647	14,685	12,962
	7 " " '03	355,803	201,638	154,165	82,388	71,777
	7 " " 02	298,039	157,399	140,640	77,528	63,112
GLENS FALLS, N. Y.						
Hudson Valley Ry. Co.	3 m., June '03	110,046	92,708	17,338	44.587	† 27 249
	3 " " '02	91,631	61,866	29,765	36,958	† 7,193
HAMILTON, O.						
The Cincinnati, Dayton & Toledo Trac. Co.	1 m., July '03	51,637	26,141	25,496	16,084	9,413
	3 " " '03	144,307	74,930	69,377	48,204	21,173
	3 " " '02	131,224	65,596	65,629	49,508	16,121
HANCOCK, MICH.						
Houghton County St. Ry. Co	1 m., June '03	16,417	9,566	6,851	2,929	3,923
	1 " " '02	16,008	9,453	6,555	2,604	3,951
	12 " " '03	182,576	121 202	61,374	33,200	28,174
	12 " " '02	158,580	90,395	68,186	28,310	39,876
HAZLETON, PA.						
Lehigh Traction Co.	1 m., July '03	14,477	5,771	8,706	------	------
	1 " " '02	7,170	5,262	1,908	------	------
	7 " " '03	77,424	45,448	31,976	------	------
	7 " " '02	60,652	38,783	21,919	------	------
HOUSTON, TEX.						
Houston Electric Co.	1 m., June '03	37,237	21,976	15,261	6,713	8,548
	1 " " '02	31,899	16,679	15,220	6,250	8,970
	12 " " '03	298,220	246,216	152,004	77,240	74,763
	12 " " '02	322,560	187,731	134,829	------	------
ITHACA, N. Y.						
Ithaca Street Ry. Co.	3 m., June '03	29,637	15,137	14,500	5,218	9,282
	3 " " '02	26,062	26,622	† 559	5,720	† 6,279
JACKSONVILLE, FLA.						
Jacksonville Electric Co	1 m., June '03	20,359	12,847	7,512	2,996	4,517
	1 " " '02	16,784	9,236	7,548	3,125	4,423
	12 " " '03	223,465	153,850	69,614	34,746	34,868
KNOXVILLE, TENN.						
Knoxville Traction Co. & Knoxville Electric Light & Power Co,	6 m., May '03	125,073	68,761	56,311	37,132	19,179
	6 " " '02	100,456	65,589	34,867	36,409	* 1,542
LEXINGTON, KY.						
Lexington Ry. Co	1 m., July '03	32,725	18,441	14,284	5,412	8,872
	1 " " '02	29,815	15 386	14,429	4,321	10,108
	3 " " '03	86,653	50,146	36,507	16 236	20,271
	3 " " '02	78,058	42,230	35,828	13,483	22,345
LIMA, O.						
Western Ohio Ry. Co.	1 m., July '03	24,506	10,777	13,729	10,625	3,103
LONDON, ONT.						
London St. Ry Co	1 m., July '03	18,317	10,909	7,408	2,212	5,196
	1 " " '02	16,337	9,297	7,040	2,311	4,729
	2 " " '03	93,886	62,145	31,741	15,100	16,641
	2 " " '02	81,401	52,464	28,937	15,904	13,033
MILWAUKEE, WIS.						
Milwaukee El. Ry. & Lt. Co.	1 m., July '03	270,499	130,101	140,398	75,383	65 015
	1 " " '02	237,376	110,928	126,448	67,989	58,459
	7 " " '03	1,707,175	864,216	842,960	499,830	343,130
	7 " " '02	1,512,005	723,232	788,773	457,543	331,230
MINNEAPOLIS, MINN.						
Twin City R. T. Co	1 m., July '03	364,471	164,037	200,433	60,937	139 496
	1 " " '02	337,452	142,369	195,083	58,733	136,349
	7 " " '03	2,283,125	1,086,410	1,196,715	426,255	770,460
	7 " " '02	2,003,892	922,740	1,081,152	410,267	770 885
MONTREAL, CAN.						
Montreal St. Ry. Co.	1 m., July '03	216,237	116,157	100,079	24,696	75,383
	1 " " '02	198,656	93,967	104,689	19,930	84,760
	10 " " '03	1,788,178	1,109,810	678,368	189,363	489,005
	10 " " '02	1,643,837	940,860	702,977	164,228	538,748
NEW YORK.						
Interborough Rapid Transit Co	3 m., June '03	3,361,974	1,302,089	2,059,885	684,563	1,375,322
	3 " " '02	2,968,537	1 401,106	1,567,431	655,849	911,582
	12 " " '03	12,555,196	5 460 794	7,094,402	2,820,859	4,273,544
	12 " " '02	11,291,711	5,518,585	5,773,126	2,699,671	3,073,455
OLEAN, N. Y.						
Olean Street Ry. Co	1 m., June '03	7,435	3,758	3,678	2,376	1,302
	12 " " '03	74,866	38,715	36,152	21,228	14,923
	12 " " '02	56,040	29,118	26,922	16,493	10,428
PEEKSKILL, N. Y.						
Peekskill R. R. & Lighting Co	12 m., June '03	106,757	*63,605	43,152	27,215	15,937
	12 " " 02	86,795	*56,392	30,403	23,125	7,277
PHILADELPHIA, PA.						
American Railways	1 m. July '03	143,037	------	------	------	------
	1 " " '02	120 291	------	------	------	------
	12 " June '03	1,240,807	------	------	------	------
	12 " " '02	1,009,504	------	------	------	------
Pueblo Suburban Traction & Lighting Co	1 m., June '03	41,867	34,841	7,026	------	------
ROCHESTER, N. Y.						
Rochester Ry	1 m., July '03	115,281	56,275	58,986	25,896	33,089
	1 " " '02	99,570	49,098	50,472	24,857	25,615
	2 " " '03	221,063	107,613	113 450	51,543	61,906
	2 " " '02	189,614	96,716	92,898	49,611	43,287
	12 " June '03	1,324,352	692,931	631,421	392 882	238,539
	12 " " '02	1,068,222	572,983	495,239	313,540	181,699
ST. LOUIS, MO.						
St. Louis Transit Co	1 m., July '03	632,704	469 744	162,960	126,110	36,851
	1 " " '02	568,173	446,164	122,009	74,233	47,776
	7 " " '03	4,100,108	------	------	------	------
	7 " " '02	3,582,760	------	------	------	------
SAO PAULO, BRAZIL.						
Sao Paulo Tramway, Light & Power Co., Ltd	1 m., June '03	102,500	32,500	70,000	------	------
	1 " " '02	------	------	54,284	------	------
	6 " " '03	632,364	195,016	437,348	------	------
	6 " " '02	------	------	326,886	------	------
SAVANNAH, GA.						
Savannah Electric Co.	1 m., July '03	50,312	27,194	23,118	9,832	13,286
	1 " " '02	46,551	24,449	22,101	9,583	12,518
	12 " " '03	503,230	297,612	205,618	115,501	90,118
	12 " " '02	461,010	275,244	185,766	------	------
SCHENECTADY, N. Y.						
Schenectady Ry. Co	3 m., June '03	190,666	106,360	84,306	35,832	48,474
	3 " " '02	111,465	84,372	27,093	20,351	6,742
SEATTLE, WASH.						
Seattle Electric Co	1 m., June '03	175,513	117,546	57,967	24,053	33,915
	1 " " '02	151,317	109,332	41,986	21,557	20,429
	12 " " '03	2,018,907	1,429,737	589,170	282,473	306,696
	12 " " '02	1,655,130	1,134,301	520,828	249,555	271,274
SYRACUSE, N. Y.						
Syracuse Rapid Transit Co	1 m., July '03	71,945	39,490	32,454	20,266	12,188
	1 " " '02	62,570	34,364	28,205	19,025	9,180
	2 " " '03	137,589	77,500	60,089	40,483	19,605
	2 " " '02	123,433	69,164	54,268	38,050	16,219
TERRE HAUTE, IND.						
Terre Haute Elec. Co.	1 m., June '03	38,485	24,366	14,119	6,560	7,559
	1 " " '02	25,136	19,726	5,409	6,280	† 871
	12 " " '03	410,346	279,888	130,458	78,059	52,399
	12 " " '02	307,824	264,610	43,214	68,758	† 25,545
TOLEDO, O.						
Toledo Rys. & Lt. Co.	1 m., June '03	141,545	71,806	69,739	41,135	28 604
	1 " " '02	122,682	65,142	57,540	37 854	19,686
	6 " " '03	772,178	401,206	370,972	242,070	128,902
	6 " " '02	671,284	352,381	318,903	227,033	91,870
Lake Shore Electric Ry. Co	1 m., July '03	67,186	* 34,061	32,125	------	------
	1 " " '02	49,129	* 25,961	23,161	------	------
	7 " " '03	327,089	* 119,437	107,652	------	------
	7 " " '02	248,555	* 158,912	89,643	------	------
YOUNGSTOWN, O.						
Youngstown - Sharon Railway & Light Co.	1 m., July '03	47,297	* 24,259	23,038	------	------
	6 " " '03	246,182	* 152,636	93,546	------	------

NEWS OF THE WEEK

CONSTRUCTION NOTES

LOS ANGELES, CAL.—The end of August marked a decided reduction in the construction force of the Pacific Electric Railway Company, as most of the interurban lines planned by the company for the present have been completed. The line to Whittier is all completed, except the laying of rails, which are late in arriving. The poles are up, the trolley wire is strung and the roadbed is ready for the steel.

LOS ANGELES, CAL.—Standardizing the lines of the Pacific Electric Railway Company in Pasadena has been completed and the construction camps are now at work on the division into Rubio canon.

SAN FRANCISCO, CAL.—Representatives of the Standard Oil Company propose to build an electric railway to connect Point Richmond with West Berkeley. The franchise, for which application has been made, calls for a road from San Pablo via Richmond, Barrett Station and Steege to West Berkeley, where connections can be made with other steam and electric lines for San Francisco. At Point Richmond the Pacific Coast Oil Company, which is a branch of the Standard Oil Company, has large petroleum refineries, the oil being pumped through a 300-mile pipe line from Bakersfield. Among the promoters of the enterprise are: John C. Black, superintendent of construction of the refineries of the Pacific Coast Oil Company; E. A. Gowe, of the same company; C. Kinney, an electrical contractor, and L. D. Dimm, a manufacturer of lubricating oils. Some of the stock has already been paid in. The passenger business will be taken care of with high-class equipment, and there will also be a light freight and express service. The electric power for the operation of the road can be supplied from the Bay Counties transmission lines. The route will be through a growing manufacturing district along the bay shores of Contra Costa and Alameda Counties.

NEW HAVEN, CONN.—Thomas C. Perkins, of Hartford; Fred C. Hinds and Charles H. Wilson, of Boston; Edwin C. Pinney, E. C. Dennis and Alvarado Howard, of Stafford Springs, have been elected directors of the Stafford Springs Street Railway Company at a recent meeting. It was also voted to accept the amendments to the charter as granted at the last session of the Legislature. The amendment covers the right to construct a two-track road over Park Avenue, East Main Street and East Street, also from the Springs to the State line on the route to Monson by the way of Orcuttville and Eliothorpe. The amendment changing the principal office from Stafford Springs to New Haven was also accepted.

PLAINVILLE, CONN.—A meeting of the incorporators of the Plainville & Farmington Tramway Company was held at the office of Knapp & Seymour, in Bridgeport Friday, Sept. 11, and organization effected. This company proposes to operate the road already built. The stockholders are: J. T. Patterson, of Bridgeport; J. B. Cornwall, of Bridgeport; Arthur Perkins, of Hartford; Howard H. Knapp, of Bridgeport; W. J. Carroll, of Hartford. They were elected directors of the company, and at the meeting of the directors J. T. Patterson was chosen president and treasurer, and W. J. Carroll, secretary. They will hold office until the annual meeting in February. The directors voted to instruct and empower the president to make arrangements for putting the road into operation at an early date. It is believed that cars will be running this fall. It is said that the roadbed is in good condition and that the little overhead work required can be done in a few days. The company is negotiating for cars and for supplying of power.

WASHINGTON, D. C.—The District Government has granted the formal permit to the Philadelphia, Washington & Baltimore Railroad, as the Pennsylvania Road is known here, to construct the twin tunnel under the United States Capitol Building and the adjacent blocks and streets. The permit had been held up for several weeks because of a difference between Major Biddle, the Engineer Commissioner, and the railroad engineers in regard to the motive power to be used to propel cars in the tunnel. Major Biddle insisted that electricity should be used, and the railroad men wanted to be allowed to use steam. Electricity was finally agreed on. The tunnel will be 3000 ft. long, beginning at the intersection of Massachusetts Avenue and First Street, Northeast, going under Capitol Hill to New Jersey Avenue and D Street, Southeast. The total cost of the work will be approximately $800,000. There will be two branch tunnels connecting with wards and tracks of the Pennsylvania Road in South Washington.

HAZLEHURST, GA.—The City Council has granted a right of way and other privileges to Russell & Seeckle, promoters of the proposed electric railway from this city into the western portion of this county.

GAINESVILLE, GA.—The Atlanta, Buford & Gainesville Railway Company has applied for a charter and proposes to erect an electric plant on the Chattahoochee River to furnish power for operating a street railway from Gainesville to Atlanta, and for furnishing power for Buford and other points along the line. Over 500 acres of land have been purchased and several hundred dollars have been spent on surveys. Options are being taken on large tracts of land near the river. The petitioners for charter are: H. D. Jaquish and C. C. Sanders, of Gainesville; M. S. Garner, G. W. Thompson, J. O. H. Brown, of Buford; E. J. Michael, of Idaho; J. W. Peterson, W. W. Gorman and G. W. Winslow, of Chicago, and D. B. Stancliff, of Atlanta. The capital stock of the company is to be $100,000, with shares at $100 each.

CHICAGO, ILL.—Marshall Sampson, one of the receivers of the Chicago Union Traction Company, who has just returned from New York, is quoted as authority for the statement that steps are to be taken at once to equip with electricity all the lines of the company now operated by cable. A large increase in the number of cars is also indicated from Mr. Sampson's remarks.

EAST ST. LOUIS, ILL.—Incorporation papers have been filed by the Municipal Traction Company, of East St. Louis. The new company proposes to build electric railways through the southeastern part of the city. The capital stock is $100,000. The officers of the company are: C. O. McCasland, president; C. G. Derleth, vice-president; P. J. Soucy, treasurer, and D. H. Morrell, secretary.

GALESBURG, ILL.—The Galesburg, Monmouth & Rock Island Railway Company has awarded part of the contracts for constructing its proposed line between Galesburg, Monmouth and Rock Island, and construction work will be begun at once. About 70 miles of line are to be built. Fourteen motor cars and ten trailers will be operated. The general contractors are the Arbuckle-Ryan Company. The power station will be equipped with three 500-kw alternating-current direct-connected generators, Corliss engines and Sterling boilers. The officers of the company are: G. F. Duncan, president; E. Woodman, secretary and treasurer; S. L. Nelson, manager and purchasing agent.

JERSEYVILLE, ILL.—The Union Traction Company, of Jerseyville, has been incorporated, with a capital stock of $2,500. The object of the company is to build an electric railway and furnish light and power. The incorporators are: A. O. Auten, June M. Rhoades and Joseph W. Becker.

KEWANEE, ILL.—The City Council has granted a fifty-year franchise to the Kewanee, Cambridge & Geneseo Electric Railroad Company.

RIVERTON, ILL.—Within a few days work will begin on the construction of a power plant for the Decatur, Springfield & St. Louis Electric Railway. The company has purchased the old paper mill site at Riverton, and the power house will be built there on the Sangamon River. The building will cost $230,000.

SPRINGFIELD, ILL.—The Central Traction Company, Jerseyville, has been incorporated, with a capital of $2,500, to operate an electric railway. A. O. Auten, J. M. Rhoades and J. W. Becker are named as incorporators.

ANDERSON, IND.—Officials of the Indiana Union Traction Company announce that they are ready to receive bids for the erection of carshops in this city, work to begin at once. The company proposes to build and repair all of its own cars. The buildings will cover about six acres of ground, and cost upwards of $300,000.

CORYDON, IND.—An election has been ordered for Harrison and Franklin Townships to vote on a proposition of subsidy to the Louisville & Southern Indiana Traction Company.

INDIANAPOLIS, IND.—The Indiana Union Traction Company has purchased Broad Ripple Park, which consists of 30 acres, and will expend $75,000 in improving and beautifying it. The company will lay a double track between the city and the park, in order to handle traffic.

JEFFERSONVILLE, IND.—A franchise has been granted to Capt. E. J. Howard, and the old, and perhaps the only, mule street car line in Indiana will be changed to an electric line.

LOGANSPORT, IND.—The Union Traction Company has filed in the Circuit Court a number of suits to appropriate land for the right of way of the Logansport, Hammond & Chicago Traction Company. This is the first move of the kind upon the part of the company.

LOGANSPORT, IND.—The reconstruction of the old narrow-gage street railway system in this city has begun under the superintendency of E. C. Folsom. The downtown portion will be double tracked and also the line to Spencer's Park. An entire new equipment will be required, including ties, rails, wire, poles and rolling stock. The property is now in the hands of the merged company, known as the Indiana Union Traction Company.

MONTPELIER, IND.—A new interurban railway is projected between this city and Marion. C. H. McNath, of Indianapolis, and W. L. Padgett, of Chicago, capitalists, and others, have investigated and examined the proposed route, and say they are highly pleased with it. The proposed line will run almost directly east and west, passing through Roll, and will give a line through the best part of the oil fields of Blackford and Grant Counties.

PRINCETON, IND.—At the annual meeting of the stockholders of the Evansville & Princeton Traction Company the following directors were chosen: J. S. Heston, S. T. Heston, E. J. Baldwin, W. L. Sonntag, J. G. Legrange. The directors then elected the following officers: President, Joseph S. Heston, Princeton; secretary and general freight and passenger agent, E. J. Baldwin, Princeton; treasurer and purchasing agent, Samuel T. Heston, Princeton; general manager, William L. Sonntag, Evansville.

PRINCETON, IND.—The Evansville & Princeton Traction Company's line, the first interurban electric line in Southern Indiana, has been completed, and a party of business men made the trial trip Sept. 10. The electrical equipment is not yet all in place, and steam dummies will be operated until all the electrical work is completed. The road is 27 miles long, and runs through the richest portion of the State. Work will next begin on the Hazleton extension, which will add 9 miles to the system.

WABASH, IND.—President Tuttle, of the Wabash-Rochester Traction Company, is said to be meeting with much encouragement and success in his efforts to revive the line between the two cities. The line is 37 miles long, and $105,000 in subsidies have been voted to the enterprise.

MUSKOGEE, I. T.—C. N. Haskell, for the Muskogee Traction Company, has given a bond of $10,000 to commence work on the street railway in Muskogee within thirty days. Cars are to be running within fifteen months.

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EDITORIAL NOTICE

Street railway news, and all information regarding changes of officers, new equipments, extensions, financial changes and new enterprises will be greatly appreciated for use in these columns.

All matter intended for publication must be received at our office not later than Tuesday morning of each week, in order to secure insertion in the current issue.

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An Important Departure in Railway Management

The Boston Elevated Railway Company inaugurated last week a step for the benefit of its employees which should certainly be appreciated by them. The plan is so radical that the results of the experiment—for the company admits that the proposition is largely experimental—will be watched with a great deal of interest by other railway companies. It is an almost trite saying that the processes of law are both tedious and expensive. So well recognized has this fact become that many men whose financial resources are not large, and even those who have considerable capital, are often willing to stand serious injustice rather than go to the expense which consultation with a lawyer as to their legal rights would entail. The result is that in many cities legal aid societies have been established to give gratuitous legal advice to those who otherwise would not consult a lawyer.

The Boston Elevated Railway Company, realizing the benefit of such advice to its employees, issued on Sept. 14 the following notice:

Hon. Russell A. Scars, manager of the legal department, authorizes the publication of the following notice:

Beginning Monday, Sept. 14, 1903, any employee of this company will be furnished legal advice concerning his personal affairs by the legal department, free of charge. Any employee desiring to avail himself of the above may call at the offices of the legal department, at 101 Milk street, room 300, and, upon showing himself to be an employee, will be assisted in his affairs, as far as legal advice is concerned, by the attorneys of the company.

This undertaking is largely experimental, and should it be deemed expedient to enlarge, qualify or discontinue the same, due notice will be given.

We believe that co-operation of this kind between a large company and its employees is of the most practical character, and that it will be appreciated by the latter as much as perhaps any other step which a railway company could take.

The Right of Way

Although the Saratoga Convention has passed, there are many subjects discussed at the meetings which will provide food for thought for a long time to come. With the three associations in session, the topics to which attention was directed were extremely varied and covered practically every branch of street railway work. We shall feel justified, therefore, in referring occasionally, in the next few issues, to some of the papers read at Saratoga and the facts to which they direct attention.

We wish that every influential newspaper in the country would give place to Mr. Vreeland's admirable convention paper and to the discussion that followed it. It would do more to promote a clear understanding of the issues involved and to establish sensible and friendly relations between the public and the street railways than any other piece of missionary work which we could indicate. Instead of a proper comprehension of the motives and intentions of the street railway manager there is generally to be found a silly hostility which has no sound basis of any kind. Demagogues are howling about soulless corporations and pointing the finger of scorn at street railways, when the great mass of the people are steadily profiting by their work. We grant that franchises have sometimes been obtained by questionable methods, that roads are sometimes greatly over capitalized, that employees are sometimes careless and insolent, and that street railways in common with most other things have their faults, but, nevertheless, the average passenger gets full value for his nickel. The most sordid selfishness on the part of a street railway management would stop short of repelling passengers consciously. If a road has watered its stock by so much the more it finds it for its interest to keep on good terms with the one necessary source of its dividends. And the discussion of Mr. Vreeland's paper shows most plainly that the consistent attitude of enlightened street railway men is a recognition of their duties to the public and a cordial desire to promote good service. Last winter we had occasion more than once to call attention to the necessity of public co-operation with the street railways to lessen the almost intolerable congestion that occurs in great cities, and in no way can this be more effective than in defining the relative rights of the majority who ride in street cars and those of the minority who do not.

The trolley car is the poor man's automobile, and it is emphatically for his interest that it should not be blocked or hindered in its progress, delayed by needless restrictions or shut out from the streets which he wishes to traverse. If you look into the merits of any controversy regarding a proposed fran-

chise, in nine cases out of ten you will find that it is the few trying for their own selfish ends to curtail the rights of the many in the common highway—Ebenezer Gotrox trying to appropriate the public domain for his 60-hp Purple Demon, instead of using it in common with his fellow-citizens. Now, the right of the road is for all men, and the public can and should make such provisions as may insure convenient and peaceable use of the highway to all comers. But, as was pointedly suggested in this discussion, the general laws concerning the right of way are imperfect, antiquated, little known and carelessly enforced. So long as the streets are used only by a small variety of vehicles running at rather moderate and uniform speeds, very simple regulations are sufficient to secure relative safety and the enforcement of them is easy. But such a condition no longer exists. The streets are now used by vehicles operated at speeds which were never seriously contemplated in the old regulations, and an entirely new set of conditions has thereby arisen. It was not a serious matter in the old horse-car days if a dray jogged along for a block or two in front of an ambling car; the speeds of the two were not widely different, and there was hardly an excuse for bad language in the situation. Now, when cars must make their 8 m. p. h. or 10 m. p. h., in response to public demands and to meet public needs, it is very easy to cause annoying delays and to throw traffic hopelessly off its appointed schedule. The automobile, operating at similar or greater speed, and not like the street car, confined to a track, raises a new series of difficulties, and altogether the time is fully ripe for a reconsideration of the whole question.

Much can be done, as the discussion shows, by informal personal appeals to owners of vehicles. Most men, especially business men used to large affairs, have learned to respect the rights of others in our common daily life, and at least have learned not to infringe them recklessly. So, understanding that a friendly understanding of mutual rights is a good thing for all concerned, they are quite willing to lend a hand in the practical solution of the right of way question. But this informal and voluntary action does not go far enough. It is high time to revise the rules of the road to meet the radically new conditions that have arisen, and to enforce the rules, once established, without fear or favor. If a city is to reap the full benefits of modern rapid transit it must see to it that street cars are not delayed at every block by wanton violations of law or of common decency in such matters. We stand committed in this generation to urban life, but we have not yet learned how to make that life reasonably comfortable. As Mr. Vreeland intimated, in many foreign cities the details of everyday life are much better regulated than here, mutual rights are far more clearly defined, and infractions of the rules dictated by public policy are far more rigorously dealt with. We think, with him, that street railways could and would accept on their part much closer public regulation than is now usual if they could at the same time be sure of their own proper rights in the streets. As it now is the public calls loudly for faster and more frequent service, and blocks the streets so as effectively to prevent it. When one tries to crowd a million or two human beings into a few square miles one must remember that they require space in which to move about, and must keep that space clear. A city under the present regime is like a tenement with narrow halls cluttered by the ash pails and garbage barrels of every slatternly family in the place. You cannot win it for cleanliness and respectability until a passageway is cleared and kept cleared to the freer space outside its walls.

The Conduct of Labor and Other Organizations

The recent experience in the New York building trade with a notorious labor leader has illustrated in a very striking way the tremendous hold which a labor leader has on the sentiments of the members of his union. It seems to make little difference how incompetent or even dishonest he may be in his conduct of the affairs of the body. After he has once been elected to his position the rules applicable to the conduct of other business associations seem to be regarded as of little weight compared with the false idea that the leader must be sustained in any position he takes, whether it is right or wrong. Once having installed him in control of their affairs the labor union finds its leader as hard to get rid of as Sindbad found the Old Man of the Sea.

Now, this is extremely unfortunate, for all experience goes to show that in organizations of this kind it is the almost universal tendency for the radical and reckless element to get the upper hand. The conservative men, even when in a majority, find it difficult, if not impossible, in any general meeting, to offer satisfactory opposition to the views of the more hot-headed members. The very fact that the men when gathered in general assembly see a large body of their fellow workers, gives them the idea of the strength which they would possess if acting as a unit, and the spirit of opposition is almost always an easier one to awaken than that of conciliation. In any meeting of this kind there are always some soreheads, and as men with grievances are usually more glib talkers than those who have no complaints, they are often able to create a feeling of dissatisfaction in the minds of a considerable portion of their hearers who would never have had this thought without outside suggestion. The popular sentiment, at a meeting of this kind, is often that those who talk against a fight are inspired by cowardice, while those who advocate a contest, often because they have nothing to lose therefrom and everything to gain, have a great deal of pluck. This feeling, together with that of class friendship, will often keep in power a disgraced labor leader against the better judgment and sense of the majority of the men composing his union.

These facts are too well known to admit of dispute, and we venture the assertion that more than half of the strikes ever instituted were originally opposed by the better judgment of the majority of those who participated in them. Of course, after a strike has commenced, and especially after it has continued for some time, other events arise which obscure the original cause of the dispute. The employers accept the announced sentiments of the labor leader as representing the opinion of the majority of the men, and are apt to take steps which are considered arbitrary by the latter. It is an exception when an Arthur is selected to a post of responsibility among the employees.

A street railway manager who has had a long experience in the handling of men said recently in commenting upon these facts that for the reasons here mentioned he did not consider it advisable to encourage his men to hold mass meetings. In this policy he has had the support of the best element among the men themselves, who did not wish to be forced by their comrades into any action contrary to their better judgment and welfare. This is even carried so far that in a mutual benefit association which was organized some time ago by the men themselves, it was voted to hold no annual meetings. The names of the candidates for the office of managers of the association are nominated by the members of the retiring board each year, and are duly posted on the bulletin boards of the different car houses. They are then voted for by ballots, which

are dropped in boxes located in each car house. The company contributes a certain amount to the funds of the association annually, the men also make their weekly payments to the treasury, and sick and death benefits are paid therefrom. A novel feature of the conduct of the finances, however, is that at the end of each year the entire amount of money remaining in the treasury is distributed equally among those members who have received no benefits during that period. The result is that it is not uncommon for a member to receive back as much as he paid in, and in some cases somewhat more, due to some men leaving during the year and to the initial donation of the railway company.

While this distribution is of itself a departure in the administration of mutual benefit associations of this kind, the most original feature of the plan is undoubtedly that of having no annual meeting, club rooms or other places at which the men assemble as a body. This policy has been strongly advocated by many members of the association who have been afraid that if any more tangible organization was started they would be forced as members of a body to take action which they would not approve as individuals. The best men on his road, according to this manager, and, in fact, on any road, as a rule, are those who do not have to be cajoled into doing good work by club rooms, billiard tables and other pastimes. They have their own social resources, can provide their own pleasures, and only wish to be let alone by their fellow workers and allowed to do their daily work. This class of man, still quoting from the manager already mentioned, constitutes the majority of the employees of most roads, but, as a rule, not so large a majority or so persuasive in argument that they can successfully combat a hot-headed minority anxious to make trouble if given the opportunity.

Transfer Frauds in Chicago

The Chicago City Railway Company has detected frauds in connection with its transfers, and has secured indictment against a newsboy and three conductors. It seems that the conductors have been giving transfers to this newsboy, and that he has been selling a transfer with a paper for 5 cents, the conductors sharing in the profits.

It is thought that there may be other similar cases, and they will doubtless be prosecuted vigorously, as the company is determined to stamp out these abuses. A few years ago it was customary in Chicago for passengers to ask for transfers even when they did not need them, and then to give them to newsboys, who would sell the transfers along with their papers. This kind of fraud was stopped by the company, however, after a great deal of hard work; but it seems that it has been gradually increasing again, and that some of the conductors have become involved in the affair.

It is always difficult to prevent frauds of this kind, as experience has shown in many cities. We know of one company whose management suffered great losses through abuse of transfer privileges on account of an understanding between employees and saloonkeepers, who were always supplied with transfers, which were freely dispensed to customers. In Chicago conductors were instructed not to accept transfers when it was apparent that they had been improperly secured, and this naturally lead to many complications. It served to check the abuses somewhat, however. Before the order was given newsboys dealt openly in transfers. Restrictions and careful inspection finally eradicated the evil at that time, but apparently the reform was not permanent and more stringent measures will be necessary before it is entirely wiped out.

The Denver Movement

The city of Denver has been engaged in a lively campaign during the last two months over a new charter, which embodies many of the peculiar views that have been so popular for several years throughout the West. As might be expected, under the circumstances, the advocates of municipal ownership were busy while the proposed charter was being prepared, and as a result the restrictions that it is proposed to place upon all franchises hereafter will make them very unattractive to investors; in fact, there is very little left of the old idea of a franchise in the license or revocable permit which it is proposed to substitute for it. An individual or a company may secure permission to engage in some public enterprise for which formerly a franchise would be granted, but now if the project prove profitable the city may step in and secure possession at any time "at a reasonable valuation;" the grant may be amended or repealed, and the rates charged by the grantees for the service performed are subject to revision at all times by the city. Stock and bonds can be issued only against actual cash invested or property of equal value, and the entire management is subject to the general supervision of the city. It is quite probable that the movement for the adoption of this measure will fail.

And yet the plan outlined is the logical culmination of the populistic tendencies in vogue throughout that section of the country, and of the ideas that are gaining ground in the East as well. The men who framed the proposed charter for Denver were consistent at least, although the frankness with which they avowed their purpose stripped the municipal ownership fallacy of many embellishments, and presented it in its true light, so that every man now must know that his support of such measures means approval of a policy of confiscation. They have thus unwittingly done a real service to the entire country. If they have awakened a sense of responsibility among the men who are habitually "against corporations" and impressed upon their minds the danger of encouraging these attacks upon legitimate enterprise, as seems quite likely at present, the movement will prove as great a public benefit as it originally threatened to become a public calamity.

Temporary Relief Denied Chicago

Mayor Harrison, of Chicago, has refused to authorize permits to change some of the Union Traction cable lines to electric traction as a temporary expedient to relieve congestion. This plan was talked of by the receivers, and was favorably considered by disinterested taxpayers, but because of the Mayor's opposition it will probably be abandoned.

This action on the part of the Mayor is in keeping with his attitude throughout the present controversy. He has taken a very narrow view of the question, sacrificing the interests of the city and the convenience of the people in order to gratify his personal spite and make cheap political capital out of the situation. Chicago, to-day, affords a striking example of a great city with financial and industrial interests of great magnitude, which are entirely lost sight of, if, indeed, they are comprehended, by the small-fry politicians comprising the present municipal administration. The avowed purpose of this clique is to keep the traction question open for political advantage, and every effort to relieve the situation that has thus far been made by the companies or the people who are suffering as a result of this policy has been vigorously opposed by the band under Mayor Harrison's leadership. It is about time for the self-respecting element in the City Council, particularly the transportation committee, to assert itself.

ELECTRIC TRAMWAYS IN AUCKLAND, NEW ZEALAND

An extensive electric tramway system is nearing completion in and about Auckland, and this city will soon enjoy the proud distinction of being the first in New Zealand to have electrically-operated tramways throughout. The new system not only serves the city of Auckland but crosses North Island to the neighboring suburbs of Onehunga, and serves a total popu-



SOME SPECIAL TRACK WORK

lation of about 70,000. The change from horse to electric traction in Auckland has occupied about eighteen months, during part of which interval a 'bus service was temporarily substituted for the displaced horse cars. The advent of electric traction should be very welcome to the residents of Auckland, for the steep hills on which their city is built have made animal traction very slow and laborious.

In July, 1901, contracts covering the track construction, overhead line, power station, feeder system and cars were placed with J. G. White & Company, of London, Eng., who in turn sublet the contract for rails and conduit to John McLean & Sons, of Auckland, and the building of the car house to J. Ellingham, also of Auckland, but undertook the general supervision of the construction of the tramways by their own engineers.

TRACK CONSTRUCTION

All of the old track had to be relaid, and as several new lines were added, there are at present in operation about 34 miles of line, only about 4 miles of which is single track.

Since nearly all streets in Auckland are from 40 ft. to 60 ft. wide, the company has encountered no construction difficulties in installing so large a proportion of double track. In fact, the clearance between such tracks is fully 6 ft., permitting the extensive use of center poles. Where single track is installed it is not placed in the center of the street, but provision is made for the installation of another track alongside when increased traffic demands it.

The rails are of the full-grooved type, are 6½ ins. high, and weigh 92 lbs. to the yard. They were rolled in standard lengths of 37 ft., as it was found that this was the greatest length that could conveniently be shipped. Angle plates are used, and the rail-joints are bonded with 0000 B. & S. copper bonds of the Chicago type. The sub-construction used is concrete stringers, in which the rails are bedded to a depth of about 1 in., and which are 18 ins. wide by 9 ins. deep. All Auckland streets are macadamized to a depth of 9 ins. throughout except Queen Street, where 2 ins. of Neuchatel asphalt, laid on a bed of 6-in. concrete, is used for paving. In this street the concrete under the pavement is made continuous with the deeper concrete under the rails. As the rainfall in Auckland is excessive, amounting in some years to 60 ins. or more per annum, arrangements have been made for draining the track through slots in the rail groove. These slots are connected through narrow culverts with the sewer system. The rails were supplied by the Lorain Steel Company and the special work is of the same company's guaranteed type.

FEEDER CONDUITS

The conduits for the feeder cables are of the Camp type, and have ducts varying in number from one to twenty-four, several spare ducts having been laid for further extensions. The conduits are inclosed in concrete 4 ins. thick, and are run into manholes about 90 yds. apart, except on curved track, where they are placed closer together. These manholes are of two sizes, 4 ft. x 4 ft. internally by 5 ft. deep, and 2 ft. 5 ins. x 3 ft. 5 ins. internally by 3 ft. 6 ins. deep. The covers, which are of cast-iron, have asphalt tops 2 ins. thick, instead of being corrugated. The ducts are laid so as to drain into the manholes, some of which are connected with the main sewer by a special line of drain pipe to prevent the collection of water.

Many difficulties had to be overcome



CENTER POLE OVERHEAD CONSTRUCTION

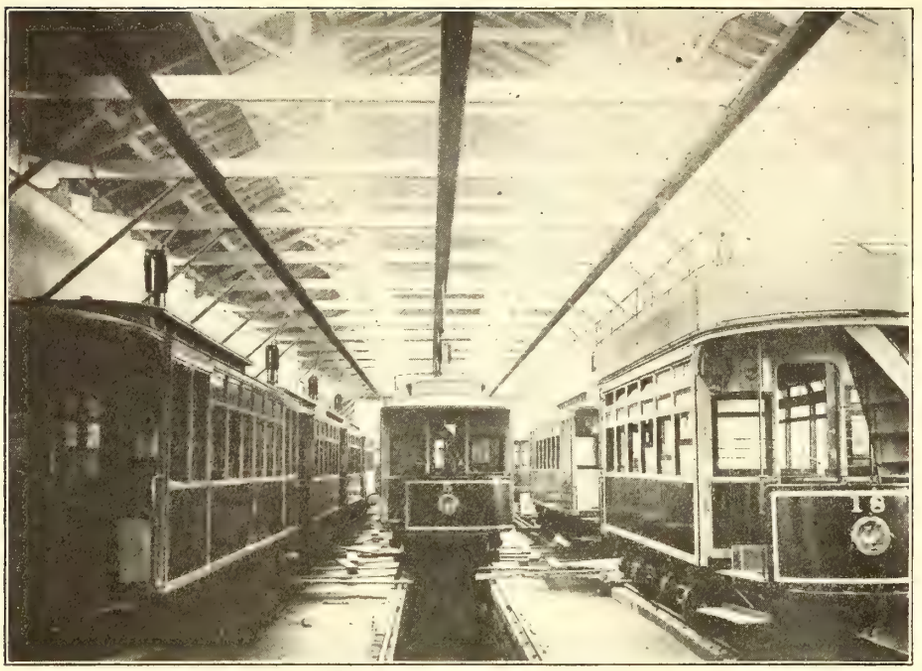
owing to the great number of gas and water pipes crossing the conduit way. The presence of telephone poles on both sides of the road also caused trouble, as the telephone department would not permit the laying of conduits near the telephone poles. To



OPENING OF THE AUCKLAND ELECTRIC TRAMWAYS



VIEW ALONG QUEEN STREET



INTERIOR OF CAR SHED

guard against contact between falling telephone and trolley wires the telephone wires had to be insulated where they crossed the trolley wire, and a number of telephone poles had to be replaced by higher ones. All the expenses of these alterations were borne by the tramway company.

All feeder cables are of Callender manufacture. The overhead feeders used in the city are paper insulated, but the conduit feeders are insulated with vulcanized bitumen. The feeder boxes are placed on the edge of the foot paths. In the suburbs the feeder cables are carried on the center poles on special arms fastened above those carrying the trolley wire and are not insulated.

OVERHEAD CONSTRUCTION

Center poles are employed wherever the streets are wide enough to permit their use, otherwise side poles with span wires have been adopted Span-wire construction is also used at all curves and junctions. In the city the poles are 115 ft. apart, are set in holes 6 ft. deep on 6-in. concrete, and surrounded by a wall of 8-in. concrete. All center poles have cast-iron wheel guards to prevent accidents from vehicles, and are made conspicuous by being painted white for 6 ft. above the ground. The trolley wire is carried 21 ft. above the rails. Some of the poles in Queen Street are also surmounted by arc lamps.

All city poles are made of iron; those used in the outlying districts are made of a hardy native wood, and are tarred at the bottom for 7 ft.

The trolley wire used is round No. 00 B. & S. hard-drawn copper, divided into half-mile sections. The section boxes are fastened to the poles. A separate telephone circuit for the exclusive use of the tramway has also been installed. The wires for this telephone system are carried on the center poles.

POWER STATIONS

The power station is located close to Waitemata Harbor, and is approximately



SINGLE DECK, DOUBLE-TRUCK, COMBINATION TYPE CAR



SINGLE-DECK, SINGLE-TRUCK CAR

105 ft. square. It has a steel frame work filled in with brick, and a roof of corrugated iron laid over boards about 1¼ ins. thick. The boiler house adjoins a wharf, thus saving the cost of coal cartage. To provide for future extensions the left-hand walls of both engine and boiler house are made of corrugated iron only.

The power equipment consists of:

Four Babcock & Wilcox boilers, fitted with chain-grate stokers. Each boiler has 2100 sq. ft. heating surface and operates at a pressure of 150 lbs. per square inch.

One 360-tube Green economizer.

Three horizontal cross-compound Corliss engines made by Cole, Marchent & Morley, Ltd. The normal output of each engine is 475 ihp, and maximum output 700 ihp, at 100 r. p. m., with steam pressure of 150 lbs.

Three 300-kw, eight-pole, direct-connected, direct-current, 500-volt to 550-volt, compound-wound railway generators, made by the General Electric Company, with one 25-kw auxiliary unit and four boosters.

The switchboard is in an elevated position along the front wall of the building, and contains seventeen panels, namely, three generator, one load, one Board of Trade, four booster, six feeder, one lighting and one spare panel. The panels are of

polished blue Vermont marble, and the board was furnished by the General Electric Company.

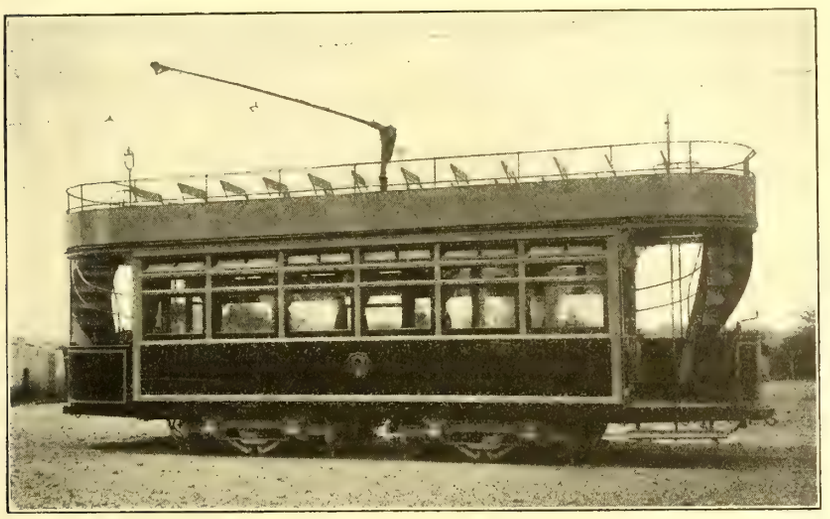
The engineers' offices are in a separate building adjoining the power house.

CAR HOUSES

The principal car depot and shops are situated in Ponsonby. The chief building is in two bays, 354 ft. and 328 ft. long, respectively, and each 39 ft. wide. It contains a car house with six lines of track and accommodations for forty-four cars, blacksmith, fitter, carpenter and paint shops, repair and testing rooms. A complete set of woodworking machinery and a drying oven have also been installed. Above the general machine shop there is a special loft for seasoning timber. A second car house is in course of erection at Epsom. It will have a capacitiy of thirty cars.

CARS

All the cars used were constructed by the Brush Electrical Engineering Company, Ltd., London. They were sent to Auckland in sections and erected there. The three types shown in the accompanying illustrations are now standard. The first is a single-truck, single-deck car, fitted with two 40-hp Brush motors, type 1200. It has a separate compartment for smokers and seats thirty-two passengers. The second illustration shows a single-deck, double-truck combination-type car with closed center and open ends for smokers, and seats forty-eight passengers. The company also operates a double-deck, double-truck car with four-motor equipment, seating eighty passengers. All cars are fitted with hand brakes, Spencer slipper brakes and Brush controllers. Owing to the numerous steep grades on the lines the operating apparatus is of specially high efficiency.



DOUBLE-DECK, DOUBLE-TRUCK CAR

The width of all cars is 7 ft. 6 ins., and cross seats are used throughout. The cars have straight instead of curved sides and vertical paneling to prevent moisture lodging in the joints. The windows are made wide and low.

The present rolling stock consists of forty-three cars, with eight more in course of construction.

CAR ROUTES

The cars began running on Nov. 24, 1902, on which day the Newton-Ponsonby line started with a 10-minute service. This headway was reduced, however, as soon as more cars became available. On Dec. 11 the College Hill-Ponsonby line was opened, and on Dec. 24 the first car started for Newmarket, via Ryker Pass, sixteen months before contract time.

MANAGEMENT

The Auckland Electric Tramway Company is controlled by the British Electric Traction Company, of London, and has the following officers: C. S. B. Hilton, chairman; Paul M. Hansen, general manager; R. P. Simpson, secretary; C. Keary, chief electrical engineer; Ed. Duncan, assistant electrical engineer; R. Rodgers, depot manager; H. A. Dando, superintendent of overhead work. W. S. Turner, formerly of New York, has been superintending the erection of this tramway on behalf of J. G. White & Company, Ltd., with C. W. G. Little, chief engineer; Selwyn Grant, chief assistant engineer, and J. Stewart and M. F. Carey as resident engineers.

CONVENTION SUGGESTIONS

Among the suggestions made at the Saratoga Convention not the least important was that contained in the opening address of the chairman relating to the plan of making the gatherings of the Association partake more of the nature of business meetings than has heretofore been the case. This plan has been very generally discussed since the return of the members of the Association and is highly commended. Without entirely eliminating the social feature, it is agreed that the present plan should be changed and more prominence be given to the business features and less to entertainment. To do this it was suggested that a permanent place of meeting be selected, that a business-like method of defraying expenses be established, and that delegates and visitors pay for their own entertainment individually instead of permitting or expecting the local street railway interests to do so. This proposition will be acted upon at the first meeting of the executive committee and will have many warm supporters.

The plan proposed by Mr. Mailloux and advocated by several other members that the discussion of papers need not necessarily close with the meeting at which they were presented, will doubtless be adopted, and some provision made for continuing the consideration of certain topics from one meeting to another, as the subjects frequently gain importance with advancing years. For instance, the subject of steam turbines is every year acquiring new interest for street railway men, and although two papers have been presented before the Association there has been very little discussion by members in the meetings. Next year it is expected that some of the members will have practical experience with these machines in commercial operation, and the discussion of the relative merits of the turbine and reciprocating engine based upon the performance of the new machines will doubtless prove a valuable addition to the Association's record.

The collection of data on several subjects might be continued indefinitely and with good results. On the subject of handling freight and express on electric roads, for instance, information is wanted, as the excellent paper by Mr. McClary demonstrated. For several years this branch of the business has been receiving some attention, especially where interurban lines have been in operation, yet only comparatively few companies seem to be familiar with the possibilities of this branch. Just now interest in this topic is increasing, and it is apparent that this subject will be one of greatest importance by the time another convention is held. Therefore, in this and similar cases, it is urged, the discussion could with advantage be continued from year to year.

The complaint of the supply men will doubtless be heeded, as the practical street railway men are anxious to encourage the idea of holding good exhibitions. This has come to be regarded as an established feature of the annual gatherings, and the mechanical men will be particularly interested in securing a continuation of this part of the programme.

SYSTEM OF REPORTS OF DENVER CITY TRAMWAY

The system of making daily and monthly reports to the auditor and officers of the Denver City Tramway Company is an elaborate and extensive one, comprising, all told, about fifty forms and blanks, and, although there is much work involved in these details, the management feels that it is fully justified. The example of the Denver Company might be followed with profit by other railways in the preparation of these reports, and in the gathering and recording of statistics that will assist in the operation and maintenance of the property. The system in use has been gradually evolved to meet the needs of the several departments, improvements and alterations being made from time to time as necessity demanded. Much credit for its development is due to John A. Beeler, vice-president and general manager, who has been identified with the company for nearly fifteen years. J. B. Hogarth, the auditor of the company, has supervised the perfection of the details and has introduced many original and valuable features.

RECEIPTS

The department of the company requiring the largest amount of report and record work is that for the receipt and disbursement of material and stores. All goods are delivered at the general store room, which is located at the Broadway shops. Originally the yard used for storage of rails, ties, rough lumber, paving rock and other heavy material adjoined the storeroom. The extension of the track construction and the increased stock carried, as a result of the growth of the system, necessitated other space for this heavy material, and a yard, one block from the shops, connected by the company's own tracks with a third rail for steam railroad cars, has been in use for six years. This additional yard was illustrated on page 195 of the Street Railway Journal of Aug. 8. The yard is 821 ft. long and 100 ft. wide for half its length, and 200 ft. wide beyond that.

The blanks and forms used in connection with the receipt of goods in this yard and the general storerooms are of interest. Slips for local deliveries are checked by the receiving clerk and turned in to the storekeeper's office. One form is used for entering goods that are received from out of town, and another is used for the same purpose for goods delivered in carload lots at the yard. This latter blank, while serving the purpose of checking bills, also enables the office to check claims for demurrage referred to the store department. A special form has been prepared, and is made out in duplicate for verifying weights, etc., and is attached to the goods-received slip where occasion demands.

All these local delivery slips, goods-received slips and yard foreman's unloaded reports are turned in at the office of the storekeeper at the end of each day, and entered in a "material and goods" receipt book, under columns, "Date," "From Whom" and "Articles." This account is kept in a loose-leaf receipt book, 23 ins. x 18 ins. The accompanying cut (Fig. 1) is a reproduction of the headings of one page, in which it will be noticed items are arranged alphabetically. The list is carried out on the five pages immediately following that reproduced, two half-sheets being inserted to avoid repetitions of the general entry. There are seventy-six separate columns, containing names of machines, material or finished products itemized, and these are arranged in their alphabetical order. The purchasing department requires from dealers that bills be made promptly upon shipment of goods, and these bills usually follow the next day after the delivery of local shipments. The out-of-town bills are always in before the goods arrive. In this manner, by keeping right after the bills, the receipts can be checked, the amount of bill entered, the distribution made, and the bill passed as to shipments received in good order and sent directly to the auditor's office. Bills are worked from the purchasing agent to the storekeeper, and from the storekeeper to the auditor.

The material carried in stock is divided into seventy-six practical working headings, and this division is the foundation for all reports, statements and records from the ledger to the smallest blanks where details show.

The last day of the month, the last bill having been filled in, this receipt book is made to balance. A credit slip form, with summary sheet form, is entered in this book at the end of the month and distributed as in the case of bills for other deliveries. When footed, postings are made directly to the ledger, which is the total charge on the debit side of the ledger account of material headings.

DISBURSEMENTS

Disbursement of stores start from the original authority requisition form, and a modification is also used for all goods sent out beyond the shop limit where receipt is desired, duplicates being given to the person receiving the goods. These two forms and the oil report (gotten up so that oil and grease can be checked more readily) are priced and extended, and distribution noted on the original form. They are assembled on a memorandum sheet form, and then carried to the daily disbursement blank shown in Fig. 2. The original of this report is kept by the storekeeper for posting to a permanent disbursement book kept with cardboard cover, while the duplicate is sent to the auditor and the triplicate to the engineer's office. Any material or scrap recovered is shown daily on this sheet.

Denver City Tramway Co. Material and Stores.

DATE.	Bill No.	FROM WHOM	ARTICLES	Invoice Total	Freight	Labor	Total	Axles	Armatures	Brake Shoes	Brake Appliances	Bell Cord and Fittings	Bearings	Brush Holders and Parts	Building Material	Brooms and Brushes	Bolts, Nuts and Washers

FIG. 1.—HEADINGS IN LOOSE-LEAF RECEIPT BOOK, SHOWING MATERIALS RECEIVED

The preparation of this daily disbursement report is necessary on account of the daily expense of operation which is shown from the accounting department. This system is quite extensive, and considerable detail work is required, yet while considerable copying of figures is done, the material items are not rewritten at all, but are priced and extended on the original authority.

A standard requisition form on the purchasing agent has been adopted. This requisition is made by the storekeeper monthly, and as few requisitions as possible are made by other departments or at other periods than the first of the month.

An estimate blank is used by the track and overhead department, and occasionally by the mechanical department when an unusual job is on hand. This blank enables the head of the department to make up estimates intelligently, and gives the storekeeper opportunity to check over and make purchase requisitions for the material in demand, of which he is short.

A balance sheet made to the accounting department each month has been arranged, showing amount on hand, amounts taken into store account from various sources and the balance on hand. All that is necessary to make out this report is to total the various forms in use and fill in amounts at the storeroom and then the accounting department can have the balance sheet for checking.

DAILY SUMMARY OF MATERIAL AND STORES DISBURSED DAY MONTH, 190—. STOREKEEPER.

MATERIAL HEADINGS	Total	EXPENSE ACCOUNTS 1	2	3	4	5	6	7	8	9	13	14	21	22	23	24	28	29	30	31	32	Total	SPECIAL ACCOUNTS
Axles																							
Brake Shoes																							
Brake Appliances																							
Bell Cord and Fittings																							
Bearings																							
Brush Holders and Parts																							
Building Material																							
Brooms and Brushes																							
Bolts, Nuts and Washers																							
Belting and Lacing																							
Babbitt Metal and Solder																							
Car Trimmings																							
Cloth																							
Crossings and Switches (O. H.)																							
Commutators and Parts																							
Controllers and Parts																							
Carbon Brushes																							
Cement and Fire Clay																							
Crossings and Switches (Track)																							
Cotters, Nails and Rivets																							
Drawbars and Coupling Pins																							
Electric Supplies																							
Fuses																							
Fuse Boxes and Lightning Arresters																							
Fenders and Parts																							
Glass																							
Gongs and Bells																							
Gears																							
Gear Cases and Parts																							
Hangers and Insulators																							
Iron																							
Incandescent Lamps																							
Insulating Material																							
Journal Boxes																							
Journal Brasses																							
Lumber																							
Magnet Wire																							
Miscellaneous Light Fixtures																							
Miscellaneous Line Material																							
Miscellaneous																							
Oil, Grease and Waste																							
Painting Material																							
Poles																							
Pinions																							
Packing																							
Paving Stone																							
Rails																							
Rail Bonds																							
Rubber																							
Seat Covering																							
Steel																							
Sheet and Round Metal																							
Steam Fittings																							
Shafts and Keys																							
Screws																							
Scrap Metal																							
Springs																							
Truck Frames and Parts																							
Ties																							
Track Material																							
Trolley Wheels and Bushings																							
Trolley Poles and Fittings																							
Trolley Rope																							
Tools																							
Wheels																							
Wire																							
Total																							
Net																							

1 2 3 4 5 6 7 8 9 13 14 21 22 23 24 28 29 30 31 32

FIG. 2.—DAILY DISBURSEMENT BLANK

CAR No.	MAINTENANCE OF BODY							MAINTENANCE OF TRUCKS						ELECTRICAL MAINTENANCE								ACCIDENT ACCOUNT		APPLIANCE			
MONTH	Date	Fenders	Glass	Heaters	Paint	Sand Boxes	Misc'l	Total	Brakes	Journals	Wheels		Misc'l	Total	Armat and Fields	Bearings	Commutators	Gears and Pinions	Gear Case & Wiring Cleaning	Lightning Damage	Trolleys	Controllers	Misc'l	Total	Description	Amount	Description	Amount	GRAND TOTAL	Mileage	Cost per M.

FIG. 3.—LOOSE-LEAF RECORD FOR MONTHLY WORK

COST OF MAINTENANCE BY EQUIPMENTS. D.C.T.Co.

YEAR	MAINTENANCE OF BODY												MAINTENANCE OF TRUCKS								ELECTRICAL MAINTENANCE											
Months	Closed 16 ft.	Brill 20 ft.	Laclede 24 ft.	Combination 24 ft.	Combination 30 ft.	Combination 41 ft.	Berkley Washer Open	Trailers	Work Cars	Snow Plows and Sweepers	Miscell. Body	Total	Brill Double No. 27 C.	Brill Single Mas. Trac.	McGuire Double Brass	St. Louis Double	Remis Single	Peckham Single	Work Car W. S. R.	Master Tax or Trailers	Miscell. Truck	Total	C. P. 65	C. E. 60.	W. P. 50	W. P. 30	Westinghouse K	Contactors L	Trolleys	Motors Electric	Total	Amount Total
No. of Equipments																															
January																															
February																															
March																															
April																															

FIG. 4.—SUMMARY FOR PERMANENT RECORD

THE DENVER CITY TRAMWAY COMPANY

Record of Electric Line Construction, Maintenance, etc., for _____ *190—*

	ACCOUNT	LOCATION	WORK DONE	SUSPENSIONS			SPAN WIRE	Trolley Wire	O H Switches	O H Rings	O H Brackets	Sundries	POLES				COST		
				CARS	INSULATORS	HANGERS											MATERIAL	LABOR	TOTAL
				814 815 816	18975	19788 19789 19790	1/4" 5/16" 3/8"	1/0 0/0	17343 17344	18332 18333	2401	1/0 4/0	30 35						

FIG. 5.—DAILY RECORD OF LINE CONSTRUCTION

THE DENVER CITY TRAMWAY CO.

Record of Construction Work, Etc., for _____ 190__

Name of Laborer or Artisan	Location	State fully amount and character of work. (1) Hauling, (2) Trench and Grading (3) Removing Track, (4) Track Laying, (5) Bonding, (6) Placing Special Work, (7) Paving (including Concreting, (8) Planking, Culverts, etc., (9) Blacksmithing. Give shop job numbers or specify fully any other work	Dollars	Cts

FIG. 6.—NEW TRACK CONSTRUCTION

DEPARTMENT OF TRACK AND ROADWAY

The Denver City Tramway Co.

Estimate of Labor

For _____

Denver, Colo. _____ 190__

Quantity	DESCRIPTION OF WORK	Rate	Unit	Dollars	Cts.
	Cubic Yards Trench Excavation				
	Cubic Yards Grading Excavation				
	Cubic Yards Fill				
	Feet of Track Removed, lbs. per yard				
	lbs. per yard				
	Special Track Work Removed				
	Miles of Track Laying lb. Rail, Track Feet				
	Miles of Track Laying lb. Rail				
	Ft. Curve Track Building, placing				
	Switches, Complete, Building, placing				
	Curve Crossings, Building, placing				
	Square Crossing, Building, placing				
	Railroad Crossings, Building, placing				
	Switch Lever Attachments, Building, placing				
	Spring Attachments, Building, placing				
	Safety Lever Attachments, Building, placing				
	Square Yards Trap Rock Paving Blocks				
	Square Yards Sand Stone Paving Blocks				
	Square Yards Sheet Asphalt Paving				
	Cubic Yards Concrete (square yards)				
	Cubic Yards Ballast				
	Cubic Yards Sand				
	Ft. B. M. Lumber Framed in Culverts				
	Ft. B. M. Lumber in Track, Crosswalks, Etc.				
	Bonds				
	Hauling				

By _____ Engineer

FIG. 7.—ESTIMATES FOR TRACK AND ROADWAY

THE DENVER CITY TRAMWAY COMPANY.

FOREMAN AT CENTRAL LOOP:

Place banners or signs reading _____

on the number of cars and lines marked below, commencing at _____ o'clock ____ M., of _____ day of _____, 190__. Take the same off at _____ o'clock, of _____, 190__, and return this slip to superintendent.

NUMBER	LINES	NUMBERS OF CARS	CHECK OFF
	Arvada		
	Aurora		
	Argo		
	Berkeley		
	Broadway		
	Colfax Avenue		
	Curtis Street, West		
	Goss Street		
	Eleventh Avenue		
	Harman		
	Larimer Street		
	Lawrence Street		
	Montclair		
	Myrtle Hill		
	Nineteenth Avenue		
	Park Hill		
	Rocky Mountain Lake		
	Stout Street		
	Seventeenth Avenue		
	Seventeenth Street		
	South Tremont		
	Twenty-second Avenue		
	Welton Street		
	West Thirty-eighth Avenue		
	West Twenty-ninth Avenue		
	West Twenty-third Avenue		

Superintendent.

FIG. 11.—ORDER FOR BANNERS

Form 166

The Denver City Tramway Company

INSPECTOR'S REPORT

Date, ... 190__, Time ..... M.

Line, ... Car, ...

Conductor, ...

Motorman, ...

Were conductor and motorman neat in appearance, and wearing badges? .....

Was car well ventilated? .....

Was car swept? .....

Were lamps clean? .....

Do car or windows need washing? .....

Were sand-boxes filled? .....

Was heat turned on contrary to regulations? .....

REMARKS

(Here report any repairs needed on car, or violations of the rules by crew.)

.....

.....

Form 41. 1012-4-3-03.

..... 190

Line .....

Time on .....

Street on .....

Street off .....

Time off .....

Car No. .....

Cond.'s No. .....

Total passgrs. carried .....

Fares registered .....

Free passengers .....

Bicycles .....

Policemen .....

Firemen .....

Mail Carriers .....

Sisters of Charity .....

Children under 6 years .....

Employes with badges .....

Employes with tools .....

Failed to register .....

Failed to collect .....

Short .....

No. children between 6 and 12 yrs. .....

Was Cond. polite to passgrs.? .....

(over)

FIGS. 8 AND 9.—INSPECTORS' REPORT BLANKS

FORM 44

THE DENVER CITY TRAMWAY COMPANY.

Mr. _____ Sup't _____ Division.

Dear Sir:—

Please have _____ cars at _____

_____ M., _____, 190___, for _____

_____. Take party to _____

_____

Collect $ _____ from _____

Date _____

SUPERINTENDENT.

THE DENVER CITY TRAMWAY COMPANY.

Denver, _____ 190___

RECEIVED OF Conductor _____

_____ Dollars, amount collected from

_____ on Special Car No. _____ this date. Car run

from _____ to _____

DIVISION SUPERINTENDENT.

THE DENVER CITY TRAMWAY COMPANY.

Denver, _____ 190___

RECEIVED OF _____ In payment for

_____ cars run this day from _____ to _____

and return.

Conductor No. _____

FIG. 10.—FORMS USED FOR CHARTERED CARS

_____ LINE FORM 50

DATE _____ 190__

CAR _____ WITH CAR _____

TRIP NO.		TIME HR	TIME MIN	CASH DOL. CARS	CASH CTS	Half Fares	Emp. & Comp. Tickets	Transfers	Fares Registered	Total Passengers	FREE PASSENGERS Report by Name or Number	Bicycles
1	DN											
	UP											
2	DN											
	UP											
3	DN											
	UP											
4	DN											
	UP											
5	DN											
	UP											
6	DN											
	UP											
7	DN											
	UP											
8	DN											
	UP											
9	DN											
	UP											
10	DN											
	UP											
11	DN											
	UP											
12	DN											
	UP											
13	DN											
	UP											
14	DN											
	UP											
TOTALS												

The Denver City Tramway Co.

FENDER _____

NOS. _____

CAR OUT _____ M. _____ STARTER

CAR IN _____ M. _____ FOREMAN

TIME

OFF _____ OFF _____

ON _____ ON _____

TRANSFERS

SERIES No. _____ OFF _____

TO _____ ON _____

SERIES No. _____ OFF _____

TO _____ ON _____

SERIES No. _____ OFF _____

TO _____ ON _____

REGISTERS

REG. END. _____ REG. END. _____

REG. COM. _____ REG. COM. _____

TOTAL CASH _____

WAGES DEDUCTED _____

AM'T TURNED IN _____

Received of THE DENVER CITY TRAMWAY CO., for services this day, the amount set opposite our respective names.

RATE	AMOUNT	Badge
		_____ MOT. _____
		_____ MOT. _____
		_____ COND. _____

FIG. 12.—TRAINMEN'S TRIP SHEET

The material is divided under seventy-six practical headings, which usually convey sufficient knowledge to make it unnecessary for any deeper details in cases where detailed statements are called for. This, of itself, is of great value where the management goes into detail so extensively as does the Denver City Tramway Company.

A price-list book is carried which is divided alphabetically into the seventy-six material headings, and shows all items contained in each account. The bills being worked up promptly enables this price list to be kept up to date on values.

Other forms used in this department include a daily report of scrap and second-hand material received, and is sent to the purchasing agent; a report to the auditor at the end of each month, and a blank used in taking the semi-annual inventory.

DETAIL CAR RECORD EXPENSE

Another interesting example of the Denver City Tramway Company's method of carrying out detailed expense accounts is that used in determining the cost of car equipments. On the time slip is shown a complete description of the work done. This slip is approved by the foreman and turned in to the timekeeper. The standard requisition blank is used, and on it must appear the car numbers for all material drawn at the shops. This blank and the division car house foreman's report of material used daily, which must also show car numbers, are both turned in to the storekeeper. Memorandum sheets are used for assembling material and labor from requisitions and time slips.

A loose-leaf record is used which secures a permanent description of the car. In connection with this form there is used one shown in Fig. 3, which has three main classifications or sub-divisions, i. e., maintenance of body, maintenance of trucks, electrical maintenance. This latter sheet is intended to run for one month, when it is removed and a summary taken off and transferred to the form in Fig. 4, which at the end of the year is ready for the annual statement. The line, "miscellaneous pro rata," is to cover small items, like bolts, screws, etc., that cannot be carried to car numbers, and is also used for credits of material recovered. This record enables the management to determine what each style of equipment costs and the cost per car-mile.

ENGINEERING DEPARTMENT

In the engineering department a comprehensive system has been worked out. When repairs are needed or work ordered a form is filled out by the superintendent, inspector or trouble man, giving the location and nature of trouble. This notice is given to a foreman or workman who is to do the job. He signs and returns it to the superintendent's office when the work is done, making note of what material was used and what job number it falls under. A time slip is then made out by the workman, showing a description of work done, and is approved by the foreman and turned in to the timekeeper.

In the line department a special requisition blank is made out in duplicate, showing where the material is used.

A time sheet is made out for the day, showing the names of the men, the nature of the work performed and the time consumed on each job. This is sent in to the engineer's office.

Fig. 5 is a form for daily record of electric-line construction, maintenance, etc., and shows the job number, location, the work done and the material used with costs.

On another form is kept a record of electric-line maintenance, divided into renewals and betterments and repairs and emergency work. This is carried out in the engineering department and turned in to the auditor.

In a similar manner a daily record of track repairs is made up on a form showing complete description of work and material used, including ties, joints and bonds.

A separate form, Fig. 6, is used for new track construction work. Estimates for the track and roadway department are made upon a form shown in Fig. 7.

The daily report blank for power house maintenance and operation includes records for steam and electric plant under maintenance, and wages, fuel, water, oil and waste, and miscellaneous under operation. The number of tons of coal and price per ton are also included. Another item is the output in kilowatt-hours and cost per kilowatt-hour. The average horsepower for 18 hours, the total horse-power-hours, cost per horse-power-hour, and pounds of coal per horse-power-hour are also entered, and all items are carried out in dollars and cents.

BLANKS USED IN TRAIN SUPERINTENDENT'S OFFICE

Blanks used in the office of the superintendent of train service are as follows:

Fig. 8 is used by the open inspectors of the trainmen, while Fig. 9 is used by the private inspectors who report on the conductors' work.

Fig. 10 is a form used for the special or chartered-car service and consists of the superintendent's order to the division superintendent, the latter's receipt to the conductor for the amounts collected for the use of the car, and the conductor's receipt given to the patron leasing the car. The tramway company does a large chartered-car business, and its facilities are such that it can have a special car ready for a party at the downtown loop within a few minutes from the time it is ordered.

The company also does a large business in carrying banners and signs on the cars. These banners are all placed by the foreman at the central loop, and the order blank shown in Fig. 11 is used to specify the lines, the car numbers and the number of banners.

TRAINMEN'S TRIP SHEET

The trainmen on the Denver system credit themselves at the end of each run, and the trip sheet, Fig. 12, is used by the conductor. Besides giving the necessary data concerning passengers carried, this slip must show the time the men run, the blocks of transfers used, records of registers and receipts of motorman and conductor for wages received.

The trainmen's wages are regulated according to period of service, and are as follows: First year, 20 cents per hour; second year, 22½ cents per hour; third, fourth and fifth years, 23½ cents per hour; sixth and succeeding years, 25 cents per hour. In order to assist the men in computing their wages a table is printed which shows the amount of wage for any of the four scales and for any time from 5 minutes up to 12 hours and 55 minutes. Under 2 minutes counts as nothing, and 2 minutes or over is counted as 5 minutes, so the tables show the wages for every 5 minutes of time. This table is printed on heavy cardboard in convenient size for carrying in the vest pocket when folded. Some of the men have memorized this table and seldom have to refer to it in computing their day's wages.

AUDITOR'S REPORTS

In the auditor's department of the tramway company the standard accounting system is used. All bills are paid by duplicate voucher, the original bill being kept by the auditor, and the distribution made to the proper department and expense account in spaces provided on the back. The voucher proper is printed on colored paper, and is honored for payment as a sight draft at the company's bank when properly signed and endorsed.

The chief task of the auditing department is the compilation of a daily record of operating expense and the daily balancing of the company's books. In order to do this the superintendents of all departments, as was shown in the case of the storekeeper's and engineer's departments, send in daily reports of their operating expenses. These reports are classified and carried out on a form (Fig. 13), and the items of general expense are added, the labor and material accounts being kept separate, but combined in the "total" for the day and for all the days of the current month. The figures for the corresponding days of the previous year are also given in another column for com-

parison. Maintenance of way and structure and maintenance of equipment are added for the total maintenance, and the

THE DENVER CITY TRAMWAY COMPANY.

DAILY RECORD OF OPERATING EXPENSE, ETC., FOR _____ 190..

ACCT. No.	CLASSIFICATION	FOR CURRENT DAY LABOR	MATERIAL	TOTAL	TOTAL FOR ..DAYS OF CURRENT MONTH	CORRESPONDING .....DAYS OF PREVIOUS YEAR
	MAINTENANCE OF WAY AND STRUCTURE					
1	Track and Roadway					
2	Electric Line					
3	Buildings and Fixtures					
	TOTAL					
	MAINTENANCE OF EQUIPMENT					
4	Power Plant Steam					
	Electric Plant Equipment					
5	Cars					
7	Electric Equipment of Cars					
8	Miscellaneous Equipment					
9	Miscellaneous					
	TOTAL					
	TOTAL MAINTENANCE					
	OPERATION OF POWER PLANT					
10	Power Plant Wages Steam					
11	Fuel for Power					
12	Water for Power					
	Lubricants and Waste for Power Plants					
14	Misc. Supplies and Expenses of Power Plants					
	TOTAL					
	CAR SERVICE					
15	Superintendence of Transportation					
17	Wages of Conductors and Motormen					
18	Starters and Gatemen					
19	Wages of Other Car Service Employes					
20	Wages of Car House Employes					
21	Car Service Supplies					
22	Miscellaneous Car Service Expenses					
23	Sanding and Sanding Track					
24	Removal of Snow and Ice					
	TOTAL					
	TOTAL TRANSPORTATION					
	GENERAL EXPENSE					
27	Salaries of General Officers					
	Salaries of Clerks					
28	Stationery and Printing					
29	Miscellaneous Office Expenses					
30	Store Room Expenses					
31	Stable Expenses					
32	Advertising and Attractions					
33	Miscellaneous General Expenses					
34	Damages					
35	Legal Expenses Incident to Damages					
36	Other Legal Expenses					
37	Rents					
38	Insurance					
	TOTAL					
	TOTAL OPERATING EXPENSE					
	TOTAL FIXED CHARGES					
	SURPLUS					
	TOTAL EARNINGS					

AUDITOR

FIG. 13.—DAILY RECORD OF OPERATING EXPENSE

operation of power plant and car service are added for the total transportation. The total operating expense is brought down, total fixed charges and surplus added and summed up to give the total earnings for the day for the current month and corresponding period of the previous year.

The daily balance sheet with different accounts, assets and liabilities is shown in Fig. 14. For the month the sheet, Fig. 15, is made up, showing a comparative statement of operating expenses for the current month, for the year to date and for the corresponding periods of the preceding year. This sheet also contains a statement of mileage, passengers, car transfers, etc., a comparative statement for the month of earnings and expenses (both fixed and operating), and a statement of the earnings and mileage by lines for the month. From this sheet the annual statement is easily and quickly obtained.

Fig. 16 is a reproduction of a blank made up to show the daily

Form 12

THE DENVER CITY TRAMWAY COMPANY

DAILY APPROXIMATE STATEMENT OF PASSENGER RECEIPTS

_____ 1903

COMPARING EACH DAY OF THE WEEK WITH THE SAME DAY OF THE CORRESPONDING WEEK LAST YEAR

	1903	1902	INCREASE	DECREASE
Total Passenger Earnings for ..... Days of Current Month as compared with same days of last year				

Assistant Treasurer

FIG. 16.—DAILY PASSENGER RECEIPTS

statement of passenger receipts with increase or decrease over the preceding year.

Weekly comparative statements are also made showing the mileage and earnings for the several lines and also for each division.

AUDITOR'S MONTHLY LETTER

For the benefit of the president and the vice-president and general manager of the company, the auditor gets out what is called a "monthly letter," on the 10th or 11th of each month. This letter consists of eighteen to twenty typewritten pages, and contains a wealth of information on the operation of the several departments. This feature was original with Mr. Hogarth, and he varies the nature of contents from month to month as he sees fit. Some of the letters examined contain accounts of the chartered car and banner business, important new track and line work completed or begun during the month, data concerning power house operation, analysis of increase or decrease of passenger earnings on certain lines and on the whole system, discussion of special days of large traffic, recommendations as

The Denver City Tramway Co. Balance Sheet _____ 190 .

CONSTRUCTION ACCOUNTS
Track and Overhead Construction
Power Plant Equipment
Cars and Attachments
Buildings and Fixtures
Electric Equipment of Cars
Real Estate
Tools and Appliances
Office Furniture and Fixtures
Miscellaneous Equipment

Securities

CASH ASSETS
Cash,
Mercantile Trust Co., N. Y.
Central Trust Co. of N. Y.,
First National Bank, Denver

MATERIAL ASSETS
Materials and Stores
Fuel Stock,

APPORTIONMENT ACCOUNTS
Damages
Insurance
Taxes
Licenses to Cars
Water
Telephone Service
Transfers

INDIVIDUALS AND COMPANIES
Miscellaneous Accounts Receivable
U. S. Government—P. O. Department
Denver Rock Co.
North Denver Sewered Pipe

Capital Stock 5 0 0 0 0 0 0 00

Denver Tramway Co.	4 per cent. Bonds, due July 1, 1908	4 9 8 0 0 0 00		
Denver Tramway Co.	6 " " Jan. 1, 1910,	1 2 1 9 0 0 0 00		
Metropolitan Railway Co.	6 " " Jan. 1, 1911,	9 5 1 0 0 0 00		
Denver City Tramway Co.	" " Apr. 1, 1919,	2 0 0 0 0 0 0 00		
Denver Consolidated Tramway Co.	5 " " Oct. 1, 1933	1 1 6 7 0 0 0 00	6 8 3 7 0 0 0 00	

City Guarantee Paving Bonds, 6 per cent
Due Mch. 1, 1901 Mch. 1, 1902 Mch. 1, 1903

ACCRUED INTEREST
Denver Tramway Co. and Met. Ry. Co. 6 per cent. Bonds, Jan. 1 and July 1
Denver Consolidated Tramway Co. " " " Apr. 1 and Oct. 1
Denver City Tramway Co. 5 " " Apr. 1 and Oct. 1
City Guarantee Paving Bonds 6 " " Jan. 1

Deposit Fees, (Conductors and Motormen

Hospital Fund

Outstanding Tickets (Ticket Sales

Surplus Account

ACCOUNTS PAYABLE
Vouchers—Unpaid Bills of Month ending _____
Unclaimed Wages,

TAXES ACCRUED } 1/2 half due Mch. 1 and Aug. 1

FIG. 14.—DAILY BALANCE SHEET

THE DENVER CITY TRAMWAY COMPANY

Comparative Statement of Operating Expenses for the Month of__ 190 , Compared with 190

Acc't No.	CLASSIFICATION	CURRENT MONTH 190 AMOUNT	CURRENT MONTH 190 Per Mile	CURRENT MONTH 190 AMOUNT	CURRENT MONTH 190 Per Mile	INCREASE OR DECREASE	JANUARY 1ST TO DATE 190 AMOUNT	JANUARY 1ST TO DATE 190 Per Mile	JANUARY 1ST TO DATE 190 AMOUNT	JANUARY 1ST TO DATE 190 Per Mile	MONTHS INCREASE OR DECREASE
	MAINTENANCE OF WAY AND STRUCTURE										
1	TRACK AND ROADWAY										
2	ELECTRIC LINE										
3	BUILDINGS AND FIXTURES										
	TOTAL										
	MAINTENANCE OF EQUIPMENT										
4	POWER PLANT STEAM										
5	ELECTRIC PLANT EQUIPMENT										
6	CARS										
7	ELECTRIC EQUIPMENT OF CARS										
8	MISCELLANEOUS EQUIPMENT										
9	MISCELLANEOUS										
	TOTAL										
	TOTAL MAINTENANCE										
	OPERATION OF POWER PLANT										
10	POWER PLANT WAGES STEAM										
11	FUEL FOR POWER "										
12	WATER FOR POWER "										
13	LUBRICANTS AND WASTE FOR POWER PLANTS										
14	MISCELLANEOUS SUPPLIES AND EXPENSES OF POWER PLANTS										
	TOTAL										
	CAR SERVICE										
16	SUPERINTENDENCE OF TRANSPORTATION										
17	WAGES OF CONDUCTORS AND MOTORMEN										
18	STATIONERY AND PRINTING										
19	WAGES OF OTHER CAR SERVICE EMPLOYES										
20	" OF CAR HOUSE EMPLOYES										
21	CAR SERVICE SUPPLIES										
22	MISCELLANEOUS CAR SERVICE EXPENSES										
23	CLEANING AND SANDING TRACK										
24	REMOVAL OF SNOW AND ICE										
	TOTAL										
	TOTAL TRANSPORTATION										
	GENERAL EXPENSE										
25	SALARIES OF GENERAL OFFICERS										
26	" " CLERKS										
27	STATIONERY AND PRINTING										
28	MISCELLANEOUS OFFICE EXPENSES										
29	STORE ROOM EXPENSES										
30	STABLE EXPENSES										
31	ADVERTISING AND ATTRACTIONS										
32	MISCELLANEOUS GENERAL EXPENSES										
33	DAMAGES										
34	LEGAL EXPENSES INCIDENT TO DAMAGES										
35	OTHER LEGAL EXPENSES										
36	RENTS										
38	INSURANCE										
	TOTAL										
	TOTAL OPERATING EXPENSE										

COMPARATIVE STATEMENT OF EARNINGS AND EXPENSES

*(Both Fixed and Operating) for Month of__ 190_*

	CURRENT MONTH 190 AMOUNT	CURRENT MONTH 190 AMOUNT	CURRENT MONTH PERCENTAGE Increase	CURRENT MONTH PERCENTAGE Decrease	JANUARY 1ST TO DATE 190 AMOUNT	JANUARY 1ST TO DATE 190 AMOUNT	MONTHS PERCENTAGE Increase	MONTHS PERCENTAGE Decrease
PASSENGER EARNINGS								
ADVERTISING								
CHARTERED CARS								
MAILS								
OTHER								
TOTAL EARNINGS								
OPERATION								
MAINTENANCE OF WAY AND STRUCTURE								
" EQUIPMENT								
OPERATION OF POWER PLANTS								
CAR SERVICE								
GENERAL EXPENSE								
TOTAL OPERATING EXPENSE								
NET EARNINGS FROM OPERATION								
DEDUCTIONS FROM INCOME								
TAXES APPORTIONED								
INTEREST, DISCOUNT AND EXCHANGE								
INT. ON FUNDED DEBT, APPORTIONED								
" FLOATING "								
TOTAL FIXED CHARGES								
SURPLUS								
LESS DIVIDENDS PAID NOS.								
NET SURPLUS								

Per Cent. of Earnings used in Operation .. ... Per Cent. ..... Per Cent. .....Per Cent. .... Per Cent, ...Per Cent. .. ....Per Cent

AUDITOR'S OFFICE, DENVER, COLO.

AUDITOR.

STATEMENT OF MILEAGE, PASSENGERS, CARS, TRANSFERS, ETC.

Month of and Year to Date, 190 , Compared with 190

CLASSIFICATION	CURRENT MONTH 190 TOTAL PER MONTH	CURRENT MONTH 190 AV'GE PER DAY	CURRENT MONTH 190 TOTAL PER MONTH	CURRENT MONTH 190 AV'GE PER DAY	INCREASE OR DECREASE	JANUARY 1ST TO DATE 190	JANUARY 1ST TO DATE 190	MONTHS INCREASE OR DECREASE
MOTOR MILEAGE								
TOTAL CARS RUN								
PASSENGERS CARRIED FOR REVENUE								
" " FREE								
TRANSFERS REDEEMED								
TOTAL PASSENGERS CARRIED								
PER CENT OF OPERATING EXPENSES TO EARNINGS								
AVERAGE EARNINGS PER DAY								
" OPERATING EXPENSES PER DAY								
COST PER MOTOR MILE								
PASSENGERS CARRIED PER CAR PER DAY								
PER CENT TRANSFERS REDEEMED								

EARNINGS AND MILEAGE BY LINES.

*Month of__ 190_*

LINE	EARNINGS TOTAL	EARNINGS PER DAY	EARNINGS Per Mile	MILEAGE MOTOR
BROADWAY				
COLFAX AVE.				
LAWRENCE ST.				
STOUT ST.				
22ND AVE.				
19TH "				
SOUTH TREMONT				
11TH AVE.				
HARMAN				
WEST 23RD AVE.				
BERKELEY				
WEST 29TH AVE.				
ROCKY MTN.				
PARK HILL				
MONTCLAIR				
LARIMER ST.				
WELTON ST.				
17TH ST.				
17TH AVE.				
WEST DENVER				
ARGO				
GOSS ST.				
MYRTLE HILL				
WEST 38TH AVE.				
ARVADA				
TOTAL FOR MONTH 190				
TOTAL " " 190				
INCREASE OR DECREASE				

FIG. 15.—COMPARATIVE STATEMENT

to what extensions or improvements seem advisable from the auditor's point of view for an increase in net earnings, discussion of results produced by opening up some new line, making an improvement or introducing any reform or benefit for the employees, standing of the hospital and sick benefit funds, report on the legal expenses for the month, etc. One of the most important parts of the letter each month is a page devoted to miscellaneous statistics containing data as to passenger earnings, operating expenses, car mileage, power house operation, etc. A sample page for last May is shown herewith:

May, 1903. Miscellaneous Statistics:	May, 1903	May, 1902
Passengers per car per day		
Per cent passengers riding on transfers		
Average passengers carried per trip		
Gross earnings per motor-mile, cents		
Operating expense per motor-mile, including construction and extraordinary items, cents		
Operating expense per motor-mile, not including construction and extraordinary, cents		
Gross earnings per car-hour		
Operating expense per car-hour, including construction and extraordinary items		
Operating expense per car-hour, not including construction and extraordinary		
Per cent earnings used in operation, including construction and extraordinary		
Per cent earnings used in operation, not including construction and extraordinary		
Average wages of trainmen per hour, cents		
Per cent of passenger earnings retained by trainmen as wages		
Average earnings per car per day		
Passengers carried free, employees		
Passengers carried free, complimentary		
Average earnings per revenue passenger, cents		
Average earnings per passenger, revenue and non-revenue, cents		
Average earnings per passenger, revenue, free and transfer, cents		
Average distance each one-way trip, miles		
Average speed per hour, miles		
Earnings per mile of track		
Kilowatt output hours, two plants		
Kilowatt output hours, six plants		
Cost per kilowatt-hour, cents		
Average kilowatt-hours per car per day		
Current consumed per car-mile, kilowatt-hours		
Per cent of earnings set aside for taxes		
Per cent of earnings set aside for interest		
Per cent earnings paid out, damage claims		
Number car-hours, two-motor cars		
Number car-hours, four-motor cars		
Gross earnings per car-hour, Denver & Northwestern		
Gross earnings per mile of track, Denver & Northwestern		
Per cent earnings used in operation, Denver & Northwestern		

The compilation of this monthly letter is necessarily something of a task, but it forms a very valuable record for the general manager or president to have constantly on file. By referring to it the exact status of any part of the company's system is instantly determined, without summoning heads of departments for consultation. Again, any recommendations from the officials reporting to the auditor find it an excellent path for reaching the management, and the advantage of being considered from the viewpoint of the auditing department, which is a most vital part of a traction system. In the preparation of this monthly letter and the daily reports Mr. Hogarth has followed the plan adopted by many of the large Eastern steam railroad corporations. It certainly is valuable for the traction officials who desire to keep constantly informed as to the operating expenses and earnings of the system.

Passenger traffic from Battle Creek to Detroit is said to be as heavy over the interurban lines now as over the railroads. In less than one month 2500 tickets have been sold at Jackson for Detroit on the Hawks-Angus line to which the Jackson-Battle Creek line contributes.

MULTIPLE UNIT SYSTEM ADOPTED FOR THE NORTHWESTERN ELEVATED

The Northwestern Elevated Railroad Company, of Chicago, is now changing its motor-car equipment from the plan of running a single motor car at the head of a train to a mixed multiple-unit system. The change is being made by E. C. Noe, who was appointed general superintendent the first of this year.

No additional motors will be purchased with which to make this change. The present motor cars, purchased before Mr. Noe took the management of the road, are equipped with four General Electric 55-motors of 160 hp each. It is proposed to take two motors off each of the present motor cars and place them under some new cars which are now under process of construction by the St. Louis Car Company. The plan of operation is to have five-car trains during the rush hours and three-car trains during the middle of the day.

At present, with the heavy motor cars equipped with four motors, it is necessary to run these motor cars underloaded during the greater part of the day. With the mixed multiple-unit system which has been adopted the first and fourth cars of each five-car train will be motor cars. When three-car trains are being operated only the first car will be a motor car, and one motor and one trail car will be disconnected from the rear of the train. The arrangement is a very flexible one, and is well adapted to the conditions of service. While there is thus greater motor capacity per ton of train with the five-car train than with the three-car train, this extra motor capacity is desirable with the five-car train, because the five-car trains are operated during the rush hours, when the greatest motor capacity is necessary, when the stops are longer, the rates of acceleration higher and the passenger loads heavier.

In connection with the adoption of the multiple-unit system loops will be provided for all trains at the outer terminals of the road, which will result in enough saving in the cost of switching to pay for these loops in a short time. The present terminus is at Wilson Avenue. The line will be extended to Ravenswood. The local trains will run only as far as Wilson Avenue, where a loop will be built at the surface, underneath the express tracks. The express tracks will continue straight over this terminus on the elevated structure.

The standard gearing which this company has adopted gives a maximum speed of about 27 m. p. h. Some of the present gears give 33 m. p. h., but this is considered too high to give the greatest efficiency with the schedules feasible on this road.

In the United States there are several women who are officers and directors of electric railway companies, and who are active in the management of the property of the companies in which they are interested. One system in Indiana is managed by a woman. Miss Mary Hook is a director of the Los Angeles Traction Company and acts as its secretary. At Long Island City, N. Y., however, there is a young woman, Miss Ida M. Tritt, who probably has the distinction of being the foremost street railway woman in America. Miss Tritt is secretary and treasurer of the New York & Queens County Railway Company, which operates 82 miles of electric railway in Queens Borough. Miss Tritt was born at Carlisle, Pa., and after fitting herself for school teaching she took a course in stenography, which she was convinced would open up to her a field much more lucrative. After acting for some time as stenographer and bookkeeper for a large manufacturing company near her home, a friend of her father offered her the position of private secretary to him in the management of the Union Traction Company, of Philadelphia. So well did she acquit herself in this position that when this gentleman became interested in the management of the New York & Queens County Railway Company he tendered Miss Tritt the position which she now holds.

WESTINGHOUSE TURRET SYSTEM OF ELECTRO-PNEUMATIC CONTROL

Some particulars were published in the issue of Sept. 5 of the Westinghouse turret system of electro-pneumatic control, exhibited at the Saratoga Convention by the Westinghouse Air Brake Company, by whom it is manufactured. The system is radically different from the company's former electro-pneumatic system of control, and has been worked out during the last nine months by the engineers of the Westinghouse Air Brake Company, and the Westinghouse Electric & Manufacturing Company, under the personal direction of Mr. George Westinghouse himself.

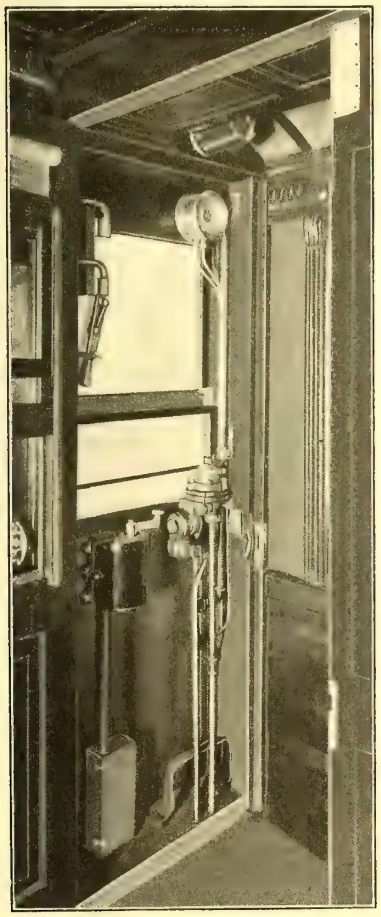


FIG. 1.—MOTORMAN'S CAB, SHOWING MASTER CONTROLLER, JUNCTION BOX AND AIR-BRAKE OPERATING VALVE

It has been known in railway circles for some time that the Westinghouse Companies were planning to place on the market a train control system of an improved type, to be known as the "turret" system, but no details of construction were made public until the system, as a complete whole, was exhibited at the Saratoga Convention. The control is now being installed on several cars of the Manhattan division of the Interborough Rapid Transit Railway Company, and a contract has just been closed with the Brooklyn Rapid Transit Company for 264 control equipments of the turret type.

As briefly described in the issue of Sept. 5, the main current connections are made by a series of "unit switches," or breakers, grouped in a circular case, or "turret," underneath the car, the movement of the individual switches or breakers being secured by air power, controlled by magnets from a battery circuit through a master controller.

As the actuating mechanism is not directly connected to the main source of electrical energy, the connections for the low voltage control circuits are the only ones which have to be established between the cars of the train. Seven wires only are required in the train line battery cable. Another advantage claimed for the use of the separate electrical circuit is that the controlling apparatus can be worked while the main current is cut-off. This makes the control independent of any momentary interruption of the current due to the blowing of a fuse, to bad third-rail contact, or to any other cause; therefore, the motors can be reversed and used for braking at any time if necessary, even if the rail is dead.

Fig. 1 illustrates the interior of a motorman's cab on one of the Manhattan cars. As will be seen, the master controller and air brake operating valve are mounted on the inside end panel of the car, so that the door of the motorman's compartment, when the apparatus is not in use, can be shut against the end panel, completely enclosing the controlling apparatus. The master controller occupies only a very small amount of room, its outside dimensions being: Height, 7½ ins.; width, 6 ins., and depth, 4½ ins. When the controller is in use the door, as in the regular Manhattan equipment, is swung parallel to the side of the car, providing a closed compartment for the motorman. The master controller is mounted so that the controlling handle is 34 ins. from the floor.

The interior of the master controller is illustrated in Fig. 3.

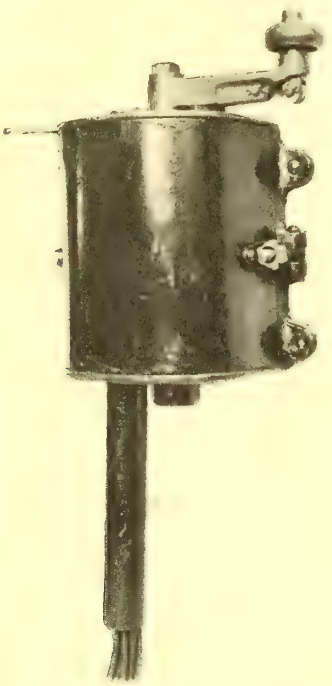


FIG. 2.—MASTER CONTROLLER, WITH CASE CLOSED

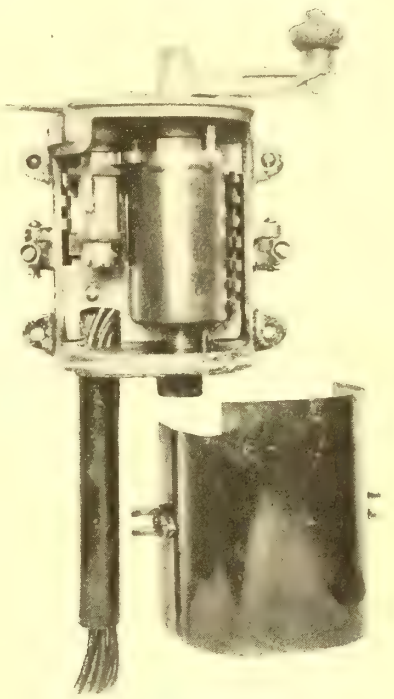


FIG. 3.—MASTER CONTROLLER, WITH CASE OPEN

As only 14 volts are used in the battery or controller circuit, the rotating cylinder of the master controller is of wood, with copper plates, and copper spring fingers. The reverse cylinder is interlocked with the controller cylinder by a simple device, which prevents the movement of the former unless the latter is at the "off" position, or the latter, unless the reverse cylinder

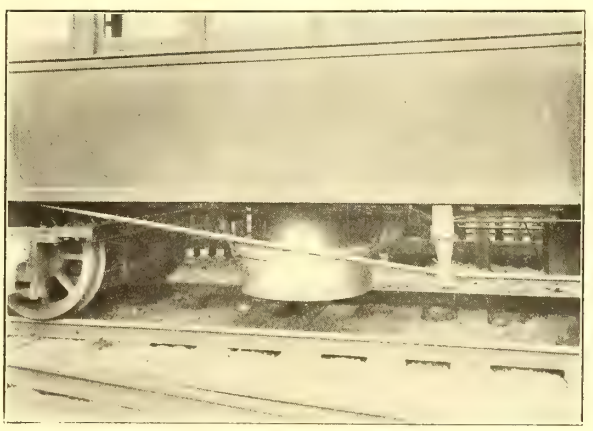
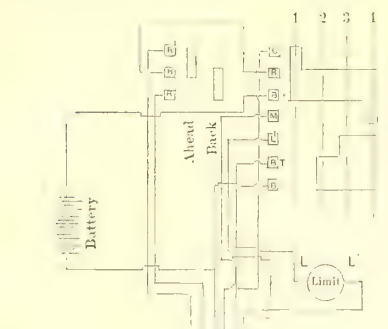


FIG. 4.—SIDE VIEW OF CAR, SHOWING TURRET

is at either the forward or backward step. The master controller handle is provided with a spring return, making it a "dead man's handle." There is also a device by which if the motorman lifts his hand at any time from the controller handle the brakes are automatically applied, unless the reverse handle has first been turned to center. By a corresponding device, if the brakes are applied while the power is on, the power is automatically cut off. The first result is secured by a connection between the spring return handle and the air brake system, and the second by a connection between the air brake system and a small air cylinder, whose piston opens the battery circuit.



paratus are led. This box measures 13½ ins. high x 5 ins. wide x 3 ins. deep, and is shown open in the engraving. The master controller, which weighs only 16 lbs., is so mounted on its support that it can be easily detached from it and removed.

The batteries for operating the electro-pneumatic switches of the controlling apparatus are carried under the car in a box 25 ins. x 16½ ins. x 16½ ins., and weigh, complete, with the box, 300 lbs. They consist of two sets of seven cells each of the Electric Storage Battery Company's type D-5. Two sets are used to insure absolute continuity of service, and each is in series with a set of lamps for charging by the line current. Either is of sufficient capacity to supply all the current required for a day's service, and to receive a sufficient charge during the night while the lights are on.

No power wires are carried above the floor, except to one main switch, which is located in one of the motormen's compartments. There is also no apparatus above the car, except the master controller and battery switches.

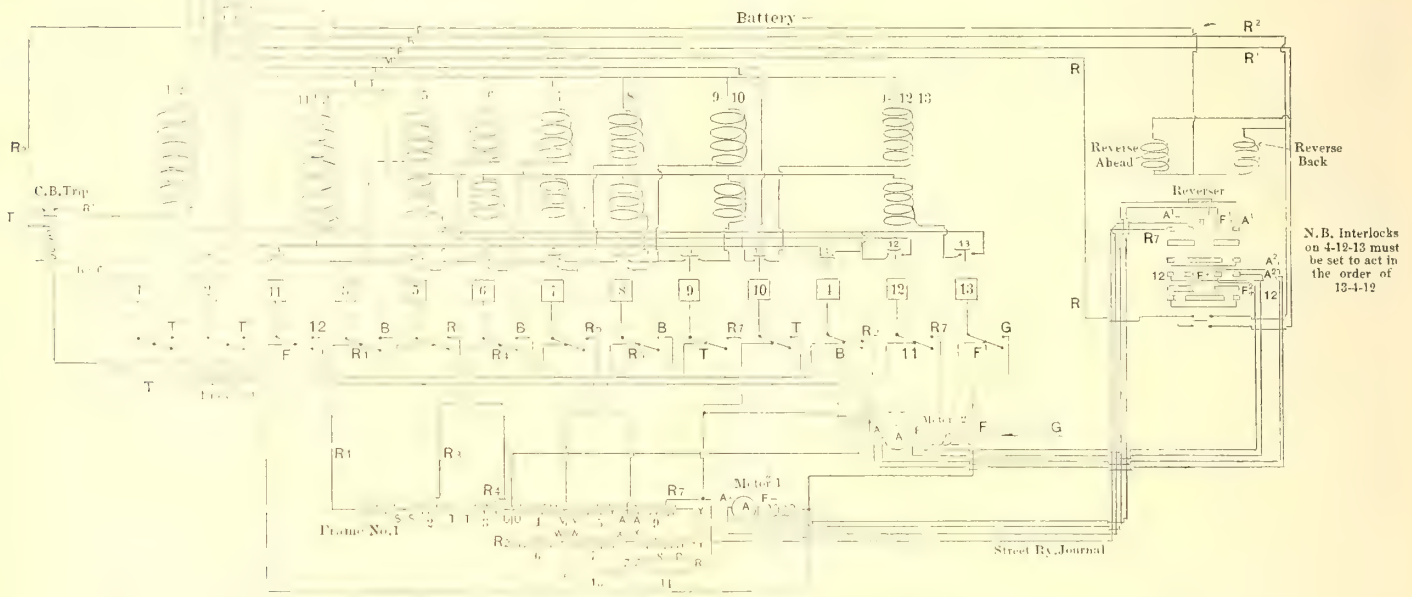


FIG. 5.—SCHEMATIC DIAGRAM OF CONNECTIONS OF TURRET SYSTEM OF ELECTRO-PNEUMATIC CONTROL

Fig. 4 gives a view of the side of the Manhattan car, equipped with the system, and Fig. 5 a diagram of the connections. The reverse switch, Fig. 9, is located as near the motor truck as possible to reduce the length of wire. It is of the

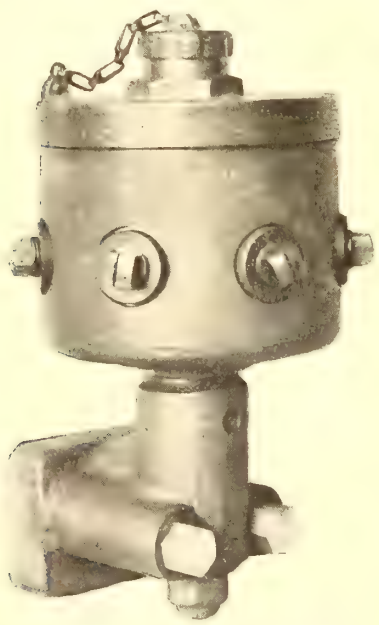


FIG. 6.—ELECTRO-PNEUMATIC VALVE

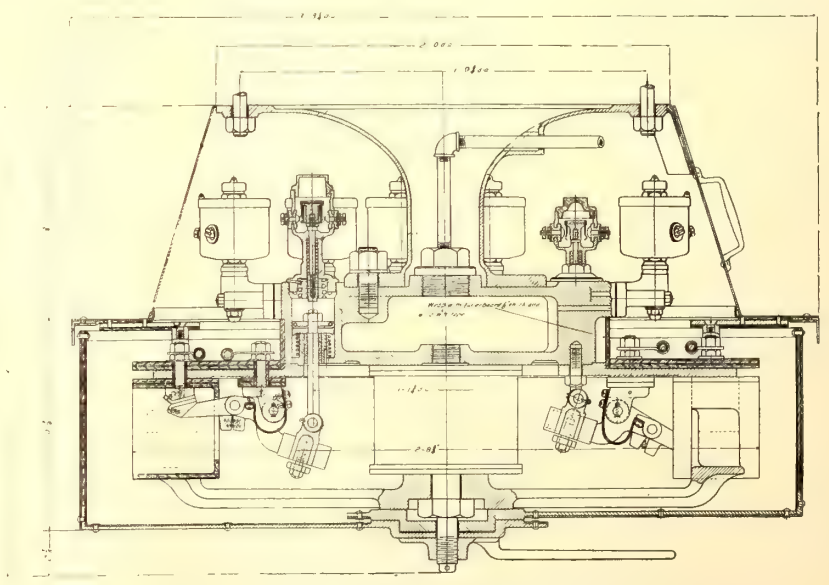


FIG. 7.—CROSS SECTION OF TURRET CONTROLLER

Just below the master controller, as will be seen from Fig. 1, is a junction box, to which the terminals of the seven battery wires used in operating the turret controller and other car ap-

usual type, with copper contacts, but is operated by two air cylinders, controlled by electro-pneumatic valves, worked from the reverse cylinder of the master controller. The electro-pneumatic valves are illustrated in Fig. 6, and are similar to those used in the drum electro-pneumatic train-control system. Adjoining the reverse switch is the limit switch, shown in Fig. 8, for governing the acceleration. These two switches are usually mounted on the opposite side of the car from the resistance, while the turret controller is located in the center of the car.

The turret control is made up of thirteen unit switches, or breakers, arranged radially around an air reservoir, and inclosed in a cylindrical casing. Figs. 11 and 12 show the turret controller open, Fig. 13 the turret closed, and Fig. 7 a section of the turret. The individual switches are operated by pneumatic pistons, controlled by electro-pneumatic valves, Fig. 6, and operating against a spring pressure of about 70 lbs. This arrangement gives a very positive movement to the breakers and permits the adoption of any length of break which may be found necessary satisfactorily to prevent arcing. A cogent reason for the use of air pressure operating against a spring to perform this office is that being freed from the limitations of electromagnetic operation all possibility of the welding or sticking of the contact surfaces is eliminated. As an additional precaution the switch finger levers are not rigid but are flexible, so that as they are drawn up by pneumatic pressure, and again as they are released by spring pressure, there is a slight rubbing of the contact surfaces at the moment of engagement or disengagement which would tend to shear off any welding of the surfaces.

At the center of the turret is an air reservoir, from which the air to the different pneumatic cylinders for the individual switches is supplied. These cylinders are drilled in the reservoir casting, so that no piping between them and the reservoir is required. The thirteen unit switches, or breakers, are arranged radially around the turret, and have one common blow-out coil, which is located at the center. The arms of the spider supporting the individual switches form the pole pieces for the blow-out, and as the magnetic field is horizontal, the direction of current in the contactors is arranged so that the arc is always blown out radially. As several of the switches work together, only eight pneumatic cylinders and controlling valves are required for the thirteen switches.

From this preliminary description of the apparatus employed

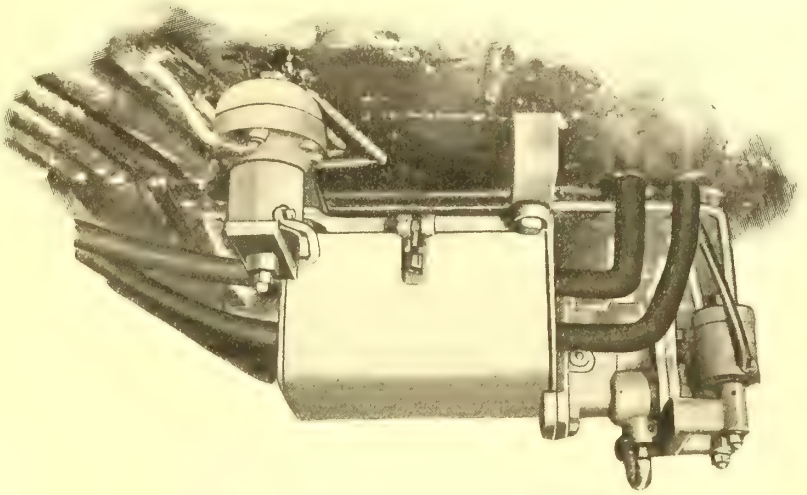


FIG. 8.—LIMIT SWITCH AND REVERSER

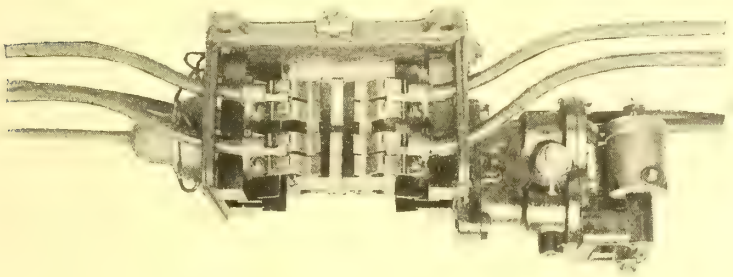
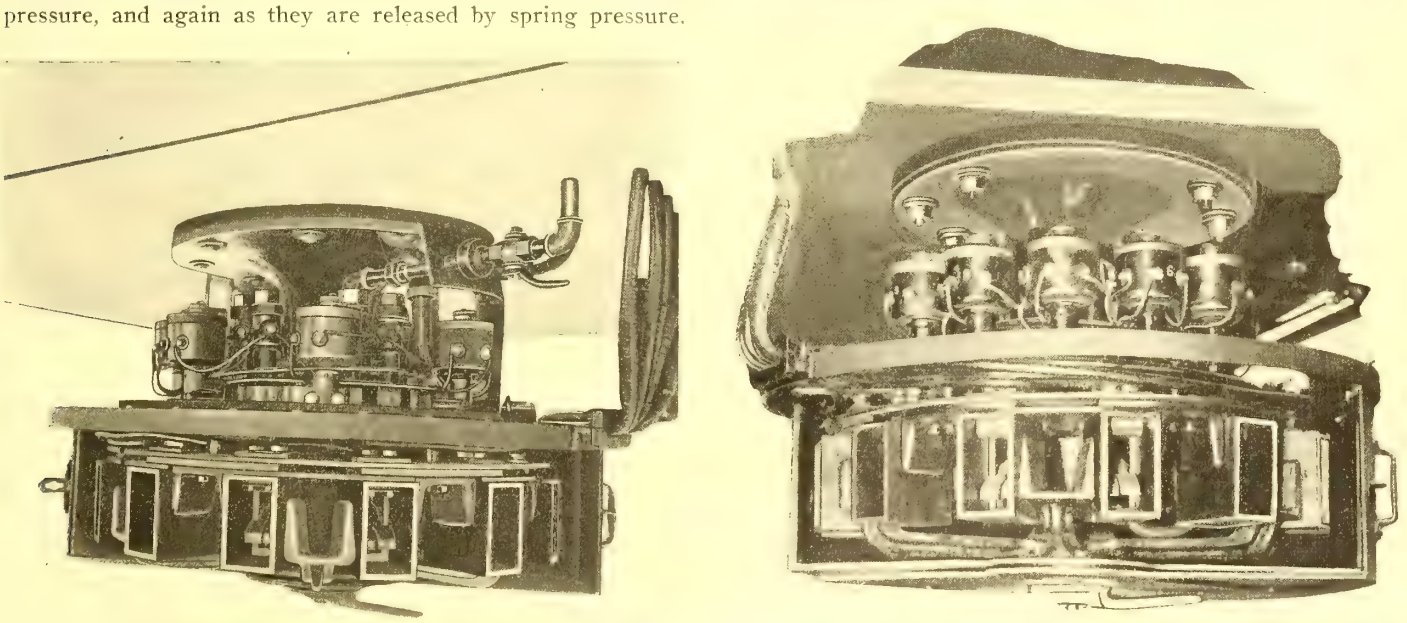


FIG. 9.—ELECTRO-PNEUMATIC REVERSER, WITH CASE OPEN



FIG. 10.—ELECTRO-PNEUMATIC REVERSER, WITH CASE CLOSED



FIGS. 11 AND 12.—DIFFERENT SIDES OF THE TURRET CONTROLLER, WITH CASE OPEN

the connections of the system, as shown in Fig. 5, will now be understood.

The first step on the master controller throws the reverser. The circuit then closed, actuates the circuit breaker relay, which controls the two pneumatic pistons, 1 and 2, closing the circuit breaker.

The second step on the master controller places all the motors

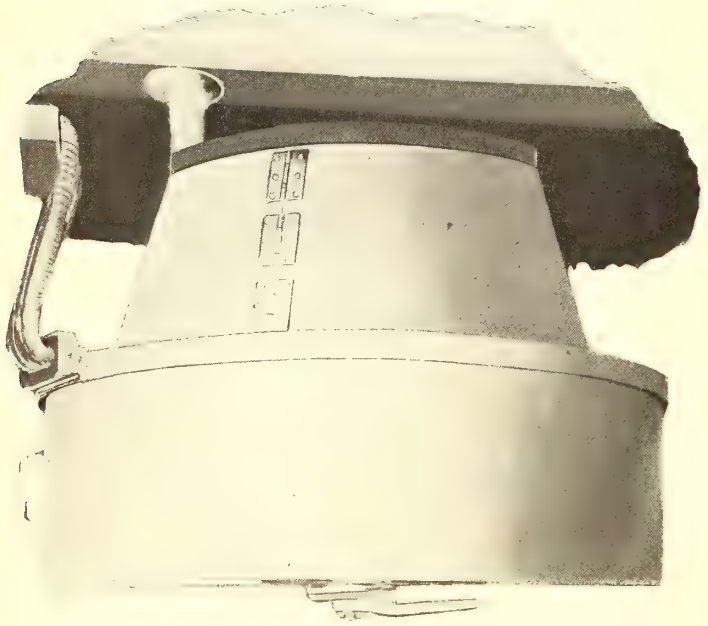


FIG. 13.—TURRET CONTROLLER, WITH CASE CLOSED

in series, by actuating the pneumatic cylinders 11 and 3, which close the series connection and also the connection through rheostat R-1.

The third step is that which cuts out the resistances. This is done by closing the circuit through the limit switch, and also that through coil No. 5. The action of switch No. 5, in closing, is to establish a circuit through No. 6; when No. 6 closes a circuit is established through No. 7, and so on up to No. 10, or the full series, thus gradually cutting out the resistances. As each piston drops in closing its switch, it also closes a "holding connection," shown directly above each piston, which cuts out the limit switch coil. This prevents the switches, after they have once closed, from opening when the limit acts. The limit simply prevents the next switch from picking up.

The fourth position is that of the motors in parallel. This is accomplished by means of the solenoid 4, 12 and 13, which actuates the switches of the same numbers. When these switches start to close they open the circuit on switches 3 and 11, and as soon as they are fully closed they establish a circuit through the holding coil. The current then starts to pick up the resistance coils, controlled by switches 6, 7, 8 and 9. No. 6 being the first resistance used in the multiple position.

The circuit breaker trip, indicated at the extreme left of the diagram, is actuated by the main circuit, and is intended to interlock the circuit breaker, so that in case it opens while the power switch is closed the breaker can not be reset until the power switch has again been opened.

The amount of wiring required by the system is very small. All wires are run in electrobestos conduit, which insures a thorough fireproof construction.

The air for operating the pneumatic switches is taken from the main train line, and is first conducted to an auxiliary reservoir through a feed valve, in order to insure uniform pressure, and thence into the reservoir, already described, in the center of the turret. The auxiliary reservoir is also provided with a check valve, so that it will retain sufficient air to operate the system in case the main supply should fail.

Although the system described and illustrated is that applied to one car only, it is easy to see that any number of motor cars can be operated from one master controller by conducting the battery connections from the master controller to any number of turret controllers mounted on any number of motor cars. The number of battery wires required for the train cable is only 7, and as the train cable carries only 14 volts, there are no high voltage wires on the trail cars, and no high voltage couplings at any point.

The weight of the complete apparatus used per car on the Manhattan equipment is as follows:

	Pounds
Turret controller	695
Reverse switch	118
Resistances	490
Circuit-breaker relay	39
Storage battery	300
Three junction boxes	36
Supplementary reservoir	45
Two master controllers	39
Storage batteries, fourteen cells	202
Four, seven-point, receptacles	32
One reducing valve	15
Total	1711

CORRESPONDENCE

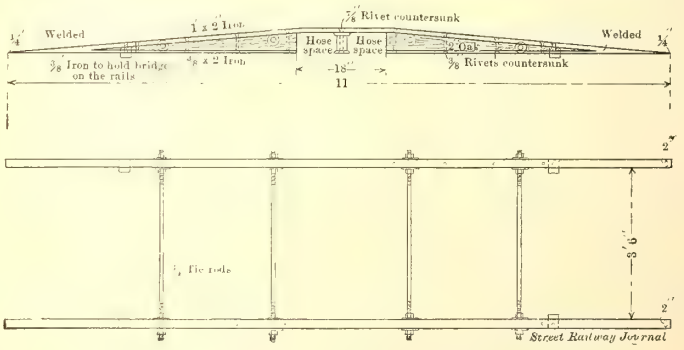
DENVER HOSE BRIDGE

THE DENVER CITY TRAMWAY COMPANY
Denver, Col., Aug. 25, 1903.

EDITORS STREET RAILWAY JOURNAL:

As a matter of general interest and because of inquiries for information concerning a simple device in the form of a "hose bridge," which has been in use on our system for the last three years, I present herewith a plan and section of the device together with a description of its construction and application.

During the year 1900, after having suffered from very serious delays to our traffic, on account of numerous lines of fire hose stretched across our tracks, we began experimenting and finally constructed the device shown in the accompanying plan and elevation. The bridge has given us perfect satisfaction ever since, and has kept our cars moving on even headway many times when they must otherwise have been stopped. We have a wagon fitted up for the special purpose of carrying four of these hose bridges, which are kept at our principal wrecking station in the central loop. Our office is



ELEVATION AND PLAN OF HOSE BRIDGE

connected with the fire alarm signal system of the city. If the alarm shows that there is a fire in a locality where the hose would be likely to be laid across our tracks, and within a reasonable distance from the center of the city, the despatcher notifies by telephone the men of the emergency crew, who hitch one of the wreck teams to the hose-bridge wagon, and away they go to the fire, often arriving there as soon as the fire department. Two men easily handle one of the bridges, either in putting it on or taking it off the wagon. The space under a bridge will accommodate from one to four lines of 4-in. hose.

The bridge is laid on the track, the clamps fitting the rail, and the line is open for traffic. When approaching a bridge the car slows down to about 2 m. p. h., and passes over at about the same speed. While the bridge is not at all cumbersome, it holds our heaviest cars, and we have never yet had a car leave the rail. We have had cars run over a set of these bridges on one line for over ten hours, without even having a man there to direct their movements. No patents have been applied for, and any company is free to make use of the device. It has received the approval of the chief of Denver's fire department, and has earned dollars for the Denver City Tramway Company, and we feel that we could not now get along without it. We shall be very glad to furnish any other information which may be desired by those especially interested, and trust that the foregoing description may convey some idea of the device to your readers.

S. W. CANTRIL, Superintendent.

A NEW COIN-COUNTING MACHINE

The accurate counting and proper handling of a large number of coins is a heavy task, necessitating the employment of persons who, unless specially skilled, often find it difficult to continue for any length of time without great fatigue, while errors are likely to arise because of miscount. The only sure way to accurately count coins is one by one, and this is the basis upon which is designed the counting and wrapping machine built by the National Coin Counting Machine Company, of New York. In this machine each coin is advanced separately, registered and assembled in a row with the others, ready to be transferred to the wrapping device before the next coin is handled. By this method it is absolutely impossible to make an error in count, because the coins are counted one by one. After the requisite number of coins is advanced the registering of the final coin of the bundle sets in operation the wrapping mechanism, which is normally inoperative. The bunched coins are then transferred from the buncher to the wrapper by means of the holder, which then returns to its original position, ready to receive the coins of the subsequent bundle. Twenty coins of the second bundle may be counted while the first bundle is being wrapped. In this way no time is lost in the count.

It is claimed that this machine will count and wrap three coins a second, or 180 coins (from four to nine bundles) in one minute.

The immense labor saving is at once realized by making the comparison to hand labor, which can as a maximum, providing no error in count occurs, count and wrap one bundle per minute. The machine, therefore, will do the work of from four to six men, without taking into consideration the loss in time if a miscount is found with hand labor. The above speed is limited only by the examination of the coins by the operator, as they are fed into the machine from the table upon which they were first deposited. Experience has shown that 180 coins examined per minute is a safe and conservative limit which should be expected from the average operator.

It does not require any knowledge of machinery to run and operate this machine. It occupies little space, is entirely automatic and requires no attention. However, it is necessary for the operator to learn to place the roll of paper from which the wrappers are cut, into the machine. The machine can be operated by hand, foot or electric power.

A contrivance of this kind is particularly useful in the counting rooms of street railway companies, where so much coin is handled, not only on account of its accuracy but its labor-saving features. The company does not sell these machines, but charges a fixed rental, which covers their use and maintenance.

NEW CARS FOR ALBANY, N. Y.

The members of the Street Railway Association who visited Albany during convention week were interested in the excellent equipment and service of the United Traction Company. The car shown in the accompanying cut is one of ten recently built by the J. G. Brill Company. It is somewhat unusual in a car of this length to have the roof of steam car form, but with the style of vestibule used it is very appropriate, and undoubtedly adds to the strength, longitudinally, of the upper structure. Folding doors give entrance to the vestibules on one side only, the other side being solidly paneled. The windows of vestibules and at sides of car are arranged to drop into pockets. The seats are placed longitudinally, and afford seating for thirty-six passengers. The interiors are handsomely finished in cherry with ceilings of decorated quartered oak.

The general dimensions of the cars are as follows: Length over end panels, 28 ft.; length over crown pieces and vestibule sheathing, 37 ft. 5 ins.; from panel over vestibule, 4 ft. 8½ ins.; width over sills, 7 ft. 3½ ins.; over posts at belt, 7 ft. 10 ins.; sweep of posts, 3¼ ins.; size of side sills, 4¾ ins. x 6¾ ins.; end sills, the same; sill plates, ½ in. x 6 ins.; thickness of corner posts, 3¾ ins., and of side posts, 2¾ ins. The cars are furnished with angle-iron bumpers, "Dedenda" gongs and ratchet brake handles of the builders' make. The trucks are Brill 27-G, with 4-ft. wheel base, 4-in. axles and equipped with two 30-hp motors each.



NEW CAR FOR ALBANY

The directors of the Trinidad Electric Company, Ltd., have submitted to the shareholders of the company the first report and statement of assets and liabilities as of Dec. 31, 1902, and the profit and loss account from June 1, 1901, the date when the purchased properties were taken over, until Dec. 31, 1902. The net earnings of the company during the period of construction, as is shown by the profit and loss account, have been sufficient to pay the bond interest and leave a balance of $3,636 to the credit of this account. An examination of the financial statement shows clearly that, considering that the plants of both the lighting and tram-line concerns have been in a state of reconstruction, the company has done remarkably well. From June 1, 1901, it has met its financial engagements and earned $39,328. The electric lighting is now satisfactory, and the tram-line service is about reaching completion. With regard to the statement of the directors that the tram receipts may exceed the expectations formed when the company was organized, it is firmly believed that this will be very largely the case. The directors of the company are: John F. Stairs, president; Hon. W. Gordon-Gordon, vice-president; C. Archibald, W. B. Ross, K. C., R. E. Harris, K. C., and B. F. Pearson.

LEGAL DEPARTMENT

CONDUCTED BY WILBUR LARREMORE, OF THE NEW YORK BAR

POLICE POWER AND ROADBEDS

From the very large number of judicial explanations of the police power of the State, we select the following from matter of Jacobs (98 N. Y., 98): "That power is very broad and comprehensive, and is exercised to promote the health, comfort, safety and welfare of society. Its exercise in extreme cases is frequently justified by the maxim salus populi suprema lex est. It is used to regulate the use of property by enforcing the maxim sic utere tuo, ut alienum non laedas. Under it the conduct of an individual and the use of property may be regulated so as to interfere, to some extent, with the freedom of the one and the enjoyment of the other; and in cases of great emergency engendering overruling necessity, property may be taken or destroyed without compensation, and without what is commonly called due process of law. The limit of the power cannot be accurately defined, and the courts have not been able or willing definitely to circumscribe it. But the power, however broad and extensive, is not above the Constitution. When it speaks, its voice must be heeded. It furnishes the supreme law, the guide for the conduct of legislators, judges and private persons, and so far as it imposes restraints, the police power must be exercised in subordination thereto. Judge Cooley, speaking of the regulation by the Legislature under the police power of the conduct of corporations holding inviolable charters, says: 'The limit to the exercise of the police power in these cases must be this: the regulations must have reference to the comfort, safety and welfare of society; they must not be in conflict with any of the provisions of the charter, and they must not, under pretense of regulation, take from the corporation any of the essential rights and privileges which the charter confers. In short, they must be police regulations, in fact, and not amendments of the charter in curtailment of the corporate franchise. (Const. Lim. [4th ed.] 719.)'"

In village of Carthage vs. Frederick (122 N. Y., 268), a municipal ordinance was upheld as involving a legitimate exercise of the police power, and as not being unconstitutional, which prohibited owners of real estate, under penalty, from suffering snow and ice to remain on sidewalks fronting their premises later than ten o'clock of the forenoon of any day after the same shall have fallen or collected thereon. The court took the view that such an ordinance did not unduly interfere with rights of property and that it was necessary for public safety while not unduly entailing private inconvenience. The court said in part: "In this latitude the accumulation of snow upon sidewalks in large quantities is a matter of course. Its presence retards travel, interrupts business and interferes with the safety and convenience of all classes. It is a frequent cause of accidents and thus affects the property of every person who is liable to assessment to pay the damages caused by a failure to remove it. But how is it possible for the authorities of a large city, with many hundred miles of streets, to remove the snow in time to prevent injury to those who have the right to travel upon the sidewalks, unless they can require the owners and occupants of adjacent property to remove it? Every man can conveniently and promptly attend to that which is in front of his own door, and it is both reasonable and necessary that he should be compelled to do so."

Upon considerations analogous to those advanced by the New York court it was held by the Supreme Court of Illinois in City of Chicago vs. Chicago Union Traction Company (Oct., 1902, 65 N. E., 243) that a city ordinance requiring a street railway company to clean between its rails, all streets occupied by the company, was valid and enforcible. It appeared that owing to the presence of the tracks, the street, instead of sloping from the center, had a flat crown 16 ft. in width, and that the rails retained dirt in the center of the street, and that, owing to such conditions, it was more difficult and expensive to clean the street. It was accordingly decided that the ordinance was a reasonable exercise of the police power. The court said in part: "It does not seem unreasonable that the city should require the traction company to clean and render healthy that portion of the street occupied by the tracks of the road, under the circumstances of the case. In order to secure the public health and comfort, the property of individuals and corporations may alike be subjected to reasonable restrictions and burdens. It does not appear unreasonable that the traction company, having, in the exercise of the special privilege enjoyed by it of using the street, contributed to the unsanitary condition which injuriously affects the public health and comfort, should be required to aid in removing such conditions. The privilege enjoyed by the defendant in error company to maintain its railway in the street and operate its cars thereon is to be exercised in the interest of the public. It was to serve the public that the privilege was granted to it. Its business and property are impressed or affected with a public use. It may, therefore, be subjected to municipal regulations of a greater scope, in the interest of the public at large, than that of a railroad company exercising its franchises on its own roadbed."

In contra-distinction to this decision may be cited that of the Court of Errors and Appeals of New Jersey in Fielders vs. North Jersey St. Ry. Co. (November, 1902, 53 Atl., 404). In the latter case it was held that a city ordinance requiring all street railway companies to pave, repave, and keep in repair, under the dierction and to the satisfaction of the proper municipal authorities, the space between the rails of their tracks and between the tracks, and the space for 1 ft. outside of each outer track, is not a valid exercise of the police power conferred upon the municipality by the Legislature. The court said: "The traction company is in the enjoyment of a public franchisé granted by the Legislature. It has a use of the streets differing only in kind from that of other citizens using them, and has no interest in the soil. It is under a general obligation to keep its rails in repair so that they shall not become an obstruction to travel. It is also bound by any contract it may lawfully have made with the municipality in consideration of the grant of its local privileges. But entirely independent of any such consideration, and irrespective of any disturbance of the street surface in the operation of the railway, this ordinance attempts to impose upon every traction company the duty to pave a considerable portion of every street over which it passes, although it may bring no additional wear and tear upon the pavement, and the further duty to keep such pavement, when laid, at all times in repair. To call this 'regulation,' or an exercise of the police power, is a misuse of terms. It is taxation pure and simple. It calls upon the company to perform a function not essentially different in character, although vastly more onerous, than the once familiar operation known as 'working-out' the township road taxes by the labor of the inhabitants. Gen. St. p. 2817, Sec. 51 et seq. A power that will not support the imposition of license fees fixed on a revenue basis will certainly not support an ordinance of this character. We therefore hold that the ordinance is not supportable as an exercise of the police power, and, since no other legislative authority exists for its enactment, it imposed no duty upon the defendant company to repair the pavement between its rails, or to repave that portion of the street."

It would seem that the circumstances disclosed by these recent cases in Illinois and New Jersey, and the reasoning of the respective courts thereon, afford a test for the determination whether a given ordinance imposing obligations upon a street railway company is, or is not, a valid exercise of police power. If the company be merely required to perform acts in and about its tracks and roadbed which are rendered necessary by the existence of the track, the burden so imposed is legitimate. If, however, it be attempted to shift upon a street railway company a duty of paving or cleaning, which has no essential relation to the roadbed, and which would exist if there were no railway, the ordinance must be condemned. The cases last cited refer to a very large number of previous decisions in various courts, and it is not contended that the distinction here suggested has been uniformly observed; indeed, the authorities upon the sub-

Note.—Communications relating to this department should be addressed to Mr. Larremore, 32 Nassau Street, New York.

ject are conflicting and irreconcilable. It is to be hoped, however, that such distinction will be kept in mind in the future. It is oppressive, as well as illogical, to saddle street railways with ordinary municipal functions and duties under pretense of an exercise of the police power.

LIABILITY FOR NEGLIGENCE

NEW YORK.—Parties—Bringing in New Party—Discretion of Court.

1. Where, after suit for an injunction and for damages for the operation of a railway in front of plaintiff's premises, it appears that the original plaintiff has parted with the fee in the land without reserving any rights therein, so that all that remains is the question of past damages, it is improper for the court, in the exercise of its discretion, to bring in the grantee as a party plaintiff, for the causes of action of grantor and grantee in such case are totally distinct.

2. Under Code Civ. Proc. Sec. 452, as amended by Laws 1901, c. 512, which provides that, where a complete determination of the controversy cannot be had without the presence of other parties, the court must direct them to be brought in, and where a person not a party has an interest in the subject of the action or in real property, the title to which may be affected by the judgment, or in real property for injury to which the complaint demands relief, and makes application to be made a party, the court must direct him to be brought in—the question whether a party should or should not be brought in is still within the discretion of the court.

3. After suit for an injunction and for damages for the operation of an elevated railway in front of plaintiff's premises, plaintiffs conveyed to a third party, the deed expressly reserving "all claims" against the railroads "for injury either to the fee value or rental value," and the grantee covenanting to "consider himself a trustee for the grantors of the easements appurtenant to said premises in so far as they are affected by the operation of said railways," etc. Thereupon the grantee joined in an application to be made a party plaintiff. Held not improper for the court, in the exercise of its discretion, to grant the application.—(Pope et al. vs. Manhattan Railway Co. et al., 80 New York Supp., 316.)

NEW YORK.—Taxation—Assessment of Corporate Franchises—Commission to State Authority—Violation of Constitution.

1. Laws 1899, c. 712, amends Tax Law, Sec. 2, subd. 3, by adding to the subjects of taxation therein specified the franchise to construct, maintain, or operate over or under streets or public places of any municipality the tangible property thereon, which was previously assessible as realty, and provides that the value of such tangible property, plus the value of the franchise, shall be assessed together, under the designation of a "special franchise," by the State Board of Tax Commissioners, which shall report such assessment to the local assessor, to be placed on his roll; taxes to be levied and collected against it as against other property. Held to violate Const. art. 10, Sec. 2, guarantying the local selection of local officers, in so far as it withdraws the tangible property from the jurisdiction of the local assessors, though the amount of property thus withdrawn is relatively small.—(People ex rel. Metropolitan Street Railway Co. vs. State Board of Tax Commissioners, 80 New York Supp., 85.

NEW YORK.—Streets—Title of Abutting Owners.

1. Where a patent to certain land abutting a street was granted by a Dutch Governor of New York, and thereafter patents to the same land were granted by English Governors in confirmation of the previous grant, conveying the lands by the same description, such subsequent grants operated to transfer the title to the center of the street, though the street was laid out during a time when it was subject to the Dutch law, by which the fee of the streets was in the sovereign.—(Paige vs. Schenectady Railway Co. Lansing vs. Same. Van Epps vs. Same. Beattie vs. Same. Whitmyre vs. Same. Thompson vs. Same, 82 New York Supp., 192.)

NEW YORK.—Easement in Street—Extinguishment by Abutting Owner—Consent to Elevated Railroad—Bona Fide Purchaser—Extinguishment of Easement—Notice.

1. On a paper containing a consent for construction of an elevated railway over, through, and along a street, to be signed by abutting owners, one of them signed his name after the words, "I am in favor of an elevated road over the middle of the street, but not on the sidewalk." In subsequent proceedings in court by the railway company for permission to construct the road because of failure to obtain the consent of a majority of the owners, he was not put down in its list of those who had consented. Held, that he had not made a consent extinguishing his easement in the street, and the company did not act on the writing as a consent, but it was only an expression of willingness to sign a more restricted consent.

2. A purchaser of property is not affected by his grantor's consent to construction of an elevated railroad in the street in front of it, extinguishing its easement in the street, he not having knowledge of it, it not being recorded, and there being one railroad in the street.—(Shaw et al. vs. Manhattan Railway Co. et al., 79 New York Supp., 915.)

NEW YORK.—Board of Railroad Commissioners—Procedure—Discretion as to Hearing Evidence—Application for Certificate of Public Convenience—Rights of Contesting Railroads—What Roads Entitled to Oppose Application.

1. On an application to the Board of Railroad Commissioners for the certificate, provided for in Sec. 59 of the railroad law (Laws 1890, c. 565, amended by Laws 1892, p. 1395, c. 676), that public convenience and necessity require the construction of the proposed road, it has a very wide discretion as to what evidence it will and what it will not hear.

2. The Board of Railroad Commissioners may grant the certificate provided for in Sec. 59 of the railroad law (Laws 1890, c. 565, amended by Laws 1892, p. 1395, c. 676), that public convenience and necessity require the construction of a proposed railroad, though another road, which has had the legal right to build through the same territory for fifteen years, opposes the application, and shows that it is ready and able now to build itself.

3. A railroad which itself did not show any right to build within the limits of New York City had no standing to object to the issuance to another company of the certificate provided for in Sec. 59 of the railroad law (Laws 1890, c. 565, amended by Laws 1892, p. 1395, c. 676), that public convenience and necessity required the construction of its proposed road within the city.—(People ex rel. New York City & Western Railway Co. vs. Board of Railroad Commissioners of State of New York et al., 81 New York Supp., 26.)

NEW YORK.—Constitutional Law—Home Rule—Taxation—Special Franchise Tax—Validity—Obligation of Contracts—Due Process of Law.

1. Const. Art. 10, Sec. 2, providing that all city, town, and village officers whose election or appointment is not provided for by the Constitution shall be elected by the electors of such cities, towns, and villages, or some division thereof, or appointed by such authorities thereof as the Legislature shall designate, prohibits the transfer of the duties and privileges belonging to local officers to State officers.

2. The supreme taxing power of the Legislature should not be crippled by the home rule provision of Const. Art. 10, Sec. 2, so as to take from the Legislature the right to create a new system of taxation, and bring in property of a new character, hitherto untaxed, with some other property incidental thereto, and worthless without it.

3. The general franchise of a corporation gives it a right to do business by the exercise of the corporate power so granted, but does not give it a right to anything in the public highways without special authority from the State, or some officer or body acting under the authority of the State.

4. The right granted to a corporation to construct, maintain, or operate in a public highway a street railway, or to do something in such public highways which, except for the grant, would be a trespass, is a special franchise.

5. Laws 1899, p. 1589, c. 712, amending the general tax law (Laws 1896, p. 795, c. 908), authorizes for the first time the assessment or valuation for general taxation of all special franchises by a State Board of Taxation Commissioners appointed by the Governor, and declares that the right or permission to construct or operate some structure for public use in, under, above, on, or through streets, highways, or public places, such as railroads, gas pipes, water mains, poles and wires for electric lines, and the like, is a special franchise, and provides that, for purposes of taxation, such a franchise is made real property, and includes the value of the tangible property of a person, copartnership, association, or corporation in or upon any such places, or, in, under, or upon the public waters in connection with the special franchise, and is to be taxed as a part thereof. Held, to include nothing but what is in the street, directly or indirectly, and to exclude power houses, depots, and all structures not within the lines of the street.

6. Laws 1899, p. 1589, c. 712, known as the "Special Franchise Act," and amending the general tax law (Laws 1896, p. 795, c. 908), confers on State officers the right to assess such franchises, and to assess the tangible property annexed thereto, which was formerly assessed by local boards of assessment. Held, not to violate the principle of the home rule provision of Const. Art. 10, Sec. 2, providing that all city, town, and village officers whose election and appointment are not provided for by the Constitution shall be elected in such cities, towns and villages, or appointed by the authorities thereof, because it creates a new system of taxation, and brings within range a new character of property, requir-

ing new methods of valuation, and the exercise of functions which never belonged to local assessors, and because the property formerly assessed by local assessors is an inseparable part of the special franchises mentioned in the statute, and because the power to assess the special franchise, of which the tangible property formerely assessed by the local assessors is an inseparable part, never belonged to localities, and never could be exercised with uniformity by their officers, and, therefore, was, of necessity, conferred upon State officers having a jurisdiction co-extensive with the limits of the State.

7. Legal principles are established by what was decided in the opinions of a given case, and not by expressions used arguendo.

8. The special franchise act (Laws 1899, p. 1589, c. 712) is not unconstitutional, as impairing the obligation of a contract, as it changes no part of the corporate grant, and alters no stipulation therein, increases no payment, and exacts nothing from the owners of the franchise that is not exacted from the owners of property generally.

9. The special franchise act is not objectionable as incapable of execution.

10. The special franchise act is not unconstitutional on the ground that due process of law was not observed thereunder in the taxing of the franchises.—(People ex rel. Metropolitan Street Railway Co. vs. State Board of Tax Commissioners. People ex rel. Twenty-third Street Railway Co. vs. Same. People ex rel. Central Cross-Town Railway Co. vs. Same. People ex rel. Consolidated Gas Co. of New York vs. Same. People ex rel. Brooklyn City Railway Co. vs. Same. People ex rel. Coney Island & B. R. Co. vs. Same. People ex rel. New Amsterdam Gas Co. vs. Same, 67 N. E. Rep., 69.)

NEW YORK.—Eminent Domain—Damages—Costs.

1. Code Civ. Proc., Sec. 3372 (Condemnation Law), provides that, "if the compensation awarded by the commissioner exceeds plaintiff's offer, the court shall, in the final order, direct that defendant recover of plaintiff costs of the proceeding as allowed in the Supreme Court, including allowances for proceedings "before and after notice of trial." Held, that the trial spoken of is the one before the appointment of commissioners, and a landowner awarded more than plaintiff's offer is not entitled to costs in the proceedings before the commissioner, as though a trial had been had.—(Brooklyn Union Elevated R. Co. vs. Case, 18 N. Y. Supp., 527.)

OHIO.—Street Railroads—Consent of Abutting Owners—Eminent Domain.

1. The consents of owners of lots abutting on a street to the construction and operation of a street railroad on such street are not property rights that can be appropriated under the power of eminent domain.

2. Such consents are not property rights, but rights in their nature personal to each owner of an abutting lot.

3. Such personal rights were bestowed by the general assembly on owners of abutting lots as a check upon the power of municipal authorities to authorize street railroads to be constructed and operated against the wishes of the owners of lots on such street.

4. The owners of abutting lots are free to give or withhold such consent, upon such terms as to them severally may seem proper, and there is no public policy in this state against giving such consent for a valuable consideration moving from the street railroad company to such lot owner.—(Hamilton G. & C. Traction Co. vs. Parish, 65 N. E. Rep., 1011.)

PENNSYLVANIA.—Railroads—Injunction—Crossing by Street Railway.

1. Where a railroad company had located, but not constructed, a branch across a public road, it could sue to enjoin a street railway company from constructing its road across such branch at grade until the rights of the parties at the crossing were adjusted.—(Ohio River Junction R. Co. vs. Freedom & C. Electric St. Ry. Co., 53 Atlantic Rep., 773.)

PENNSYLVANIA.—Street Railroads—Contracts—Abandonment—Damages.

1. A street railroad company obtained a right of way, and covenanted to grade and pave the portion thereof not occupied as a roadway by its tracks. Thereafter it abandoned the location by reason of its failure to gain the municipal consent, and placed no tracks whatever upon the land. Held, that the owner was not entitled to recover from the railroad company the cost of the grading and paving, but only nominal damages.—(Hays et al. vs. Wilkinsburg & E. P. St. Ry. Co., 54 Atlantic Rep., 322.)

PENNSYLVANIA.—Street Railroads—Use of Tracks—Evidence.

1. Though a street car company has a superior right to use its tracks, it does not forbid their use by the public so as to render a person placing himself or his horse and vehicle on the tracks for any legitimate use of the street a trespasser.

2. Plaintiff was unloading a piano from a wagon, and waited for two street cars to pass, and then backed his wagon against the curb with the horse standing on the tracks. He sent a man down the street to signal any car that might approach. One came, without giving any warning, at an unusual rate of speed; and although the motorman had an unobstructed view for three or four squares, and was given a notice to stop, he struck the horse and wagon, injuring plaintiff. Held, that a verdict for plaintiff would be sustained.—(McFarland vs. Consolidated Traction Co., 54 Atlantic Rep., 308.)

PENNSYLVANIA.—Street Railroad—Lease of Tracks—Objection by Borough.

1. A borough cannot object that a street railroad company incorporated under a special act of the Legislature, giving it a right to lay its tracks in the borough without municipal consent, has exceeded its powers in entering into an agreement for the lease of its tracks; such question being for the commonwealth only.—(Minersville Borough vs. Schuylkill Electric Ry. Co. et al. (No. 2.) 54 Atlantic Rep., 1053.)

PENNSYLVANIA.—Street Railroads—Use of Streets—Breach of Conditions—Forfeiture of Right—Laches.

1. Where a street railway company has been granted by a borough the right to use a street on the condition that such right shall be forfeited if it does not within a year build a certain extension, the borough can remove the track from the street if the extension is not constructed within a year.

2. Where a street railroad has failed to build an extension, which was the condition of its obtaining the use of the streets, indulgence by the borough in commencing proceedings to compel removal of the tracks, where the delay leads to no change in the situation, is not laches on the part of the borough.—(Minersville Borough vs. Schuylkill Electric Ry. Co. et al. (No. 1), 54 Atlantic Rep., 1050.)

PENNSYLVANIA.—Townships—Boroughs—Street Railroads—Consent of Abutting Owners.

1. Act April 28, 1899 (P. L. 104), relating to the organization of townships of the first class, did not create such township into a borough.

2. Street railway companies cannot be constructed upon the highways in townships of the first class without the consent of the abutting owners, such construction being an additional burden, and therefore a taking of or injury to the property of such abutting owner.—(Dempster vs. Union Traction Co. et al., 54 Atlantic Rep., 501.)

TEXAS.—Railroads—Right of Way—Use of City Streets—Foreclosure Sale—Rights of Purchaser—Abandonment of Rights—Statutory Provision.

1. Where a city ordinance granted a railroad the right to occupy a street for right of way purposes, and the company built on a portion of the street, and its successor in title assumed possession of the track, and extended the same, though not so far as the ordinance authorized, the city's grant of the whole street was accepted, including the portion on which no road was constructed.

2. Where a railroad had obtained from a municipal corporation its unconditional consent to the construction of a railroad on one of its streets, a purchaser at foreclosure sale of all the properties, privileges, and franchises of the railroad acquired its rights to the use of the whole street, including a part over which no road had been actually constructed.

3. The fact that the charter of the purchasing company conferred on it power to occupy the streets in the city in question for right of way purposes, subject to the condition precedent that it obtain the city's consent, did not require it to surrender the right of way which it had acquired by its purchase, and reacquire the same by exercise of its charter powers.

4. Where a railroad for many years delayed to use a portion of the right of way granted it on the streets of a city, and the city thereupon granted the right to another company, a decision in favor of the former company in injunction proceedings brought by the latter involves the conclusion that there had been no abandonment of the first granted right of way.

5. Where a railroad was granted a right, unconditioned as to time, to build on a certain street, and for 14 years such right of way, for a distance of a block and a half, was entirely unused, such delay did not necessarily, and as a matter of law, constitute an abandonment.

6. Rev. St. art. 4558, providing that any railroad corporation which shall fail to equip at least 20 miles of its right of way every year after the second of its incorporation, until the whole is completed, shall forfeit its corporate existence, and that its powers shall cease so far as relates to the portion of the road then unfinished, does not apply to a failure to occupy a short portion of a right of way granted in a street to connect with another line; the road having been built into the city along such street, in due time after the grant.—(Denison & S. Ry. Co. vs. St. Louis S. W. Ry. Co. of Texas, 72 S. W. Rep., 161.)

TEXAS.—Railroads—Right of Way—Use of City Street—Foreclosure Sale—Rights of Purchaser—Forfeiture of Rights.

1. Where a railroad had obtained from a municipal corporation its unconditional consent to the construction of a railroad on one of its streets, a purchaser at foreclosure sale of all the properties, privileges, and franchises of the railroad acquired its rights to the use of the street.

2. The fact that the charter of the purchasing company conferred on it power to occupy the streets in the city in question for right of way purposes subject to the condition precedent that it obtain the city's consent, did not require it to surrender the right of way which it had acquired by its purchase, and reacquire the same by exercise of its charter powers.

3. Where a city ordinance granted a railroad the right to occupy a street for right of way purposes, and the company built on a portion of the street, and its successor in title assumed possession of the track, and extended the same, the city's grant to the use of the street was accepted.

4. Where a city granted a railroad permission to use a street for right of way purposes, another railroad, which was subsequently granted a right of way over the same street, could not insist that the first grantee had forfeited its rights by failing to exercise proper diligence in completing its track, only the state or city being entitled to enforce a forfeiture.—(Denison & S. Ry. Co. vs. St. Louis S. W. Ry. Co., 72 S. W. Rep., 201.)

TEXAS.—Highways—Use of Railroad—Right of County to Sue—Measure of Damages—Evidence—Instructions.

1. Rev. St. 1895, art. 4426, provides that a railway may construct its road along or upon a highway which the route of such railway may intersect or touch, but that it shall restore such highway "to its former state, or to such state as not to unnecessarily impair its usefulness." Held that, where a railway thus appropriates a highway, a county may maintain an action for any damages resulting from the appropriation.

2. Where a railroad appropriated a portion of a highway, and constructed a new road near to and parallel with the old one for the distance that the latter had been appropriated, the measure of damages to be recovered by a county for such appropriation is the amount required to put the new road in as good condition as the old road was in when appropriated.

3. A railroad appropriated a highway, and, to replace it, built a new road parallel thereto. Held, in an action by the county against the railroad for damages, that it was error to admit testimony showing the condition of the old road long before it was appropriated, or of the new road long after it was completed.

4. A railroad appropriated a highway, and, to replace it, built a new road parallel thereto. In an action by the county for damages for such appropriation there was evidence that the railroad had made excavations adjacent to the new road since its construction. Held, that it was error to refuse a charge that no damages could be allowed on that account, where the pleading did not authorize a recovery for such damages, as the jury were liable to consider such evidence in the absence of such an instruction.—(St. Louis S. F. & T. Ry. Co. et al. vs. Grayson County, 73 S. W. Rep., 64.)

VIRGINIA.—Deed of Trust—Rights of Grantor—Streets—Dedication—Validity—Foreclosure of Deed—Rights of Purchaser—Recovery of Land—Ejectment—Estoppel—Acquiescence.

1. Where a corporation owned land subject to a deed of trust, it had no power, as against the holder of the deed, or a purchaser on foreclosure thereof, to dedicate any portion of the land to the public as a street.

2. Where, at the time an owner of land subject to a deed of trust attempted to dedicate a portion thereof to the public as a street, and contracted with a street railroad company to grant a right of way over the same, and pay the company a bonus, the deed of trust was duly registered, and the holder of the deed notified the railroad company of his rights in the land, a purchaser on foreclosure of the deed was not estopped from maintaining ejectment against the railroad company to recover the land.

3. In a suit to restrain a purchaser of land under a deed of trust from maintaining ejectment to recover land occupied by a railroad company for its right of way under a contract between it and the grantor after the execution of the deed, evidence held insufficient to show that the grantee in the deed had acquiesced in plaintiff's use of the land.

4. Where the only reference to a map and prospectus of a land company contained in a deed of trust of the land and in deeds of release for lots sold was in connection with the description of the released lots furnished by the map and the price list in such prospectus, such deeds did not estop the grantee from objecting to the construction of a railroad on a street shown by the map.—(Newport News & O. P. Ry. & Electric Co., vs. Lake et al., S. E. Rep., 566.)

WEST VIRGINIA.—Municipal Corporations—Grant of Franchise—Notice of Application—Common Council—Vacancies—Election to Fill—Parol Evidence—Fraud.

1. In granting a franchise or privilege, the council of a municipal corporation or a county court performs a legislative, and not a judicial function, and the notice required by section 1 of chapter 29, p. 82, of the Acts of the Legislature of 1901, is provided merely in aid, protection, and extension of the right to be heard by petition, and need not set forth the day on which the application will be, or is expected to be, acted upon. As the act requires the application to be filed 30 days before action upon it, and forbids any action upon it until after 30 days' publication of notice, the notice is merely intended to apprise the public of its pendency.

2. A statute requiring notice to be "given by publication for thirty days in some newspaper of general circulation" published in a county or city, is sufficiently complied with by publication in the successive issues of a weekly newspaper through the period of time named.

3. Under a city charter requiring a quorum, composed of a majority of the members of the council, for the transaction of business, less than a quorum cannot convene a session of the council and transact business.

4. Where, in such case, less than a quorum meet, and attempt to declare the seat of an absent member vacant, and elect another person to his seat, and still another to the seat of a member whose resignation has been placed in the hands of the mayor, but not acted upon, before the other regular members appear, thus illegally giving themselves an apparent majority in the council, the alleged elections to fill vacancies are void, and the strangers so obtruded upon the council have no right to vote, and no measure can be passed by their votes.

5. Although, in a collateral proceeding, parol evidence is not admissible to contradict the record of the proceedings of the council of a municipal corporation, it is admissible in such case to show that the council had not, and could not have, convened at all, or acquired the right to make a record, when the alleged elections took place, although the minutes contain the recital, "Roll of members called, and a quorum found present."

6. Fraud both lurks and deals in generalities.—(City of Benwood vs. Wheeling Ry. Co. et al., 44 S. E. Rep., 271.)

TEXAS.—Passengers—Carriers—Insults to Passengers—Damages.

1. Allowing a leading question to be asked as to a matter not questioned in the pleadings or evidence is not prejudicial.

2. A passenger on a street car may recover damages where she is carried past her destination against her will, and thereafter the motorman addresses her in an insulting manner, and shakes his fingers and an iron bar in her face.

3. One hundred dollars damages is not too great where a passenger on a street car is carried past her destination against her will, and the motorman thereafter addresses her in an insulting manner and shakes his fist in her face.—(San Antonio Traction Co. vs. Crawford, 71 S. W. Rep., 306.)

TEXAS.—Carriers—Street Railways—Sudden Start—Injury to Passenger—Care Required—Trial—Instructions—Omissions—Requests.

1. An omission of the court to charge an element of damage pleaded is not error, in the absence of a request to give an instruction covering the omission.

2. Where, in an action for injuries to plaintiff's wife by the premature starting of defendant's street car while boarding it, the court charged that, if she signaled for the purpose of taking passage, and the car came to a standstill, and while she was attempting to enter the car was suddenly started without warning, and she was thereby injured, and such sudden starting was negligence on the part of the company, and such negligence was the proximate cause of her injury, plaintiff was entitled to recover, such instruction was sufficently comprehensive to justify the court in refusing a requested charge on the subject of defendant's negligence.

3. In an action for injuries to a passenger, an instruction that negligence in the failure to use that high degree of care that would be exercised by a prudent person under like circumstances was erroneous, the carrier being required to use "the utmost care" for the safety of its passengers.—(Knauff vs. San Antonio Traction Co., 70 S. W. Rep., 1011.)

TEXAS.—Street Railways—Injury to Passenger—Contributory Negligence—Question for Jury—Petition—Exceptions—Harmless Error—Leading Question—City Ordinance.

1. A passenger got on an open street car, which had a running board along each side and aisle through the center. It had no conductor. He put his fare in the box at the front end and walked back on the running board to one of the only two vacant seats near the rear, and as he was stepping up to take the seat he was struck by a girder of the bridge the car was crossing and

knocked off and injured. He was sixty years of age, weighed 220 pounds and had passed over the bridge on the cars almost daily for six months, but testified that he had not noticed that the track was so near the girders as to endanger passengers standing on the running board. There was no obstruction in the center aisle except the dresses of the lady passengers sitting next to it. Held not to be contributory negligence as matter of law.

2. Where, in an action against a street railway company, the petition alleged an ordinance of the city requiring a conductor and motorman for each car, but the ordinance was not offered in evidence, nor any issue which could be evolved from such allegation submitted to the jury, the error, if any, in overruling defendant's exception to that part of the petition was harmless.

3. Where a motion to strike out an amended supplemental petition is aimed at the pleading as a whole, it must be regarded as a general exception, and, if any part of the pleading presents a valid replication to any part of defendant's answer, the motion is properly overruled.

4. In an action against a street railway company for injury to a passenger, resulting from being knocked off the running board of a car by a bridge girder, a witness who had testified that plaintiff was on the running board when first seen by him was asked: "On what part of the running board when you first saw him?" Held, that an objection to the question as leading could not be sustained.

5. Where the fact that plaintiff was on the running board of a street car at the time he was injured was undisputed, error, if any, in admitting, over an objection that it was leading, a question as to what part of the running board he was on when first seen by the witness was without prejudice.

6. Where, in an action against a street railway company for injury to a passenger, who was knocked off the running board of a car by a bridge girder, the petition alleged negligence in running at excessive and unlawful speed, in violation of a certain ordinance, such ordinance was relevant to the issue, and properly admitted in evidence.—(San Antonio Traction Co. vs. Bryant, 70 S. W. Rep., 1015.)

TEXAS.—Street Railways—Negligence—Personal Injuries—Discovered Peril—Instructions—Contributory Negligence—Burden of Proof.

1. Assignments of error which are not in the form of propositions and have no propositions submitted thereunder cannot be considered.

2. The petition in a suit against a street railway company alleged that the conductor invited plaintiff on the car, and while it was in motion negligently ordered him to get off, but did not diminish the speed, though knowing plaintiff was going to get off, so that in doing so plaintiff was injured. Held not to authorize a recovery on the ground of discovered peril.

3. Where it was in issue whether defendant street railway company's conductor compelled plaintiff and other boys to alight from a moving car, an instruction referring to language used by the conductor as an "order" was objectionable, as leading to an inference that the boys were bound to obey.

4. In an action against a street railway company, in which it was alleged that defendant's conductor compelled plaintiff and other boys to alight from a moving car, plaintiff testified that two of the other boys got off of their own accord, that his brother got off before he did, and that he had no intention of becoming separated from the other boys. Defendant contended that plaintiff was not compelled to get off, but did so to prevent being separated from his companions. Held, that failure to instruct on this phase of the case, that defendant would not be liable if plaintiff got off voluntarily, was error.

5. Where a suspicion of contributory negligence could be inferred from the case as made by plaintiff, it was error to instruct that the burden was on defendant to show contributory negligence by a preponderance of the evidence.—(Denison & S. Ry. Co. vs. Carter, 70 S. W. Rep., 322.)

UTAH.—Witnesses—Statement of Physician—Privilege—Presumption.

1. Under Revised Statutes, section 3414, providing that a physician cannot, without the consent of his patient, be examined in a civil action as to any information acquired in attending the patient, which was necessary to enable him to prescribe for the patient, a physician who was sent by a street railway company to examine a passenger who had been injured was not entitled to testify as to any information acquired while attending such person.

2. Where a physician was sent to make an examination of a passenger injured by a street railway company, it will be presumed that the relation of physician and patient existed with regard to such examination, and that the information obtained was for the purpose of enabling the physician to prescribe and act for the patient.—(Munz vs. Salt Lake City R. Co., 70 Pacific Rep., 852.)

CHARTERS, FRANCHISES AND ORDINANCES.

ILLINOIS.—Judgment—Res Adjudicata — Appeal—Questions Reviewable.

1. As a railroad company leasing its line is absolutely liable for negligent acts of its lessee, a judgment on the merits for defendant, in an action against the lessor railroad company for negligence of its lessee, is conclusive against the right of plaintiff in that action to recover in a subsequent action against the lessee based on the same act of negligence.

2. Where, in an action against a lessor railroad company for damages resulting from the negligence of the lessee, a trial on the merits resulted in judgment for defendant, the court could not, on appeal from a judgment for defendant in a subsequent suit on the same negligent act against the lessee, review the action of the trial court in the first case in giving instructions.

3. Where a second action is on the same claim or demand as the former one, the judgment in the former suit, if rendered on the merits, is an absolute bar, and concludes both parties and privies, not only as to every ground of recovery or defense actually presented, but also as to every ground which might have been presented.—(Anderson vs. West Chicago St. R. Co., 65 N. E. Rep., 717.)

ILLINOIS.—Corporations—Consolidation—Dissenting Stockholder—Rights—Confiscation of Shares.

1. Where, at the time a subscription for the stock of an electric company was made, Starr & C. Ann. St. c. 32, par. 65, was in existence, which authorizes corporations created under the laws of the State to consolidate under certain restrictions on the vote of two-thirds of the capital stock, such statute became a part of the subscription contract; and a dissenting stockholder has no right to demand of a company, with which his company was consolidated, payment in cash for his shares.

2. Where a corporation with a capital of $250,000 was consolidated with a new company, incorporated with a capital of $500,000, the par value of the shares of both being $100, the fact that none of the capital of the consolidated company was paid in, except the amount of the shares of the old company, which shareholders were authorized to turn over to the new in exchange for the same number of shares of the consolidated company, did not amount to a confiscation of one-half in value of the old shares, in the absence of a showing that the balance of the stock of the consolidated company was not in good faith subscribed and was not of the par value of $250,000.—(Mayfield vs. Alton Ry., Gas & Electric Co., 65 N. E. Rep., 100.)

INDIANA.—Eminent Domain—Property Appropriated to Public Use—Necessity.

1. To warrant the condemnation of land already appropriated to a public use, the power of condemnation must be conferred by the Legislature in express terms or by necessary implication.

2. Act 1901, p. 461 (Burns' Rev. St. 1901, Sec. 5468a, subd. 5), which conferred authority upon an interurban street railway "to construct its road upon or across any stream of water, water course, road, highway, railroad or canal, * * * which the route of its road shall intersect, does not purport to authorize it to appropriate a railroad right of way longitudinally in whole or in part.

3. The condemnation of a railroad right of way for street railway purposes was not shown to be necessary so as to warrant a holding that it was conferred by necessary implication, where it was merely claimed that, unless the railroad way was condemned, the street railway would "be compelled to diverge from its right of way as surveyed and located to such an extent and in such a manner as it will render hazardous, dangerous, and impracticable the constructing of its lines and the operation of its cars."—(Indianapolis & V. R. Co. vs. Indianapolis & M. Rapid Transit Co., 67 N. E. Rep., 1013.)

MICHIGAN.—Railroads—Suburban Electric Line—Right to Take Private Property—Construction Within Certain Distance of Fence—Applicabilty of Statute.

1. A corporation operating a suburban electric railway has no right, on an abutting owner's refusal to sell a strip off the front of his land for a track, to enter thereon, without attempt to exercise any power of eminent domain, cut trees, grade the property, and construct its track; and equity will enjoin it from so doing.

2. Comp. Laws, Sec. 4097, occurring in a chapter headed, "The Performance of Labor on Highways and the Commutation Therefor," provides that surplus earth or gravel taken from one portion of the road may, with the consent of the highway commissioners, be used to fill in depressions in any other road in the district, provided that no earth shall be dug, plowed, or scraped nearer than 8 ft. of the margin of the highway without the consent of the owner of the adjacent premises. Section 6446 provides that any street railway company may extend, construct, use, and maintain a street railway in and along the highways of any township upon such

terms and conditions as may be agreed on by the company and the township board. Held, that the power of the township board to authorize the construction of a street railway was not limited by Sec. 4097 so as to invalidate its permission to a company to build within 8 feet of the highway margin.—(Freud vs. Detroit & P. Ry. Co., Chandler et al. vs. Same., 95 N. W. Rep., 559.)

MICHIGAN.—Municipalities—Agreement with Street Railway to Maintain Streets—Authority—Construction of Contract.

1. A street railway company taking over certain franchises granted to another company consented to a low fare as a consideration for an agreement with the city, that all paving, repaving, or repairing of pavements on streets used by the company should be at the expense of the city, except in certain instances, and that there should be no charge whatever, in any form or manner, against the company for repaving and repairing of pavements and streets on which the company operated its cars. Held, that by this agreement the city bound itself to repair the foundation necessary for the support of the company's tracks.

2. A city has authority to bind itself to construct and maintain at its own expense the foundation required in its streets for the support of street car tracks, though such foundation must be heavier and stronger than that required by the ordinary traffic on the streets.

3. A city does not engage in a work of internal improvement by agreeing with a street railway to pave and repair the streets used by the street railway at its own expense, and without requiring any assistance from the street railway company.—(City of Detroit vs. Detroit United Ry., 95 N. W. Rep., 736.)

MICHIGAN.—Municipal Corporations—Street Railways—Ordinances—Ultra Vires—Jurors—Competency—Taxpayers—Res Judicata.

1. In an action by a city against a street railway company on a liability incurred for the expense of supervising construction of the street railway, and for materials furnished, taxpayers were not incompetent as jurors on the ground of interest.

2. A city ordinance authorizing the construction of street railway tracks, and providing that the 6 ins. of concrete required by the ordinance as foundation for ties to rest on shall be laid by and at the expense of the city, was not invalid as ultra vires.

3. A taxpayer brought proceedings to enjoin a city from fulfilling an agreement by ordinance to lay at its own expense a concrete foundation for a street railway company, claiming that the ordinance was ultra vires. Held, in an action by the city against the railway company, in which the railway set up a counterclaim for work done in concreting, that the decision that the ordinance was ultra vires was not res judicata; the company not having been a party to the former action.—(City of Detroit vs. Detroit Ry., 95 N. W. Rep., 992.)

MICHIGAN.—Street Railways—Additional Servitude—Lowering Grade—Presumption—Construction of Road at Side of Highway.

1. The construction and operation of a street railroad on a highway is not an additional servitude.

2. An abutting owner has no right to compensation because the grade of a highway is lowered for a street railroad which is built to conform thereto, though the highway is owned by a plank road company, the change of grade being with the consent of it and of the township.

3. An abutting owner has no right to compensation because a street railroad is constructed, on a lowered grade, so close to the side of the highway as to subject his fence and land to the danger of sliding into the highway.

4. The lowering of the grade of a highway by a street railway company without objection by the township will be presumed to be with its consent.—(Austin vs. Detroit, Y. & A. A. Ry., 96 N. W. Rep., 35.)

NEW YORK.—Railroads—Crossings—Proceedings—Nature—Sufficiency of Petition—Decision by Railroad Commissioners—Effect—Temporary Crossing—Appeal—Review.

1. A proceeding under Railroad Law (Laws 1890, p. 1082, c. 565, as amended by Laws 1892, p. 1382, c. 676) Sec. 12, providing for the appointment of commissioners to determine the compensation to be paid by a railroad being constructed for the right to intersect an old road, and the point, grade, and manner of such intersection, if the corporations fail to agree thereon, is not one commenced or required by law to be conducted under the condemnation law, and hence the petition may be accompanied by an order to show cause returnable in less than eight days, the time required by Code Civil Procedure, Sec. 3361, and Sec. 780 gives the court or a judge thereof the power to make such orders returnable in such time.

2. A petition in a proceeding under Railroad Law (Laws 1890, p. 1082, c. 565, as amended by Laws 1892, p. 1382, c. 676), Sec. 12, for the appointment of commissioners to determine the compensation to be paid by a railroad for the right to intersect the track of other roads, and the point and manner of such intersection, which alleges that the petitioner is a corporation, that the route of its road as laid out crosses the other road; that it desires to intersect such road, specifying the place; that the two corporations cannot agree on the compensation for or the points or manner of such intersection; that the requisite consent of property owners and municipal authorities has been obtained; and that the road is in actual operation on both sides up to the point of the desired intersection—is sufficient to confer jurisdiction on the court to appoint commissioners.

3. A decision by the Board of Railroad Commissioners under Railroad Law, Sec. 68, which gives such commissioners authority to determine whether a surface road shall cross a steam road above, below or at grade, and to fix the proportion of the expenses for such crossing to be borne by each road, that a surface road shall cross a steam road at grade, and bear all the expenses connected with the crossing, does not bar an application by the surface road for an order of court for a temporary crossing.

4. Laws 1893, p. 463, c. 239, Sec. 1, which provides that when a petition has been made by a surfce railroad desiring to cross another railroad for the appointment of commissioners to determine the grade, compensation, etc., for such crossing, the court may authorize a temporary crossing, was not repealed by Laws 1897, p. 794, c. 754, as amended by Laws 1900, p. 1590, c. 739 (Railroad Law, Sec. 68), which provides that all steam and surface railroads thereafter crossing a steam railroad shall be above, below, or at grade of such existing road, as the Board of Railroad Commissioners shall determine, and that such board shall fix the proportion of expenses to be paid by each railroad.

5. So far as Railroad Law (Laws 1890, p. 1082, c. 565, as amended by Laws 1892, p. 1382, c. 676), Sec. 12, authorizes the appointment of commissioners to determine the amount of compensation to be paid by one railroad for the right to intersect another, and the manner of such intersection, it is not repealed by Law 1897, p. 794, c. 754, as amended by Laws 1900, p. 1590, c. 739 (Railroad Law, Sec. 68).

6. Where the order of court granting a surface railroad a temporary crossing over a steam railroad at a place where, by a decision of the Board of Railroad Commissioners, the surface road was to have a permanent grade crossing on compliance with certain conditions, required the giving of a bond conditioned on the faithful performance of all conditions that might be imposed by the board, it cannot be said that the temporary cross was permitted without compliance with the conditions imposed by the decision of the board.

7. In a proceeding by a surface railroad for the appointment of commissioners to determine the compensation, etc., for a crossing over the track of certain steam railroads, which the Board of Railroad Commissioners had decided should be at grade, defendants consented in writing to permit an engineer designated by the board to determine the point of intersection, without prejudice to other issues, after they had served answers admitting that they refused to allow petitioner to comply with the board's decision, and after an order to show cause why a temporary crossing should not be granted had been served. Held, that the consent was properly disregarded in granting the temporary crossing.

8. An appeal from an order granting a railroad a temporary crossing over the track of other railroads in a proceeding for the appointment of commissioners to determine the compensation, etc., for a perminent crossing, is not an appeal from a final order, and therefore a specification in the notice of appeal of an intention to bring up intermediate orders for review is not effective for such purposes, as Code Civil Procedure, Sec. 1301 and Sec. 1358, relate to appeals from final orders.—(Oneonta, C. & R. St. Ry. Co., vs. Cooperstown & C. V. R. Co., et al., 83 New York Supp., 308.)

WISCONSIN.—Street Railways—Franchises—Right to Use Streets—Rights of Abutting Lot Owners—Condemnation.

1. Rev. St. 1898, Sec. 1862, expressly authorizes municipal corporations to grant to street railway companies the right to use streets or bridges within the corporate limits for the purpose of laying tracks and running cars thereon. Held, that such grant by ordinance, being legislative in character, is not subject to revision by the courts at the suit of an abutting owner on the ground of inexpediency.

2. An ordinance granting use of streets to a street railway company only covers such rights as the Common Council has power to grant, and does not affect the right of the abutting lot owners, who own the fee to the center of the street, subject only to the public easement, and whose rights may be condemned as authorized by Rev. St. 1898, Sec. 1863a, as amended by Laws 1899, p. 537, c. 306, amended by Laws 1901, p. 686, c. 465.

3. A street railway company authorized by ordinance to construct its tracks on a public street, the fee to which is in the abutting lot owner, cannot burden the street with its tracks without obtaining the consent of such lot owners, or resorting to condemnation proceedings.—(Lange vs. La Crosse & E. Ry. Co., 95 N. W. Rep., 952.)

FINANCIAL INTELLIGENCE

Wall Street, Sept. 23, 1903.

The Money Market

A sharp recovery in sterling exchange has been the incident of the week in the money market. This movement, as it bears intimately on the question of the autumn money supply, is worthy of careful observation. It has not been occasioned, as might ordinarily have been expected, by any further hardening of foreign money rates. On the contrary, the foreign situation has improved over a week ago. Both the Bank of England and the Bank of Germany reported large additions to their surplus resources for the week ending last Thursday, the former institution having now regained an equal ratio of reserve to liabilities with a year ago. Neither of them found it necessary, in view of their stronger financial condition, to make a further advance in their discount charge. Consequently rates for money in the open markets have relaxed a trifle, and exchange has moved in favor of London, so far as the continental cities are concerned. That our own rates for sterling should have gone up rapidly, in face of these developments, indicates that the exchange market at this time is governed by other influences. The factor of most importance is the relatively small export trade in staple products, due entirely to the fact that prices for our cotton and grain have been forced so high by speculation that Europe is withholding its usual purchases. The figures for cotton particularly show that for September so far, the movement has been one of the smallest of recent years. Exports of wheat are less than half what they were at this period of 1902. These conditions are naturally reflected in an abnormal scarcity of commercial bills, and bankers who sold exchange short a fortnight ago, expecting to be able to cover when supplies should have become larger, have had to bid up rates sharply during the last week in order to complete their contracts. The practical consequences of all this are that gold imports as a possibility for our market have been rendered remote, and can no longer be counted as a probable auxiliary for bank reserves this autumn. In other respects the situation is unfolding along the lines that were suggested a week ago. Currency shipments to the interior, although still considerably less than last year, are increasing slowly. The Treasury is drawing heavily as the result of the enormous import trade, and there is no offset, either immediate or prospective, in sight. Last Saturday's bank statement showed a further loss of over $4,000,000 in cash holdings, and the surplus reserve was reduced to $13,000,000, Owing to the liquidation in industrial stocks, on the Stock Exchange loans decreased for the first time in five weeks, and this made the bank exhibit rather brighter than it would have otherwise been. It must also be remembered that the present surplus compares with a deficit of $1,300,000 last year. But, as already remarked, the stronger condition of the banks can hardly mean more than that the exhaustion point of surplus reserve will be postponed beyond the time that it has been reached in the last few preceding years. There has been no change in call money rates, which are still governed by the slackness of the demand from speculative quarters. Call money is quoted at 2¼ per cent. Time money rates, however, have hardened decidedly during the week. Sixty-day loans have been marked up from 4½ per cent to 5 per cent, and loans extending over the first of the year from 5½ per cent to 6 per cent on good mixed collateral.

The Stock Market

Interest in the Stock Exchange dealings has converged this week upon the industrial quarter of the market, which has been extremely unsettled by heavy liquidation, and a severe decline in United States Steel issues. This fall began with the sinking fund 5 per cent bonds which were adversely affected by the call for the extension of the underwriting syndicate which was to have expired on October 1, but has now been renewed for another nine months. Apparently some of the syndicate members have suddenly unloaded their allotments of the bonds, causing the sharp break which first attracted attention to the steel group. The movement in this quarter, however, has been completely overshadowed by the great weakness disclosed in the common stock, which, breaking all previous low records, sold down on Monday as low as 16⅞. There is still a great difference in opinion as to the real cause of trouble in these securities; some authorities feel sure it foreshadows an early reduction, if not a passing altogether of common share dividends. Other people believe that it is a forerunner of price-cutting and a general reaction in the steel trade, while others still, interpret the decline to liquidation not based on either of these causes, but simply due to the necessities of overburdened capitalists who are selling out their holdings of steel in order to protect their commitments elsewhere. We are inclined to accept this last as the correct analysis of the situation. Matters reached an acute stage at the end of last week in an incipient panic on the Pittsburg Stock Exchange, which is the home market for many of the steel industrials. In New York a strong bear party seized the opportunity afforded for a general attack upon the industrial shares, selecting particularly the securities of the steel-producing and steel-using companies. Owing to the extraordinary extent to which United States Steel issues are distributed in the hands of small investors, possibly no single event of the season has had a more unsettling effect upon general sentiment in the market than has their downfall during the past ten days. Had not liquidation already gone to great lengths in other directions the effects would unquestionably have been more serious. As it is, the railroad shares, although holding comparatively steady, have, as a rule, declined, and the reassuring news from the harvests has fallen flat. Regarding the crops, it may be said that only ten days more of uncertainty remain before corn can be considered out of danger. Some damage was done by the heavy frosts in certain sections a week ago, but it does not appear to have been at all serious, and, in fact, the whole question of the crops will soon be eliminated from Wall Street discussion. The condition, as we have described it, in the money market offers an unanswerable argument against new speculation for the rise, and in this way it becomes also a contention against any important advance in prices during the immediate future. But what the market is now most anxiously concerned about is the outcome of events in the steel and other industrial stocks, and it is upon their course that the immediate movement in the general list seems more particularly to depend.

Dealings in the local traction group have been less conspicuous altogether than they were a week ago. Manhattan and Metropolitan were marked down sharply while the turmoil in the steel stocks was at its height, but there was no special significance to their decline. No further demonstration was attempted against Brooklyn Rapid Transit, although the extreme reluctance of these shares to recover must be disappointing and discouraging to their holders. The best opinion is that recent selling of Rapid Transit stock has come from rather important speculative sources, probably from certain large speculators who started in some time ago to bull the stock, and have now elected to take heavy losses rather than to continue their hopeless enterprise. The publication yesterday of the new franchise tax valuations for the year attracted some discussion, as it showed an increase of $16,000,000 in assessable values. But, until a more detailed statement is given out it is, of course, impossible to tell how this extra burden is distributed.

Philadelphia

Prices have generally moved downward during the week in the Philadelphia market. Philadelphia Company common, affected like other speculative issues by the violent decline in Lake Superior securities, sold down from 39⅛ to 38¼, the lowest figure on record. All the stocks affiliated with the Rapid Transit Company have weakened, under the influence of the company's rather disappointing annual report. Although gross earnings showed an increase of $1,300,000, and total income an increase of $500.000, this was more than offset by additional fixed charges which left a surplus of only $408,000, as compared with a surplus of $1,078,000 in the fiscal year of 1902. Rapid Transit stock declined from 14 to 13½, Philadelphia Traction from 96 to 94½, and Union Traction from 44 to 43¾. An unfavorable report for the year was also issued by the American Railways Company, in which net income was shown to have decreased $28,000. Following its publication the stock fell two points from 45 to 43. The only other transactions recorded were in Consolidated Traction of New Jersey from 61 to 60, and Chicago Union Traction at 5.

Chicago

Liquidation confined to scattering lots has been the feature of the week in Chicago. Metropolitan Elevated common sold down to 18 and the preferred to 55, both of these being new low records. Northwestern preferred broke to 60 and South Side also made a new

low level, declining from 96 to 94. The weakness in all these cases results not so much from selling pressure as from a total absence of buying orders. Lake Street Elevated has also been weak, declining a point to 5½. There are no new developments in the reorganization proceedings of this company, but the latest advices from Chicago indicate that attempts to rehabilitate the company by means of an assessment on the stockholders will not succeed, and intimate that the road will eventually pass into the hands of interests identified with the Northwestern Elevated. It is said by those who have seen the figures for the eight months ending August 31, that the earnings for the City Railway for the current fiscal year will be substantially larger than those of the previous year. The stock has been steady at 175. Only one or two sales have occurred in Chicago Union Traction at 5. The full effect of the more liberal use of surface transfers on the North and West sides has now been felt, and no further increase in surface competition is to be expected until the franchise matter is settled and the several systems radically improved. This will probably be a matter of some years, so that the elevated roads do not have to fear yet awhile that their business will be cut into by the surface lines.

Other Traction Securities

Very little of consequence has occurred in the Boston dealings during the week. Trading in Massachusetts Electric, which ordinarily is fairly active, has been next to nothing. The common stock sold down to 19¾ and back to 20, while the preferred has changed hands between 78½ and 79. West End common sold as high as 90½, and later at 88¾ "ex" the dividend. The preferred sold at 108. Boston Elevated, on fractional lots, went from 137 to 137½, down to 136, then back again to 137. In Baltimore the liquidation in the United Railway issues noted for sometime past has continued. There is a good deal of talk that the company in replacing its old rails with new, may have to dispose of some more bonds in order to pay for the improvements. Although officials of the road deny this the market has taken the attitude of anticipating another bond issue. The income bonds accordingly have declined from 62¼ to 62⅛, the general mortgage 4s from 90¼ to 89¼, and the stock from 10½ to 10. Other Baltimore transactions for the week include Northern Traction 6s at 106, City & Suburban 5s at 112, and City Passenger 5s at 106½. On the New York curb the week's dealings in the Traction securities have amounted to almost nothing. Sixty-five shares of Interborough Rapid Transit sold at 97, and 300 shares at 95½ to 95⅝, 125 St. Louis Transit sold at 17½, and a small lot of Washington Traction & Electric preferred at 39.

The Cincinnati market showed slightly improved activity over last week. About 500 shares of Cincinnati Street Railway sold at between 129½ and 130¼. Detroit United sold to the extent of 140 shares, opening at 70 and closing at 68. Two hundred Toledo sold at 22½, a very low figure. Columbus Railway preferred sold at 100½, and the common at 89; both small lots. There was considerable activity in traction bonds. Eighteen thousand dollars' worth of Mansfield Railway, Light & Power Company's 5s sold at 101, $14,000 worth of Zanesville Railway, Light & Power at 101, and $11,000 worth of Columbus, Delaware & Marion at the same figure. Toledo, Bowling Green & Southern 5s brought 97½ for $6,000 worth, Northern Ohio Traction 5s brought 99, while Columbus Railway 5s brought 105.

It was one of the quietest weeks on record in Cleveland. The total sales numbered less than 200 shares of stock. Northern Texas Traction declined two points, selling at 32¾. Northern Ohio Traction sold at 18 for small lots, but the offerings at that figure were in excess of the demand.

Security Quotations

The following table shows the present bid quotations for the leading traction stocks, and the active bonds, as compared with last week:

	Closing Bid Sept. 15	Sept. 22
American Railways	43½	43
Aurora, Elgin & Chicago	a20	a20
Boston Elevated	137	137
Brooklyn Rapid Transit	38¾	37¼
Chicago City	*170	170
Chicago Union Traction (common)	5	4½
Chicago Union Traction (preferred)	32	30
Cleveland Electric	69	a70¾
Columbus (preferred)	—	—
Consolidated Traction of New Jersey	59	60
Consolidated Traction of New Jersey 5s	104¾	104½
Detroit United	68	65¼
Elgin, Aurora & Southern	a42	a42
Lake Shore Electric	—	—
Lake Street Elevated	5¾	5⅜
Manhattan Railway	133	132½
Massachusetts Electric Cos. (common)	20	19
Massachusetts Electric Co. (preferred)	78	78
Metropolitan Elevated, Chicago (common)	18	18
Metropolitan Elevated, Chicago (preferred)	55	53
Metropolitan Street	113¾	112
New Orleans (common)	10¼	10
New Orleans Railways (preferred)	30	30
North American	75	75
Northern Ohio Traction & Light	17¾	15
Philadelphia Rapid Transit	13½	13½
Philadelphia Traction	96¼	94½
St. Louis Transit (common)	18	17
South Side Elevated (Chicago)	95	94
Syracuse Rapid Transit	a30⅝	—
Syracuse Rapid Transit (preferred)	a76½	—
Third Avenue	108	108
Toledo Railway & Light	20	20
Twin City, Minneapolis (common)	91¾	—
Union Traction (Philadelphia)	43⅝	43¾
United Railways, St. Louis (preferred)	68	65

a Asked. b Last sale. * Ex-dividend. † $10 paid.

Iron and Steel

The record of the iron trade continues to be much the same as in the past few weeks. Consumption is enormous—it is estimated at the rate of 19,000,000 tons of pig iron per annum—but production is larger still, and the furnaces are competing actively for orders. No further cuts, however, have been announced in prices, although more are expected in the immediate future. The finished branch of the industry continues in a flourishing condition. The settlement of the labor troubles in the building trades promises to add greatly to the volume of business in structural material, which is already very heavy. A more active demand is also observable in wire products, with conditions favoring higher prices. Quotations are as follows: Bessemer pig iron $17 to $17.35 a ton, Bessemer steel $27, and steel rails $28.

Metals

Quotations for the leading metals are as follows: Copper 13¾ cents, tin 27¼ cents, lead 4⅜ cents, and spelter 6 cents.

PROPOSED SUIT BY JERSEY CITY QUASHED

The onslaught against the Jersey City & Bergen Railroad Company by the Mayor of Jersey City has received a severe set back by the Attorney-General of New Jersey, who characterizes as next to outrageous the attempt of the Mayor to compel the company to apply for new franchise rights, because the claim is made that the company's charter expired nineteen years ago, and that the company is in default of car license fees imposed in its charter. The company is now controlled by the Public Service Corporation, recently organized, and pays local taxes in Newark, and a car license in addition. It seems that negotiations with the Mayor were conducted by the company in a friendly spirit until it was seen that the whole thing was a most unfriendly move. Then the company prepared to combat the attempt to usurp its rights. Before the case could be begun by the city, however, the Attorney-General had to be fully informed as to the issue, it also being necessary to secure his consent to launch the contest. The Attorney-General, as soon as application had been made to him, positively refused to countenance the suit, and flatly refused to permit the issue to reach the courts. In disposing of the case he declared that he is convinced of the impropriety of the attack upon the company, because Jersey City, by the passage of an ordinance, permitted the lessee of the Old Jersey City & Bergen Company to expend a large sum of money in transmitting its motive power on the assumed existence of its corporate existence. A mortgage, he declares, was several years ago placed upon the property and franchise of the company and its allied roads to secure millions of dollars worth of bonds now held by individuals, banks and institutions of all kinds. During all this time Jersey City has remained silent. Very recently a large amount of new capital has been invested in an enterprise of which the railroad is an important constituent. And, concluding, the Attorney-General says: "It would, it seems to me, be very unwise and injudicious at this late day to hazard the risk of loss of confidence and public alarm that might and would probably arise from the exploitation of the suggestion, based, as it is, upon a mere technicality, whose legal force does not impress me, and for these reasons I feel constrained to refuse the application."

ANNUAL REPORT OF THE AMERICAN RAILWAYS COMPANY

The annual report of the American Railways Company for the year ending June 30, 1903, has just been made public. Besides the general operating figures, and the balance sheet, details are given of the holdings of stock by the company. The report shows that the gross earnings of the subsidiary companies were $1,245,298, an increase of $238,802 in excess of 1902. This is a gain for the year of more than 23 per cent. After paying all fixed charges, interest and taxes, the net income was $274,692. Dividends were paid to the stockholders of the company amounting to $223,774, leaving a balance of $50,917 to be added to the credit shown in 1902, of $330,865, which makes the surplus, June 30, 1903, $381,783. The holdings of stock are given as $3,709,300, while the holdings of bonds are given at $599,991. The total par value of the stock and the bonds is given as $4,309,291, and the cost is given as $3,493,256. The stock owned by the subsidiary companies is given as follows: Bridgeton & Millville Traction Company, $116,525; Altoona & Logan Valley Traction Company, $247,150; Du Page Construction Company, $3,400,000. The bonds owned by the subsidiary companies are given as follows: Bridgeton & Millvale Traction Company, $250,000; Du Page Construction Company, $2,600,000.

The figures of earnings, as given in the report, follow:

Year ending June 30—	1903	1902
Gross sub-companies	$1,245,298	$1,006,496
Income		
Interest on bonds and dividends on stocks.	274,073	207,608
Miscellaneous income	148,954	162,776
Gross income	$423,028	$370,384
Deductions from income—		
General expenses	37,079	31,146
Printing, etc.	1,027	5,534
Legal expenses	1,977	1,765
Taxes	8,319	3,386
Interest on bonds	99,428	25,427
Department, office, etc.	503	393
Total deductions	$148,336	$67,652
Net income	274,691	302,731
Dividend (American Railway stock)	223,774	178,178
Surplus	50,917	124,552
Profit and loss, balance June 30	381,783	330,865

The general balance sheet follows:

ASSETS

June 30—	1903	1902
Cost stocks and bonds	$3,493,256	$3,468,196
Bills and accounts received	3,938,998	2,830,460
Tax on capital stock to Dec. 31, 1901	.....	1,687
Office furniture, etc.	3,168	2,792
Engineering department, instruments	1,359	744
Discount loans not due	5,308	3,492
Interest on bonds owned	15,000	15,000
Dividends declared, not due (stock owned)	.....	.....
Du Page Construction Co., advertising	.....	.....
Bridgeton & Millville extension	.....	.....
Port Norris extensions, etc.	.....	234,586
C. & J. E. Railway Company, construction.	213,495	.....
Collateral Trust 5 per cent bonds, in treasury	.....	910,000
Cash	42,582	67,303
	$7,713,171	$7,534,264

LIABILITIES

Capital stock	$3,903,000	$3,751,000
Collateral Trust 5 per cent bonds	2,448,000	2,500,000
Bills payable	890,000	875,000
Bills audited	28,702	11,036
Vouchers	22,305	.....
Account insurance fund	25,890	29,442
Interest accrued on bonds	10,200	6,625
Interest accrued on floating debt	110	3,730
Taxes accrued	3,180	.....
Balance due sub-companies	.....	26,564
Profit and loss	381,783	330,865
Total	$7,713,171	$7,534,264

ANNUAL REPORT OF THE PHILADELPHIA RAPID TRANSIT COMPANY

The annual report of the Philadelphia Rapid Transit Company for the year ending June 30, 1903, was made public at the annual meeting of the company, held last week. This is the first annual report of the company, and the figures of the Union Traction Company and its constituents are taken for purposes of comparison. The receipts from passengers show an increase for 1903 of $1,308,574, while the earnings from operation show an increase for 1903 of $476,020. The gross income for 1903 showed a gain of $485,860. The net earnings, after licenses and taxes had been deducted from the gross income, were $398,999. The net profit for 1903 showed a decrease of $672,151, but the obligation of the company to the Union Traction Company and its constituents must, of course, be considered. The operating figures follow:

OPERATIONS OF THE PHILADELPHIA RAPID TRANSIT COMPANY FOR THE YEAR ENDING JUNE 30

	1903	1902
Receipts from passengers	$15,277,806	$13,969,232
Operating expenses	7,234,892	6,402,338
Earnings from operation	$8,042,914	$7,566,894
Miscellaneous receipts, interest, etc.	158,766	148,925
Gross income	$8,201,680	$7,715,820
Licenses and taxes paid and accrued	990,702	903,841
Net earnings	$7,210,978	$6,811,979
Fixed charges, paid and accrued	6,805,089	5,733,939
Net profit	$405,889	$1,078,040

REPORT OF TREASURER OF THE PHILADELPHIA RAPID TRANSIT COMPANY FOR THE YEAR ENDING JUNE 30, 1903.

RECEIPTS

Capital, instalment on shares	$3,079,370
Passenger receipts	15,268,634
Chartered cars	9,173
United States mail	38,872
Real estate (rents)	18,788
Advertising	61,250
Miscellaneous	258,112
Bills receivable	31,750
Interest	25,022
Open account	1,250,000
	$20,040,971

DISBURSEMENTS

Bonus on charter and organization expenses	$115,325
Fire insurance fund	850,000
Pay rolls	5,102,114
Operation, construction and equipment accounts	5,383,400
Stocks of underlying companies	1,578,059
Advances to leased lines	323,188
Sundry advances	135,687
Advances to agents	10,500
Taxes and licenses	625,571
Fixed charges	5,267,399
Real estate purchased	334,213
	$19,725,456
Balance	$315,514

THE BALANCE SHEET, AS OF JUNE 30, 1903, FOLLOWS

ASSETS

Cash	$315,514
Cash in agents' hands	10,500
Fire insurance fund	850,000
Advanced to leased lines	323,188
Supplies	905,599
Construction and equipment	2,013,459
Real Estate	334,213
Accounts receivable	128,568
Sundry stocks	1,578,059
Franchise account	115,325
Total	$6,574,425

LIABILITIES

Capital stock	$3,000,000
Second instalment account capital	79,370
Accounts audited, but not due	307,719
Fixed charges and taxes accrued	1,954,392
Open accounts	827,055
Profit and loss	405,889
Total	$6,574,425

During the year approximately twenty-five miles of new lines were built, some being extensions to existing lines and others entirely new railways. Of the new railways, Fifty-Eighth Street and Sixtieth Street, running from Woodland Avenue to Lansdowne Avenue; Allegheny Avenue, from Glenwood Avenue to Kensington Avenue, and the Torresdale Avenue line, running from Orthodox Street to Cottman Street, have been put in operation. Twenty-three and one-half miles of track were renewed during the year under review, the materials used in all cases being much heavier than used in the original construction. There was also laid during the year 550,564 lineal feet of duct conduits.

The power equipment has been increased by 1500 kw. A number of new cars of the large type have been added to the equipment.

Th only reference made to the elevated railway and subway, from Sixty-Third Street and Market Street, to Delaware Avenue and South Street, was that plans have been prepared and work begun on the road, and the statement that "the properties on the east side of Front Street, from Market Street to Arch Street, have been acquired."

PROGRAMME OF THE NEW YORK STATE STREET RAILWAY ASSOCIATION

As already announced in these columns, the twenty-first annual convention of the New York Street Railway Association will be held this year at the Yates House, Syracuse, on Oct. 6 and 7. A list of the papers and the subjects to be discussed at the meeting was published on page 568 of the issue of Sept. 12. The executive committee is very desirous to have a large attendance, and has requested the announcement be made that supply men are particularly invited and will be tendered a cordial welcome. There will be space provided for small exhibits in the writing room and rotunda of the hotel. Applications for space should be addressed, with full particulars, to Philip J. Honold, care Syracuse Rapid Transit Company, Syracuse, N. Y.

Syracuse is always an attractive city to visit, and particularly so at this period of the year. The Syracuse Rapid Transit Company has made a number of improvements in its system during the past two or three years, so that, from a street railway standpoint, the visitor to the city will find a great deal to interest and instruct him in a study of the street railway system. The general entertainment programme has been drawn up under the direction of Mr. Connette, the popular general manager of the Rapid Transit Company, and is a most attractive one. The complete programme follows:

PROGRAMME

TUESDAY, OCT. 6—

9:30 a. m.—Meeting of the executive committee

10:00 a. m.—Meeting of the Association.

Order of business:

1. Roll call.
2. Approval of minutes.
3. Address of the president.
4. Report of the executive committee.
5. Minutes of the special meeting of the executive committee.
6. Report of the treasurer.
7. Reading of papers on practical street railway subjects and discussion of the same.
8. Miscellaneous business.
   (*a*) The appointing of nominating committee.
   (*b*) Nomination of officers.
   (*c*) Election of officers.
   (*d*) Selection of place of next meeting.

ENTERTAINMENT

10:30 a. m.—A committee of ladies will meet visiting ladies in the parlors of the Yates Hotel, to accompany them on a trolley ride in parlor car "Syracuse" over the lines of the Syracuse Rapid Transit Railway Company to points of interest. The trip will end at Onondaga Valley, where luncheon will be served.

2:30 p. m.—Tally-ho coaches will be in waiting to take the party to the Onondaga Indian reservation and Green Lake Park. This will be a trip through a picturesque and beautiful country. If the weather is unfavorable other entertainment will be provided.

8:00 p. m.—Annual dinner, Yates Hotel.

WEDNESDAY, OCT. 7—

9:30 a. m.—Meeting of the Association.

1. Unfinished business.
2. Reading of papers and discussion of same.

12:00 m.—Adjourn.

ENTERTAINMENT

9:30 a. m.—The ladies will be given a trolley ride in special cars to Edwards' Falls over the lines of the Syracuse & Suburban Railroad Company. Special cars will leave the corner of Fayette Street and Montgomery Street.

1:00 p. m.—A trip to Skaneateles on special cars over the line of the Auburn & Syracuse Electric Railway Company. This route is designated the "Scenic Route," as very picturesque landscapes can be seen along this line. On arrival at Skaneateles arrangements have been made to take the party on the steamboat "City of Syracuse" for a trip on Skaneateles Lake, one of the most beautiful lakes in Central New York. The cars for this trip will leave promptly at time designated, and all who desire to go must be on hand promptly.

5:30 p. m.—A Bohemian luncheon will be served at Long Branch, on the line of the Syracuse, Lakeside & Baldwinsville Railroad, and there will be music and dancing in the very fine dancing parlor; also those desiring to bowl will find a first-class bowling alley at this point, which will be free for the use of all delegates wearing badges.

SPECIAL

As soon as the guests arrive at the hotel and register, a badge will be supplied by the Association, which will entitle the wearer to free transportation during the convention on the lines of the Syracuse Rapid Transit Railway Company, the Auburn & Syracuse Electric Railway Company, the Syracuse, Lakeside & Baldwinsville Railway Company and the Syracuse & Suburban Railroad Company.

TRANSFER SWINDLE AT BOSTON

The Boston & Northern Street Railway Company seems to have run down an extensive scheme to defraud the company by means of bogus transfer slips. Several employees have already been arrested, and more will probably be implicated before long. It is said that no less than five plates have been traced to different parts of Boston, and that the majority of the conductors have been guilty of handing in the bogus slips. Reports from some quarters say the loss to the company has been heavy, but President Sullivan, of the company, is quoted as saying that it does not amount to more than $10,000.

INDIANA COMPANY TO AWARD CONTRACTS

The Kokomo Railway & Light Company, of Kokomo, Ind., will receive bids up to Oct. 14, 1903, at office of the company and the Indiana Interurban Construction Company, in Kokomo, for the complete construction of power house, sub-station and installation of all machinery and all equipment. Detail plans and specifications covering this work will be on file on and after Oct. 1, 1903, at the office of the companies. Bids will be received for the whole work complete or in part.

STRIKE AT SEATTLE A FARCE

For the second time within a year the people of Seattle have been inconvenienced, and the Seattle Electric Company has been caused an unnecessary amount of annoyance, through attempts by the local branch of the Amalgamated Association of Street Railway Employees of America to tie up the street car lines of the Seattle Company in the hope that the demands of the men for new conditions of service would be acceded to by the company. Last March the first fiasco was witnessed, and on Sept. 9 the second comedy was gone through. The strike of Sept. 9 was declared because President Furth, of the company, flatly refused to grant the demands made or to submit them to arbitration. These demands included recognition of the union, the reinstatement of all men discharged by the company because of their connection with the union since the strike last March, a wage scale of 30 cents an hour, time and a half for overtime and on legal holidays and other unimportant demands. Of the 600 employees it is said that seventy-five abandoned their cars. The service was not affected materially, and there are no reports of intimidation or violence.

STREET RAILWAY PATENTS

[This department is conducted by W. A. Rosenbaum, patent attorney, Room No. 1203-7 Nassau-Beekman Building, New York.]

UNITED STATES PATENTS ISSUED SEPT. 15, 1903

738,773. Car Truck; Edward Cliff, New York, N. Y. App. filed May 2, 1903. The bolster floats upon two leaf-springs arranged transversely of the truck beneath each end of the bolster, said springs being supported upon swinging links.

738,774. Car Truck; Edward Cliff, New York, N. Y. App. filed June 10, 1903. A modification of the preceding patent.

738,883. Car Brake; Thomas E. McCollum, Toronto, Can. App. filed Nov. 10, 1902. Relates to a "momentum brake."

738,840. Car Truck; Edgar Peckham, New York, N. Y. App. filed March 28, 1901. Relates to the manner of mounting a spring support for the bolster; other features are claimed.

738,841. Truck; Edgar Peckham, Kingston, N. Y. App filed Sept. 25, 1902. An improvement of the preceding patent, relating to the construction of the side beam.

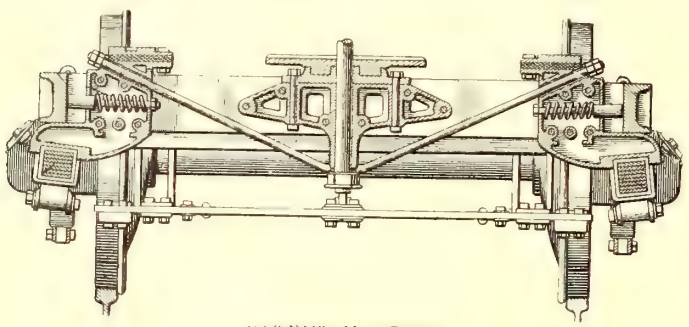
738,856. Brake-Shoe; Alfred L. Streeter, Chicago, Ill. App. filed March 23, 1903. A two-part brake-shoe, each part having a malleable iron loop to form an attaching lug with its ends upturned and embedded in the cast metal of the shoe.

738,900. Automatic Car Fender with Brake Attachment; William K. Given, Pittsburg, Pa. App. filed Jan. 2, 1903. Means whereby the brakes are automatically applied when the fender comes in contact with an obstruction.

738,906. Track Instrument for Railway Signaling; Lewis R. Hummel, Omaha, Neb. App. filed Aug. 29, 1902. The flange of a car wheel tilts the cover of a box placed beside the rail and alters the condition of a circuit closer in the box.

738,919. Suspension of Trolley Wires; Martin T. A. Kubierschky and Paul Herkner, Berlin, Germany. App. filed June 8, 1903. Grooves for the reception of the ends of the wires having keys therein which engage the wires and increase their grip with the tension on the wires.

738,926. Trolley; Harry E. Myers, Kittanning, Pa. App. filed Oct. 13, 1902. A pair of pivoted guards mounted on the trolley



PATENT NO. 738,841

head and having extensions projecting across the periphery of the wheel to keep the wheel on the wire.

739,017. Car Mover; Richard Miller, Appleton, Wis. App. filed Dec. 9, 1902. Details of construction.

739,032. Electric Railway; Willis N. Stewart, London, England. App. filed Nov. 24, 1902. Main and auxiliary motors carried by the train, the former being supplied by storage batteries and the latter taking current from an overhead conductor at points only where additional power is required.

739,056. Make and Break Switch for Electric Signals; Charles B. Campbell, Waterloo, Iowa. App. filed Jan. 20, 1903. Details of a make and break switch to be operated by contact of a trolley wheel.

739,057. Automatic Signal for Electric Railways; Charles B. Campbell, Waterloo, Ia. App. filed Jan. 20, 1903. Details.

739,066. Circuit Breaker for Automatic Electric Railway Signals; Roy A. Doty, Waterloo, Ia. App. filed March 31, 1903. A mechanism which will, without short circuiting, break the circuit through the signal lights after a predetermined number of cars have left a track section upon which they have been moving.

739,074. Railway Vehicle; George Gibbs, New York, N. Y. App. filed Dec. 8, 1902. The frame of the car is of metal as is also the outside sheathing, the lining being non-metallic, non-splintering and non-combustible or of slow-burning composition.

739,135. Car or Other Vehicle-Stopping Device; Joseph P. Angell, Pine Bluff, Ark. App. filed April 14, 1903. A skid having portions to be engaged by and to extend beneath a vehicle wheel, and a wheel or roller journaled on the skid adapted to simultaneously engage the wheel and the rail, said skid being normally held above and in advance of the car wheels.

739,164. Trolley; Elmer E. Frederick, Easton, Pa. App. filed April 30, 1903.. Three metal balls set in ball bearings in a trolley harp between which the wire runs.

739,179. Trolley Alarm and Indicator; William H. Hillyer, Atlanta, Ga. App. filed July 19, 1902. An indicator showing the conductor or motorman when the trolley is off the wire.

739,223. Trolley Harp; Harrie A. Ripley, Westdale, Mass. App. filed Jan. 26, 1903. Details.

PERSONAL MENTION

MR. JAMES MURDOCK, of Lafayette, Ind., one of Indiana's most prominent electric railway promoters, and the head of the syndicate owning the traction lines at Richmond, has returned from an extensive visit to Germany. Mr. Murdock appears to be much improved in health.

MR. H. H. HUNT, manager of the Tampa Electric Company, of Tampa, Fla., has been called to the home office of Stone & Webster, in Boston, to take charge of their southeastern group of properties as district manager. Mr. G. W. Wells has succeeded Mr. Hunt at Tampa.

MR. WILLIAM S. BARSTOW, consulting electrical engineer, announces that he has removed his offices to 56-58 Pine Street. (Suite 1100, 1101, 1102, 1103), New York City. Mr. Barstow will continue to give special attention to the engineering and development of electrical properties.

MR. FREDERICK A. WRIGHT, a well-known railroad man of New York City, died at his home in Brooklyn last week. He was at one time a general superintendent of the Brooklyn City Railroad Company, and later was in charge of the claim agents' department of that corporation.

SIR DAVID BARBOUR, Lord Ribblesdale, Mr. George Gibb and Sir J. Dickson Poynder, members of the Royal Commission of London Street Traffic, which was appointed last July to study American street railway systems, sailed for New York Sept. 18 on the White Star Line steamer "Arabic."

MR. J. S. YOUNG, general passenger agent and assistant superintendent of the Toledo Railways & Light Company, of Toledo, has resigned from that company to become auditor of the Rapid Transit Company, of Chattanooga, Tenn., controlled by the United Railways, Light & Water Company, of Philadelphia, Pa.

MR. HENRY E. HUNTINGTON arrived in Los Angeles, Cal., Sept. 5, on a brief trip of inspection of the properties of the Pacific Electric Railway Company, the Los Angeles Railway Company and the Los Angeles Traction Company. He has but recently become interested in the latter system. The plan is to raise it to the same standard of excellence that characterizes his other lines at Los Angeles.

MR. FRANK S. CUMMINS has been appointed chief engineer of the Interurban Railway Company and the Des Moines City Railway Company, of Des Moines, Ia. Mr. Cummins pursued his engineering course at the University of Wisconsin, and has been connected with the Chicago, Rock Island & Pacific Railway and the Des Moines, Iowa Falls & Northern Railway. The Interurban Company has 40 miles of line in operation, and will build between 30 miles and 50 miles more.

MR. WALTER L. ADAMS has been elected general manager of the Milford & Uxbridge Street Railway Company, of Milford, Mass., succeeding Mr. E. W. Goss. Mr. Adams formerly was superintendent and purchasing agent of the Montville Street Railway Company, and the Norwich Street Railway Company, of Norwich, Conn. He was connected with the Norwich Company from 1892, when he came from Newburyport, Mass., where he was interested in street railway work until July, 1903. When the Montville Company was organized in 1900, he was appointed to act for that company also.

IMPORTANT CHANGES have been announced in the officials of the Allis-Chalmers Company. Mr. G. O. Dixon, of Scranton, Pa., has been appointed general manager of all the plants in the combine. Mr. Dixon was formerly at the head of the Scranton company, which became a part of the engine-building combine. Mr. David Harlowe, of Milwaukee, formerly superintendent of the Clinton Street works of the E. P. Allis Company, in Milwaukee, has been named as general transfer manager of the company, with authority at every plant. Mr. William P. Harper, assistant purchasing agent of the company, has been promoted to general purchasing agent. This position has been held by Mr. H. F. Young, of the Gates Works.

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EDITORIAL NOTICE

Street railway news, and all information regarding changes of officers, new equipments, extensions, financial changes and new enterprises will be greatly appreciated for use in these columns.

All matter intended for publication must be received at our office not later than Tuesday morning of each week, in order to secure insertion in the current issue.

Address all communications to

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114 Liberty Street, New York.

Merchants' Association in Politics

The Merchants' Association having failed to impress the Legislature sufficiently to induce that body to accept its advice on matters pertaining to the transportation problem in New York, has turned its attention to the local political organizations, and has endeavored to persuade the leaders to incorporate in their respective platforms pledges of "reforms" in the present street railway methods and facilities offered the people of this city. The suggestions seem to have been received with scant courtesy, judging from the daily newspaper reports, even in quarters where attention might reasonably be expected. The trouble seems to be that reformers are impatient with each other as well as the world at large, and thus we find very often that one reformer resents as an unwarranted intrusion or interference any suggestion offered by other reformers. Each is engrossed in his own particular brand of reform, and looks upon the evil which he is trying to eradicate as the greatest calamity the world has ever been called upon to suffer. They are all bent upon effecting the salvation of the community—in their own way—even though the people may be openly indifferent. When Jerome and Fulton and Cutting and Russell—all reformers of the first magnitude—cannot agree on what and how to reform, it seems hopeless to look for harmony and unanimity with such a factor as the Merchants' Association "butting in," if we may borrow an expression much in vogue among reformers.

It would seem as if successful business men after suffering rebuffs on all sides and receiving neither encouragement nor approval in any form, would stop to consider the cause of this feeling. We have no doubt that the vast majority of members of the Merchants' Association are honest in their efforts to secure relief, but they have made a grievous mistake in entrusting the direction of the movement to men who lack judgment and discretion. They have accomplished nothing, although they had splendid opportunities, because they did not know how to use them. They antagonized everybody they encountered, denounced corporations and public officials indiscriminately for conditions which the merchants themselves did as much to create as any one else, but the culmination of their folly was in a threat to secure legislation which would place the objectionable officials and the railway companies at their mercy. The bill which they offered the Legislature as a solution of the problem "failed of passage," because it was recognized as unnecessary, impracticable and inexpedient, and when they appealed to the city conventions last week even Mr. Low's political managers did not treat them seriously. The Merchants' Association has itself alone to blame for its lack of influence in this community.

Subway Extensions

In the discussion before the Rapid Transit Commission last week regarding future work upon the subway, the contractors called attention to the fact that an undertaking of such magnitude could not be successfully accomplished without subjecting the public to some inconvenience, and they reminded the board that the great benefits to be derived from the early completion of this improvement ought to reconcile, as they would certainly compensate, the merchants and property owners affected for the temporary annoyance and financial loss sustained. Unless the public was prepared to make sacrifices the work could not be prosecuted expeditiously, and the whole plan might as well be abandoned at once, for the relief sought could not be obtained. It was estimated that under the restrictions proposed by the Rapid Transit Commission it would take at least ten years to finish the extension of the subway in lower Broadway now under construction, whereas the increased facilities are now badly needed. It should not be necessary to call attention to the fact that the present subway operations are only the beginning of the underground construction which will be required; and it must go on without intermission for many years to come, until Manhattan Island and the rivers on each side of it are honeycombed with tunnels, if this city is to enjoy fully the advantages of its position, and the people are to be afforded suitable transportation facilities.

Broadway merchants, hotel keepers and property owners still oppose the tearing up of that thoroughfare through the shopping and theatrical district so strenuously that serious attention is being given the suggestion that the proposed route be changed to Seventh Avenue. Objection is to be looked for in that quarter, also, but the annoyance and loss would not be nearly so great as in the case of Broadway, at least while the work was in progress. The effect upon the respective districts, however, is hard to predict. Many Broadway property owners fear that the subway in Seventh Avenue would raise the im-

portance of that thoroughfare so that Broadway's supremacy would be endangered, and for this reason they are urging the adoption of deep tunnel plans which would permit of the building of the line along the route originally selected without obstructing the thoroughfare seriously.

The Commissioners do not seem inclined to approve such a radical change, yet, in any event, they must assume the responsibility in the settlement of this controversy, and the urgency of the case demands prompt and decisive action.

The Use of Oil Versus Grease

The use of oil as against grease for lubrication of all of the journals on an electric railway equipment is now thoroughly established for all the larger sizes of motors, and its advantages for use in this particular have induced many companies to introduce it on the older, smaller motors, which were designed originally to use grease. It is now being realized that grease as a journal lubricant is somewhat in the nature of a makeshift. Its use, heretofore, has been largely due to the inadequacy or complication of methods of oil lubrication. As soon as heavier motor equipments came into use grease, because of its stiffness, was found to give inadequate lubrication, and the use of oil was practically forced upon elevated and interurban railway companies.

The discussion at the convention of the American Railway Mechanical and Electrical Association showed that even on the smaller motors there is an immense saving in journal wear when oil is substituted for grease, and that there are a number of devices now available whereby oil can be used without undue waste. This, of course, does not mean that oil is to be substituted for grease in locations where it is impossible properly to feed oil to the surfaces to be lubricated without excessive loss of oil, but it has been found that oil can be used on motor bearings of all sizes with advantage.

The Increasing Use of Light Gear Cases

The discussions at the Saratoga Convention of the American Railway Mechanical and Electrical Association also revealed the fact that gear cases of lighter construction than the ordinary cast-steel or cast-iron cases are finding favor in a great many places, and that their use is probably on the increase. Some roads are using gear cases made either entirely or in part of sheet steel, riveted to a frame of angle-irons, which form the corners. Others are using gear cases made of wood fastened to metal frames. Sheet steel and canvas have also been employed. A tendency is noticeable among the larger companies to make various improvements in the methods of fastening gear cases to motors when new motors are being constructed. So far the use of sheet steel or wood-gear cases has been mainly confined to older equipments, but it is a question whether the use of gear cases of this kind will not increase rather than diminish in the long run. A gear case of sheet steel or wood is very much lighter than one of cast-iron or steel, and this fact alone makes the lighter gear case less liable to destroy itself than the heavier gear case, to say nothing of the advantage of saving in weight of equipment. Of course, the sheet steel and wood gear cases are not strong, but those who advocate this form for universal use argue that many of the blows which they receive in service are sufficient to break any gear case, no matter whether it is of cast-iron or made of some lighter material, and that, furthermore, if a light gear case does become loose it is simply torn off the motor like a piece of paper and is left behind, while a heavy cast-iron or steel case would wreck the gears, and possibly wreck the car as well, in high-speed interurban service. It is also argued that as long as a gear case is something that is sure to be destroyed at times in any event, it is better to have a cheap one that will only wreck itself and not endanger the car also. It would seem that the movement toward lighter gear cases is entirely logical.

Block Signals

There is now a number of automatic electric block signal systems offered on the market for use on both single and double-track electric railways. In other words, manufacturers and inventors are making strenuous efforts to meet the great demand which has suddenly sprung up for a simple, reliable automatic block signal system. The block signal systems offered for use on electric roads are nearly all of them very similar from an operating standpoint, although differing considerably in details and in the number of wires required. All of them are radically dissimilar from the automatic block signals used on steam roads. They differ not only in construction and circuits, but require an entirely distinct set of operating rules from steam railroad block signal systems. These rules are a little more complicated than those governing steam railroad block signals, but it is doubtful whether any automatic block signal system for electric roads will soon be offered which will not involve these slightly more complicated rules.

The essential difference in the operation of the two systems is, briefly, that the ordinary signals used on steam roads are two-position signals, while those which have been most commonly used on electric roads are three-position signals. The steam road signal either indicates "clear" or "danger." There is no opportunity for it to indicate anything else. Electric road signals, as commonly installed, however, have three indications, one indicating "danger" and the other indicating "clear," and a third or normal position, which is neither "danger" nor "clear." The motorman must, of course, not attempt to enter nor can a clear signal be safely construed as an indication of a clear block unless upon approaching a signal and passing under its trolley contact the motorman should see it operate from a "normal" to a "caution" or a "danger" position.

The reason that electric railway signals have to be so constructed that the motorman must see them change to "danger" or "caution" when his car goes under the signal contact, is that there is at present no known practicable means of indicating continuously the presence of a car in a block, as there is with the track circuit used on steam road signals. It is necessary with the electric railway signal to have it operated by the passage of the car under a trolley contact, and to have it remain at "danger" until set to "clear" by the passage of the trolley wheel at the far end of the block. It is, therefore, possible to have signals stuck in "clear" position through the interruption of circuits, or the failure of the apparatus to operate, and were the precaution not taken that signals indicate "clear" only when the motorman sees them change from "normal" to "clear," there would be no safe way of operating with such apparatus. The indication of the electric railway block signal is, therefore, dependent on its action before the eyes of the motorman rather than upon its position.

In some ways this is a good point. It also has its objectionable features. There was a time in the history of block signaling on steam roads, and not very long ago either, when a large number of steam road managers strongly preferred, and even insisted on, a signal which should operate from danger to clear position in sight of the engineer as the train approached, the idea being that this would show the engineer

that the signal was in operative condition and not at "clear" because it was stuck there.

The objection to a signal which must assume a "clear" position before the eyes of an approaching motorman in order to really mean "clear," is that sometimes if the motorman sees the signal at clear he may assume that it changed as he approached without his actually having seen it change. This, however, is a matter of operating discipline. No block signal system is worth anything unless there are rules strictly observed in regard to it. No block signal system is an absolute protection. It is only a valuable additional safe-guard that few roads can, in the long run, afford to be without.

The Record Broken

As we go to press the report comes in that the new series of tests on the Berlin-Zossen line has resulted up to date in reaching the tremendous rate of 117 m. p. h. Experiments were in progress for about ten days, beginning at a speed of about 90 m. p. h., and pushing gradually from day to day onwards until all previous records were broken and the car was driven at the prodigious speed noted, faster by at least a few miles than any structure of man's device has ever before run. Only projectiles can claim a higher speed. The cars, we understand, are the same as used in the previous trials, and have been fully described in our columns, while the track and roadbed have, since their failure at speeds above 90 m. p. h. in the previous work, been put in condition to stand the strains of speed never before attempted. The most gratifying feature of the new tests is that neither cars nor tracks have given trouble, and that there is every expectation that when the tests are resumed the speed will be pushed to the rate of 125 m. p. h., which was the original aim of the tests. And unless the track again shows signs of weakness we will venture to predict that 125 m. p. h. will be exceeded by a comfortable margin. The German government happens to need this Berlin-Zossen line, which is a strictly military road, for a few days, and work will then be resumed on this most brilliant series of experiments. We extend our heartiest congratulations to our German friends on the splendid work they have accomplished, and our most sympathetic hopes that before many days they will have passed the goal which they set for themselves in the beginning. We are proud of their success as part of the world's tribute to the twentieth century.

And more than this, we must confess to a large measure of personal satisfaction in the achievement, for at the very beginning of the Zossen work we freely predicted its success, and took the position that the one thing to be feared was the track. We have consistently held to the position that ample power had been provided in the motors and that the contact devices would deliver that power. We have steadily contended that some of our own countrymen who have deduced enormous and forbidding air resistances from coasting experiments, have been in the wrong, and that high speeds instead of verging on the impossible were clearly within reach. The event has already proved the substantial correctness of our views. As the higher speeds have actually been reached the demand for power has uniformly been found smaller than has been predicted, and very high speeds are certainly within reach whenever commercial demand for them arises. With 117 m. p. h. actually attained, and 125 m. p. h. soon to come, the technical status of the art may be considered as already determined. A train speed of 100 m. p. h., or even more, is not a dream but a certainty whenever it is demanded, and our hope is strong that we shall have the pleasure of riding at that speed before we are many years older. We have heard now for years of the hundred-mile-an-hour train, but until the daring Zossen tests were initiated it seemed afar off, for the necessary enterprise was painfully lacking.

Our only source of regret is that this achievement should not have fallen to the lot of some of our own countrymen. Time and again we have tried to goad them into activity, but the necessary initiative was not forthcoming. We are by no means disposed to belittle American work in electric railroading, for it has been by far the most important factor in the art, and American apparatus and methods have been carried by American engineers wherever the sun shines. Even the Pyramids look down upon the American trolley car. But of late there has been too much disposition to look upon our methods and apparatus as finalities, to be subject to minor improvements as a matter of course, but still representating so nearly the ideal that we could afford to standardize and rest upon our laurels. Standardize if you like, but if you rest upon your laurels they will surely wither. The engineer had better follow the suggestion of Kipling's fine old pirate:

> And they asked me how I did it, and I gave 'em the Scripture text,
> You keep your light so shining a little in front o' the next!
> They copied all they could follow; but they couldn't copy my mind,
> And I left 'em sweating and stealing a year and a half behind.

Too much complacency gives the other fellow a chance to catch up, by which he generally profits. It is unfortunately true that the trend of railway affairs in the United States is such as to hamper startling innovations. The main steam railway lines are tied up in large consolidated systems, and all the weight of their influence stands against any enterprise that would tend to force them out of their profitable and comfortable rut. The proposal of building a long electric line to operate at a hundred miles an hour would strike terror, ill hidden by assumed scorn, into general railway circles. But if American enterprise would not be left behind by foreign competition it must be on the move. Our German friends have the pole in the race already, and it will take a hot pace to win out from them.

Construction Work Next Year

The present indications are that the coming year will hardly see the amount of construction of new interurbans that has been done during the last year, owing to the condition of the financial world at present. Beginning with last spring there has been a steady decline in the value of the majority of securities and an increase in rates of interest, which indicates that there is not the amount of money seeking investment in new enterprises that there was a year ago. So many new enterprises have been floated during the last few years that a great drain has been made upon money seeking investment, and it would look as if the long-expected check to the unusual activity in interurban construction had come. This does not mean that there will not be considerable new work during the next few years, but it does mean that abnormal and unjustified activity in this direction will cease. Manufacturing companies have not as yet felt any marked decrease in orders, nor is it likely that they will for some time to come, as so many large companies, which are almost independent of the state of the money market, are being forced to make extensions by great increase in traffic. The only projects that are suffering from the present financial conditions are those new ones which are least attractive and most visionary.

Everything considered, probably it is a good thing that this check has come at this time, as it will prevent the building of roads which are not warranted, and will tend to keep the electric railway industry on a firm basis.

AUBURN & SYRACUSE ELECTRIC RAILWAY

More than usual interest centers in the recently opened interurban railway between Auburn and Syracuse, because of the direct competition with steam lines which is thus created in this territory. From Syracuse, as a center, there are at present three competitive lines in operation, one reaching Auburn, 26 miles distant, by a line paralleling the Auburn road of the New York Central; another to Baldwinsville, 13 miles, paralleling the Lackawanna, and a third to Fayetteville, 14 miles, paralleling the Chenango branch of the New York Central. The Auburn & Syracuse road is at present single track, although graded for double track for half the distance, and it runs on private right of way for 17 miles. Part of the road was built some time ago, and the completed system was opened on June 23.

The Auburn & Syracuse Electric Railroad Company is a consolidation of the Auburn City Railway, controlling the city lines in Auburn, and the Auburn Interurban Electric Railroad Company, which operated a line from Auburn to the village of Skaneateles. A map and profile of the completed line between Auburn and Syracuse are presented in Fig. 1. It will be seen that this line traverses a well-settled and prosperous farming country. Skaneateles Lake, one of the most beautiful spots in Central New York, lies along the route of this line, and contributes greatly to its patronage. There are two other lakes within reach of this road, namely, Owasco, which is 2 miles south of Auburn, and Otisco, 3 miles south of the railroad and several miles east of Skaneateles Lake.



FIG. 1.—MAP AND PROFILE OF INTERURBAN ELECTRIC RAILWAY

Many residents of Auburn and Syracuse enjoy their holidays at the lakes in this vicinity. Owasco Lake is popular as a summer resort and as a fishing ground, and is easily reached by a branch of this road, formerly part of the Auburn City Railroad. Fig. 2 is a typical line view looking toward Syracuse and showing Onondaga Lake in the distance, and Fig. 3 is a view of Long Bridge over Nine-Mile Creek and the tracks of the Marcellus Electric Railway.

The road serves a population of approximately 165,000 in cities and villages which it passes through, besides a large number of people living in the country, who patronize it freely. At the present time it is not giving express service, but this will be provided soon. It is necessary now for the farmers to drive from 4 miles to 8 miles to the nearest station on the Auburn branch of the New York Central to make express or freight shipments.

ROADBED

The country through which this line passes being of a rolling nature, the road necessarily has a number of short but heavy grades, some being as high as 9 per cent. The longest grade is 3½ per cent and 1 mile in length. The sharpest curve is one of 10 degs., having a radius of 574 ft., while the next one is a 6-deg. curve, having a radius of 955 ft. The 6-deg. curve is on a grade of 1¾ per cent.

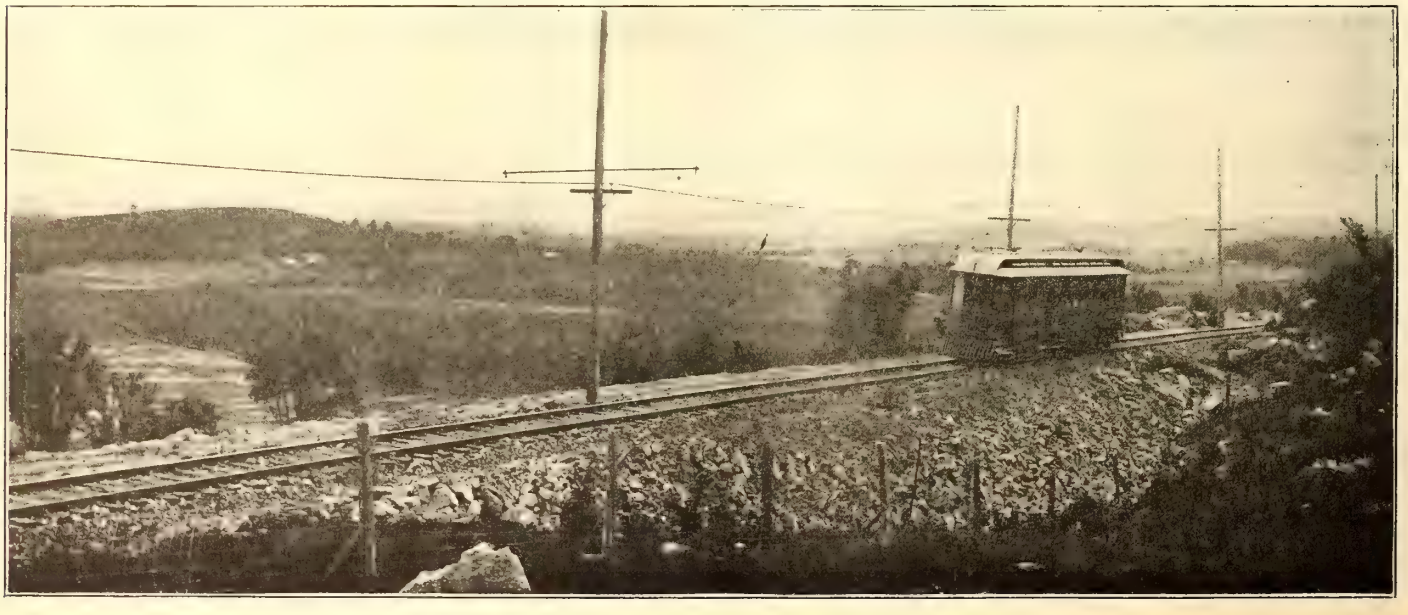


FIG. 2.—TYPICAL LINE VIEW, SHOWING ONONDAGA LAKE IN THE DISTANCE

The roadbed is already graded part of the distance for double track, which it is proposed to lay between the two cities. All rails weigh 70 lbs. to the yard. Cross-ties are 8 ins. x 8 ins. x 6 ft., and of cedar, chestnut or Southern pine.

The regular schedule time required for the run, including all stops between Auburn and Syracuse, is an hour and thirty minutes, with a maximum speed on the level of 1 mile per minute.

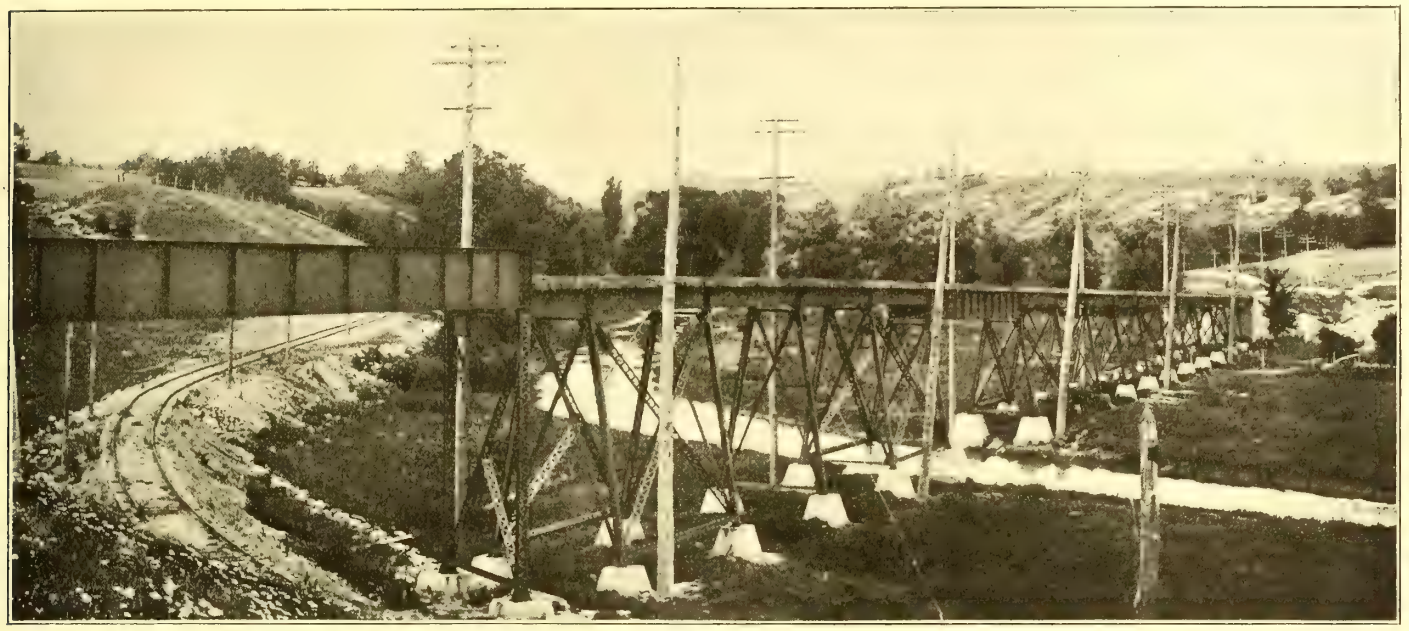


FIG. 3—LONG BRIDGE OVER NINE-MILE CREEK AND THE TRACKS OF THE MARCELLUS ELECTRIC RAILWAY

MAIN POWER HOUSE

The main power plant is located at Auburn, and several views of this station are presented herewith. Fig. 4 is an exterior view showing the Auburn branch of the New York Central & Hudson River Railroad at the left, together with a trestle used in unloading coal. The opposite end of this trestle connects with the Lehigh Valley Railroad, which crosses the New York Central just beyond the power house. Fig. 5 is a view of the engine room, showing two 650-kw, three-phase, 360-volt, 25-cycle Westinghouse generators, driven by two 1000-hp Westinghouse cross-compound condensing Corliss engines. Fig. 6 is another view of the engine room, and shows one 50-hp motor-exciter set, two 400-kw rotary converters and a fifteen-panel switchboard. Fig. 7 is a view of the transformer room of the main power house. This is directly below the engine room and contains three 300-kw oil-insulated self-cooling transformers. The leads and cables going to the main switchboard, which is directly above the transformers, are distinctly shown. These features will be described more in detail in their proper place.

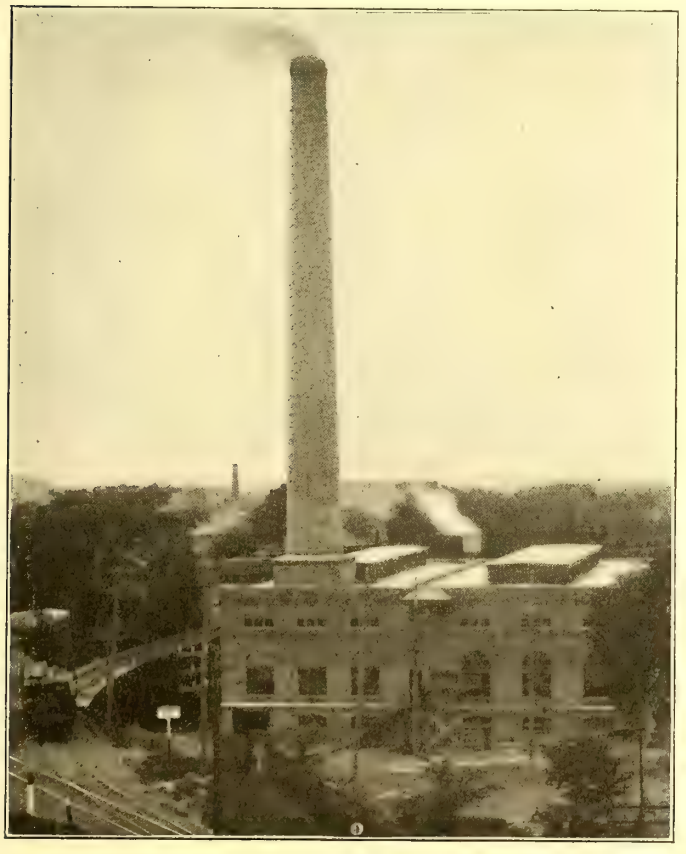


FIG. 4.—EXTERIOR OF MAIN POWER HOUSE AT AUBURN

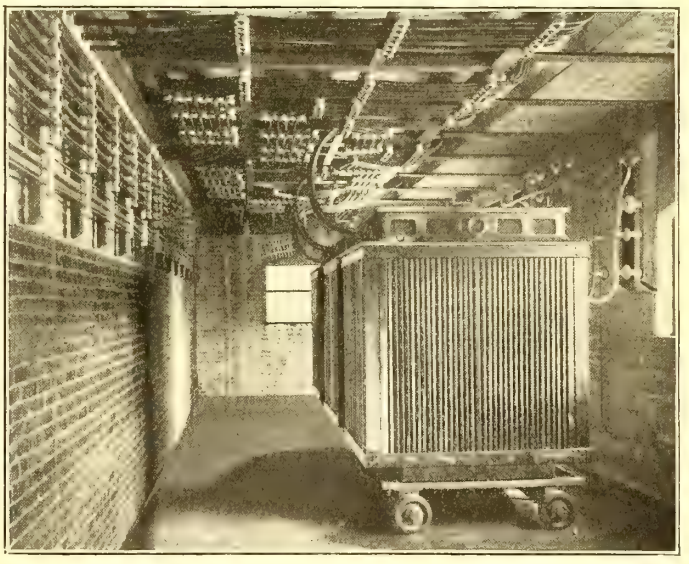


FIG. 7.—VIEW OF TRANSFORMER ROOM, DIRECTLY BELOW SWITCHBOARD IN AUBURN POWER HOUSE

The steam equipment of the power house consists of five safety water-tube boilers, each of a capacity of 250 hp at 125 lbs. steam pressure. They may be operated at a higher pressure when desired. A Greene economizer, having 280 tubes, heats the boiler feed water. All steam piping is extra heavy, and was furnished by the Walworth Manufacturing Company.

The two large engines have a capacity of 1000 hp each, at 150 lbs. steam pressure. They are of the Westinghouse-Corliss horizontal cross-compound condensing type, operating at 100 r. p. m. The cylinders are 22 ins. and 44 ins. x 48 ins. Each engine is fitted with a Deane steam pump simplex condenser.

Directly connected to the engines are two 650-kw, three-phase Westinghouse generators, operating at 100 r. p. m. On ordinary occasions one of these generators is sufficient to carry the load, but on days of heavy travel both are operated in parallel.

There are two Westinghouse rotary converters in the generating station. These receive alternating current direct from the generators at 360 volts, three phase, and deliver direct current at approximately 600 volts. Each has a normal capacity of 400 kw, and operates at 500 r. p. m. They are provided with induction motors mounted upon the ends of the shafts for use in bringing their armatures up to speed for synchronizing. The starting motors are furnished with three-pole, double-throw switches, which admits of applying two different voltages to the primaries of the induction motors, thereby giving different speeds for synchronizing. A closer adjustment in speed is obtained by changing the strength of the rotary fields.

Each rotary converter is furnished with a magnetic oscillator, which furnishes lateral motion to the armature, preventing the formation of ridges on commutator surfaces.

There are two 37½-kw, 125-volt exciter sets in the generating station, either of which is of sufficient capacity to excite the field of both generators. One is directly connected to a 50-hp, three-phase type-C induction motor, giving 3000 alternations, operating at 720 r. p. m., and the other to a Westinghouse 9½-in. x 9-in. standard engine, operating at 300 r. p. m. The steam-operated outfit is used for starting up the plant, after which the motor-driven set is paralleled with it and the first one shut down. The alternating-current generators then operate as self-exciting machines by furnishing alternating current to drive the exciter outfit.

The switchboard consists of 14 panels of blue Vermont marble, placed side by side, 8 ft. from the wall, and contains the usual complement of switches and instruments. The two generators operate in parallel upon a common set of bus-bars, from which are operated the rotaries. All direct-current instruments are the long-scale dead-beat type-F, and are finished in black. Their scales subtend an angle of nearly 300 degs., and have uniform divisions from 20 per cent to full scale deflection.

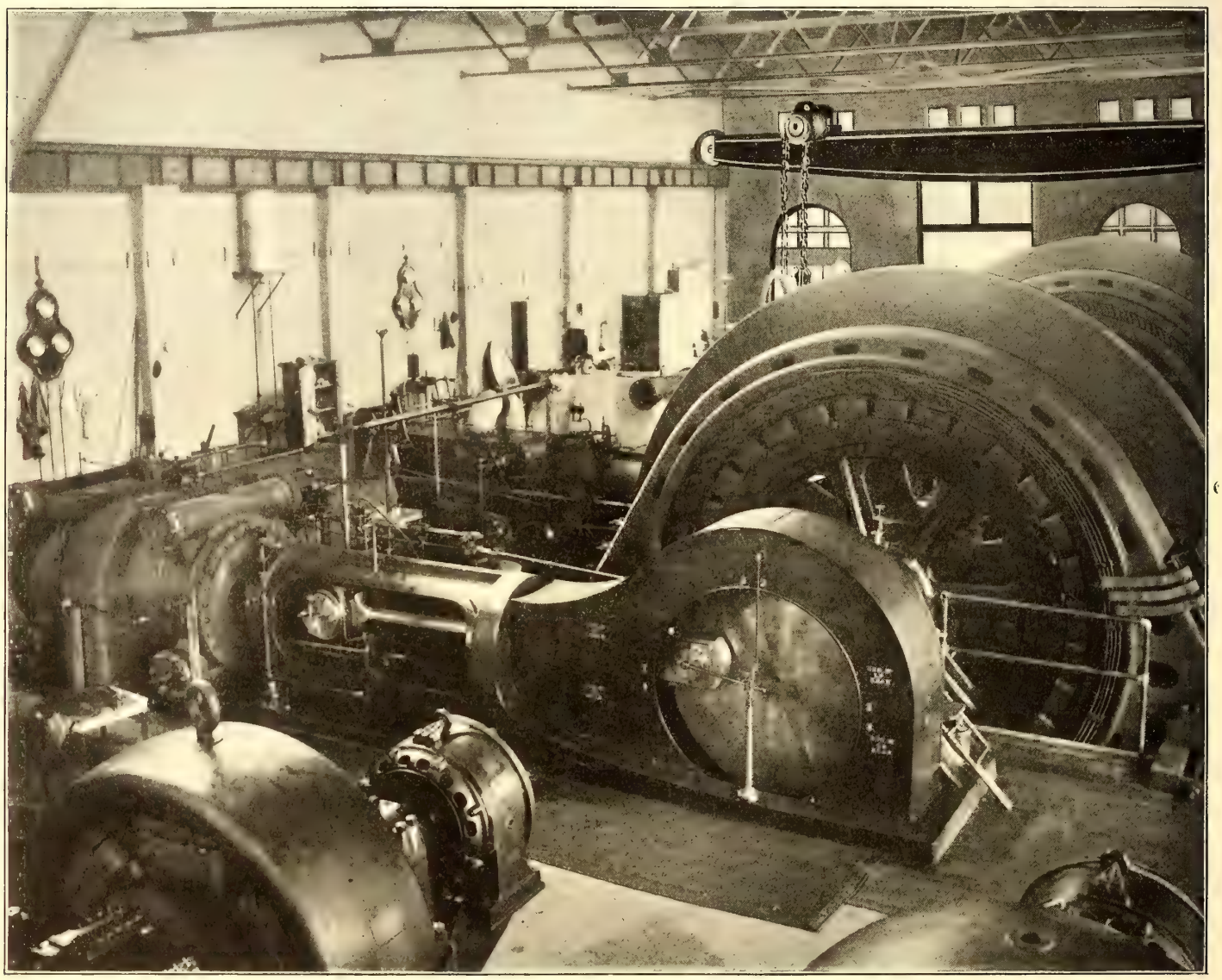


FIG 5.—ENGINE ROOM IN MAIN POWER HOUSE AT AUBURN

In view of the fact that the load is practically balanced one ammeter serves to measure the current for each machine. The current in any phase of the three-phase circuit may be measured with this ammeter by the use of special connections and plug switches. This is accomplished by opening the plug switch which controls the secondary winding of the series transformer connected to the phase whose current is to be measured.

In front of one of the panels is a swinging arm, which has mounted upon it two alternating-current voltmeters, one power factor motor and one synchroscope. This arm may be swung in any position, enabling the instruments mounted thereon to be plainly read at any point along the switchboard. This is

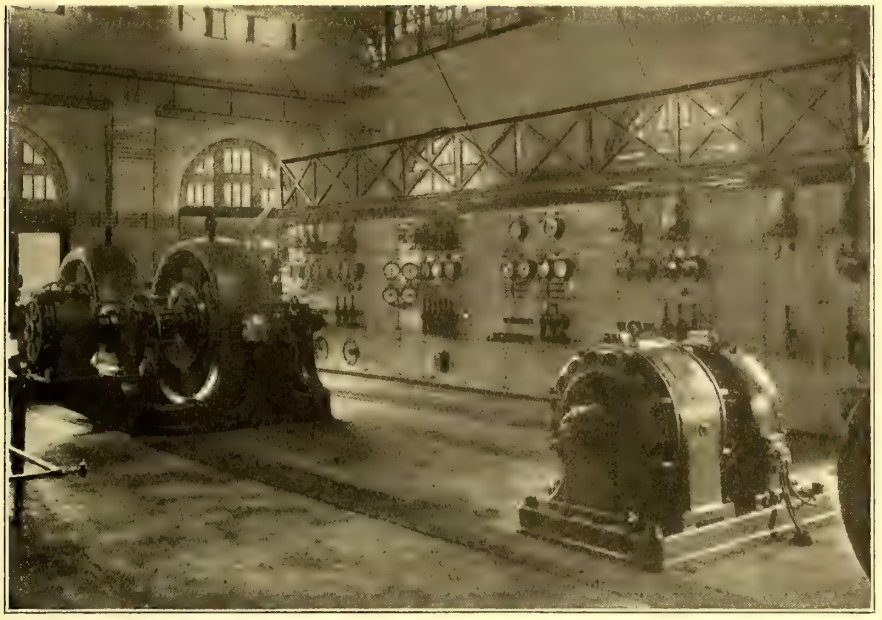


FIG. 6.—SWITCHBOARD, ROTARY CONVERTERS AND EXCITER IN MAIN POWER HOUSE, AUBURN

very convenient for attendants when synchronizing the generators or rotaries, as the voltage of each machine and the relative phase relation are in plain view when operating the field rheostats and switches.

The power factor meter may be connected to either generator or rotary converter by the use of a plug switch. This enables the attendant to adjust the field of the machine for minimum armature current. It also indicates whether the current is lagging or leading. The synchroscope is used to throw the generators and rotaries in multiple, and it shows at all times whether the incoming machine is too fast or too slow and exactly how much. If the incoming machine is too fast the pointer will revolve in one direction, and if too slow it will revolve in the opposite direction. When the needle is in an upright position its pointer is at zero on the scale, showing that the two machines are in step and the paralleling switch may be closed.

The generator voltage is raised to 16,500 volts, three-phase, for transmission to the two sub-stations by three 300-kw, oil-insulated self-cooling transformers. These transformers are mounted in a fireproof apartment directly under the switchboard. The leads are carried from the switchboard to the transformers through an opening in the floor 6 ins. wide, extending the length of the switchboard and immediately back of it. This avoids the necessity of bending the low-tension cables. The high-tension leads from the transformers are carried up along the wall of the building, passing through high-tension switches, all of which are mounted upon the wall, 15 ft. above the switchboard. Adjacent to the switches are also mounted the low-equivalent lightning arresters and choke coils. The transformers in the basement are mounted upon small trucks, having wheels to facilitate handling in case it is necessary at any time to shift their position. There is an extra transformer kept ready to place in service should an accident occur during operation. These transformers are connected in delta, and switches are provided upon the transformer switchboard panel for cutting out any of the transformers without interrupting the service.

The main power house also contains two 120-kw, two-phase, revolving armature-type Westinghouse generators, which furnish current at 2200 volts to the Citizens' Light & Power Company for lighting in the city of Auburn. The power house is laid out for 1000 kw additional generator capacity.

TRANSMISSION LINE

The transmission line consists of two distinct three-phase high-tension lines mounted on opposite ends of the same cross-arms. This pole line, in addition to carrying the high-tension lines, carries the trolley feeder cables. It also furnishes supports for the trolley wire. Only one high-tension line is in service at the same time, the other being kept as a reserve.

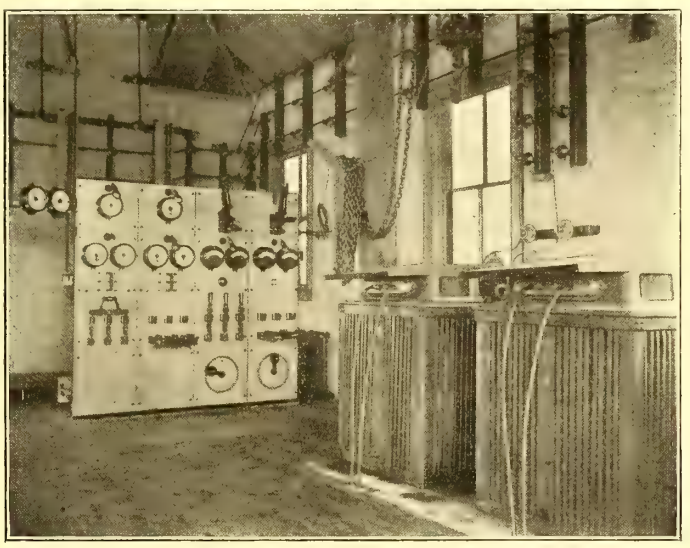


FIG. 9.—SWITCHBOARD AND TRANSFORMERS IN HOWLETT HILL SUB-STATION

SUB-STATIONS

There are two sub-stations, one at Skaneateles and the other at Howlett Hill. The Skaneateles plant contains one 400-kw rotary converter, which is similar to the machines in the generating station, with one alternating-current and one direct-current switchboard panel for controlling it. In this station are three 150-kw, oil-insulated self-cooling trans-

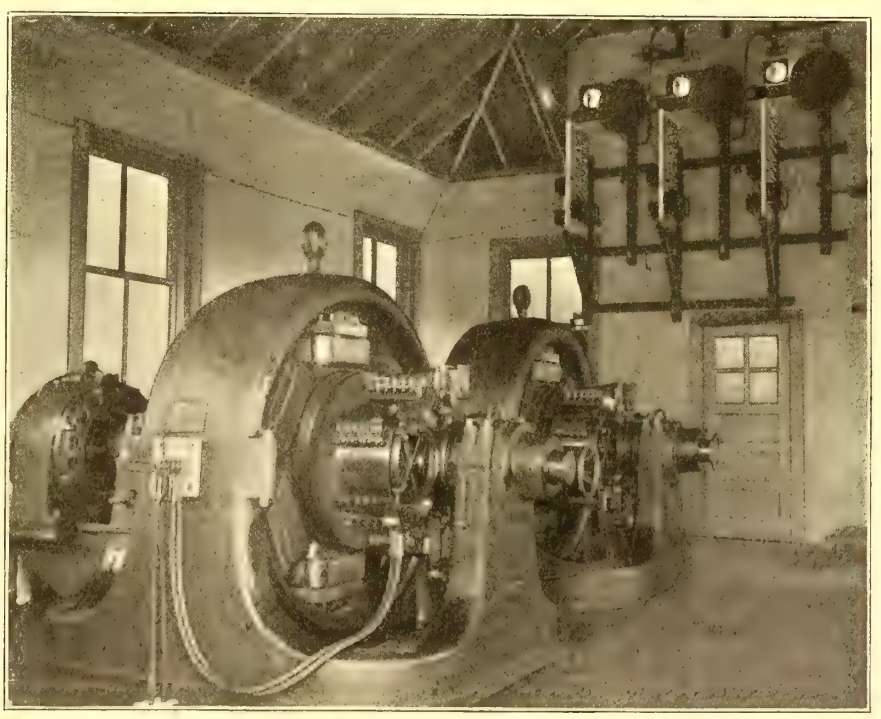


FIG. 8.—ROTARIES IN HOWLETT HILL SUB-STATION

formers, connected in delta, which reduce the line voltage of 16,500 volts to suitable voltage to give 600 volts on the direct-current side of the rotary. This station is protected from lightning by Westinghouse low-equivalent arresters similar to those used at the generator station end of the line.

The Howlett Hill sub-station contains two 400-kw rotaries, also duplicates of those in the generating station. These are fed by three 150-kw transformers, duplicates of those in the Skaneateles station. These transformers are intended for the operation of only one rotary at a time. Both sub-stations are protected by low-equivalent lightning arresters. Fig. 8 is an interior view of the Howlett Hill sub-station, showing two 400-kw rotary converters. Fig. 9 is another view of the same station, showing the switchboard and two of the transformers, each of 150-kw capacity.

EQUIPMENT

The motors used on the Syracuse division of this road are all Westinghouse No. 76, four motors to a car. These motors have a continuous capacity of 55 amps. at 400 volts, and in a shop test, operating at this load for ten hours, the rise in temperature did not exceed 75 degs. C. In actual service, owing to improved ventilation, it is estimated that the temperature rise will be considerably less, probably not over 55 degs. C.

The rolling stock on this road consists of six passenger cars, each with a seating capacity of fifty-six people. Each car is 50 ft. in length outside, 40 ft. inside, weighs 30 tons, and has a smoking compartment. They were made by the Kuhlman Car Company, of Collinwood, Ohio. The weight of these cars, the speed at which they operate, and the steep grades made the question of safety devices an important one. The Westinghouse Air Brake Company furnished the brakes and the motor-driven pumps which are employed on each car.

The cars are mounted on Peckham No. 36-B trucks, with 5½-in. axles and pressed wrought iron steel-tired wheels.

OFFICERS

The officers of the road are: C. D. Beebe, president and general manager; W. A. Holden, vice-president; A. K. Hiscock, treasurer; R. A. Dyer, Jr., assistant general manager and mechanical engineer, and A. G. Davids, general superintendent.

The road was built by the Syracuse Railroad Construction Company, with George D. Grannis as manager and Thomas H. Mather, chief engineer.

NEW POWER STATION AT BRUSSELS

In the Street Railway Journal for Aug. 1, 1903, a notice was published of the completion of a new polyphase power station by the Brussels Tramway Company. This station is undoubtedly one of the most complete of any for railway work on the Continent and compares favorably with that in any other part of the world. It is designed to supply the power for all the tramways in the city of Brussels, which are now being converted to electric power. The Brussels system includes about 80 km (50 miles) of double track, on which an average of 190 trains of 15 tons each are operated in ordinary service, and 295 trains of the same weight in rush-hour service.

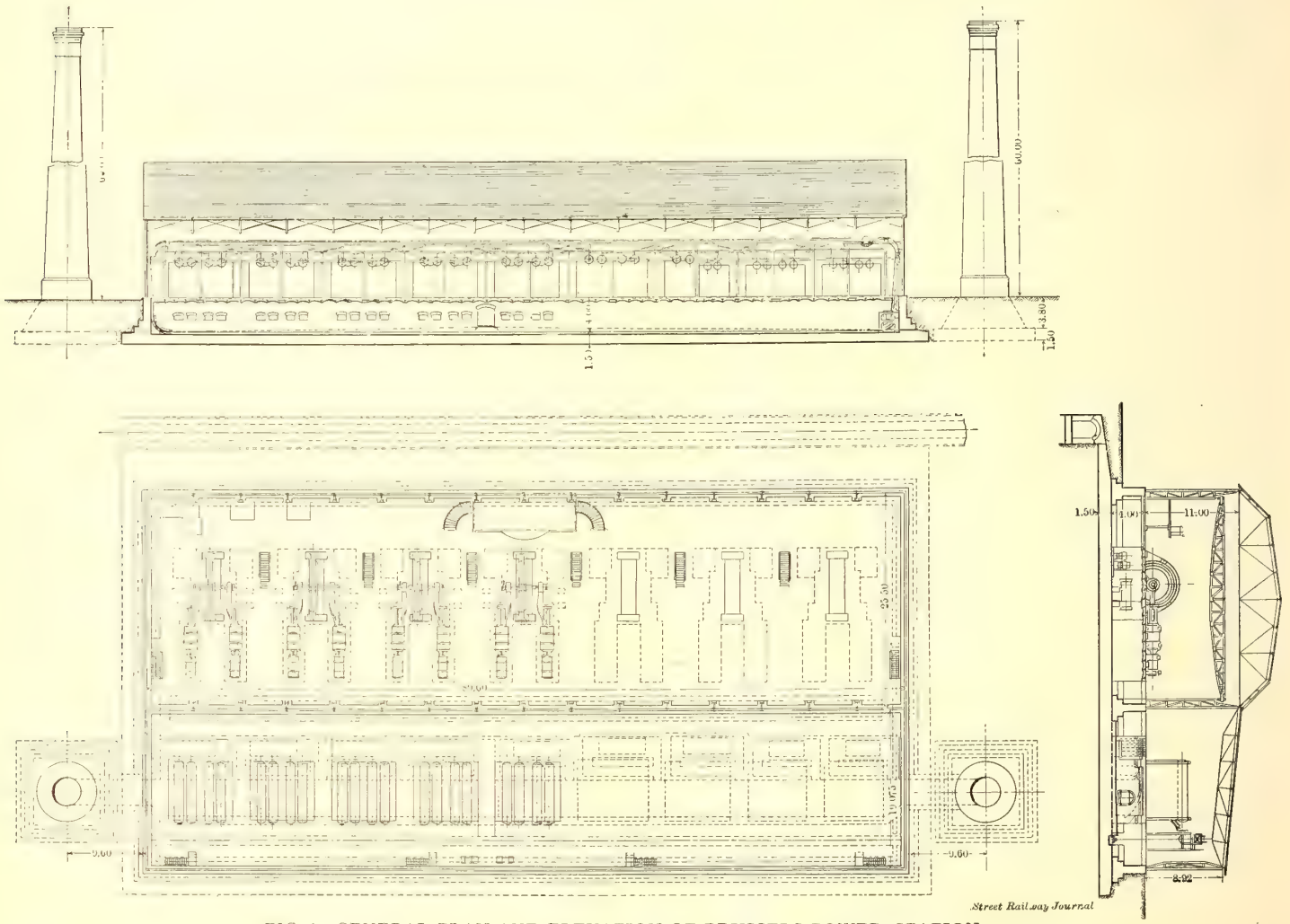


FIG. 1.—GENERAL PLAN AND ELEVATION OF BRUSSELS POWER STATION

The station is situated at Anderlecht, a suburb of Brussels, and at the side of the Charleroi Canal. The general plan of the power station is shown in Fig. 1. The engine and boiler rooms extend parallel to the canal so that they can be easily extended in case an additional power equipment is required. The foundations for the engine and boiler rooms are concrete, 1.5 m (4 ft. 10 ins.) in thickness, braced by two layers of old rails. These

rails are located respectively 20 cm (8 ins.) from the bottom and 25 cm (10 ins.) from the upper surface of the concrete. The foundations extend for 3 m (10 ft.) on each side of the center line of the walls, and on the side of the canal are connected by masonry to the aqueduct. The foundations of the building are carried up to a height of 3.8 m (12½ ft.), on which is constructed the steel frame work, which constitutes the walls proper. The foundations of the stacks are formed by two layers of concrete, 12 m (40 ft.) square and 1½ m (5 ft.) thick, on which is the masonry base of the chimneys. Water for condensing purposes is taken from the canal by means of a masonry aqueduct, and after passing through the condensers is discharged into a basin, whence it is returned to the canal by four pipes, each 0.70 m (27½ ins.) in diameter and arranged in fan shape.

The engine room contains at present four units of 1500 kw each, but there is room for the installation of three additional units of the same size. The engines were built by the Vande Kerchove Company, of Ghent, and are of the twin tandem compound type, there being two engines of from 900 hp to 1400 hp directly connected to the same shaft, which carries the rotor of the alternator. The cylinder dimensions of these engines are 630-mm and 1090-mm x 1200-mm stroke (24.8 ins. and 42.9 ins. x 47.2 ins.). They operate at 94 r. p. m., with a pressure of 9 atmospheres (120 lbs.) with the temperature of the admission steam at 275 degs. to 300 degs. C. (460 degs. F. to 500 degs. F.). The variations in speed are guaranteed not to exceed ½ per cent during constant load, 2 per cent during a rapid change in load of 25 per cent, and 6 per cent during a rapid change from 0 to maximum to vice versa. The rotor of the alternator, whose moment of gyration is 700,000 kg m (7,063,100-ft.-lbs.), is of sufficient weight to insure the synchronous operation of the alternators without any special apparatus.

The normal horse-power of the two twin engines is 1800

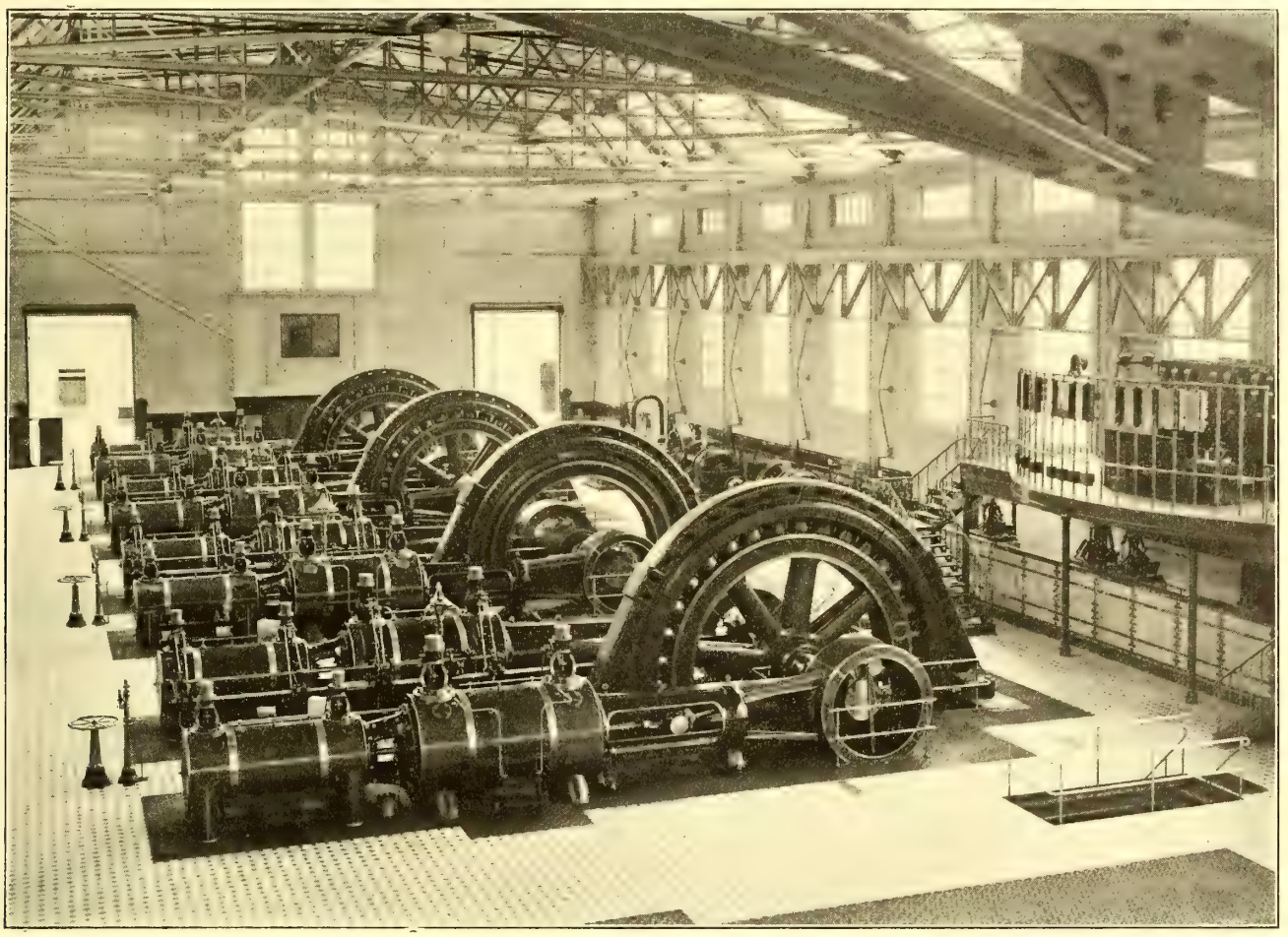


FIG. 2.—GENERAL VIEW OF ENGINE ROOM, SHOWING SWITCHBOARD GALLERY



FIG. 3.—EXTERIOR OF POWER STATION

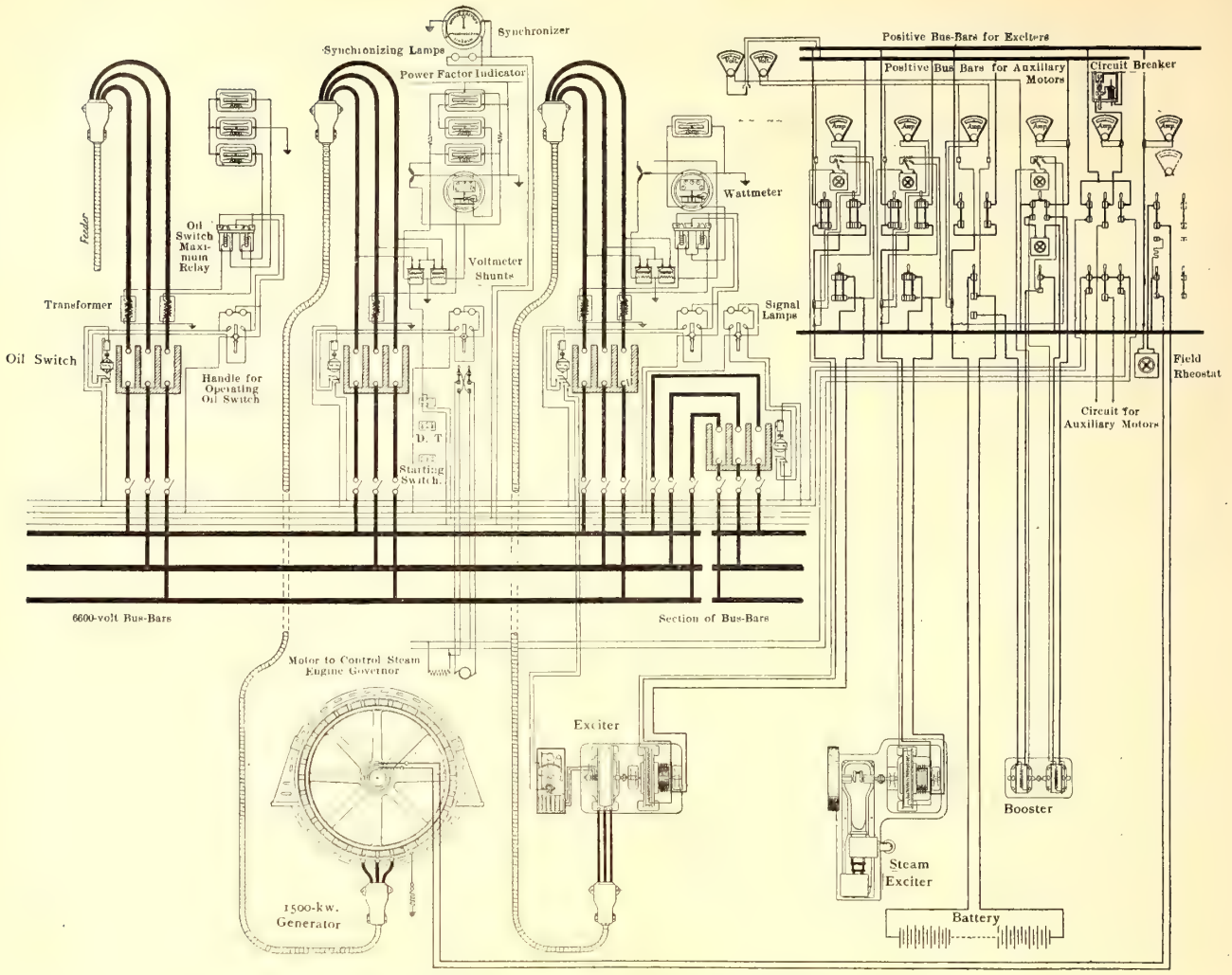


FIG. 4. DIAGRAM OF CONNECTIONS OF MAIN POWER STATION

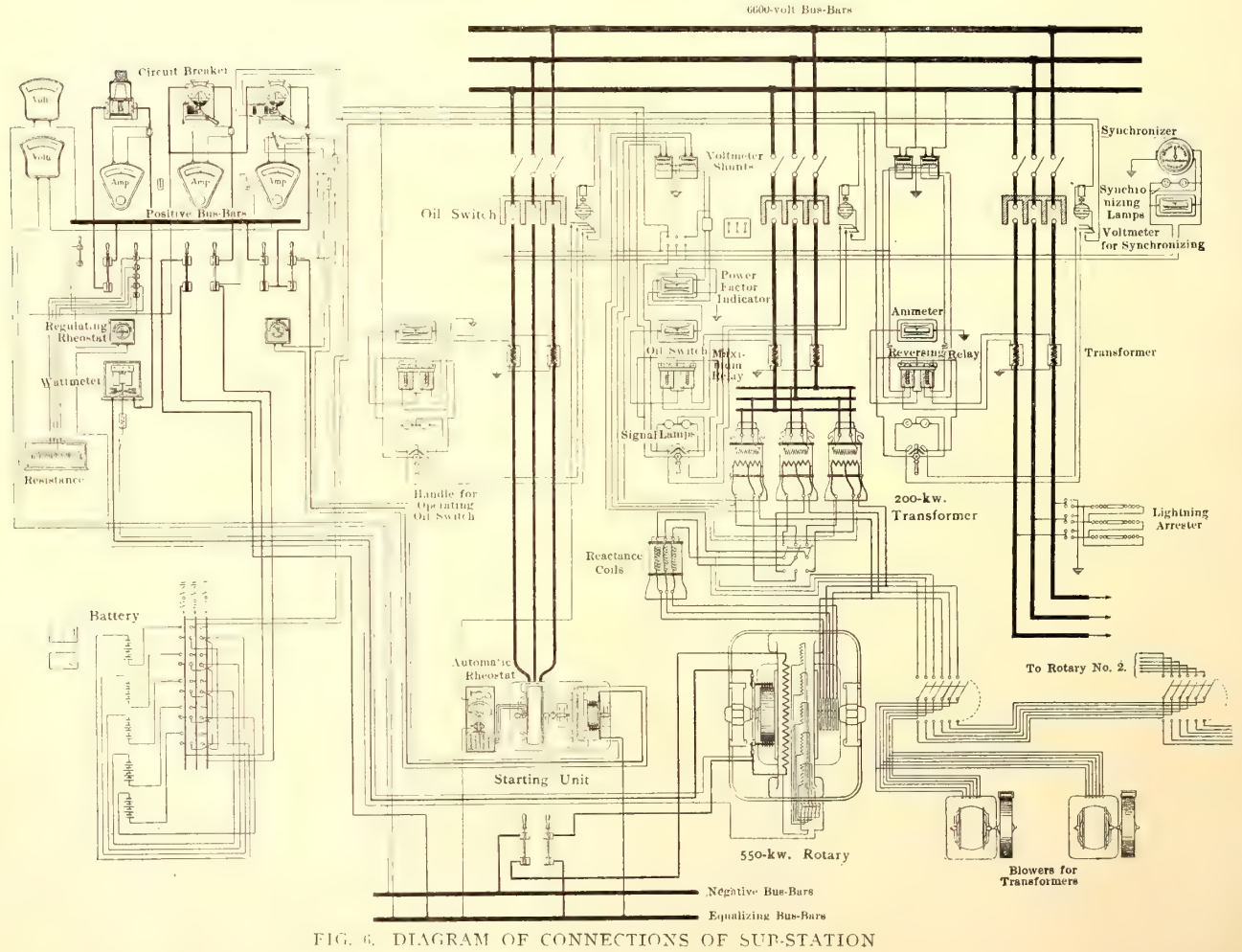


FIG. 6. DIAGRAM OF CONNECTIONS OF SUB-STATION

hp at cut-off at 23 per cent of the length of stroke, and 2800 hp at 45 per cent cut-off. There are four valves for each cylinder, operated by a simple valve gear.



FIG. 5.—SWITCHBOARD GALLERY IN MAIN STATION, WITH DIRECT-CURRENT APPARATUS AT RIGHT, BENCHBOARD IN CENTER, AND ALTERNATING-CURRENT MEASURING INSTRUMENTS ON FRAMEWORK AT LEFT

The high pressure cylinders are not jacketed. A receiver is placed between the two groups of cylinders. The discharged steam from the high-pressure cylinder before passing to the low-pressure cylinder is warmed in this receiver by means of the live steam, which traverses a set of parallel pipes contained therein. Before entering the low-pressure cylinder the steam passes through the low-pressure cylinder jacket.

Each group of engines is served by two surface condensers constructed with sets of parallel brass tubes, through which passes the water of condensation. The circulating pumps, air pumps and feed-water pumps are driven directly from the crank heads of the engines. A single governor is used for the two twin machines, acting on the four cylinders. There is also an electrical governing device controlled from the switchboard, which permits a slight displacement of the counterweight of the governor, so as to vary the speed and facilitate at the same time the synchronizing of the alternators when they are to be put in parallel. The four alternators were built by the Union Elecktricitats Gesellschaft, and supply current at 6600 volts at 25 cycles. Two of the exciters are driven by 6600-volt induction motors, the third by a steam engine.

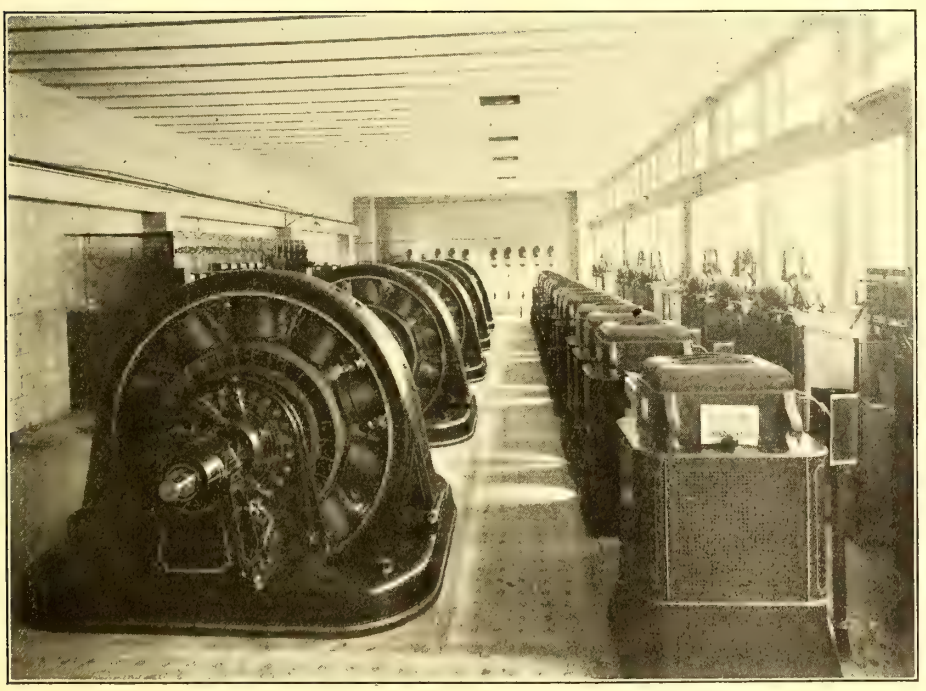


FIG. 7.—INTERIOR OF ONE OF THE SUB-STATIONS

The distribution system is illustrated in Fig. 4. The switchboard, as in all recent American work, has been designed so as to prevent any possible danger from the operator coming contact with the high-tension apparatus. All high-tension switches are inclosed in masonry cells and are operated from the switchboard by means of low-tension direct-current motors.

The switchboard proper, which is mounted on a platform where a complete view of the power station floor is obtained, is of somewhat novel design, being

divided into three distinct portions. The first comprises the low-tension, direct-current apparatus for the exciters, battery, lighting circuits and motors used around the power station.

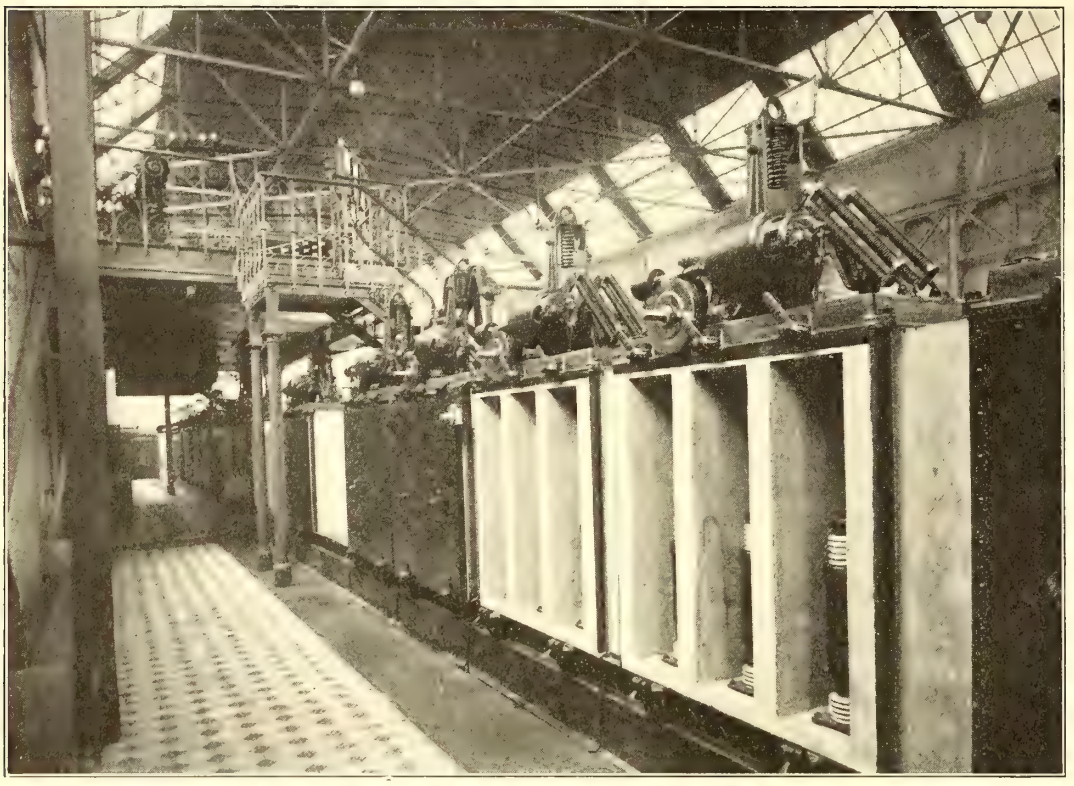


FIG. 8.—OIL SWITCH ROOM

This part of the switchboard is carried on vertical panels placed close to the rear wall, and is composed of three generating panels, one battery panel, three auxiliary motor panels and one panel for the battery booster.

The second part of the switchboard is that for controlling the high-tension switches, and the apparatus is arranged on a bench board in front of the panels already described. As the high-tension switches are operated indirectly, the bench-board carries only the low-tension apparatus for doing this work. An arrangement of signal lamps shows whether the oil switches are open or closed. This bench-board is also fitted with the rheostat connections for the alternators and with the controllers for the electrical-governing device on the engines, to which reference has already been made.

The third part of the switchboard includes the measuring and recording instruments for the alternators, feeders, motors and exciters, and the automatic relays for operating the oil switches. This apparatus is arranged in front of the bench-board, as shown in Fig. 5, and on a level with the switchboard operator's eye. It is supported on a framing of copper tubes, which are spaced about 0.30 m (1 ft.) apart, so that the switchboard operator can watch the instruments and at the same time have in front of him a clear view of the entire engine room. Each feeder, each alternator and each induction motor has its panel or collection of governing apparatus, see Fig. 5. All of these are on low tension. The feeder panels carry an ammeter for each phase. The generator panels carry a phase meter, an ammeter, a voltmeter and a wattmeter. The induction motor panels have an ammeter and a wattmeter. In the middle of the third board is a Lincoln synchronizer with synchronizing lamps. In addition each feeder and induction motor has an automatic relay for controlling its oil switches. These relays are connected in the secondaries of small transformers, and are located at the base of the board. The high-tension circuits and all of the transforming apparatus are placed in the basement of the station, as shown in Fig. 9.

The bus-bars are divided into three sections, to each of which are connected a portion of the feeders and a portion of the alternators. Of the eight feeders uniting the power station with the sub-stations, three are connected respectively to the left section of bus-bars, two to the middle and three to the right. Of the four alternators one is connected to the left section, two to the middle and one to the right. Of the two induction motors which operate the exciters one is connected to the right bus-bar section and the other to the left. The three bus-bar sections are connected to each other by means of two sets of oil switches, and this arrangement allows one section to be cut out in case of accident or repair.

The three-phase cables coming from the alternators pass first to the transformers which operate the recording instruments, then to the oil switches, then to the bus-bars. The leads to the feeders are first taken to the oil switches, then to the transformers for the ammeters, wattmeters and automatic relays for the oil switches, then to the outgoing feeders. Each leg of the feeders is in connection with two switches, of

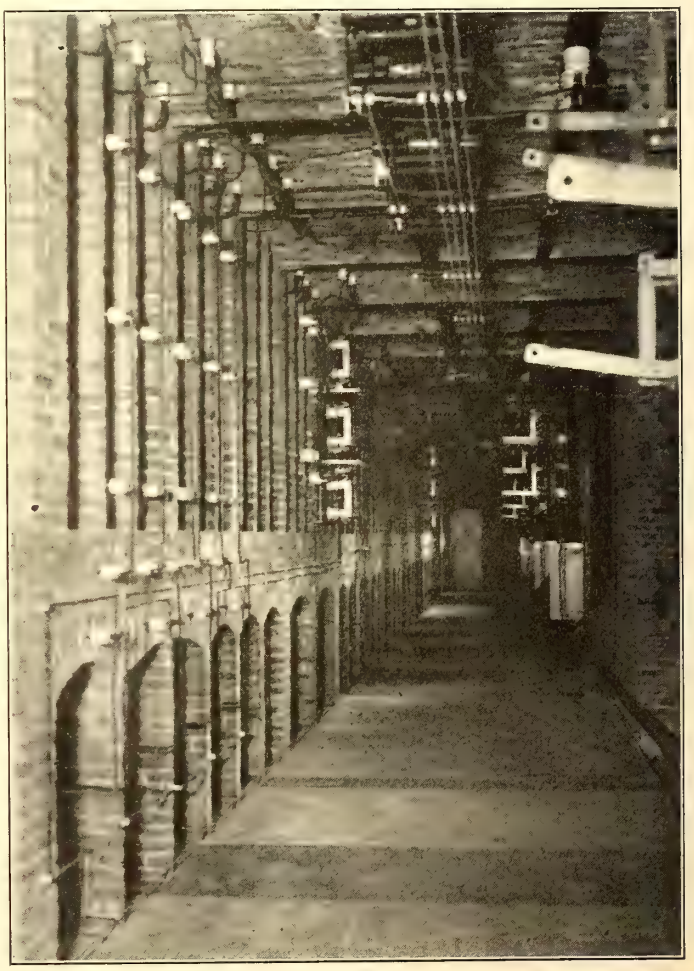


FIG. 9.—BASEMENT, WITH HIGH-TENSION WIRING

which one, always closed, is in connection with the lightning arrester, while the other, usually open, allows the earthing of feeders in case of necessity. A storage battery of 500 amp.-hours is placed in the basement to furnish current to light the station at night and as a reserve for the exciters. The oil switches were supplied by the General Electric Company, and are similar to those used in the Manhattan and other stations in recent work.

BOILER ROOM

The boiler room contains ten Babcock & Wilcox boilers of 350 sq. m (3255 sq. ft.) heating surface, arranged in five batteries of two each. Each boiler is equipped with chain stokers, and each battery with a Green economizer. The boilers are fed normally, as described above, by means of pumps directly connected to the engine cranks. One electric and two steam boiler feed pumps are kept in reserve. In addition to the boilers mentioned above five boilers have been removed from the old stations and have been installed.

The chimneys are 60 m (165 ft.) in height and 3 m (9 ft. 9 ins.) inside diameter at the top.

The coal conveyor is operated by 110-volt motors. It consists of two lines of buckets, one traversing the entire length of the boiler room, the other connecting the boiler room with the coal hoist on the banks of the canal.

SUB-STATIONS

The power station is now supplying current to three sub-stations, which in all cases are located in the old power stations of the company, so that the former direct-current feeder system is utilized. The three sub-stations are nearly at the apexes of an equilateral triangle, whose center corresponds to the center of the system to be supplied with power. The equipment

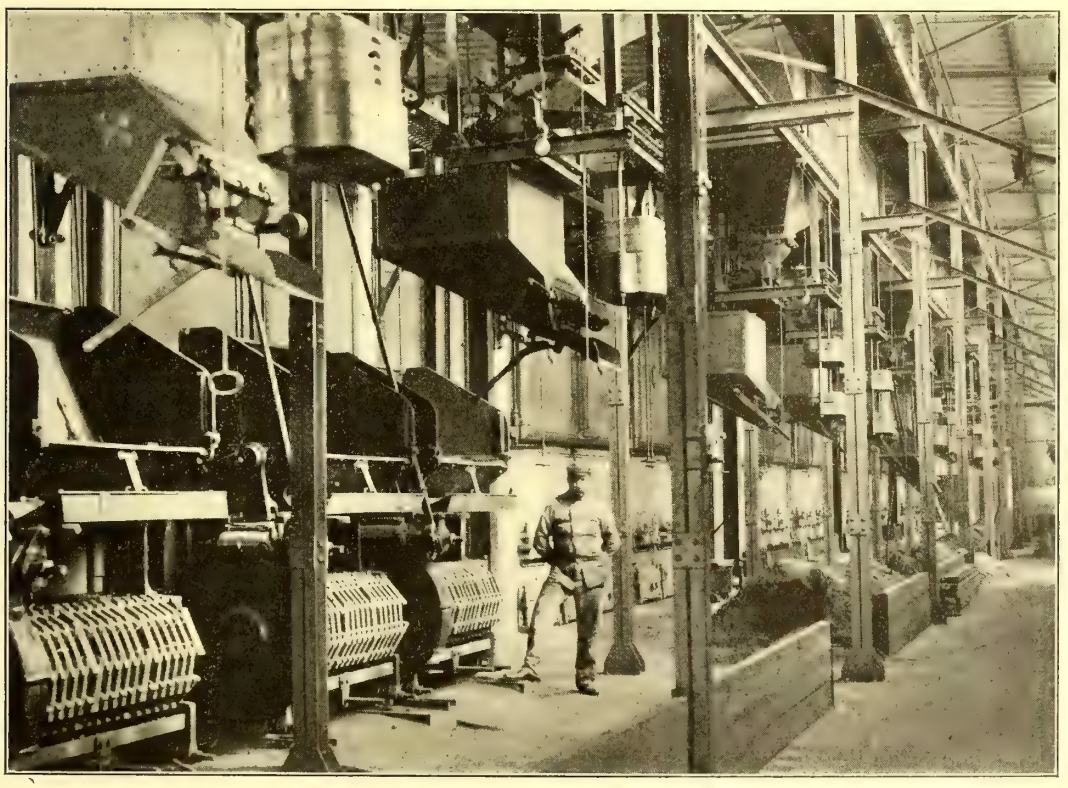
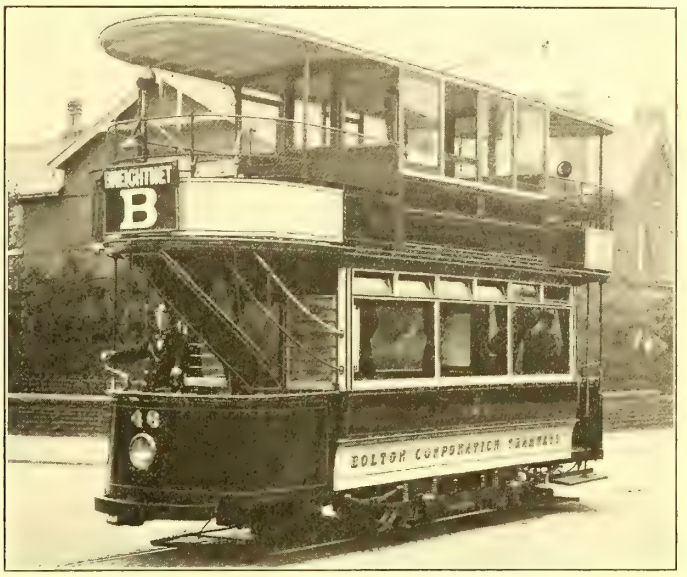


FIG. 10.—BOILER ROOM, SHOWING CHAIN-GRATE STOKERS

of the stations is practically the same. They contain five 550 six-phase rotary converters, each connected with three 200-kw transformers, which reduce the voltage from 6600 to 410. The transformers are air cooled. The rotaries are started from the direct-current side, and for this purpose there is in each station a starting unit consisting of a 6600-volt induction motor connected to a 75-kw direct-current generator. A battery of 60-amp.-hours at 500 volts is in parallel with this starting unit to act as a reserve.

NEW TYPE OF CAR FOR BOLTON, ENG.

The accompanying cut illustrates the Bolton type of top cover for cars which have recently been built for the Bolton Corporation Electric Tramways by Milnes Voss & Company, of



CAR WITH EXTENSION TOP IN BOLTON

Birkenhead, to the designs of Arthur A. Day, chief engineer of the tramways.

It will be noted that the seating capacity of the top deck is not in any way decreased, in fact, the car now running has seating capacity for four additional passengers. The cover is not a totally inclosed one, it being optional for a passenger to be inside or outside under cover. This enables the top to be utilized either in wet or fine weather, and also enables the design to be made to look less heavy, or perhaps rather less top heavy than a cover covering the full length of the car. The facility for getting in or out of the fully inclosed part is also much greater than in the case of the fully covered top cover, some of the latter being very awkward to get into and get out of. There is in this case fully 6 ft. of head room, enabling a tall man to stand upright on the top deck. This, however, is rather a matter of the lowness of the bridges under which the top cover has to pass. The tramways committee is so satisfied that this type meets the requirements of the public that it has already sanctioned the fitting of twelve more cars with this cover. Mr. Day thinks that there can be very little doubt that the adoption of such a cover, which does not hinder the use of the top deck in fine weather and makes it available in wet weather, will result in considerably increased traffic receipts.

It has been said by a well-known and successful railway man that "the best way to decrease operating expenses is to increase gross receipts."

COLORADO SPRINGS AND INTERURBAN RAILWAY SYSTEM

The city and interurban electric railway system of the Colorado Springs & Interurban Railway Company is typical of the West, and its operation shows the results of good management and anticipation of the needs of the public. The company operates 39 miles of track and connects the cities of Colorado Springs, Colorado City and Manitou, Col. A free park, 5 miles south of Colorado Springs and at the entrance to the famous Cheyenne Canon, is owned and managed by the company, and is a source of considerable revenue. This park is named Stratton Park, after the late W. S. Stratton, who was president of the railway company and did much to build up the company's property. The park embraces some 40 acres of ground, through which flows Cheyenne Creek. The railway company has put $70,000 worth of improvements in the park, including a steel waiting room, artificial lakes, band and refreshment stands and rustic work. The lakes are stocked with trout, and the occasion of feeding them every afternoon is quite a sight for both old and young. As may be judged from the accompanying illustrations the park is wild and rustic enough to attract picnickers as well as the many tourists who visit that locality every year. In order to create an evening traffic to the park the company employs one of the best bands in the West for concerts, and during the intermissions an excellent exhibition of moving pictures is given. No admission is charged, and as a result of its liberality the company has carried on this line as many as 3000 people and 4000 people during an evening. This means a good haul for a single line when it is considered that the population of the city is only a little over 20,000.



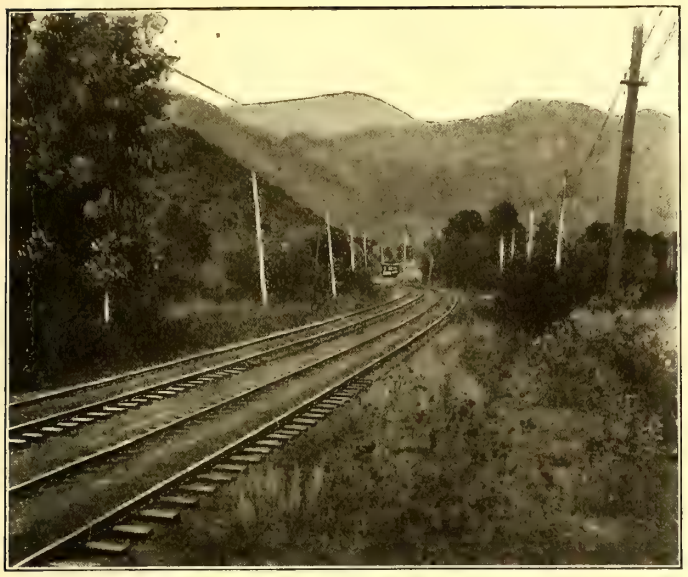
PRIVATE RIGHT OF WAY FOR INTERURBAN LINE, APPROACHING PIKE'S PEAK

Colorado Springs, however, is noted as one of the most picturesque and popular tourist resorts in the West, and the street railway company naturally derives considerable of its traffic from the transient population. This is noticeably true on the Manitou line, which, in its 6½ miles of length, runs through Colorado City, popularly known as "Old Town," passes by the gateway to the famous Garden of the Gods, traverses the principal street of Manitou, by all its hostelries, and finally ends in the center of the city, connecting, by means of a ¾-mile electric line, with the depot of the Pike's Peak cog road. With the exception of a short distance in Manitou the passenger is in full view of Pike's Peak on this entire ride, and the latter portion of the trip is made through a beautiful canon.

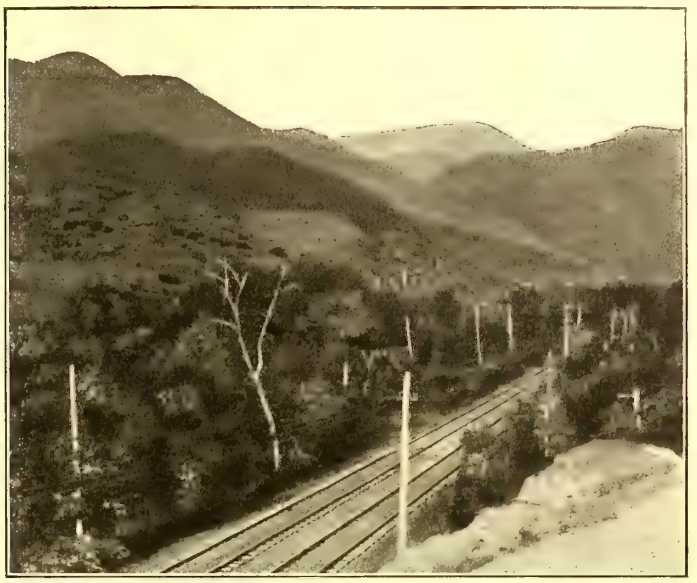
Between Colorado City and Manitou the railway has its own right of way, and this section of the road, which is illustrated in two of the accompanying views, is typical of the standard construction used throughout the system. Sixty-five-pound A. S. C. E. section T-rails, in 60-ft. lengths, are laid on 6-in. x 8-in. x 8-ft. Texas heart yellow pine ties, laid on 2-ft. centers. The track is standard gage, and is thoroughly ballasted with water-washed gravel. This gravel is obtained in the immediate vicinity, and is a disintegrated dustless granite, such as is being used by many of the steam roads in the Western part



VIEWS IN STRATTON PARK



TRACK CONSTRUCTION NEAR MANITOU



VIEW OF CAMERON'S CONE AT LEFT AND PIKE'S PEAK IN CENTER, APPROACHING MANITOU

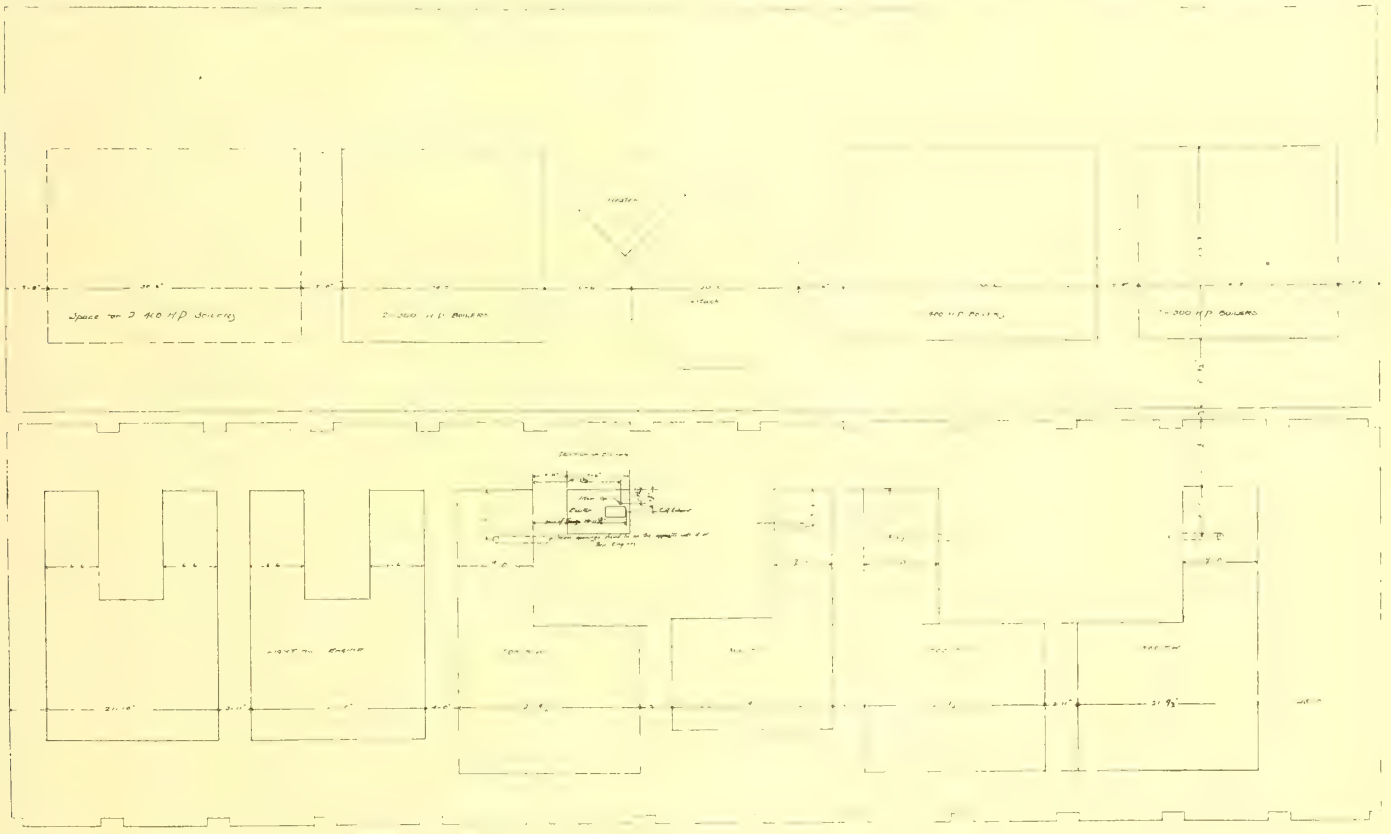
of the country. The overhead construction consists of No. 0 round trolley, suspended with Dirigo clamps and General Electric switches and cross-overs. Idaho cedar poles in 35-ft. lengths, with 7-in. tops, are used for span suspension and to carry the feeders. For the Manitou line feeders aggregating 1,800,000 circ. mils in area are employed. The Cheyenne Canon line is similarly constructed, and is fed from 1,500,000-circ. mil cables. This line is 22,000 ft. long from the central loop, while the Manitou line is 34,000 ft. long.

The central loop spoken of passes around a 400-ft. x 400-ft. block in the center of Colorado Springs, and all cars pass through it. It consists of about 2500 ft. of 75-lb. rail, double track, and considerable special work.

The ¾-mile electric line in Manitou, before mentioned, runs between the cog road depot and the Colorado Springs car line, and is operated by the management of the cog road, power and rolling stock being leased from the Colorado Springs & Interurban Railway Company.

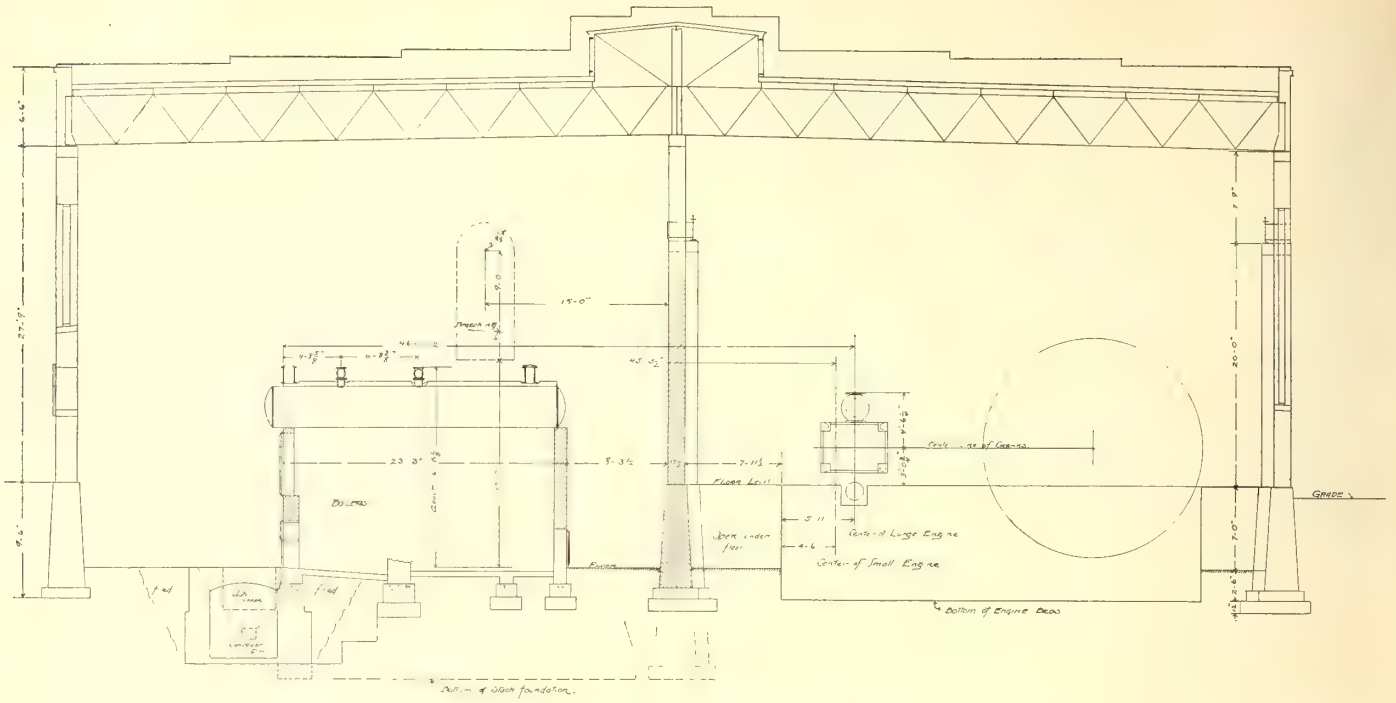
POWER HOUSE

Improvements and additions to the company's property that have recently been completed include the erection of a power house, new car houses and new shops. The power station is located at the corner of Rio Grande Street and Sierra Madre Street, adjacent to the tracks of the Denver & Rio Grande Railroad. It is a red brick structure, and is 164 ft. 6 ins. long and 97 ft. wide, divided longitudinally into two sections by a brick fire wall. One section constitutes the engine room and the other the boiler room, and each is 164 ft. 6 ins. x 48 ft. 6 ins.

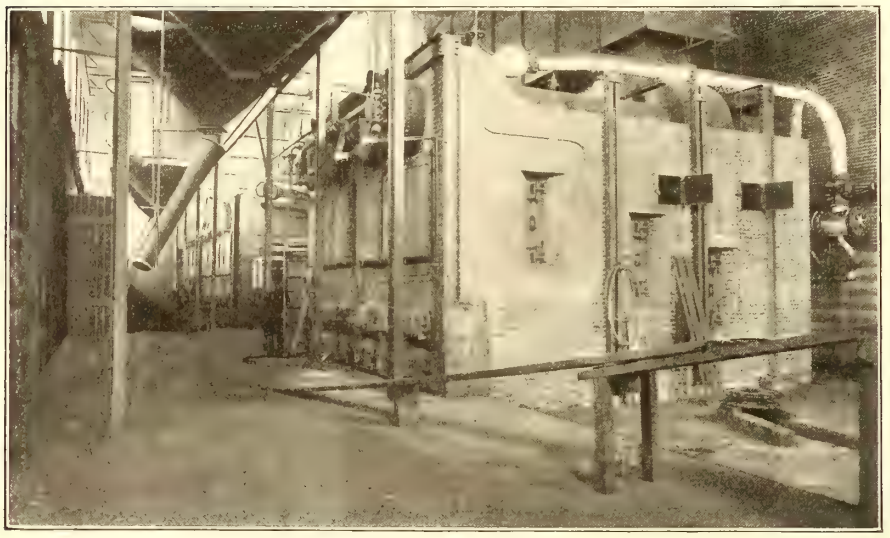


PLAN OF POWER PLANT, SHOWING ARRANGEMENT OF BOILERS AND GENERATORS

The building is built upon a concrete foundation throughout, the same material being used also for the foundations of the boiler, engine and generator units. The foundation walls go to



CROSS-SECTION OF POWER PLANT



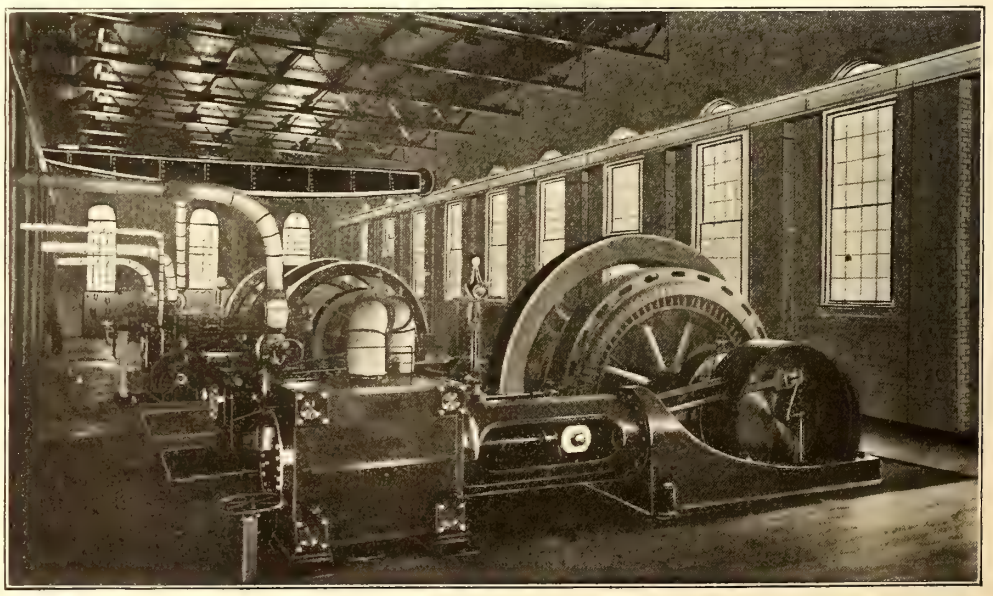
BOILER ROOM

BOILER ROOM

The boiler room equipment consists of six Cahall-type water-tube boilers. Four of these boilers are of the two-drum, sixteen-section type, with 24-ft. x 42-in. drums, and nine 20-ft. x 4-in. diameter tubes to a section. The grate surface is 66½ sq. ft., and the nominal rating of each boiler is 300 hp. The other two boilers are of the three-drum twenty-one-section type, nine tubes to a section, the drums and tubes being of the same size as in the other four boilers; the nominal rating of these boilers is 400 hp each.

For feed-water purposes there are two single Marsh 12-in. x 7½-in. x 12-in. pumps. A 4000 hp special Cochrane open heater is used for heating the feed water. On the boiler room side of the dividing wall and behind the boilers is a main steam header, 14 ins. in diameter and 140 ft. long, that supplies the

the bottom of all excavations, and average 10 ft. high, 1 ft. 9 ins. wide at the top, and 2 ft. 6 ins. wide at the bottom, being widened at each pier correspondingly. The main walls of the building are 17 ins. thick and average 38 ft. in height. They are built of the hardest brick obtainable in the local market, laid in cement-tempered mortar. The roof is carried on an all-steel construction, composed of 4-ft. lattice girders, 6-in. I-beam purlins and 3-in. T-irons. On this are laid 3-in. hollow tile laid in cement mortar and covered with 1 in. cement, to make a tight construction. The roofing proper consists of a five-ply pitch and gravel covering, making, with the cement top, a perfect fireproof roof.

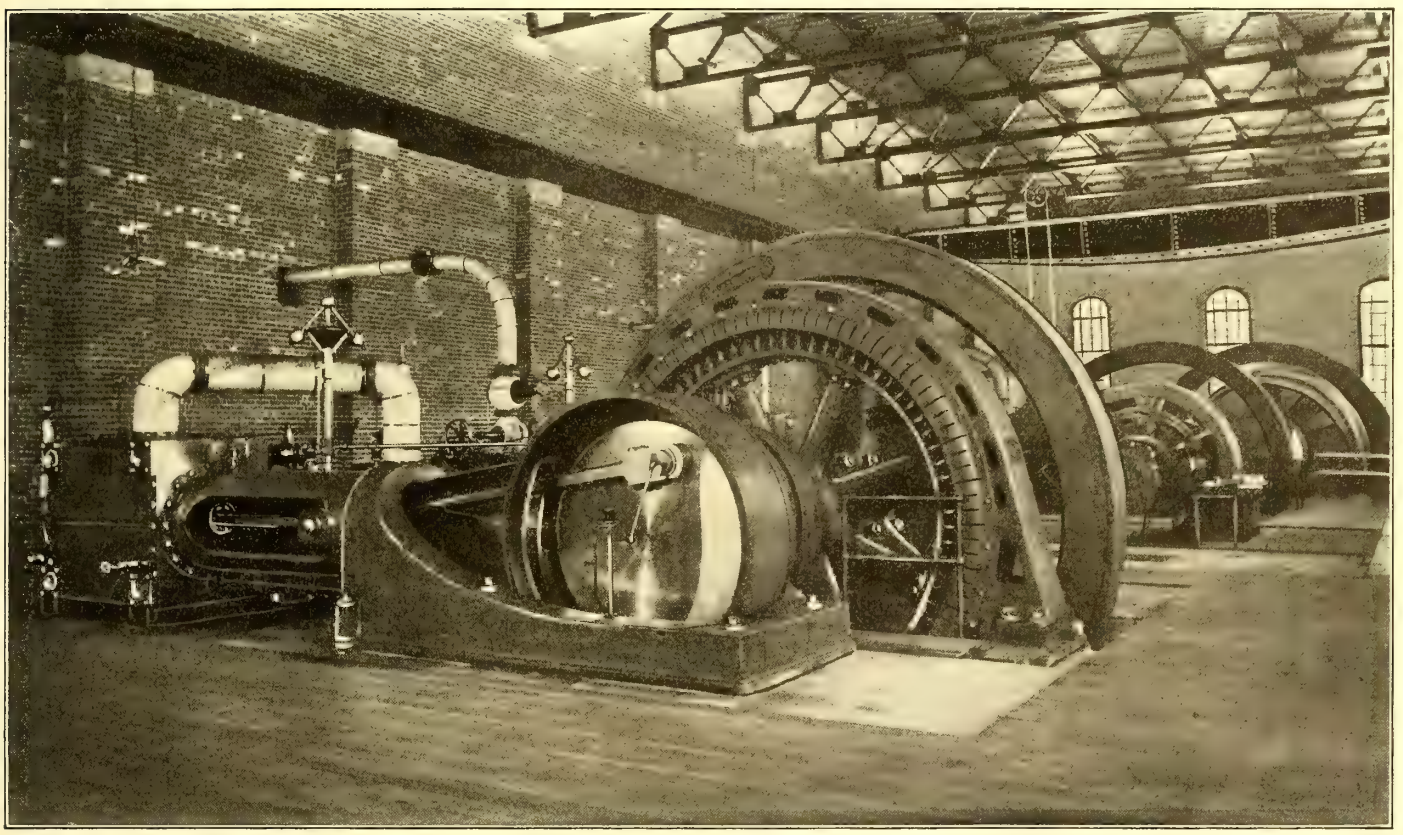


GENERAL VIEW OF ENGINE ROOM

engines with steam. This header is mounted on special roller brackets, which allow the pipe to expand and contract. The exhaust main is 24 ins. in diameter and 120 ft. long.

For handing all the coal and ashes in the boiler room a conveyor system is installed. The coal is a soft lignite, mine run, and costs $1.15 a ton. Three tons of it equal, for fuel purposes, about 2 tons of bituminous slack. It is mined a short distance north of Colorado Springs, and shipped from the mines to the power house in steel hopper-bottom cars, bought by the company for this purpose. The coal is dumped from the cars into a hopper built under the tracks outside the station, and passes through an electrically-driven crusher. It is then taken by a cross-conveyor to a longitudinal conveyor, which runs the full length of the boiler room in a concrete pit, 5 ft. 6 ins x 7 ft. 6 ins. in size. This conveyor carries the coal to the top of the room and empties it into six steel cylindrical bins, which have a capacity of 25 tons each. The coal is taken from these bins by the firemen as needed. The ashes are also removed by the same method, being taken from the ash pits to the top of the building and deposited in a steel bin, whence they are taken in cars to points on the road where they may be used for filling. The coal and ash conveying machinery was installed by the Link Belt Machinery Company.

The self-sustaining steel stack is built upon a concrete foundation, 25 ft. x 25 ft., and extending to a depth of 10 ft. below the boiler room floor. The concrete also extends 32 ft. above the floor, 20 ft. in diameter, making the concrete foundation 42 ft. high. The steel part of the stack is anchored to the concrete by sixteen 2½-in. rods, 42 ft. long, extending to the bottom of the foundation and fastened to T-rails. The steel stack is 152 ft. high, and is made up of three different sizes of steel plates, namely, 70 ft. of ½-in. steel, 50 ft. of ⅜-in. steel and 32 ft. of 3-16-in. steel. The inside diameter is 10 ft., and the total height of the stack above the boiler room floor is 184 ft.



VIEW OF RAILWAY GENERATORS

ENGINE ROOM

In the engine room are installed three direct-connected 575-volt direct-current generating units, and one direct-connected 6600-volt alternating-current lighting unit. Two of the railway-generator engines are indentical, except that one is a right-hand and the other a left-hand engine. They are Allis-Chalmers-Corliss engines, with cylinders 28 ins. in diameter and 48-in. stroke, and are equipped with two wrist plates and 60,000-lb. fly-wheels. The normal capacity of each engine is 750 hp, and each generator is a 500-kw, 10-pole General Electric machine, operating at 90 r. p. m. The third unit consists of a right-hand Allis-Chalmers-Corliss, 22-in. x 42-in., 450-hp engine, with two wrist plates and a 46,000-lb. fly-wheel, driving a 300-kw, 8-pole General Electric 575-volt generator. The alternator unit comprises an Allis-Chalmers-Corliss cross-compound 450-hp engine, with cylinders 18 ins. and 32 ins. x 42 ins., with a 50,000-lb. fly-wheel, connected to a General Electric 72-pole, 300-kw, 6600-volt, 20-amp., 60-cycle, three-phase generator, operating at 100 r. p. m. For exciting the fields of the alternator a 35-kw, 125-volt continuous-current generator is installed. It is directly driven by a marine steeple-compound 7½-in. and 12½-in. x 6-in. engine at 400 r. p. m.

Spanning the engine room and running its entire length is a 25-ton Whiting traveling crane. The crane track rests on 20-in. I-beams, supported on piers 1 ft. x 3 ft., added to the thickness of the wall.

A gravity oiling system is used for the engines and generators, the oil flowing from steel storage tanks fastened to the roof girders to the bearings, then to a filter, from which it is pumped back to the storage tanks.

All of the steam pipes are connected with the Holly system of return, whereby all the water from condensation is returned to the feed-water heaters and is used again in the boilers.

The floors of the engine and boiler rooms are of concrete, the boiler room floor being laid on gravel and that of the engine room consisting of a 6-in. suspended concrete flooring with top dressing, supported by steel construction, leaving a basement below with 8 ft. head room, where all the cables and wires

from the generators to the switchboards are run. The engine beds are all of concrete, and average 10 ft. in height. The tops around the engines are floored with vitrified tile.

machine panel, three circuit panels for multiple lighting and one circuit panel for series arc lighting. This board is built of blue Vermont marble, and is fully equipped with all the



NEW CAR HOUSES

The power house is ventilated by a double row of sash in the roof, operated by a series of sprocket chains from inside.

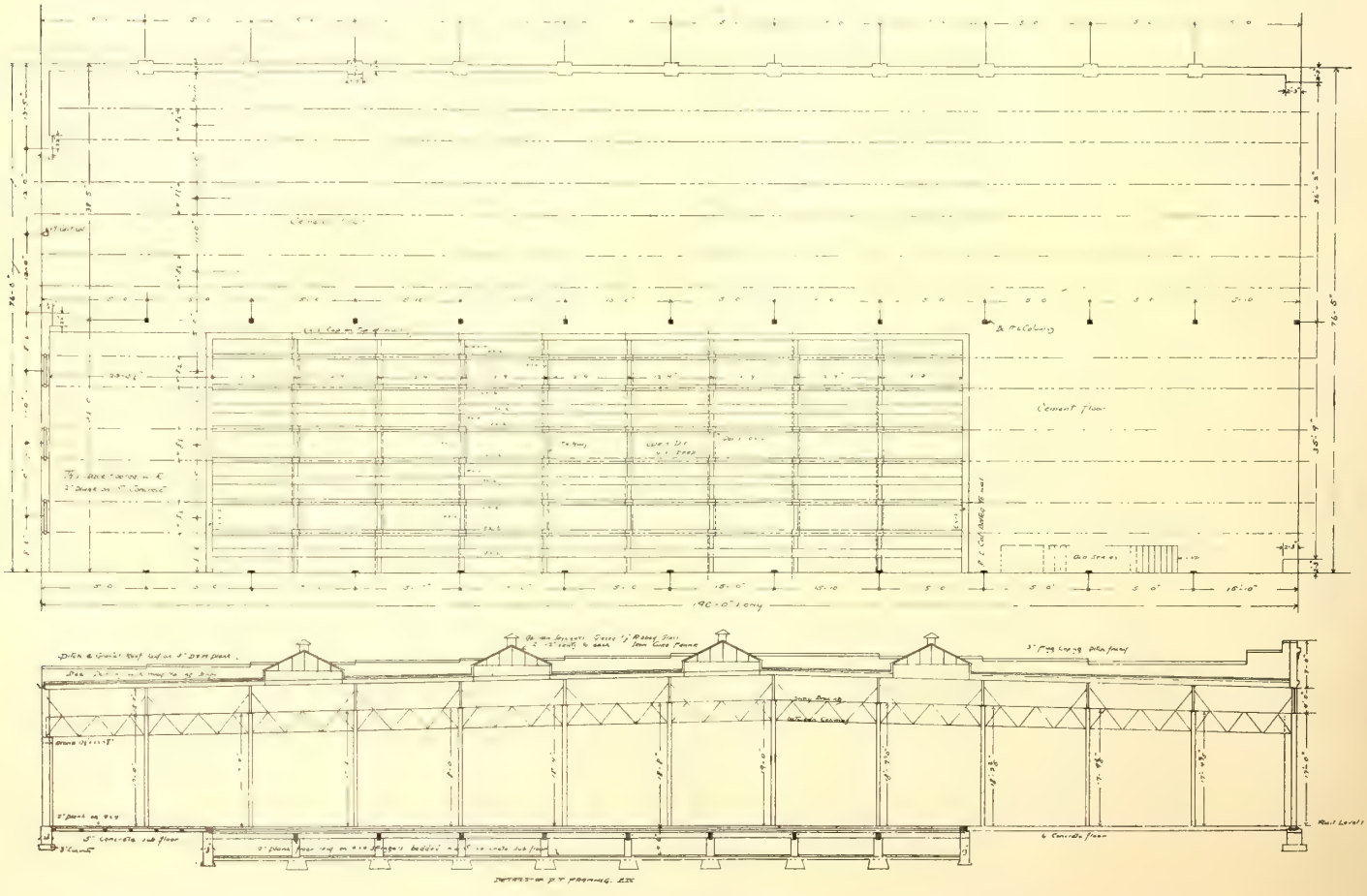
SWITCHBOARDS

The railway power switchboard consists of fifteen panels of slate, enameled black and highly finished. There are three 500-kw machine panels, each equipped with a 1200-2000-amp. circuit breaker, ammeter, field rheostat and two single-pole, single-throw, quick-break switches. A totalizing panel is equipped with a 2500-amp. recording wattmeter and voltmeter and ammeter. The remaining eleven panels are used for the feeder lines, and are provided with the necessary circuit breakers, ammeters and feeder switches.

The lighting switchboard comprises an exciter panel, one necessary instruments, switches, transformers, etc. This board and the alternator were installed for supplying the arc light service at Stratton Park. Both switchboards, as well as the other electric equipment, were furnished by the General Electric Company.

OPERATION OF STATION

Although this is a simple non-condensing plant, the cross-compound alternator unit not running now, a showing of 0.$0073 per kilowatt-hour for the month of July, including labor, repairs, oil, waste, fuel, etc., is an excellent record for operation cost, and reflects credit on the designer of the station and the operating engineer. The station used 8 1-6 lbs. of coal per kilowatt-hour during July, the cost per kilowatt-hour being



FLOOR PLAN AND SECTION OF CAR HOUSE

0.$0047. The maximum load on Aug. 13, 1903, which represents a typical summer day, was 2400 amps., while the average was about 1000 amps. This record shows that an excellent opportunity is offered for the installation of a storage battery to float on the system and smooth out the peaks, and the management of the company is fully alive to this situation, so that a battery will doubtless be the next addition made to the equipment.

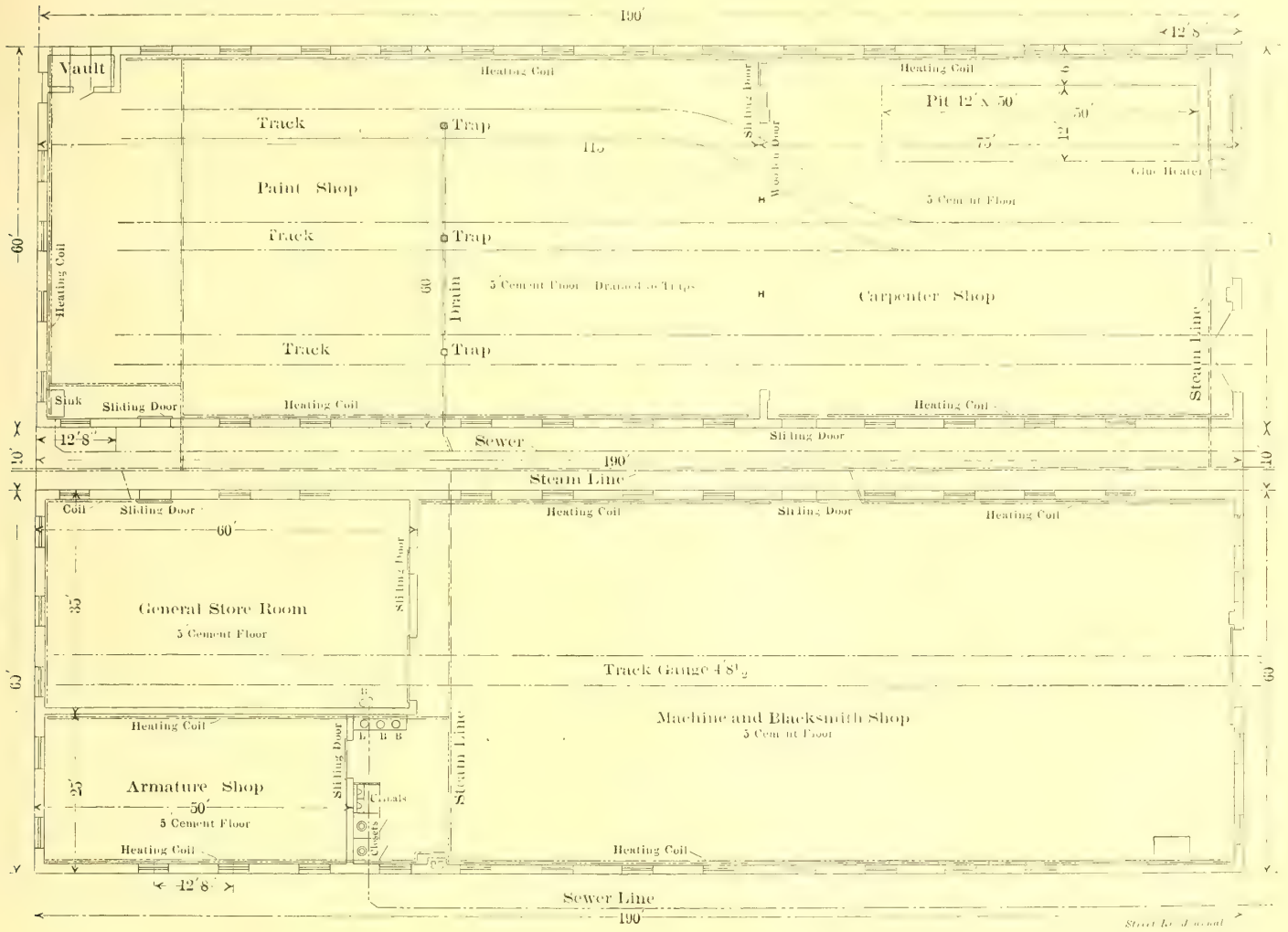
An interesting feature of the load sheet is the separate peak, beginning about 1:30 a. m. and running until 3 a. m. This is caused by the operation of two or three cars between Colorado Springs and Manitou, to connect with the Pike's Peak cog road, in order to get the tourists to the top of the peak in time to see the sun rise, which is a wonderful sight from that point. During the summer months these sunrise excursions are run from one to three times a week, and prove exceedingly popular.

A study of the main curve of the load sheet reveals the existence of a heavy workingmen's traffic about 7 a. m., and other peaks about 7:30 p. m. and 10:30 p. m., caused by the traffic to and from the evening entertainment at Stratton Park. The load during the day is irregular, depending on the weather and the trend of the tourist traffic.

In case the hydro-electric development that is now being made at Manitou by the Pike's Peak Hydro-Electric Company, proves commercially economical, it is possible that the traction company will close down its steam plant and install a transformer and rotary converter equipment to operate its system. This water-power plant will use the water supply of Colorado Springs for the development of about 4000 hp, and it is expected the plant will be completed this coming winter.

CAR HOUSES

A series of four brick and steel car houses are provided on Tejon Street for the storage of the company's cars. Each of these houses is 180 ft. long. Two are each 50 ft. wide and have a combined capacity of thirty-two double-truck cars. The car house with office rooms on the second floor is 50 ft. wide, and has three open-pit tracks with a storage capacity of sixteen double-truck cars. The new car house is 80 ft. wide with a center row of latticed steel columns. It has six tracks, three of which have open pits for repair work. This new car house has a capacity for twenty-four double-truck cars, making the combined capacity for all the houses of seventy-two cars. On the north side of the car houses is a single-track wash house,



PLAN OF SHOPS

25 ft. x 50 ft., with concrete floor for washing. It is the intention to arrange a hollow rectangle of perforated pipe above the track about the size of a car, so the roof can be quickly and easily washed off. The tracks of the car houses are connected by means of nineteen curves, with an independent track laid 14 ft., center to center, from the west track of the main line, with shut-ups at the south and north ends to this west track and a cross-over on the main line. All of the special track work is built in the company's own shops. A view of the car houses is presented herewith. These structures are provided with twenty-six sets of steel rolling doors, made by the Kinnear Manufacturing Company.

SHOPS

In the rear of the car houses are two brick buildings, with steel girders for support of the roof, and with cement floors, each 190 ft. long and 60 ft. wide. One is used for the carpenter and paint shops and the other for the machine shop, store room and armature room. The carpenter shop is 60 ft. x 75 ft., and

is equipped with a wood planer, band-saw and other necessary tools, the motor which furnishes the power being placed under the floor in a concrete pit with all the shafting. There being no shafts or belts above the floor, the result is a very neat and complete shop. The paint shop is 60 ft. x 115 ft., and has three tracks, on which six large double-truck cars can be painted at one time. A 12-ft. 6-in. skylight runs the full length in the center of the building, making a very light and pleasant shop in which to work.

In the other building the machine shop occupies a space 60 ft. x 130 ft. In one corner is installed a Sargent-Ingersoll compound-automatic air compressor, having a capacity of 200 cu. ft. of free air per minute. Compressed air is used for operating the pneumatic lifts in the shops and car houses for blowing out motors, and for instructing motormen in air-brake operation. The compressor is belt-driven, by a 50-hp General Electric, shunt-wound, 500-volt motor. This motor is also belted to a line shaft running at right angles to the shop, from which are driven a 24-in. Lodge & Davis drill press, a combination punch and shear, shearing 6-in. x 1-in. steel, and punching a 1-in. hole in 1-in. steel, a Newton cold-sawing machine for cutting off rails at any angle, a small iron planer, emery wheel, large grindstone and blower for the blacksmith forge.

The main line shaft of the machine shop runs the full length of the shop in the center of the building. It is in two sections, one section running wheel machinery, including one 150-ton hydraulic Watson-Stillman wheel press, one Putnam wheel-boring machine, which will bore and face from 15-in. to 40-in. car wheels, one axle lathe of the Putnam improved type, with crane for taking axles in and out of the lathe. This section of line shaft runs only when the wheel-boring machinery is in use. From the other section of the main line shaft are operated a 36-in. Bickford radial drill, one 26-in. J. B. Reed lathe, one 14-in. Prentice Bros. lathe, one 30-in. shaper, an automatic saw sharpener, a twist-drill grinder, a diamond tool grinder and a car-wheel grinder for truing old and new wheels. This main shaft is driven by an 8.5-kw Edison bipolar shunt-wound motor. For emergency use in case of a burn out on either of the other two motors a 15-hp Sprague motor is kept belted up and ready to run. On this floor there are also three blacksmith forges and one furnace for melting babbitt metal for refilling the different bearings of the motors and cars. A standard gage track runs through the machine shop and into the store room for handling supplies and heavy work.

The armature room is 25 ft. x 50 ft. in size, and is used for winding the armatures and fields and the different electrical parts on the cars. Air valves and pipes are also tested for leaks and defects in this room.

The store room, 35 ft. x 60 ft., contains everything that is used in the repair and maintenance of the track, overhead construction, motors and cars of the company.

Adjoining the shops and in the rear of the car houses is the company's old power-house building, which can be used for storage purposes. Between this old building and the machine shop and between the two new shop buildings are 10-ft. alleys, which will allow the free passage of fire wagons, thus adding to the safety of buildings that in themselves are practically fireproof.

On the corner of the block adjoining the car houses the company proposes to erect a handsome office building and club and athletic rooms for the use of the trainmen.

ROLLING STOCK

The rolling stock of the Colorado Springs Company includes fifteen open Narragansett-type Brill double-truck cars, equipped with 27-F Brill trucks and four General Electric No. 67 motors, giving 152 hp per car; nine closed and one open double-truck Laclede cars, with Milwaukee trucks and four General Electric No. 67 motors; five closed Brill convertible patented type of car, with 27-F Brill trucks and No. 67 motors. The rest of the passenger equipment comprises seventeen 16-ft. and 24-ft. Pullman closed cars with McGuire trucks, and seven combination (part closed and part open) cars.

For overhead work the company has a single-truck line car, equipped with two type-C No. 3 steel motors, mounted on an old-style McGuire truck. Other cars include a double-truck work and snow-plow car, with Milwaukee trucks and four General electric No. 67, 38-hp motors, two single-truck Taunton snow-plows (closed) with two No. 67 motors, two open flat-push plows, three flat double-truck work or construction cars, thirteen open eight-bench trail cars.

Most of the double-truck cars are equipped with Mosier arc headlights, made by the Dayton Manufacturing Company, while a few Syracuse incandescent headlights are also used.

SCHEDULE AND SPEEDS

The cars regularly run on schedules varying from 7½ minutes to 30 minutes, the time being lessened, of course, when the traffic demands it. Within the fire limits of Colorado Springs, a section five blocks wide and six blocks long, the company is required to limit the speed of its cars to a maximum of 8 miles an hour. Outside of that section and also in Manitou the company has no restrictions, and generally operates the cars at about 16 miles an hour. This brings the average speed of the cars up to about 12 miles an hour. An example of the scheduled time of one line is given on the branch running to Manitou. The trainmen on this line are required to make the round trip of 13½ miles in 70 minutes during the summer. For eight months of the year this schedule time is cut down to 65 minutes for the round trip.

The officers of the Colorado Springs & Interurban Railway Company are the following-named gentlemen: President, A. S. Sharp; secretary and treasurer, Carl Chamberlain; assistant secretary and treasurer, William Lloyd; manager, purchasing agent and chief electrician, D. L. Macaffree; assistant superintendent, J. Henry; chief engineer of the power station, C. C. Bibb; master mechanic, J. Eastwood. The power station and car houses were designed and built under the direct supervision of Mr. Macaffree, and he is also entitled to the credit of placing the operation of the road on its present economical and paying basis. Roberts & Bishoff, of Colorado Springs, were architects and builders of the power house, shops and car houses.

NOTES ON THE OPERATING PRACTICE OF THE INDIANA UNION TRACTION COMPANY

The Indiana Union Traction Company, which operates such an extensive network northeast of Indianapolis, has always been known as one of the most progressive and substantial interurban railway companies in the Middle West. Not only on account of the size of its system and the excellence of its territory, but on account of the up-to-date engineering and operating methods, is this company's property notable. In fact, a visit to it and a study of its methods is almost a liberal education in interurban railroading. Several articles regarding its practice have appeared in these columns from time to time, and especially in the issue of Dec. 7, 1901. Recently the attention of electrical engineers has been attracted to this property by the papers presented to the American Institute of Electrical Engineers by Professor Goldsborough and associates on tests made on the efficiency of power house, cars and transmission system. In the Street Railway Journal of Oct. 4, 1902, Clarence Renshaw gave a synopsis of the most complete series of interurban car tests ever attempted, which were carried out on the Indiana Union Traction Company's lines. The present article will serve merely to call attention to certain operating details which may be of interest and value to other interurban railway companies.

LIMITED SERVICE

Since the latter part of 1901 this company has given limited service between Muncie, Anderson and Indianapolis. These limited cars make only a few of the necessary stops, in fact, receive passengers only at the business centers of Anderson and Muncie. This limited service is remarkable, not only for its speed but for the comfort which it affords the traveler, as compared to steam service, especially in warm weather, when it is desirable to have windows open. In a recent trip over the line the writer could not help comparing the comfort and cleanliness of this limited service with the dirt and discomfort of the fast steam railroad service between the cities included in the route, to say nothing of the greater frequency of the electric service.

It goes without saying that to be able to operate cars at from 50 m. p. h. to 60 m. p. h. mile after mile over an interurban road requires first-class roadbed, freedom from sharp curves, easy-riding trucks and overhead work kept in such accurate alignment that there is no trouble from the trolley coming off. This is what the Indiana Union Traction Company has, and the "Limited" speeds over the country with practically as little interruption as the limited trains on steam roads. Of course, there must be a slacking of speed going through the small towns along the road, as frequently the right of way is along one of the streets through such towns. From the Indianapolis city limits to the business center of Anderson is 36 miles, and this run is made in 1 hour, including the time required getting into Anderson. A schedule calling for 36 miles an hour average speed is not slow, even on a steam road. In addition, 20 minutes is required to make the 3½ miles between the business center of Indianapolis and the city limits, making the time between the business centers of Indianapolis and Anderson 1 hour and 20 minutes. The time between Indianapolis and Muncie, including the stop at Anderson, is 2 hours. The fastest limited steam train between those points takes 1 hour and 15 minutes, but there is only one steam train of this kind each way a day. The distance from the business center of Indianapolis to the business center of Muncie is 54½ miles. There are four limited cars each way per day. Higher fare is charged on the limited cars than on the local cars, the fare being approximately 2 cents per mile for the limited service and about 1½ cents per mile for the local service. The limited cars are well patronized.

TRAIN DESPATCHING AND MEETING POINTS

As far as possible the limited as well as the local cars operate without stopping for telephonic orders from the despatcher, that is, as long as the cars are on schedule time and meet according to the time-table, there is no necessity for reporting to the despatcher except at terminal points. This company, it will be remembered from previous articles in the STREET RAILWAY JOURNAL, has a telephone despatching system in which each car carries its own telephone instrument, and "hooks in" on the line at terminal boxes located at sidings. There is one despatching line which is kept entirely for despatching, and no other business is conducted over it except in emergencies. The despatcher's head receiver is connected at all times across the despatching line, so that no bell signals are necessary to call the despatcher. The train crews simply "hook in" and begin to talk, provided that no one else is talking over the line. The telephone instruments on this company's lines are now furnished and maintained by the Central Union Telephone Company (Bell), as it was found more satisfactory to have instruments maintained by those expert in this kind of work than for the railway company to attempt it. It is notable that around Indianapolis the method of carrying telephone despatching instruments on each car rather than placing the instruments in booths along the line is almost universally employed, the Indiana Union Traction Company having set the example. This practice is all the more notable because of the trouble which has been experienced in many places with telephone instruments carried on the cars. In fact, some of the other lines around Indianapolis have experienced considerable trouble in maintaining their car telephones in operating condition. The officers of the Indiana Union Traction Company, however, do not seem to be aware of any special difficulties in maintaining car telephones. An investigation of the matter leads one to the conclusion that the success of the Indiana Union Traction Company with car telephones is simply due to the fact that it does not neglect them or expect them to remain in good order indefinitely without any attention, as do some of the smaller companies. A. S. Richey, electrical engineer of the company, when questioned as to why the Indiana Union Traction Company experiences so little difficulty with telephones carried on the cars as compared with other companies which have tried the same practice, said: "Of course, if we neglected our telephone instruments, and had none in reserve, we should have trouble from interference with the operation of the road, just as we should have trouble with any other piece of apparatus treated in a similar manner. It is simply a question of seeing that the cars are kept supplied with instruments that are in good working order. If a man reports his telephone instrument as not giving satisfaction it is immediately exchanged for one which has just been overhauled. The telephone company keeps a supply of instruments in good order at all times, and as fast as instruments become defective they are taken in to be overhauled and good ones put in their place. If a man has trouble in talking with the despatcher between terminal points he can usually use the instrument of some other car at a meeting point, which will enable him to get to a terminal where he can change his telephone. Of course, telephones give out and have to be overhauled, but I am not aware that our cost of maintenance is excessive. We simply consider it as we would the maintenance of any other piece of apparatus, and do not expect the telephones to maintain themselves."

The company has recently adopted a rule of having the first car to arrive at a meeting point take the siding, allowing the last car to arrive at a meeting point to go through on the main line without interruption. This saves some time over the old plan of keeping to the right at sidings.

SPRING POINT SWITCHES ABOLISHED

The use of spring point switches at turn-outs has recently been abolished. All switches are now operated by hand. The reason for this is the danger that the spring point will not be entirely closed by the spring. With cars operating at speeds of from 40 miles to 60 miles over facing-point switches, these switches cannot be made too secure. Two accidents which recently occurred to limited cars, due to the failure of spring-point switches to close effectually, convinced the management of the advisability of this change. If the spring-point switch is not entirely closed, the passage of the forward pair of trucks is likely to cause enough vibration so that it will snap closed by the time the rear trucks reach it, with the result that the front trucks take the siding and the rear trucks take the main line.

SEMAPHORES AND LIGHTS ON SWITCHES

Hereafter all switches will be equipped with semaphore blades, in place of dwarf targets, to indicate whether the switch is open or closed, and will further be equipped with electric signal lights for use at night. After some experimenting the plan adopted is to use a 300-volt incandescent lamp for each switch signal, two of these 300-volt lamps being, of course, required in series at a turn-out, one in each switch stand. A choke coil and lightning arrester are inserted in the lamp circuit at each turn-out. The 300-volt lamps employed are selected of such low efficiency that they have a long life. The lamp circuits are run each way from a sub-station, and are thrown on and off by switches at the sub-station. When operating at such high speeds as are common on these lines switch lights are cer-

tainly advisable, and are an assurance to the motorman that the line is clear.

THE OVERHEAD TROLLEY FOR HIGH SPEED

It is a matter of wonder to electric railway men who visit this system that the overhead trolley seems to be giving such satisfaction at the high speeds. Although the equipment of the majority of the cars is such that the speed does not frequently exceed 50 m. p. h., there are some equipments with which a speed of 60 m. p. h. is sometimes attained, and this is accomplished without any undue arcing of the trolley wheel or the trolley leaving the wire at curves. The behavior of the trolley at high speeds is perhaps the best proof that could be given of the smoothness of the track and the alignment of the overhead wire. Figure 8 trolley wire has been used throughout, which gives a smooth under-running surface. Practically no trouble is experienced with the trolley coming off, but to provide for such emergencies the Knutson trolley retriever is in use. The amount of wear obtained from trolley wheels in interurban service is somewhat remarkable, and their life is not anywhere as short as might be expected. Five thousand miles is the minimum life of the 6-in. Kalamazoo wheels which are used. Some wheels run as high as 7000 miles. This holds true even on the limited cars.

SHOP AND CAR MAINTENANCE NOTES

J. L. Matson, superintendent of motive power, has adopted the plan of overhauling equipments according to the mileage they have made. That is, the equipment is taken in for general overhauling after it has made a certain number of miles. This is, of course, much more logical than overhauling according to the time an equipment has been out of the shop. The mileage a truck is allowed to make before being taken in for overhauling is 12,000.

The company now uses Standard steel-tired wheels, with malleable iron hubs and spokes, cast-iron hubs having been abandoned. Steel-tired wheels have always been used on motor trucks on this road, as cast-iron wheels have not been considered safe under motors in such high-speed service. The wear on steel wheels, not including turning down, is about ⅛ in. for 13,000 miles. M. C. B. practice is followed as to maximum wear allowed on steel-tired wheels. This practice allows 1-in. thickness of steel tire as the maximum on the main part of the tread.

This company does all of its overhauling of motors and trucks from above, taking the trucks from under the car body and working on them on the open floor. Pit work is avoided as far as possible. New shops are soon to be built at Anderson which will have an overhead traveling crane for lifting car bodies, trucks and motors.

DECEMBER LOAD THE HEAVIEST

This company finds that the heaviest power station load occurs in December, due to the holiday shopping. This is contrary to the experience of many interurban lines, which have the heaviest loads during the summer. It goes to show that the company is dependent upon business rather than upon pleasure traffic for its largest income, and is a condition of affairs which should be satisfactory to those financially interested.

GENERAL EXPANSION

George F. McCulloch, the company's president, is tireless in his efforts to improve the property and to extend it to cover all of the territory north of Indianapolis. New lines are constantly being purchased and projected, and present indications are that the Indiana Union Traction Company, or allied companies, will soon control nearly all the electric railway mileage in Indiana north of Indianapolis, and will have an entrance to Chicago. This rapid expansion has necessitated a somewhat peculiar organization. General operation is in charge of A. A. Anderson, with headquarters at Anderson; A. L. Drum, assistant general manager, has charge of all the extensive new construction, with headquarters at Indianapolis.

CLAIM DEPARTMENT METHODS IN BROOKLYN

BY GEORGE R. FOLDS

The development of electric street railways has not only required the introduction into their accounting systems of many features not found in ordinary railroad bookkeeping, but has made it necessary to develop a type of claim department essentially different from that of steam roads. The vast number of trivial accidents that are continually happening, and the occasional disaster that entails claims running into the tens of thousands of dollars are all first reported by the crews on the cars, so that an easy, simple, full and careful reporting system is by no means easy of accomplishment. Promptness in getting full and accurate news of accidents involving liability to the claim department, equal promptness in acting on this knowledge, coupled with good judgment on the part of adjusters, are three essentials in the routine of this important work. The first can be obtained only by having a system of trainmen's reports perfectly adapted to the trainman of least literary ability; the second by the satisfactory organization of the claim department and thorough co-operation of all the other divisions of the service therewith; and the third, by the employment of good men as investigators, division agents and adjusters, and keeping them up to their best work by a thorough system of checking.

There are two policies which a railway may adopt in its treatment of damage claims: It may try to adjust every claim on a fair basis, or it may make it a rule to fight the majority of them in the law courts. The latter necessitates a large legal department, with often an auxiliary force of trial lawyers. It also not infrequently produces a feeling of antagonism on the part of the public, owing to the publicity given to the cases, whether the company is shown to be at fault or is entirely vindicated. For some time the policy of the Brooklyn Heights Railroad has been to adjust amicably every damage claim possible, and only the grasping unreasonableness of the claimants is now able to force the company into court. This policy has been adopted more completely last year than ever before, the amount of ready cash carried by the adjusters for immediate settlement having, for instance, been trebled. The large decrease in the amount paid for injuries to persons, as given in the last annual report, is undoubtedly due in a considerable measure to the improved work of the claim department.

In a system as extensive and intricate as that in Brooklyn there are, of course, many refinements of detail necessary in its claim department which would not be justified upon smaller or simpler properties, but perhaps some of the methods used to bring the cost of an accident to a minimum may warrant a brief description of the whole. Although the present system has been organized but a few months, and is working with great smoothness and satisfaction to employees and management, one much less elaborate would undoubtedly be more in place on a smaller road. Some of the features are entirely new, however, and others are novel in their application to this work.

The greatest importance in the Brooklyn system is attached to the reports of the car crews. For a long time the custom was almost universal of having these reports made out on loose sheets in duplicate. This work was irksome, and the employees necessarily had to wait until they reached the car houses before writing an account of the accident, and it often resulted in the information getting to persons not acting in the company's interests. A report blank has been adopted by the Brooklyn Heights Railroad, which is of the same size as the conductors' day cards, about 5½ ins. x 11 ins., and both conductor and motorman are intrusted to carry a number of them on each trip. This blank, shown below, is printed on pink paper, and contains spaces for filling in the principal facts and names, together with a few lines for a general description of the acci-

dent. As soon after each accident as possible both the conductor in charge of the car involved in the casualty and motorman are expected to make a brief memorandum upon one of these report blanks. This statement is, of course, written in pencil during lay-over time, if possible. The names and addresses of witnesses are taken on small slips, about 1½ ins. x 3½ ins., furnished for the purpose, only one name being placed on each slip. The conductor is supplied with a number of envelopes addressed to the claim clerk of his depot, in which the data, viz., his own report and that of the motorman's report and the witness slips, are inclosed. Upon arriving at the end of his run, or when passing his depot, he deposits this envelope in a locked iron box, to which the claim clerk and depot master alone have keys.

THE BROOKLYN HEIGHTS RAILROAD COMPANY.
TRIP ACCIDENT REPORT

This is to be made out during run and turned in with names of witnesses and injured party, when passing depot.

Line.....Car No.....
Date of accident.....Hour.....
.....Trip leaving.....at.....m
Place of accident.....
Number of persons on wagon.....No. of passengers.....
Was police officer present?.....Officer's No..... Precinct....
Was ambulance called?.....What Hospital?.....
Name of driver or injured person.....
Address .....
Name of owner.....
Address .....
Description of accident.....
.....
.....
.....
Signed.....Conductor No.....
.....Motorman No.....

There are claim clerks at seven of the largest depots. By employing eight men for this work each clerk gets every eighth day off duty. All the clerks employed in this work are notary publics, and it is their duty to interview the trainmen regarding accidents at the earliest possible opportunity, and take their affidavits regarding the same. This work is nearly always done when the men are on relief. As soon as the report envelopes are deposited, however, the claim clerk makes a typewritten report therefrom and forwards it to the claim department. The clerks are supplied with typewriters, in which the writing is visible at all times, and no difficulty has been experienced by them in soon mastering the art of using these machines.

This claim agent's report forms the basis upon which the investigators, adjusters and other employees of the road proceed, and five copies are made—the original, printed in copying ink, and four carbons. This report calls for the following data:

Depot Number.....Accident Report Number.....
Line.....Car No.....Open or closed....
Conductor.....Motorman .....
Date of accident.....190....Hour.....m.
Place of accident.....Grade.....
From and to what street was car going.....
Was car moving; if so, how fast.....
Direction vehicle or person was going.....
Number of persons in vehicle.....
Number of passengers in car.... { Men / Women / Children }
What other cars near.....What other vehicles.....
Damage to car.....
Injury to person or property.....
Description of accident.....

The lower part of the sheet contains the names and addresses of the injured parties and also those of the witnesses. From two of the carbon copies the claim clerk tears off and destroys the lower portion, thus removing the names of the injured parties and witnesses, and sends one each to the general and division superintendents. The remaining three copies, the original pink reports and the witness slips, are sent to the claim department at the end of the day.

The claim clerks at the principal depots attend to the business of the less important depots near. Boxes are provided for depositing the crews' report slips, and these are collected by the nearest claim clerk during the day. The trainmen are allowed to use the company's time in taking the trip to the claim clerk's office for the purpose of making their affidavits.

The claim clerks work from 3 in the afternoon until 2 the next morning. In this way all accidents occurring before midnight are fully reported to both operating and claim departments by 7 the next morning. At this hour a clerk in the claim department enters the office case number on each copy received at that office, and takes a letter press copy of the original in a book used for the purpose. This latter preserves the original information in a compact form, and one in which it can be stored in a safe, and kept free from fire or other loss. The original typewritten report is then used as a basis for the claim file, and is put away, together with the crew's report and witness slips. The two carbons are used in handling the case. One is always kept on a "Shannon" board file as a standing memorandum for the chief investigator or claim agent, and is called the "Case to Watch" carbon. The other is given to the investigator or adjuster, each of whom has a board file of his own. By examining these boards at any time the chief inspector can see just what work a man has on hand, and as the reports are filed in the order of their case number any special instruction which may be given to an investigator at work on a case can be put in the file at the proper place, when it will attract his immediate attention. By using the file system there are never any memoranda of dead cases mixed in with live ones, as when a case is concluded the carbon is taken out, checked off and sent to the file room. Other advantages of this system are that all employees have a readable and uniform style of report on all cases, that adjusters and investigators have practically all memoranda necessary for a case on a single sheet of paper, and that the office has complete information as to the work each man has on hand, and an efficient check on his work.

As soon as convenient after an accident a sworn statement is taken from the trainmen by the division claim clerk. A four-page blank is used for this purpose. The first three pages contain a series of questions as follows, and an affidavit form:

THE BROOKLYN HEIGHTS RAILROAD COMPANY.
EMPLOYEES' ACCIDENT REPORT

(Col., Per. or Veh.) Claim No.
Personal Statement, sworn to by No.

1. Did you see the accident?
2. Where did it occur? Opposite what street number?
3. What day and what hour did it occur?
4. trip leaving at m
5. What first attracted your attention to the accident?
6. Who was other trainman and where was he at time of accident?
7. Were there other people on street in vicinity of accident? Give names.
8. Give names or license numbers on all vehicles in vicinity of accident?
9. Did the party having accident appear to be injured?
10. Did such party appear insane, intoxicated, blind, deaf or lame?
11. About how old was injured party? Race or nationality and sex?
12. What was done with injured party? What ambulance or physician, if any, was called and by whom?
13. Give statements of injured party or driver of vehicle. What did he say about accident and whom did he blame?
14. From and to what street was car going.
15. At place of accident was it up or down grade or level?
16. Was car standing or moving when you first saw danger? If moving, state about how fast?
17. Had bell been given to stop? If so, for whom?
18. Where was last stop made before accident occurred?
19. State condition of weather.
20. State condition of rail, whether dry, wet or slippery.

21. Was street dry, muddy, icy or covered with snow at place?
22. Was there any car passing in opposite direction at time of accident? If so, give line and car number and state about how fast it was going.
23. Was gong on that car ringing?
24. Were there any other cars near at time of accident? If so, give lines and car numbers. Also state what cars came up after accident.
25. Give names and numbers of all employees around at time of accident.
26. Give number and precinct of any police officer who was there at time of accident or immediately after it.
27. Number of passengers. Men Women Children
28. How many on platforms of your car, front? rear?
29. What was the number of car? Was it an open or closed car?
30. Were all parts of car in good working order? (If not, state defects.)
31. Were you on time? If late, state how much.
32. If at night; (a) Was car lighted up? (b) Was headlight shining? (c) Was street lighted up at place of accident?
33. What direction was vehicle or person going with reference to car? State how fast.
34. If vehicle, state how many persons in it and who was driving.
35. State kind of vehicle and what damage.
36. How far ahead of front end of car was person or vehicle when you first saw danger?
37. How far ahead of front end of car was person or horse when first stepping upon your track?
38. Was gong ringing? If so, when and for how long?
39. Was any other warning given? If so, what?

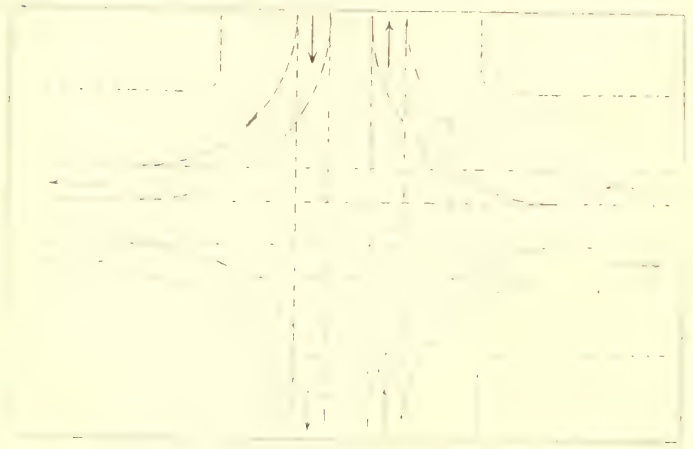


DIAGRAM OF CROSSING

40. What did the person, after having been warned or signaled, do?
41. Was your view or that of injured party obstructed; if so, by what?
42. Where was car with reference to nearest street crossing, at time of accident?
43. Give distance from front of car, after it stopped, to place of accident. If paced or measured, state who did so.
44. After stopping car in consequence of accident, was car moved again until it left the place? If so, state reason.
45. State all that was done, to your own knowledge, to avoid accident after danger became apparent.

The Brooklyn Heights Railroad Company

CLAIM DEPARTMENT

LOCAL AGENT'S DAILY REPORT Dated 190

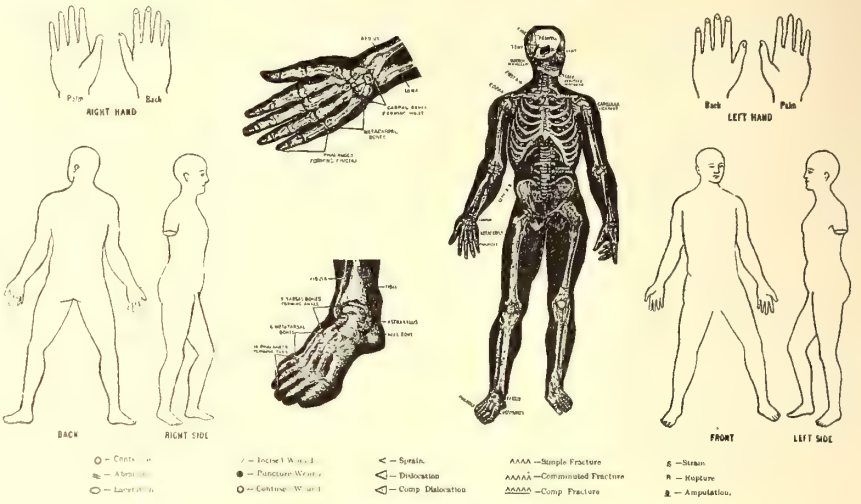
CASE NUMBER	REPORT	EXPENSE	CALLS	INTERVIEWS
TOTAL NUMBER HOURS		TOTAL		

ADJUSTER

ADJUSTER'S DAILY REPORT

46. Give general description of accident and state any incidents or features not answered above.

The above is for an accident resulting from a collision with a person or a vehicle. A slightly different form is used for injuries to persons alighting from or boarding a car. On the back



SURGEON'S CHART

of these sworn statements is the outline of a street crossing, printed in light ink. Upon this outline a diagram of the scene of the accident can be readily traced.

A new system of keeping a record of the expenses and work of employees has also been introduced into the claim department. Each morning the agent makes out a report of the work done the previous day, stating after each item the expense, number of calls, interviews or settlements. The investigators instead of settlements give the number of signed statements they can secure on each case. These daily reports are collected and summated on a weekly sheet, thus giving a convenient record of the department's labors.

There are, of course, a number of details of the system of which space does not permit extended description. Besides the carbon report slips a day book is kept of all cases, and the progress made on them. The various steps taken towards settling the claim are recorded on the report slips as they are taken. Much labor is saved by sending a printed form to the witnesses and getting their statements without a personal interview. It was formerly the custom for the division claim agents to report at the respective depots, and start out on their days investigating work from there. Now they all meet at the general offices, and can divide work among them, so as to save much unnecessary traveling and waste of the company's time. As soon as an adjuster can do nothing more with a case his carbon is marked "file," and goes in with the other documents, including the original report. A file is also kept of cases which may be adjusted later, and these are looked over from time to time.

The filing of all documents flat is a great improvement over placing them in envelopes or in pigeon holes. The board file gives easy access to all papers thereon, with the liability of losing them while being inspected reduced to a minimum. Besides these files two auxiliary card catalogues are kept. One contains the names of injured parties and witnesses, and the other the names of trainmen interested in accident cases. The cards, of course, give the file number of the claim and all information regarding the movements of the parties is recorded thereon. If a trainman resigns from the company's employ his record is looked for in the claim department's card catalogue, and if it is found he is connected with any cases of alleged liability his probable changes of address and occupation are noted on his card. Similar card catalogues are also kept by the legal department.

The surgeon's report furnished by the company is similar to

that ordinarily used in accident cases. It contains data as to the injured party's habits, residence for past five years, former physicians, previous condition of health and evidences of old injuries, disabilities or disease, etc. A surgeon's chart is also used, showing in outline the front, back and side of the human body, upon which can be indicated by signs the position and character of the injury. Both report and chart are made the same size as the other documents, so as to be readily filed therewith.

In reorganizing the claim department the following ideas have been kept in mind:

1. To have an easy and simple method for the trainmen to report accidents.

2. To secure promptness in reporting accidents and promptness on the part of the claim department in handling accident cases.

3. To secure careful and full reports from employees.

4. To give each case individual consideration and as carefully directed investigation as it may require.

5. To have men who have good judgment acting as adjusters.

6. To adjust all cases of liability or doubtful liability, and as a general rule to settle a claim as quickly after an accident as possible.

7. To give adjusters considerable latitude in settling cases.

It has been thought better to have the claim department too large than too small in order to handle such cases as collisions of cars and other emergency accidents. Great care is exercised in the selection and supervision of the men, as the management considers that it is more important to have efficiency in the claim department than in the law department, as far as the negligence part of the business is concerned.

ILLINOIS STATE ELECTRIC ASSOCIATION MEETING

The Illinois State Electric Association convened at the Southern Hotel, St. Louis, Saturday, Sept. 19. This Association is mainly composed of electric light companies, but as there are an unusually large number of companies operating both street railway and electric light plants in the State of Illinois, a number of street railway men were in attendance.

The Association was taken by a special car of the St. Louis Transit Company from the Southern Hotel to the World's Fair grounds, where several hours were spent in driving about the grounds. In the afternoon, at 3 o'clock, the Association took the steamer Illinois, which is the property of the Illinois and United States Fish Commissions, for a trip up the Mississippi River and Illinois River, which ended the next day at Beardstown, Ill. The use of the steamer was given to the Association by the fish commissioners, and the courtesy was much appreciated. At Baden the party went ashore for a short visit to the works of the St. Louis Car Company, where they found President George J. Kobusch, Vice-President and General Manager H. F. Vogel and General Sales Agent W. S. McCall ready to receive them, assisted by Messrs. Sutton, Rubenbauer, Smith and others of that company's operating force. Refreshments were served in the company's dining room, and the reception ended with rousing cheers for Messrs. Kobusch, Vogel and the St. Louis Car Company. From Baden the party proceeded to Alton, where the Alton Railway, Gas & Electric Company took the visitors around the town and afforded them an opportunity to inspect its generating station, and later in the evening gave a theater party for all the delegates. The next day, at 7 a. m., the steamer started up the river for an all-day trip, some of the party leaving at Meredotia and some at Beardstown.

Among the street railway men in attendance were W. B. McKinley, of Champaign, president of the lighting and railway properties at Danville, Champaign, Decatur, Galesburg, Quincy and Ottawa, besides the large number of interurban lines controlled by the Portland or McKinley syndicate; H. E. Chubbuck, general manager of the Illinois Valley Traction Company, La Salle, Ill.; W. A. Bixby, general manager of the Decatur, Springfield & St. Louis Railway; S. L. Nelson, manager of the Galesburg Electric Motor & Power Company; S. B. Bartlett and F. W. Bedard, of the Illinois Valley Traction Company, La Salle; C. L. Gerould, of the Galesburg Gas & Electric Company; J. W. Race and W. A. Martin, of the Quincy Horse Railway & Carrying Company.

FIREPROOF CARS

George Gibbs, consulting engineer of the Interborough Rapid Transit Company, of New York, who was one of the designers of the new subway cars described and illustrated in the Street Railway Journal, Aug. 29, 1903, has been granted a patent upon another form of construction which is in some respects a radical departure from the subway type. This car is intended for service upon electric lines, and includes many of the features of the subway cars, but it is proposed to build it entirely of metal and non-combustible material. It is the intention of the inventor to eliminate wood entirely from the car structure, owing to its tendency to splinter, which would increase the fire hazard materially, it is claimed, in case of a wreck caused by a collision or derailment.

The frame of the car is to be of metal with a non-metallic, non-splintering lining, which shall be either entirely non-combustible or of slow-burning composition. This lining will also serve the additional purpose of deadening sound and providing a heat and insulating partition. It is pointed out that a car constructed entirely of metal would be noisy and uncomfortable, and it is feared that dangers from short circuits would be greatly increased. The non-metallic lining will afford protection against the extreme effects of heat and cold which would be present in an unlined metallic car, and will deaden the sound which would be transmitted to the interior of the car if metal alone were used in the structure.

Provision is made for an all-metal frame above the floor and a metallic outside sheathing, but with a lining of non-splintering board composition, made either of wood pulp fiber, impregnated with metallic salts or of composite board made of wood pulp and asbestos or other non-combustible material capable of being formed into a board of sufficient mechanical strength and toughness. The floor frame may consist of angle-side sills, additional center sills running longitudinally, and transverse angular bridge pieces, all of these parts being of metal. The fireproofing and insulation of the floor may be composed of a board of transite or similar fireproof material laid on top of the bridge pieces. On top of the sills a flooring of metal will be formed of corrugated sheets, and on top of this a plastic flooring of asbestos, magnesia composition or similar material will be laid.

The side framing of the car is formed of iron posts, which also comprise the vertical frame between the side windows and are secured to the outside sheathing of metal so as to form a vertical truss. The sheathing is riveted to these posts and extends from the bottom of the side sills to a window sill angle piece. Around these posts between the windows finishing strips of pressed metal are secured in such a manner as to exert a spring pressure and hold the window sash in place and thus prevent it from rattling.

The roof construction employs metallic carlines extending from one end of the car to the other, while the longitudinal frame between them consists of angle pieces, and the outside roofing may be of sheet metal or of the non-metallic lining material, where lightness is particularly desirable. The interior lining consists of non-metallic, non-splintering material below the window sills and between and above the windows. Several methods of securing this lining to the posts are described.

THE WORK OF THE ACCOUNTANTS' CONVENTION

BY JOHN F. CALDERWOOD

The meeting of the Street Railway Accountants' Association at Saratoga is one upon which every member of the Association can look back with satisfaction. A few years ago there was a sentiment on the part of some persons outside of the Association, that as that body had established its standard system of accounting, there was little left for it to accomplish. Those familiar with its aims and purposes knew at the time, and all who have followed the work of the Association since must have realized, that nothing could be further from the facts. The field widens as we advance further into it, and it will require the best energies and most conscientious thought of all satisfactorily to solve the problems which present themselves at the annual meetings. The Association is fortunate in having selected as its president this year F. E. Smith, one of its five founders and original "war horses," who has been prominently identified with the work of the body ever since, and who will make an excellent presiding officer.

One of the most important fields to be undertaken in the early future by the Association was indicated by the interesting paper presented at the Saratoga Convention on freight and express accounts, by Mr. Fullerton. The system followed in Detroit, under Mr. Fullerton's direction, is probably as complete and as satisfactory as that in any other part of the country, and the Association will do well to consider the classification of these accounts in its form of report. Probably few changes will have to be made in the standard form, but whatever plan is adopted the accounts should be kept entirely separate from those of the passenger traffic. The same statement applies to any other distinctive branch of the company's business, otherwise it would be impossible for the manager to determine whether the freight or other outside business is on a profitable basis or not. This means, of course, that the freight expenses should be separated from those of the passenger business and the net earnings only included in the income account. The subject is an important one, as indications point to an early extension of the functions of the street railways in our large cities from those of the transportation of passengers only, to that of handling freight, express, ashes, garbage and other heavy material. In many cases this work will undoubtedly be undertaken by outside corporations who will compensate the railway company for the use of its tracks and power on a car-mileage basis. Mr. McClary's paper before the American Street Railway Association shows that this has already been done in several large cities in the case of express haulage, and this fact is an additional reason for the inclusion of the net receipts only in the income account.

Mr. Stiver's paper on car maintenance records indicates the differences in desirable practice between a large and small road. On the latter it is an easy matter to keep very close watch on the life of many of the different car equipment parts, while the same policy would lead to confusion if carried out on a large system. With a detailed report before him of the life of all gears, pinions, trolley wheels, bearings and car wheels, the manager of the small property has a most accurate guide in placing orders and the maintenance of such a record is not difficult if the card system is used. But with a large system, while the mileage of armatures can be recorded, it is doubtful whether it pays to keep the individual wheel mileage and a debit and credit account of the smaller parts, such as pinions, gears and trolley wheels, is out of the question. The only available plan is to divide the cost of labor and supplies into the several classifications, and taking the total number of cars work out the cost of the different minor parts on a car-mileage basis.

The bag and receiver systems of handling conductors' remittances was another subject which engaged the attention of the Association, and the additional expense of the receiver system was one of its points of disadvantage upon which stress was laid by a number of the speakers. This, however, is not its only objection, as with the receiver system considerable time is lost by the conductors who are obliged to stand in line to deposit their collections and be checked off by the chief clerk. The bag system eliminates all this and affords the additional advantage that the money is not handled by anyone until it reaches the main office. The receiver system was used in Brooklyn for a considerable time, but was abandoned in favor of "bags" after the adoption of a form of envelope which could be effectually sealed. The conductors have great confidence in the present method, and practically no trouble has been experienced with "overs" or "shorts" in the counting of the deposits, while the saving in expense has amounted to about $12,000 a year.

In addition to the papers presented at the convention several topics were introduced for discussion. Of these, the practice followed in sending money to the banks illustrates one of the differences in local conditions between the Eastern and some of the Western roads. In the Western States, where the use of silver dollars is more common than that of paper certificates, the railway companies receive large quantities of coin, and in many cases have to ship it in bulk to the nearest sub-treasury. In cities where the coin is sent to the local banks the latter usually insist upon having those of each denomination wrapped separately. In the East this practice is not required, and there is usually such a demand for copper pieces from the department stores and small retailers that dealers will call at the office of the company for it.

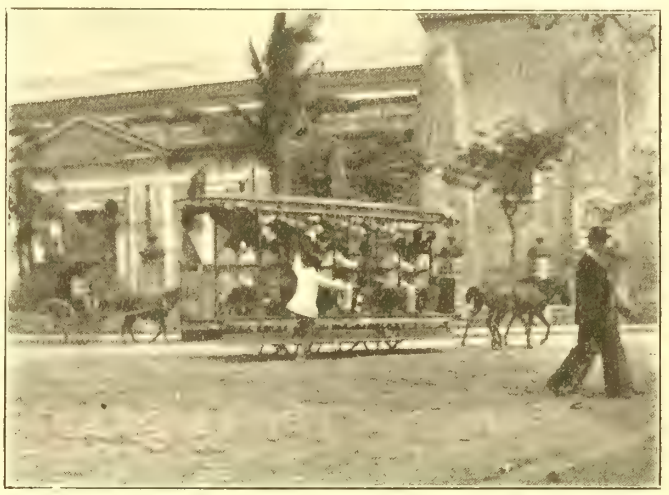
The subject of enlarging the scope of the Association was also the subject of considerable debate, and the Association did wisely in deciding not to admit to full membership outside accountants or others not directly associated with street railroading. While there are many expert accountants not in direct affiliation with street railway companies, whose experience would be of value to the Association, street railway accounting differs radically from that in any other industry, and it would be extremely unwise to give the right of participation in the councils of the Association to those who are not actively engaged in street railway work. There is also the reason that the outside accountant might make his membership in the Association the means of furthering certain fads in accounting, or for advertising purposes, so that the importance of confining the membership to active street railway accountants is sufficient to justify fully the action taken at Saratoga. The writer believes, however, that it would be of benefit to the Association if some plan were adopted by which outside accountants, investors and others could secure regularly the proceedings of the Association, and thus keep in touch with the changes made from time to time in the classification and the decisions of the body on disputed points in accounting practice. It is not only due those experts who are from time to time called upon to look into street railway properties that they should have a working knowledge of the Association's classification, but it would also be of value to the latter body in furthering the general adoption of its methods. Bankers and investors in street railway properties have also a right to understand the basis of the classifications of the accounts used on their properties, and it behooves the Association to consider whether the adoption of a by-law authorizing some action in furtherance of this end is not now advisable. Such connection should not entitle the subscriber to admission to the meetings, or certainly not to the floor or to a vote, but should carry with it the right to receive the printed copies of the transactions.

THE STREET RAILWAY OF MANILA

Before the new electric railway system of Manila has been completed and the present antiquated but picturesque bob-tail cars have been finally consigned to the scrap heap, it may be of interest to describe briefly the system which has survived the Spanish regime and is giving away only now to modern methods. Manila enjoys a distinction claimed by only a few cities just now outside of New York, London and Paris, of possessing a transportation system in which animals supply the greater part of the motive power. The cars carry twenty-four people, the law limit, and most of these people are natives. The peculiar attraction of the car is its draft animals. The native horses are all small, but those of the street railway line seem particularly miniature in stature.



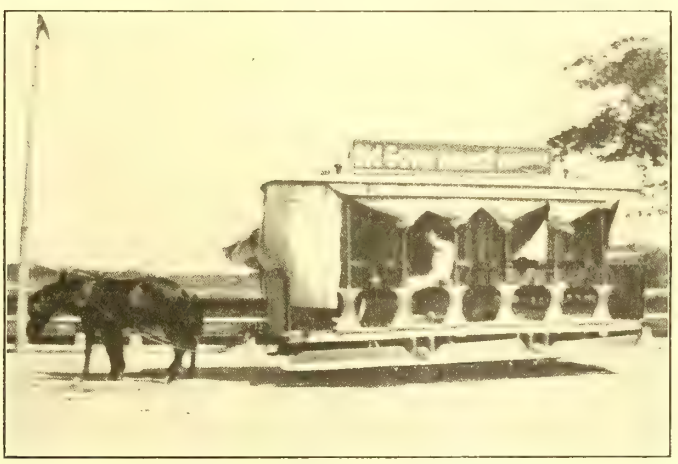
TYPICAL STREET SCENE IN MANILA



OPEN CAR USED IN MANILA

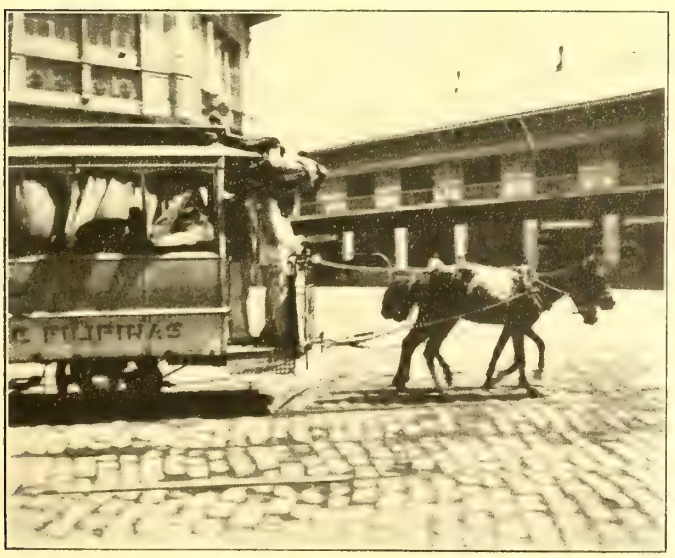
The cars necessarily travel slowly. Still, the line is considerable accommodation for the natives, and, in fact, large numbers of soldiers travel from Malate, a suburb of Manila, into the city proper for 5 cents. The line extends through some of the main streets of the city. The bulk of Manila street traffic is with the little native vehicles, but there are not nearly enough to accommodate the people. One has to wait and watch on street corners for half an hour to get a vehicle. Hundreds pass, but they are usually occupied or engaged. The native cabmen do a fine business and they are powerful. They are said to have prevented the introduction of the Japanese jinrickshaws, and, it is stated, they object to the advent of an electric line in Manila and its suburbs. But their objections seem to be carrying little weight.

Properly to understand the conditions of street car traffic in Manila reference should be made to the various systems used in the transportation of passengers and freight in the streets of Manila and the several adjoining important suburbs. The slowest medium for freight and passengers is the caribou cart, whose speed is about 3 m. p. h. These carts are in vogue even to-day in the busy streets of modern Manila, running alongside of the up-to-date express wagons of recent importation.



SPECIMEN OF ADVERTISING ON CARS

Next in order is the



SNAP SHOT OF A MANILA HORSE CAR



SLOWEST FORM OF MANILA TRAFFIC

"chicken coop" vehicle, so-called, designed with a box body with lattice sides, much like a chicken coop. This affair rests upon two wheels and has a top, and the passenger has to clamber up over the wheel to get into the coop. The fare charged is 10 cents for same distance served by the street railway line for 5 cents. Then comes the "quilizes." These vehicles are two-wheel topped buggies, and are drawn quite rapidly over the ground. The charge is 20 cents per hour and smallest charge is for a full hour. The Victoria vehicles cost about $2 per hour first hour, and are drawn by two horses. The highest speeded vehicles for passenger traffic are the automobiles. There are not more than forty or fifty in service, but they are used often, and one sees them skimming along the drives very rapidly. The present street car speed is equal to that of the chicken coop carts.

Manila has some very fine roads, which are broad and finely graded for miles, and there are some through which an electric railway line could easily be constructed.

The present railway employs natives for conductors, drivers, linemen, stablemen, etc. Haste is something quite unknown to the Filipino. He has plenty of time for everything. Cars are stopped while he says good-bye to his friends and has quite a chat, and the driver and conductor show no impatience.

The conductors are all uniformed in neat gray with gilt bindings on the cap, and evidently feel proud of their military appearance. Fare receipts are given for each 5-cent fare in place of registers, and as the receipts bear a consecutive number there is a check upon the number of fares collected.

The little narrow-gage cars are, as a rule, worn out and need painting. But the company makes no great effort to keep them up on account of the early date at which the new line will be completed. The cars are freely decorated with advertisements, and are usually crowded.

EARNINGS OF IOWA INTERURBANS

According to the reports submitted to the Executive Council of Iowa by the interurban railway companies of the State for assessment purposes, the gross earnings of every such company for 1902 were in excess of the operating expenses. The Des Moines Interurban Railway Company reported gross earnings, $26,895; operating expenses, $14,839, and net earnings, $12,057. The net earnings amounted to more than 5½ per cent interest on the actual valuation of $234,100. The larger part of the mileage of this company was only in operation during the latter part of the year. The Boone Suburban Railway Company reported gross earnings, $7,495; operating expenses, $4,553, and net earnings, $2,942. The net earnings represent more than 15 per cent interest on the actual valuation of $18,800. The Cedar Rapids & Marion City Railway Company reported gross earnings, $103,694; operating expenses, $76,429, and net earnings, $27,265. The net earnings are more than 15 per cent interest on the actual value, $179,983. The Mason City & Clear Lake Traction Company reported gross earnings, $37,330; operating expenses, $29,261, and net earnings, $8,064. The net earnings represent more than 15 per cent interest on the actual value of $52,632. The Waterloo & Cedar Falls Rapid Transit Company reported net earnings about $40,000, which represents 10 per cent interest on the actual valuation of $400,000. The Tama & Toledo Electric Railway Company reported gross earnings of $9,000; operating expenses, $8,330, and net earnings, $876. The net earnings represent more than 3 1-3 per cent interest on the actual valuation of $19,998. This company had its line in operation only for a few months during the year. The reports show that those companies which had their lines in operation during the entire year of 1902 made from 10 per cent to 15 per cent interest on the actual valuation.

ARMATURE TESTING WITH A MILLI-VOLTMETER

BY CALE GOUGH

The winding formula for street railway armatures is in itself very simple, and a workman with ordinary intelligence can usually follow it correctly. But with the 200 or 300 leads to be connected, each in its proper place on the commutator, the undivided attention of the winder is required. Even with the most experienced operators mistakes are by no means few, and when one does occur, if no method of testing is provided, it may not be discovered until the armature has been placed in the motor, where attempts to make it run properly usually result in several damaged coils and quite an amount of lost labor.

The proper use of a milli-voltmeter in the winding room will eliminate much of the uncertainty; clear up many of the mysteries concerning armatures, and prevent mistakes in connecting and winding from going far enough to cause trouble and expense.

In addition to the milli-voltmeter all that is required for making satisfactory tests is a lamp bank, furnishing about 1 amp. of current.

The terminals from the lamp bank are placed on segments, spaced about one-fourth of the circumference of the commutator apart. The milli-voltmeter leads are then placed successively on adjacent commutator segments until half the bars have been passed over. There is no necessity of going over the whole commutator. All the coils are caught when only one-half the segments have been passed over, as will be seen by following out the windings in one of the accompanying diagrams. When the armature is in no way defective the readings between all the segments will be the same. Any variation in the readings indicates something wrong.

The trouble most frequently encountered is a short circuit between two bars. Between these segments the instrument will show no reading or only a partial one, depending on the nature of the short circuit.

Fig. 1 illustrates this point. Assume the lamp bank terminals on the segments a and d, and the milli-voltmeter terminals on b and c. The milli-voltmeter should indicate the drop in the coils b to i and i to c, marked by heavy lines. But the short circuit across the bars b and c allows the current to pass directly across. The heavy coil then is cut out, and, of course, there is no drop of potential in it. Such short circuits are usually caused by a bridging of solder over the mica. Usually this can readily be seen and easily removed. If, however, the trouble is caused by a globule of solder down behind the segments, or between the bottom leads, it will be more difficult to clear up. If, upon thoroughly scraping out the mica, the reading still indicates the presence of trouble, it must be looked for elsewhere. Probably two leads have been transposed. In such an event the next two segments will show no deflection. The reason for this will be understood by reference to Fig. 2. In this cut the leads from h and i to c and b, traveling counter clockwise, are shown transposed. It is evident that the segments b and i and their connecting coils, shown in heavy lines, are not connected to the remainder of the winding, and are, therefore, dead when the lamp bank terminals are on a and d. For this reason no deflection of the milli-voltmeter will occur so long as one of its terminals is on one of the dead segments; that is, when testing from a to b and b to c, likewise from g to h, h to i.

But shorts between the segments a and b and b and c will also cause the instrument to show no reading between these segments. Doubt as to which of the two causes is present may be removed by testing directly from a to c. If bridging solder is the cause there will still be no deflection, but if the leads

are transposed the same reading will be obtained as between two adjacent segments, where no trouble is present. The reason for this is readily seen by following out the coils between a and c, as a to h, h to c, which is the same number as obtained between two adjacent segments when properly connected.

If two successive readings are smaller, but still half or greater than half of the correct reading, the trouble may be assumed to be due to bridging of solder between two segments diametrically opposite the point tested.

Explanation of this is made by reference to Fig. 1. Assume b and c to be completely short circuited, then the deflection between h and i and i and j will be but half of the correct amount. Under normal conditions the drop obtained between h and i is that in the coil connecting i and b, marked heavy, and the returning one connecting b and h. But the heavily marked one is carrying no current, for reasons already explained. When h and i are tested the short circuited coil acts simply as part of the instrument lead, and the deflection is the same as if the instrument were connected directly across h and b, which would give the drop in one coil. For the same reason the drop between i and j is similarly halved.

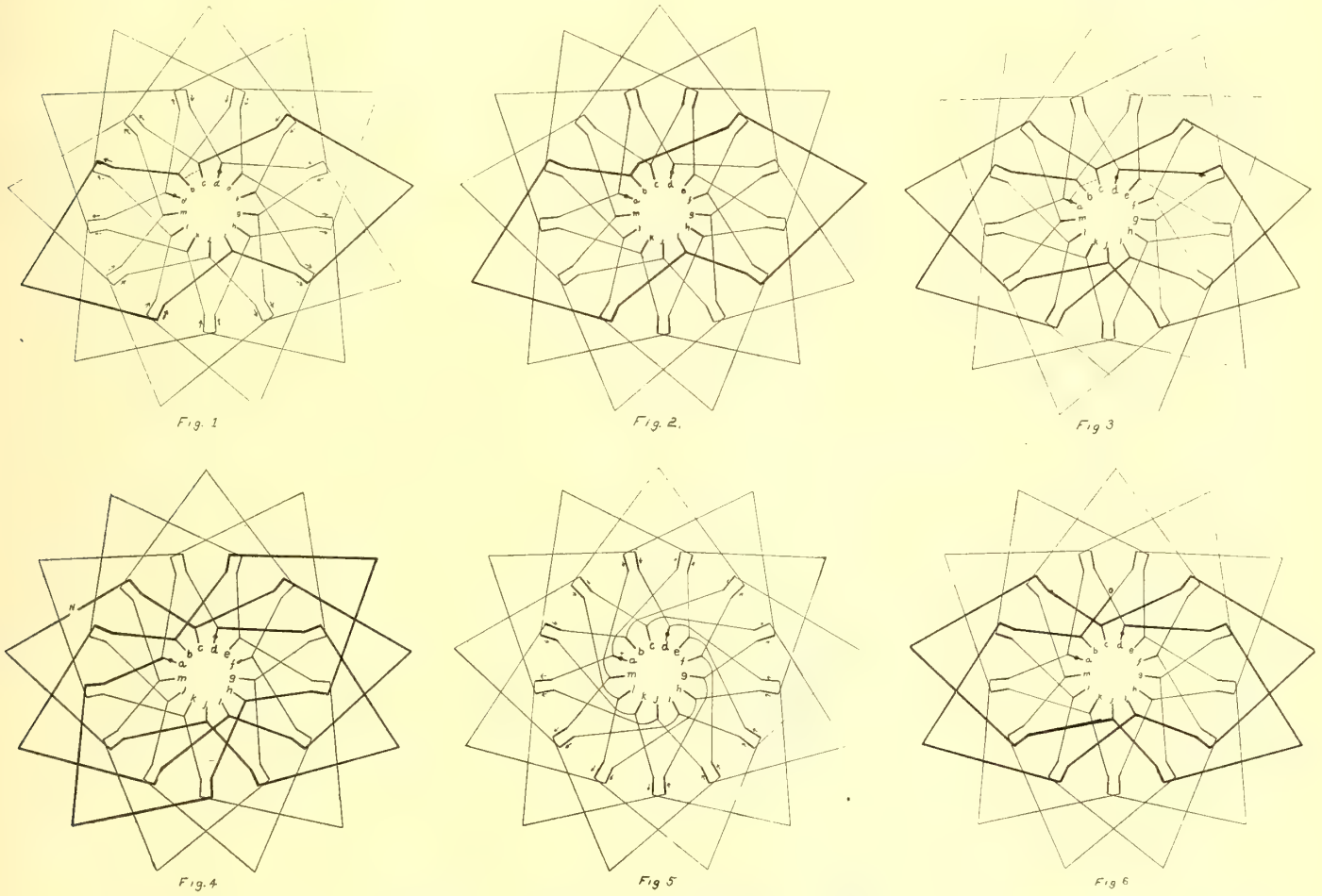
If the short between b and c is not a complete one, some of the current will travel through the heavily marked coils and the readings on the other side will be greater than half the proper amount. One short directly opposite can never cause readings to be less than half.

Two adjacent shorts on the opposite side of the commutator may cause such readings. Suppose, in Fig. 3, b to c and c to d be short circuited completely. The coils representing heavy lines will carry no current. The deflection between h and i will be half. None will be obtained between i and j, while j to k will also show half.

If no readings be obtained between several segments an open circuit may be the cause. Advancement should then be made very carefully, and the instrument leads simply tapped on the segments, for when the segments between which the open is located is reached, a deflection far beyond the scale of the instrument may be obtained and the needle seriously damaged. The reason for this may be seen by reference to Fig. 4. Assume an open circuit at n in the coil connecting j and c. The current in traveling from the lamp bank terminal on a to the one on d will take the path a to g, g to m, m to f, f to k, k to d. The other path, a to h, h to b, b to i, i to c, c to j, j to d, is broken by the open circuit at N. Since no current is flowing through this latter path, shown in heavy lines in Fig. 4, no deflection will be obtained between the connecting segments except between c and d. When the instrument terminals are placed on these segments the effect is the same as if they were placed on the segments a and d, on which the lamp bank terminals rest, for the dead winding simply acts as part of the instrument leads. The drop obtained between these segments is then the drop in the whole winding of the armature, and the deflection is, therefore, excessive. The drop between the segments a and m, m and l, etc., carrying current will be twice as large as normal, for these coils are carrying the total amperage of the lamp bank, whereas they ordinarily carry but half this amount.

It may sometimes happen that all of the top leads are connected in their regular order, but are placed one segment behind or one segment beyond their proper position.

Should the armature happen to be one of those as shown in Figs. 1, 2, 3 and 4, in which on each time passing round the armature one segment is lost, and the top leads be connected one segment beyond their proper position, the effect would not be noticeable in testing. To make one complete revolution around the armature two coils must be passed through. Since with the wrong connections assumed the terminals of each coil



ARMATURE WIRING TESTS WITH MILLI-VOLTMETER

span over one more segment than they should, in passing completely around the armature two segments will be gained. This will give a symmetrical winding, as shown in Fig. 5, but the direction of rotation with armature and field leads connected the same, will be reversed.

Why this occurs is made evident by a comparison of Figs. 1 and 5. It will be seen that the currents in two similar coils of the two diagrams referred to are flowing in opposite directions.

If the top leads of such an armature are connected one segment behind their proper position three segments will be lost in passing round the armature. The deflection between adjacent segments will be excessive, and successive readings will be very irregular in amount. This fault may easily be recognized by placing the milli-voltmeter leads together with the lamp bank terminals on segments between which two segments intervene. A reading so obtained will be the same in amount as in a correctly wound armature, with both instrument and lamp bank terminals on the same and adjacent segments.

If such a mistake as the foregoing be made on an armature having in its commutator a number of segments which is a multiple of three, three separate and distinct windings will result. The length of each winding will be one-third that in a rightly wound machine. If attempt be made to operate such an armature an excessive amount of current will be required; in fact, about nine times the normal amount. This results from the fact that the current has six paths from brush to brush instead of two, and that the e. m. f. generated in each path is one-third that in the rightly-wound machine, so that three times the normal current travels through each of three times the normal number of paths.

Sometimes it happens that through defective insulation the leads of one coil become short circuited across to those of another where they lay on each other. Such a defect will show itself in a decreased reading of the milli-voltmeter on all those segments between the two crossed leads. If the short is a complete one no reading at all will be obtained. Explanation of this feature is given in Fig. 6. With the lamp bank terminals on a and d the path of the current should be a to h, h to b, b to i, i to c, c to j, j to d. But if the leads are crossed on each other at o the current, after reaching b, instead of pursuing the long path to the brush d, will jump directly across to d. The remainder of the path, the coils shown in heavy lines, is idle or nearly idle, depending on the nature of the short. The deflection between b and c and c, d will, therefore, be small, or possibly zero. But local shorts in the commutator may give the same results. To distinguish between the two possible defects let the instrument leads, together with the lamp bank terminals, be placed on the segments b and c. The most direct path between these two segments is b to i, i to c. The short at o has a negligible effect on the current in this path. The milli-voltmeter will then indicate the drop in the path b to h and h to c. This may be compared with the drop similarly obtained between segments on some other part of the armature where no fault exists. If the trouble for which we are hunting is due to a cross, the two readings compared should be similar; if due to short circuited segments the reading between b and c will, of course, be smaller than normal.

Many of the other defects to which armatures are subject and which are often regarded as mysteries, may have their causes made clear by the intelligent use of the milli-voltmeter after the manner explained. No general code of procedure can be outlined for the work. It is only necessary that the investigator be throroughly familiar with the winding of the armature tested and apply reason to each individual irregularity of readings that may occur.

It must not, however, be assumed that an armature standing up under the milli-voltmeter test is a perfect one. Only about 1 amp. is used in testing. When the armature is subject to 100 or more amperes, in actual working, new defects, such as break-down of insulation, heating and consequent short circuiting upon each other of the coils, etc., may result.

The only certain test is to run the armature under load. The milli-voltmeter tests must not, therefore, be regarded as conclusive.

DISCIPLINE AND SAFETY ON INTERURBAN LINES

Accidents on interurban lines from head-on collisions make it daily more apparent that the weakest element in the operation of an interurban road to-day, and the one most detrimental to safety is the difficulty in securing careful employees, thoroughly trained to the essentials of safe operation of trains over a single-track railway. Despatchers on the larger interurban roads are usually men who have been trained in the despatchers' offices of steam roads, and are therefore well qualified, although the same cannot be said of the inexperienced clerks filling such positions on some of the smaller roads. Motormen and conductors, however, have usually had none of the years of training that are required on steam railroads before men are allowed to take charge of trains. It is useless to condemn broadly the practice of hiring for motormen and conductors on interurban lines men who have not had years of training, as is sometimes done, because trained men cannot always be found. To be sure, a few men can be taken from the ranks of steam railroad brakemen who do not care to wait their turn for promotion to conductors' positions on the steam roads. Aside from this, men must be drawn largely from the ranks of city street railway conductors and motormen, or else taken raw and trained to the service. These are the conditions as they exist, and it is useless to rail against them. The problem before the interurban superintendent is to make the best of the situation. Nevertheless, the management of an interurban road is open to criticism when it is not doing everything in its power, both by precept, example and the enforcement of discipline, to impress upon all employees the necessity for eternal vigilance, care and observance of rules in the operation of cars. Laxity in this direction shows itself all the way down through the operating force. There is altogether too much of a tendency to take chances and operate on the old horse-car principle among the small interurban lines, and, unfortunately, when this is the case, there are usually enough careless employees on larger lines to spoil the perfection of the organization.

"Horrible examples" of interurban train despatching methods, as they exist on some roads, have already been cited in these columns, but it will do no harm and may do some good to mention another example which came under the writer's notice recently during an extended interurban journey. The car on which the incident occurred left its terminal point about 30 minutes late. Being of an inquiring turn of mind the writer took a seat in the smoking compartment just behind the motorman's platform, where he could see the line ahead and note the methods of train operation. It would have been better for his peace of mind later on if he had been seated in the rear end of the car. After proceeding several miles the car came to a halt at a telephone connection box, which was not located at a turn-out but at the bottom of a long grade, presumably so that if the car should stop at night to use this connection there would be an excellent chance for another car coming down the grade to crash into it. The car was equipped with a portable telephone, and after making connection the motorman tried to ring up the despatcher by a few vigorous turns of the crank. After waiting for some time the attempt was repeated, without results. The telephone was then disconnected, and the car again started ahead.

The road was one over which high speed could be made, although it was not by any means straight, and as it offered

a number of excellent chances for head-on collisions, the writer naturally became a little interested in learning the location of the other car on the line. That there must be another car was certain, from the length of the line and the schedule maintained, and where there are two cars there is always a chance for a collision. After proceeding several miles more the crew stopped the car and attempted to call the despatcher from another connection box, located at a turn-out. The results in this case were as fruitless as before. The car again proceeded without any orders. Matters were becoming interesting from a railway man's standpoint. After running several miles another car was sighted in the distance, and before long it became apparent that this other car had been running towards the first car, but after the latter was observed was run on to the nearest siding. Upon arriving at that point the cars pulled up opposite each other, and the following highly entertaining and reassuring conversation took place between the motormen:

Motorman A (of the other car): "We waited here a half-hour to meet you, and then thought we'd go ahead. There ain't no box (telephone) on this car, so we couldn't find out what the matter was."

Motorman B: "Why, the power was off half an hour; that's what was the matter. We have a box on this car all right, and we tried to call up, but couldn't get no answer."

Motorman A: "What are you going to do now?"

Motorman B: "I dunno know. What are you going to do?"

Motorman A: "Go ahead, I suppose."

After which both cars pulled out, and the writer was duly thankful that there were probably not more than those two cars on the line, unless there should happen to be a special or work train. The cars on the road were capable of about 40 miles on the level.

It is this kind of general laxity that causes head-on collisions. One car with no telephone and another car with one, but for some reason unable to use it; car crews going ahead when off schedule without knowing the location of opposing cars; these are all conditions pointing to the need of a general overhauling of operating conditions.

It is not a very good recommendation for interurban operating discipline in general that an interurban manager once remarked that he thought it a good plan to have telephones in sound-proof booths and require the motorman to go inside and close the door when taking messages from the despatcher, because, as he said, "the conversation between motorman and despatcher was not always reassuring to passengers." It would seem that this statement in itself would offer the strongest possible argument in favor of having the telephone instrument in a place where every passenger could hear the motorman's conversation with the despatcher, as it might have a good influence on the discipline of the road. A conversation between motorman and despatcher which has to be carried on in a sound-proof booth is not the kind that is conducive to strict discipline. A little publicity is a good thing sometimes.

Another point where there is room for improvement is in the maintenance of telephone apparatus. While the management may not be able to make all of its conductors and motormen as careful as might be desired, it certainly is within its power to see that the means of communication between crews and despatcher is kept in first-class condition. Nothing demoralizes discipline among men as to car operation more than having telephone instruments out of order and telephone lines in such condition as to make conversation difficult. That telephone instruments will get out of order is inevitable, but nothing but the grossest carelessness in management will permit the road to be operated without plenty of reserve instruments, so located that they can be quickly substituted for defective ones. Where telephone instruments are carried on each car for the purpose of communication with the despatcher, there will be more trouble from the packing of transmitters and consequent derangement of the telephone instruments than when the instruments are located in booths along the lines. Nevertheless, the greater liability of trouble in the car telephones is practically compensated for by the ease with which defective car instruments can be exchanged for good ones. Trouble with car telephones usually makes itself known a little time in advance, and there is no great difficulty in carrying on an efficient despatching service by means of car telephones, provided the equipment is looked after carefully and inspected regularly, and no instruments which are even beginning to give unsatisfactory service are allowed on the cars. Telephone instruments are not so expensive that there is the slightest excuse in being niggardly as to quality and quantity of telephone equipment, especially since it is so important in the operation of the road.

A PUSH LINE CAR FOR SECTION WORK

The practice of interurban railway companies differs somewhat as to the method of caring for the overhead lines. On some roads overhead line work is done only by special line crews, who have line cars equipped with motors and with all the necessary tools and appliances for doing line work. The Indianapolis & Eastern Railway has part of its ordinary line maintenance done by section crews, who have a light push car with a tower for doing overhead line work. This push car can be lifted off the track for the passage of regular cars, just as any hand car, and so interferes less with the operation of the road than a fully-equipped overhead line motor car.

FAR OR NEAR SIDE

Chicago, Sept. 24, 1903.

Editors Street Railway Journal:

The street railway managers who are discussing the practicability of stopping their cars at the near crossing to take on and discharge passengers should learn a lesson from the experience of Chicago. There was a popular demand here several years ago for a rule of this kind, on the ground that accidents would be averted, and the City Council enacted an ordinance which was signed by the Mayor, directing the several railway companies to make this change. The order was put into effect immediately by the companies, and it was given a fair trial. Notices were posted in all the barns and the men received special instructions on the subject. The company had red signs made which were fastened to iron rods stuck in the curb line, reminding patrons that cars bound in certain directions stopped at the point where these signs were displayed, but the plan was not acceptable to the people, in spite of the demand that had been made for it originally, and it had to be abandoned.

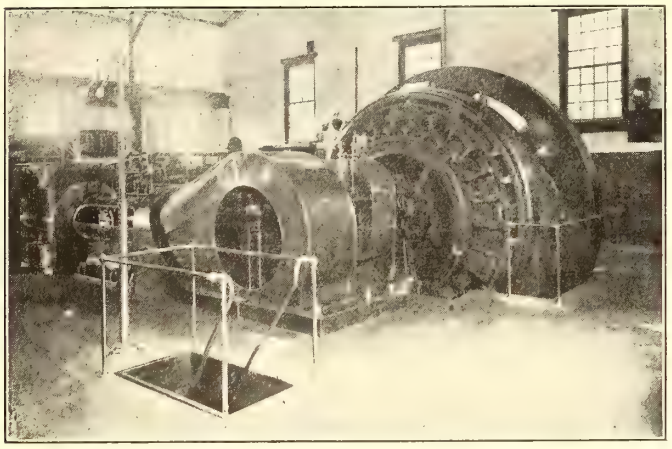
There were several reasons for this dissatisfaction. In the first place it is the general custom for passengers to leave the car from the rear platform, and in bad weather this necessitated walking the length of the car or to the sidewalk through the mud, or slush or snow. Again, the people boarding the car would invariably wait on the cross-walk for it, and then enter by the front door. At the same time it was quite likely that passengers would be leaving by the rear platform, and on cold days the opening of both doors caused much annoyance and discomfort resulting in numerous complaints.

Chicago weather is proverbially bad, and Chicago city officials for the last fifteen years have devoted so much attention to harassing the street railway companies that they have had little time to devote to street cleaning and paving, so that the conditions may be said to have been unusually severe. But in any city where there is considerable rain and snow the mud and slush are bound to make the people object to this plan. And then, too, it is very difficult to overcome the deep-seated prejudice of the public generally against innovations of this kind.

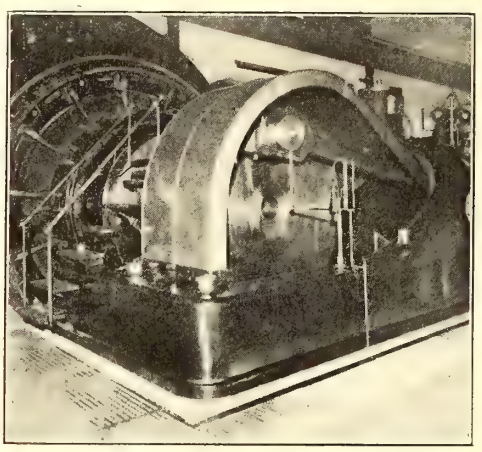
Operating Manager.

THE OIL PROBLEM IN POWER STATIONS

Most power users now realize that the success of a power station, whether it is large or small, depends almost, if not quite, as much on the proper construction and design of the system for handling the oil as for the equipment of any other part of the station, the handling of the fuel not excluded. This fact may, perhaps, be said to have received general assent only recently. At one time, while great care was taken in the design of the station in other particulars, hand lubrication was the general rule, and even now in some stations where other economies are carefully considered, antiquated methods are used in lubricating the engines. Even if an automatic system is employed the construction of the crank housings, drip pans and splashers is left to local tinsmiths.

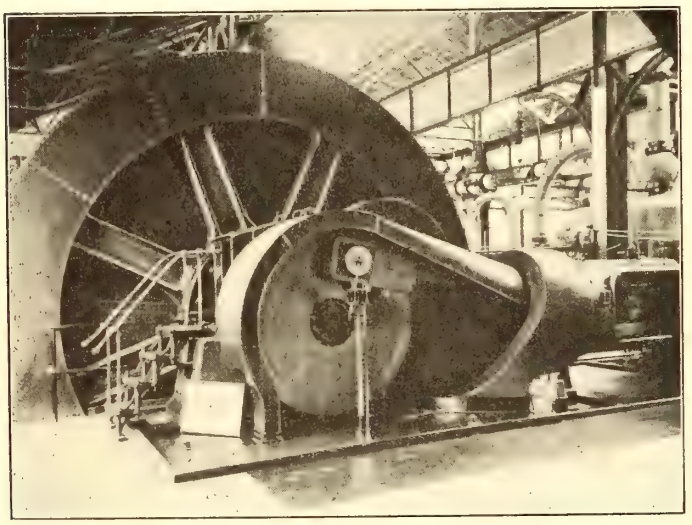


CRANK HOUSING AT LLANERCH STATION OF PHILADELPHIA & WEST CHESTER TRACTION COMPANY



CRANK HOUSING AT THIRTY-THIRD AND MARKET STREET STATION, PHILADELPHIA

The importance of automatic lubricating systems is now more generally recognized than ever before, but the advantages of treating the entire lubricating system as a unit has not received the appreciation which its importance deserves. The foundation for these systems is undoubtedly in the oil collecting devices, and it is this fact which originally induced one of the largest builders in sheet metal specialties to undertake the equipment of stations with complete lubricating systems. As comparatively little has been published in these columns as to sheet metal housings in power stations, some particulars of station practice in this direction will be of interest, whether these housings are used in connection with a complete lubricating system or not.



SPECIAL COVERING SURROUNDING WHEEL AT MT. VERNON STATION OF PHILADELPHIA RAPID TRANSIT COMPANY

An examination of the sheet steel housings in a power station will show at a glance whether they have been built by a local metal worker or by a company which makes a specialty of this class of work. Examples of the latter are given in the illustrations herewith, which show a few of the steel housings supplied in three stations near Philadelphia by Bingham & Company, of Camden, N. J., who have done a great deal of this work in all parts of the country. One of these was selected because it illustrates quite a novel construction demanded by local conditions, and which would probably not be duplicated elsewhere except under exceptional circumstances. This is the wheel housing placed around a 20-ft. fly-wheel on a Wetherill engine in the Mt. Vernon station of the Philadelphia Rapid Transit Company. This particular construction was adopted by the engineers of that company, because, owing to changes in the engines and generators at that station, it became necessary to mount the armature so that the commutator was next the fly-wheel. The housing was ordered to protect the dynamo tender when adjusting the brushes from accidentally coming in contact with the moving machinery. The other two views illustrate standard crank housings, as installed by Bingham & Company in the Thirty-Third Street and Market Street station of the Philadelphia Rapid Transit Company and the Llanerch station of the West Chester Traction Company. In the former case the engines are of the Wetherill make, and in the latter case of Hamilton-Corliss make.

In these three cases the housings are part of a complete lubricating system, also installed by Bingham & Company, who have equipped all of the plants of the Philadelphia Rapid Transit Company. Other stations equipped by them include the Edgewater plant of the New Jersey & Hudson River Railway & Ferry Company, the Warren (R. I.) plant of the New York, New Haven & Hartford Railroad, the station of the Midland Railroad, of Staten Island, and many others. A good idea of the extent of the company's business is also shown by the fact that the Cambria Steel Company has recently given the company an order to equip its entire works at Johnstown, Pa. This order covers the complete lubricator systems and oil collecting devices for its seven large plants. In this, as in many other of its installations, Lunkenheimer pressure oil cups will be used throughout, and it might be said in this connection that Bingham & Company do not confine themselves to any one system, but are prepared to install lubricating systems operated by gravity, compressed air, water pressure or steam, according to the preferences of the user, based upon local conditions. In addition to the continuous oiling equipment they also manufacture a variety of designs of oil-stand cabinets, tool closets and oil filters.

Officials of the Cleveland Electric Railway claim that since the universal transfer system was inaugurated the number of transfers has increased from 28 per cent to 44 per cent of the total fares collected. It is evident that a large proportion of the passengers are taking advantage of the company's liberality, and are making round trips on single fares. Owing to the arrangement of the lines in that city it is no easy matter for the officials of the company to evolve a plan of protection against this style of pillage, but they are working on the problem and expect to meet it satisfactorily.

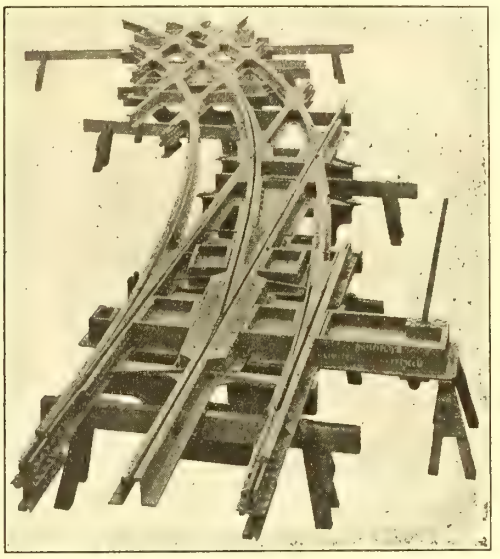
SPECIAL WORK FOR LONDON COUNTY COUNCIL

On the occasion of the visit of the Junior Institution of Engineers to Sheffield recently, the most interesting visit from a tramway point of view was the one which they paid to the enormous establishment of Hadfield's Steel Foundry Company, Ltd., where a whole afternoon was spent. The Hadfield foundry is one of the largest in the world, and has been specially erected for the most economical manufacture of tramway material. It is equipped with overhead traveling and jib cranes, all electrically driven. Among the work observed were numerous points, 7 ft. 6 ins., 13 ft. and 14 ft. long, and many special castings for the London County Council Tramways, some of these being very intricate, and from 24 ft. to 25 ft. in length. The tramway construction department was also most interesting, the setting-out, building and lay-out floors covering about 6 acres in extent. It is supplied with all the latest plant requisite for the bending, cutting, punching and drilling of the rails for their proper position in the lay-out. The bending is done by special power presses, and all the tools are electrically driven. The lay-out floor was well covered with work in various stages of construction, including double junctions with iron-bound crossings for Manchester, double junctions for Chatham, two very large junctions for Leicester, car house work for Burnley, and special junction for Stalybridge.

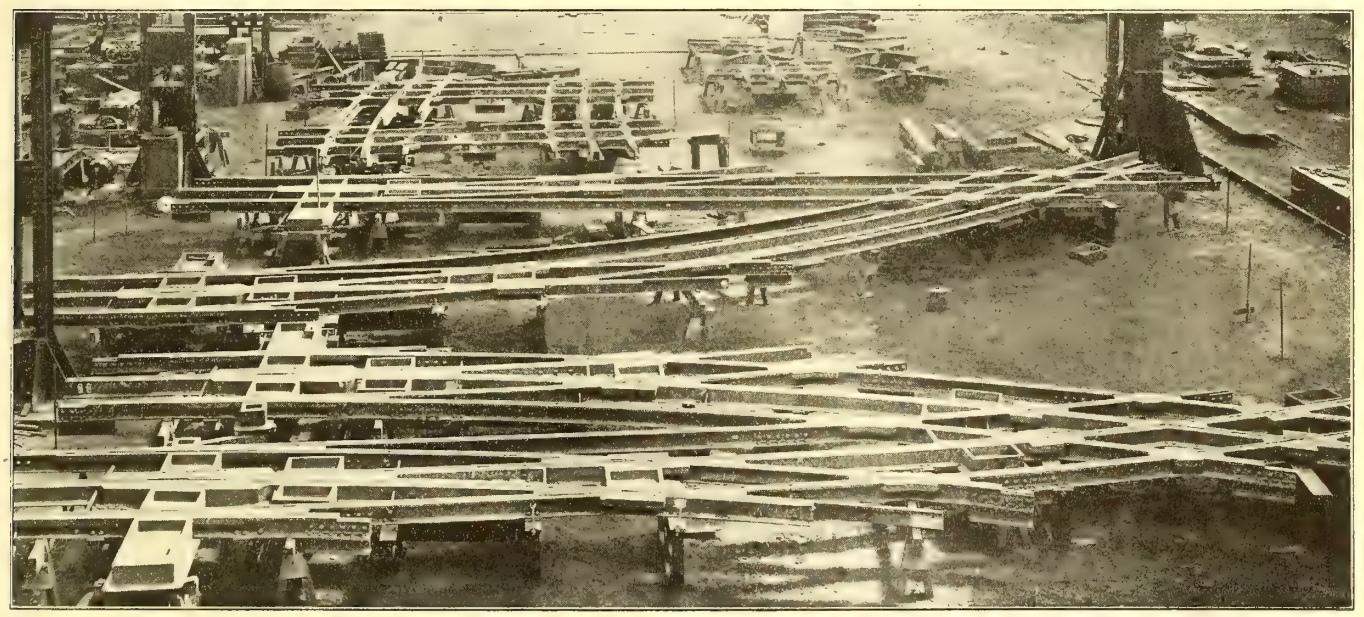
In the junctions for Bradford and Stalybridge the points, crossings and curved rails are all made of Hadfield's "Era" manganese steel.

The special work for the London County Council, however, perhaps, elicited the most attention. One of the accompanying cuts shows a general view of the work in hand, and the other one of the sections more in detail.

The points are 12 ft. long, 100-ft. radius, and are made of a special grade of Hadfield's toughened cast-steel—all the running surfaces being planed as well as the bed of the tongue. The tongues are made of Hadfield's "Era" manganese steel, and are all ground true to radius and gage. All crossings, that is, the track over track and track over slot crossings, are made of toughened cast-steel, but at the points of intersection have insert pieces of Hadfield's "Era" manganese steel. All the work has been so designed that the number of joints is reduced to a minimum; for instance, the diamond crossings are formed of four castings, and the wing and main crossing castings, which in some cases are 23 ft. to 24 ft. in length, extend from the heel of the point to the diamond crossing. All running surfaces and grooves for the wheel flanges and plow are accurately planed to their respective curves to insure smooth running and accurate gaging. The yokes are made of the best cast-iron, with the exception of some used at the diamond crossings, which, for special reasons, are built up out of angles and steel plates. The slot points are of Hadfield's patent design, which insures that no matter in what position the tongue lies the width of the slot is always the same. It also has the advantage of keeping the slot free from stones, dirt, etc., so that there is no danger of the slot tongue sticking when the track tongues are operated.



SPECIAL TRACK WORK FOR LONDON TRAMWAYS



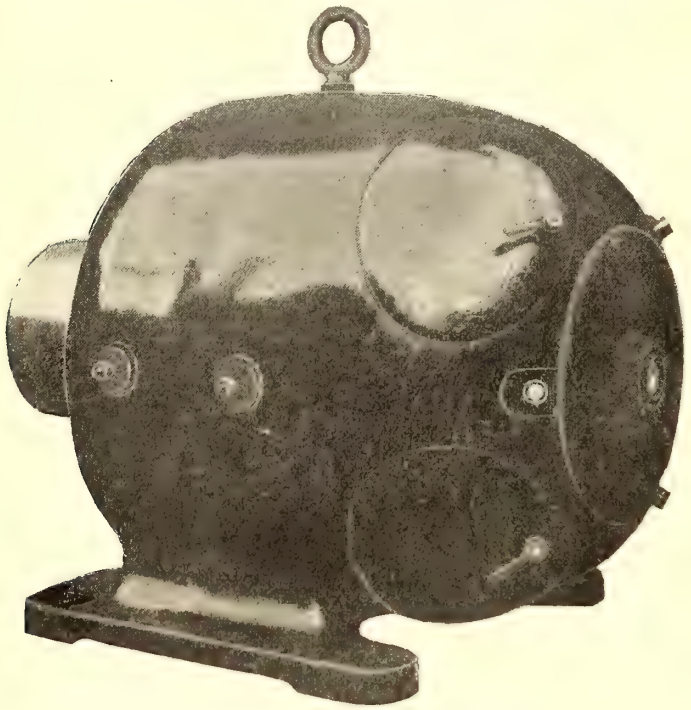
SPECIAL TRACK WORK FOR LONDON TRAMWAYS

Another very important feature of the slot points is the provision of an arrangement whereby the wheels of bicycles and other narrow-wheeled vehicles are prevented from getting into the slots. The risk of serious accidents is, therefore, considerably reduced. They are also constructed in such a way that they can be taken to pieces in a few minutes for inspection or adjustment.

Visits were afterwards made to the machine shop, smith's shop, annealing and grinding shops, where tramway work was seen in all stages, and thus a most interesting and enjoyable afternoon terminated.

RECENT TYPES OF SIEMENS' DYNAMOS AND MOTORS

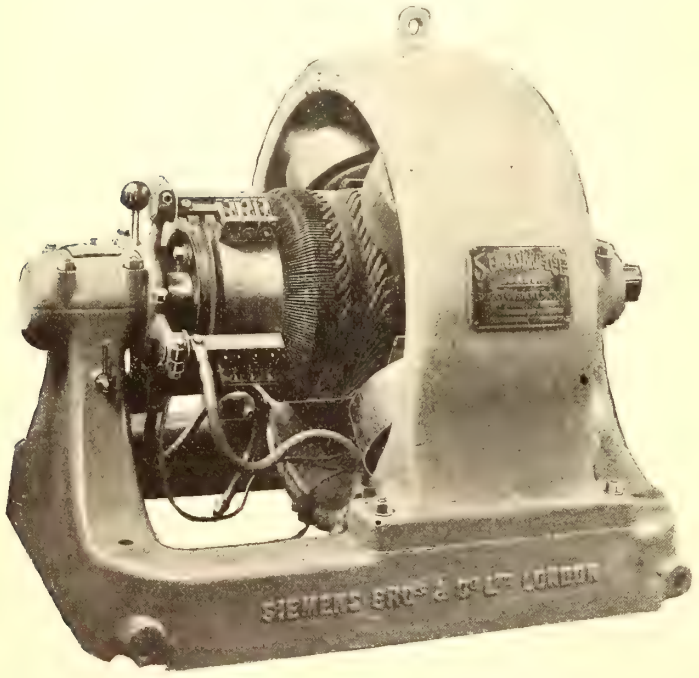
Siemens Brothers & Company, Ltd., of London and Woolwich, England, have recently designed some standard types of direct-current generators and motors. These are to be manufactured at their new Sheffield works, which, when completed, will be one of the best equipped in Great Britain. The new



FULLY ENCLOSED TYPE MACHINE

designs embody the best features of direct-current machines and are of the highest class both electrically and mechanically. The work has been carried on under the able supervision of A. S. Clift, who was for a long time chief draughtsman of the Crocker-Wheeler Company, of New York.

The machines have been divided into four classes, according

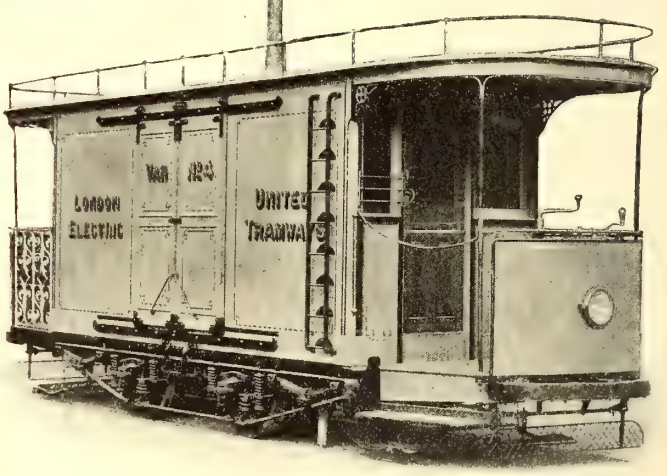


"G" TYPE MACHINE, COMMUTATOR END

to size, as follows: Type "B," from ½ B. H. P. to 2 B. H. P.; type "F," from 2 B. H. P. to 50 B. H. P.; type "G," from 50 B. H. P. to 125 B. H. P.; type "H," from 75 kw to 3000 kw. Of these, types "G" and "H" are especially suitable for tramway work. In all of these types the armatures are of the slotted drum-type form-wound, and with field coils form-wound. The type including machines from 2 hp to 50 hp is made in two forms, open and inclosed. The magnet frames of all machines are of cast-iron with wrought-iron poles cast-welded into the frame and fitted with laminated pole-shoes screwed to the pole-face.

SPECIAL CAR FOR LONDON UNITED TRAMWAYS

The British Electric Car Company, Ltd., of London and Manchester, has completed a contract from the London United Tramways for a special ticket car which is giving great satisfaction. It is used to carry large boxes of conductors' tickets and other tramway supplies from the main depot to the different distributing points on the system. The car has wide sliding doors on either side, with a small jib crane running on rollers, capable of being moved out about 2 ft. on either side, to enable stores to be hoisted and traversed to the interior of the car. Step plates give



SUPPLY CAR FOR LONDON

easy access to the roof, which is surrounded by a hand-rail, and is especially strengthened to carry heavy supplies, etc. The car is painted royal blue outside, to harmonize with part of the London United Company's rolling stock. The truck is of the "B. E." 56-type.

TWO IMPORTANT CHANGES

Two appointments of well-known street railway officials were announced last week. One was the acceptance by Richard T. Laffin, general manager of the Worcester Consolidated Street Railway Company, of the office of general manager of the Manila Electric Railway, Light & Power Company. Mr. Laffin will leave Worcester about Jan. 1, 1904, for the Philippines. The company at Manila has recently been organized by New York, Philadelphia and Detroit capitalists to operate all the lines in Manila, as described in recent issues of this paper.

The other appointment is that of Albert H. Stanley, general superintendent of the Detroit United Railway Company, as assistant general manager of the Public Service Corporation of Newark, N. J. This office has been created for Mr. Stanley, whose duties will consist largely of handling the movement of cars, while the other work in connection with the management of the company will be handled by General Manager Wheatly.

BLOCK SIGNAL SYSTEM

The American Automatic Switch & Signal Company, of Chicago, is a new corporation which has purchased all the block signal patents originally issued to Robert Skeen. Signals were made under Mr. Skeen's patents for several years by a company at St. Louis. The new company has purchased all the patent rights under which the St. Louis company was manufacturing block signals for electric roads, and engaged the services of Mr. Skeen, the patentee, who was formerly connected with the East St. Louis road, where his signals were originally installed and are still in operation. These patents date back as far as 1896, and cover broadly some very important features in automatic block signals for electric roads.

The form of signal employed in this system is shown in the accompanying cuts, Figs. 1, 2 and 3. All the mechanism of the signal is inclosed. In each signal box are two diamond-shaped targets. When the signals are employed on a single-track road between turn-outs, as is generally done, the top target shows red, as in Fig. 1, when a car is approaching in the block ahead, and the bottom target is not displayed. If there is a car in the block ahead traveling away from the signal, the top target is not displayed and the bottom target shows white, as in Fig. 2. Opposite each of these targets in the signal box are lamps showing colors similar to those displayed by the targets. The targets are not dependent for their movement upon the lamp circuits, and will operate whether the lamps light or not. When no car is in the block, as in Fig. 3, both targets are in a horizontal position, and the lamps are all out. The same signal can, of course, be employed for blocking on double-track roads.

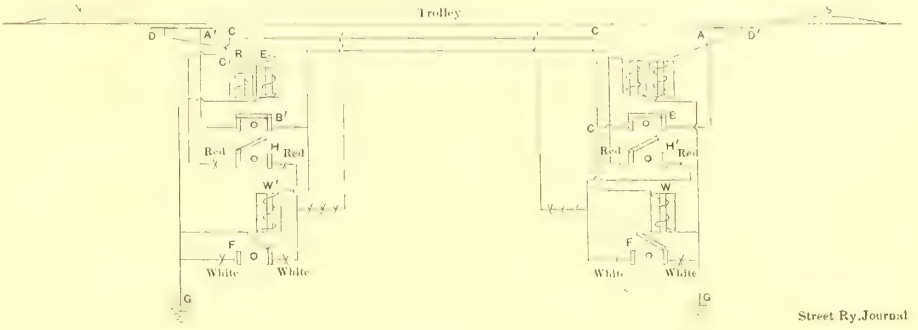
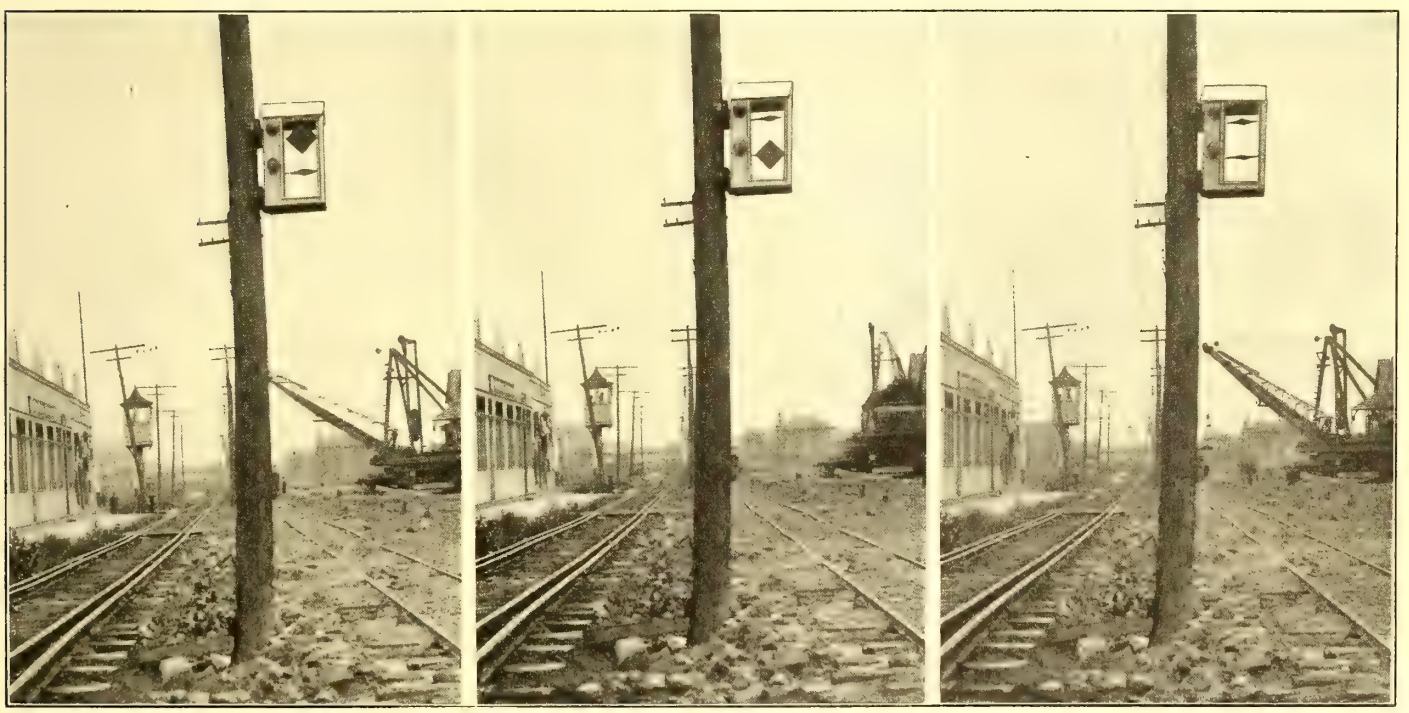


FIG. 4.—WIRING DIAGRAM

the rules under which this system must be operated no motorman is allowed to proceed into a block until he sees his signal change from normal to safety, which it should do when his trolley wheel passes the contact strip which actuates the signals. In the wiring diagram, suppose a car to be leaving the siding, S, at the right, and going to N at the left. Before proceeding past the contact strip at A, the motorman would, of course, see that the signal did not show danger. When the trolley wheel touches the contact at A it sends a momentary trolley current through the switch, B, inside the signal, and into the line wire, C, where it divides, part going into the coil, W, which is a solenoid operating the white target, and then passing to ground. The operation of this white target solenoid also closes a switch in the white-lamp circuit. The other part of the current flows from the line wire, C, to the signal at the other end of the block, where it enters the solenoid, R, which throws to "danger" the red target. This current from there flows to ground. After the red signal is thrown to "danger" the red lamps are lighted by the closing of the switch, H, which is operated by the solenoid. One end of this switch is connected to the line wire, C, which connects to the coil, R. The current will then flow from the trolley or feed wire through the red lamps and the switch, and thence through the coil, R, to the ground. Part of the current, after it leaves the red lamps, instead of passing through the coil, R, will flow from line wire, C, to the signal at the right-hand end of the block, there flowing through the coil, W, to ground, thus keeping the white target displayed. This white target, it will be remembered, was already put in a



FIGS. 1, 2 AND 3.—SHOWING THREE DISTINCT SIGNALS

The targets are 9 ins. x 9 ins., and the bull's-eyes 4 ins. in diameter.

The operation of the signal can best be understood from the accompanying wiring diagram, Fig. 4. In the diagram, as it stands, both signals are at what is called normal, or "no signal" position. This is as they would stand with no car in the block. This normal position, however, is not a safety position, as by

vertical position by the trolley wheel when it made contact at A. The white signal at the entrance to the block cannot, therefore, be displayed unless the red signal at the far end of the block is set, because if the red signal solenoid fails to act or falls back to normal position, it opens the circuit holding the white signal at the entrance to the block. The white signal cannot stay up after the trolley wheel leaves the contact at A, unless the red signal at the siding ahead has been set and the switch connected with it closed. The car, on reaching the siding at the end of the block, makes contact at D, which sends current into coil E, causing the red target to disappear and opening the red lamp circuit, as well as allowing the white target at the entrance to the block at the other end to disappear, and opening its white lamp circuit. Signals are then at normal position again. The object of switch B is to prevent both signals being thrown at once by different cars. The lamp circuits at both signal boxes are fed by three lamps in series, independent of the signal lamps. In case any of the line wires are open the signals remain locked in whatever position they were at the time of the break. At first thought this might seem to be a dangerous condition, and it would be if these signals were to be operated under the same rules that steam road signals are operated. Since, however, the signals must operate from normal to safety position in sight of the motorman as he approaches a signal, there is no reason why a signal stuck at safety position should create a dangerous condition, because a signal so stuck does not indicate safety.

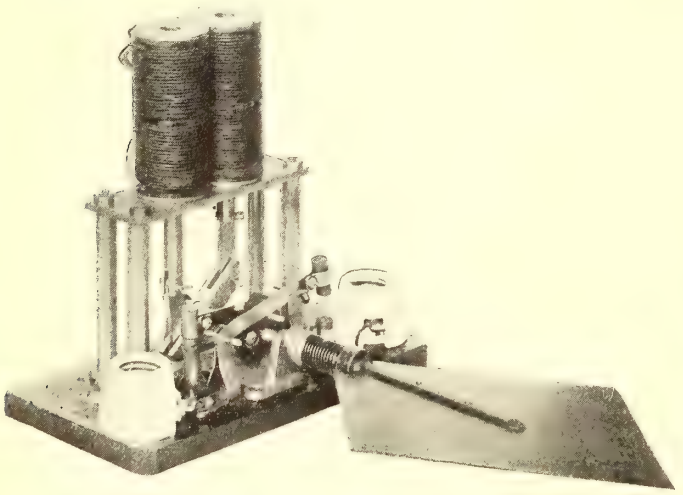


FIG. 5.—SOLENOIDS FOR RED SIGNAL

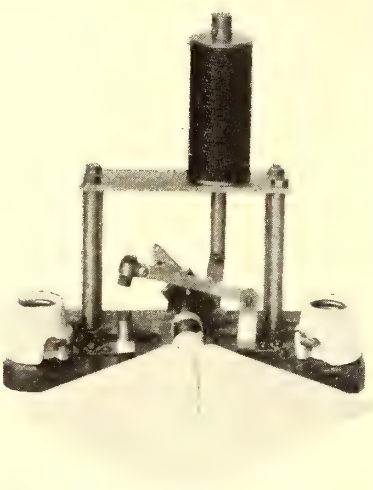


FIG. 6.—SOLENOID FOR WHITE SIGNAL

As the mechanical arrangement of the switches is not altogether plain from the wiring diagram the working parts of the red signal solenoids and of the white signal solenoid are illustrated here in perspective. The two solenoids for the red signal, Fig. 5, which work on opposite ends of the same rocker arm and actuate the target, also operate the switches B and H, shown in the wiring diagram. These switches are provided with contacts of carbon, as shown. In whichever position the red target is left it is locked in that position by a peculiar arrangement of the rocker arm and solenoid plungers until it is actuated by the current. The white signal, Fig. 6, on the other hand, returns to normal position by gravity when the current is interrupted in its solenoid. The targets are not rigidly connected to the shaft which the solenoid operates, but, as seen, are connected through the medium of a coil spring. This is to permit the plungers to work instantaneously under a brief contact, without having to overcome at once all the inertia of the target. The spring will cause the target to follow the movement of the shaft in a somewhat longer space of time than it takes the shaft to make the movement.

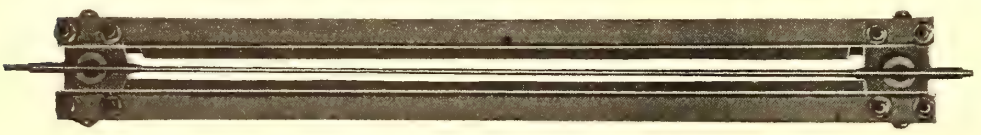


FIG. 7.—TROLLEY CONTACT

The trolley contacts, which are placed in the overhead line, and under which the trolley runs to actuate the signals, are two strips of hickory, 1¼ ins. x 2 ins., in cross-section, and 4 ft. long, with plates at each end to bolt them together, and two strips of angle-iron screwed to the inside of the 1-in. space between them, so that the trolley wheel, in passing, touches both angle-irons. The end plates have holes in their centers corresponding to the size of the stud in the trolley wire hanger, which screws into them, thereby holding the contacts on the trolley wire.

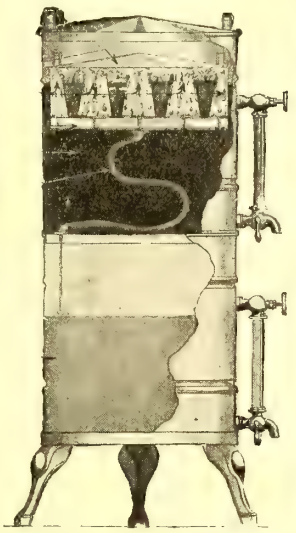
In the wiring diagram, Fig. 4, both the setting and release contacts, A and D, are shown in the main line, so that a car would reach them after passing off the siding. This is the arrangement that should be employed where the siding is not always taken by the car going in any one direction. If the sidings have spring point switches, so that all cars pass to the right at the siding, the signal releasing contacts should be placed just inside the entrance to a turn-out, and the signal-setting contacts a short distance before the exit of the turn-out. The signals should be so located that the motorman can see them operate both upon entering and leaving the block.

A rather novel application of these signals has been made on Stoney Island Avenue, in Chicago, where, owing to the construction of an intercepting sewer, a number of different lines converge and operate over a single track for a distance of about a block. In this case the signal circuits are controlled by a man stationed in a tower within sight of both approaches. Signals are operated manually instead of automatically in this case, because there are two companies using the single track, and each company has its own trolley wires. In fact, the single track is simply an overlapping piece of double track, and there are in all four trolley wires over it. As the arrangement is only temporary manual control is adopted, to avoid all confusion and complication which might arise with so many converging routes using the one strip of track. The accompanying views of the signal installed and in operation are of this particular installation. When the signals are used on third-rail roads the only modification in the apparatus needed is to use a short section of third rail opposite the regular third rail in place of a trolley contact.

A prominent railroad engineer volunteers the following opinion: When the headway between trains is 30 minutes to 60 minutes there is a good opportunity for sandwiching a "limited" car between the locals. To do this, however, it is necessary to employ the methods which have enabled steam railroads to accomplish the same thing. Their system is the outcome of years of experience and has cost them millions of dollars. It is free to be adopted by any electric road. Some of them have adopted it; others are paying for not having adopted it.

THE CAPILAR OIL FILTER

The accompanying illustration shows a new oil filter made by the Capilar Company, of Philadelphia, and which depends on a very old principle, but one which has only recently been applied to oil filters. In fact, it is somewhat strange, that although the phenomenon of capillary action has been known for so long, oil filters up to this time have been constructed entirely on the gravity principle. The name of the Capilar filter practically describes its construction, together with the fact that dirt does not climb, although oil does. All water brought over by the oil from the steam cylinder or from any of the bearings is separated from the oil during the filtering process. In this way the oil in the storage tank is perfectly clean. The wicking in the Capilar filter being saturated with oil when the filter is put in service has no affinity for water, and the separation is absolute. The manufacturers claim that this can easily be proved by the simple experiment of filling a glass with some water and polluted oil and then filtering it through an oil-saturated lamp wick on the capillary principle, as shown in the small cut herewith.



CAPILAR OIL FILTER

The construction of the filter is shown in the sectional engraving. The oil is poured into the upper chamber of the filter. On the surface of this oil is the filtering chamber or float, which consists of the filtering wicks, collecting chamber and conducting hose, by which the clear oil after passing through the wicks is led to the lower or pure oil chamber. In the larger sizes of filters provision is made so that the upper chamber can be connected to a continuous lubricating system if one is used in the station, while the lower chamber is connected to the suction of the pipe pump and delivered to the storage tank.

The filtering wicks may, when required, be quickly removed and replaced after cleaning out the collected impurities.

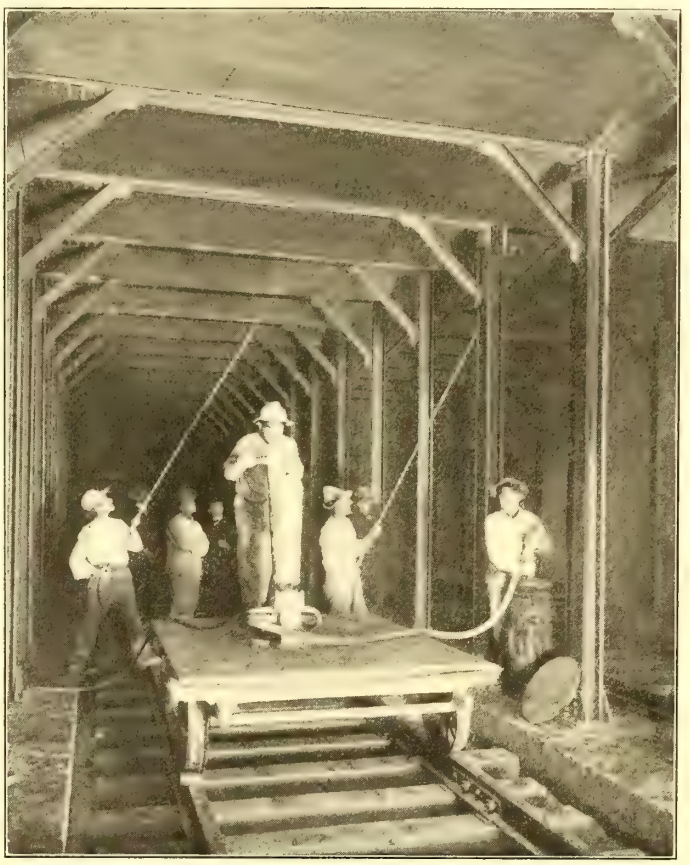


PRINCIPLE OF OPERATION OF THE CAPILAR OIL FILTER

Another advantage of the filter is that it maintains an absolutely constant flow of filtered oil. If circumstances should demand a filter 10 ft. high the flow of clean oil would be the same in the Capilar, whether 10 ft. or 10 ins. of oil for filtration were contained in it. A filter having a capacity of 1 gal. an hour at a temperature of 100 degs. F., gives a continuous flow of oil at that rate all day and every day as long as the oil supply continues, irrespective of the quantity of dirty or clean oil in its tanks. In this respect the manufacturers claim that the Capilar filter is superior to one depending entirely on gravity, as the filtration in a gravity filter varies according to the cleanness or dirtiness of the filtering medium, and the pressure or weight of oil acting upon it.

PAINTING THE INTERIOR OF THE NEW YORK SUBWAY

The accompanying cut exhibits a portion of one crew painting the section of the New York subway between Sixtieth Street and Forty-Seventh Street. The material, known as Asbestine fireproof paint, controlled by the Alden Spear's Sons Company, of Boston, Mass., and especially prepared for underground work, is applied by the employment of a small, clever device, technically termed "spraying machine." For convenience in changing the location of the machine as the work progresses, it is stationed upon a set of platform trucks particularly designed to run on the subway track. The machine is simple in construction. It consists of a 6-in. x 30-in. air chamber, which stands perpendicularly over a double-acting pump. A long



PAINTING THE INTERIOR OF THE NEW YORK SUBWAY

handle gives a powerful leverage and by gradual strokes a pressure of 100 lbs. to 120 lbs. is easily maintained. The paint is drawn to the pump through a 1-in. suction hose and distributed through two or more ½-in. discharge hose. One man at the handle can furnish sufficient pressure to supply ten or a dozen discharge hose. At the end of each distributing hose is a long spraying rod supplied with a nozzle with a minute aperture, through which the paint is forced in the form of a spray. Various descriptions of nozzles are manufactured, which change the nature of the spray. Each spraying rod is guided from right to left by an expert operator or sprayer, the stream being controlled by the sprayer by means of a stopcock. The long rod renders scaffolding entirely unnecessary, which would materially impede the progress as well as increase the expense.

It is conservatively estimated that ten men with the assistance of this apparatus can perform the same amount of work in the same length of time as 100 men using the old-style brush method of application.

The quantity of paint which will be consumed on this single contract can only be approximated. The figure is set at 250,000 gals., or about 100 carloads.

Reports of the tests now being made on the Berlin-Zossen road are being cabled to this country. On Sept. 17 word was received that a car was operated at a speed of 106 4-5 m. p. h. This is an increase in speed over the maximum obtained during the experiments last year. On Sept. 21 still better results were obtained, for the cable despatches said that in a burst of speed a maximum of 114 m. p. h. was reached.

BRILL SEMI-CONVERTIBLE CARS AT LAKE CHAUTAUQUA

The Chautauqua Traction Company, operating between Jamestown and Stow, around the western shore of Lake Chautauqua, has lately placed in commission several fine semi-convertible cars built by the J. G. Brill Company. Between Jamestown and Stow are the towns of Celoran, Lakewood, Ashville, Mayville, Chautauqua and Victoria. The large number of visitors to this popular region in the summer has made it necessary for the company to add larger cars to its equipment of a type



COMBINATION CAR FOR JAMESTOWN

suitable for through service. The cars, as shown in the illustrations, are of two types—straight passenger and combination. The straight passenger cars are mounted on 27-G trucks, capable of 30 miles an hour, and the combination cars on 27-E-1 trucks, capable of a very high speed, and this latter type will be used for express. The cars present a handsome appearance with their inclosed vestibules, steam car roofs and handsome coloring—black with green lines, gold lettering and decorations.

The straight passenger cars are seated for forty-four passengers, the seats being 36 ins. long, and upholstered in plush; having no window pockets the seats are brought against the side lining between the posts, the sides being 2 ins. thick and the width over the posts 8 ft. 2 ins.; the aisles are, therefore, 22 ins. wide. Interiors are finished in cherry, all neatly colored, carved and decorated; the ceilings are of decorated birch; the interior trim throughout is solid bronze of ample proportions, including five basket racks on either side. Length of cars over end panels, 30 ft. 8 ins.; over vestibules, 40 ft. 1 in.; from panel over vestibule, 4 ft. 8½ ins.; width over sills, 7 ft. 10½ ins.; over posts at belt, 8 ft. 2 ins.; sweep of posts, 1¾ ins.; from center to center of posts, 2 ft. 8 ins.; thickness of corner posts, 3¾ ins., and of side posts, 3¼ ins. Side sill, size 4 ins. x 7¾ ins., plated on the inside with ¾-in. x 12-in. plates, to which are substantially secured the lower portion of the posts. The 27-G trucks on which these cars are mounted have a wheel base of 4 ft., axles 4½ ins. in diameter, and 33-in. wheels.

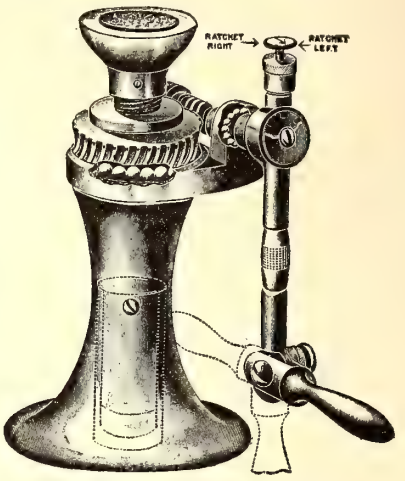
The combination passenger and baggage cars are 31 ft. 8 ins. over end panels, and 41 ft. 1 in. over vestibules. The other dimensions are the same as in the straight passenger cars. The passenger compartment is 17 ft. 2 ins. long, and the baggage compartment 14 ft. 6 ins. The passenger compartment seats twenty-four passengers, and the baggage compartment has folding seats for the use of smokers. The 27-E-1 trucks have a wheel base of 6 ft., axles 4½ in. in diameter and 33-in. wheels. All the cars are equipped with four 55-hp motors each. Weight of a straight passenger car, trucks and motors is about 43,000 lbs., and of a combination car is about 46,000 lbs.



PASSENGER CAR FOR JAMESTOWN

BALL-BEARING JACK

The accompanying cut is an illustration of one of Gaston's A. B. C. ball-bearing jacks, partially cut down to show complete workings. This type, for which Wendell & MacDuffie, of New York, are the exclusive Eastern railway agents, possesses a number of valuable features meriting description.



BALL-BEARING JACK

As implied by its name, ball-bearings are extensively used in this jack to overcome friction. The weight rests entirely on the balls. Ball bearings are also used in each end of the worm screw to catch the thrust in raising and lowering loads. To further reduce friction vaseline is used for lubrication. This is kept in an automatic grease cup, held in place at the bottom of the jack by a set screw.

The post can be quickly screwed up to the load by hand, thus saving time, because with other jacks it is necessary to turn the lever until the top of the post reaches the load. Another time-saving feature of this jack is that as soon as the load is released the post goes down automatically to its original position. Through the use of interchangeable posts and gears three speeds are obtainable—slow or two revolutions of the gear to the inch; medium or one revolution to the inch; fast or one revolution to 2 ins.

The mechanism of the jack is very simple and durable. The gear is made of Coe bronze, which is almost frictionless, and the screw and worm are of cold-rolled steel. All parts are interchangeable, and the cost of maintenance is said to be light. The jack can be used in very close quarters, thereby insuring the lifting of the weight in any place under which the head of the jack can be placed.

It is to be hoped that there may be fewer interurban roads built which deserve the appellation bestowed upon them by a well-known engineer—"monuments of efficient salesmanship."

THE CHICAGO UNION TRACTION COMPANY'S NEW CARS

The order for 100 new cars, which the receivers of the Chicago Union Traction Company recently placed with the St. Louis Car Company, as mentioned in a previous issue of the STREET RAILWAY JOURNAL, is for a semi-convertible type of car, employing the well-known Robertson channel steel sills, which permit of low car body and low window sills. The cars will be 28 ft. over the body corner posts, with 6-ft. vestibules at each end, making the total length over bumpers 41 ft. Platforms will be equipped with double folding gates. The car width is 8 ft. 4 ins., 64 ins. narrower than the cars built by this company for the Chicago City Railway. In the middle of the car six cross-seats are placed, and at the ends, occupying the balance of the space, longitudinal seats. All the seating will be made by the St. Louis Car Company. The interior finish will be of cherry and the trimmings of bronze. On each side will be six windows, each 46 ins. wide. These windows are similar to those used on the Chicago City Railway Company's cars. The paneling on the car will be concave and convex instead of straight, as on the city railway car just mentioned. Each car will have twenty incandescent lamps and also illuminated signs. The trucks are the St. Louis Car Company's No. 47 short-wheel-base truck, with rigid frame, adapted for outside-hung motors, and the sand-boxes will be made by the same company. An early delivery, during the months of November and December, has been promised, which is remarkably quick work for such a large order.

The motor equipment, four General Electric 70-motors, will be put on each car. This motor is a new type, designed at first especially for the Milwaukee Electric Railway & Light Company, and containing a number of new features, which were described in the STREET RAILWAY JOURNAL of Sept. 5, 1903.

NEW TROLLEY CATCHER

One of the most annoying and common accidents in trolley service is to have the pole leave the wire, not only causing numerous delays but serious injury to the overhead construction. To overcome this defect a simple and effective trolley

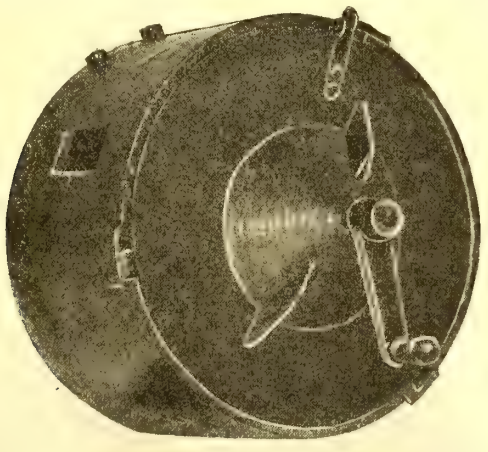


FIG. 1.—TROLLEY CATCHER COMPLETE

catcher has been recently perfected by Johnson & Morton, of Utica, N. Y. This contrivance is shown complete in Fig. 1 and in detail in Fig. 2.

Regarding its operation it may be noted that the rope draw rests by its own weight on a bearing in the case without a cap. The slack trolley rope is wound on the drum by a plain coiled spring. When the speed of the unwinding cord is suddenly increased the drum is lifted from its bearing before the cord unwinds, and a ratchet on the drumhead engages a stationary tooth in the case above it, thus preventing the turning of the drum. This action is so rapid and positive that barely half an inch of rope is paid out before the catcher operates, and the trolley pole is kept below the span wires.

The catcher will coil 15 ft. of ¼-in. rope. Although ⅜-in. rope may be used the former size is recommended. The heavier rope is not required with this catcher, as the movement of the trolley poles after leaving the wires is so short that the severe strains from suddenly stopping it are avoided. The base is fastened to the bar by three bolts, and by the use of a bayonet lock the catcher proper can be removed by a half-turn of the case,

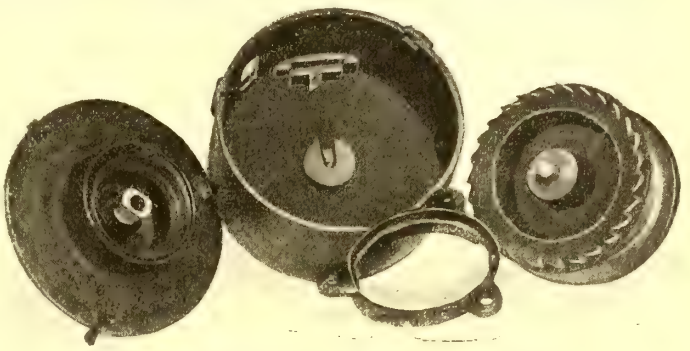


FIG. 2.—DETAILS OF TROLLEY CATCHER

but accidental loosening of the case is impossible. This method makes it possible to use only one catcher upon reversible cars, as a base can be fastened on each end and the catcher transferred when the trolley is reversed. A chain is provided on the cord drum, so that the trolley cord can be attached by a hook. A crank extending from the head of the case is connected with the cord drum so that the spring can readily be wound up. The head of the case is fastened by a latch joint, arranged to be taken off instantly, but which cannot come loose by accident.

The spring, cord, drum and interior of case are made easily accessible by simply removing the case-head. The spring is held in a recess in the case-head and can be removed without tools for replacement or inspection.

The construction and principle of operation are shown in Fig. 2. To prevent wear both the bearing in the case and the head are of chilled iron. The drum shaft and spring shaft are of the best mild steel and easily renewed at trifling cost. The rack upon the cord drum is of chilled iron and the catch of case-hardened steel. The spring is 15 ft. long, made of finely tempered steel, and winds upon a shaft 1 in. in diameter, insuring durability.

TROLLEY SUPPLEMENT OF THE SPRINGFIELD REPUBLICAN

The second section of a recent Sunday issue of the Springfield (Mass.) "Republican" was what might be called a trolley supplement. This section of the paper consisted of twelve pages, the first five of which were devoted exclusively to the description of trolley routes in the vicinity of Springfield and to advertisements from street railway companies of the attractions of their lines for pleasure traffic. The first page was devoted entirely to matter descriptive of the various resorts, a pleasing introduction on the development of the trolley leading up to this matter. The other four pages were made up of descriptive matter and advertisements from street railway companies of the special features which they offer. This scheme of combining editorial and advertising issues seems to be novel in connection with the exploitation of street railway features, and should prove beneficial to both the paper and the companies. The idea, it would seem, is worthy of serious attention at the hands of street railways and papers in other parts of the country.

The leading theaters of Columbus, Ohio, have completed arrangements with the interurban railways entering the city whereby the latter will operate special theater cars during the coming winter season.

LONDON LETTER.

(From Our Regular Correspondent.)

At the last meeting of the Liverpool Tramways committee, the general manager reported that the Board of Trade has sanctioned an increased speed of the corporation electric cars. We understand that hitherto the maximum average speed of the cars under the old limits was 5.8 miles an hour, and that now the cars may legally be driven at a maximum average of 8 miles an hour. It is believed that the actual speed of the cars will not be increased to any material extent, and practically the only effect of the official sanction will be to legalize the existing practice.

The Aberdeen Suburban Tramways Company has definitely decided to proceed with its undertaking. Of the £72,000 of capital asked for, applications for only £25,000 have been received; and obviously it was quite impossible in these circumstances that the directors could proceed to carry their whole scheme into execution. At a recent meeting, however, of the shareholders it was resolved to go on with the undertaking to the extent of the means available.

The building of the transforming station which is being erected at Birkdale in connection with the electrification of the L. & Y. Railway line between Liverpool and Southport is now completed. At the Formby power station the boilers are being placed in position. Gangs are working on the line itself both towards, and away from, Southport, and the work on the line will soon be completed.

An interesting report on the question of half-penny tramway fares was recently issued to the Glasgow Corporation Tramways committee by John Young, the general manager.

As the outcome of inquiries addressed to over fifty corporation tramway managers throughout the country he arrives at the conclusion that the opinion of the various corporations is not at present generally favorable to the adoption of half-penny fares, although seven of them—including Glasgow—have such fares in operation over their whole systems; nine have half-penny fares on certain stages; and four or five others issue half-penny tickets to workmen.

In Glasgow the half-penny stage, which is about half a mile, was originally one-half of the penny stage, but subsequently the penny stage was doubled, while the half-penny stages remained practically as they were originally fixed. Mr. Young gives figures showing that one-third of the passengers travel at the half-penny fare, while the receipts from them are 18 per cent. Sixty-one per cent of the passengers travel at the penny fare, the receipts from them being 69 per cent; and 7 per cent of the passengers travel at over the penny, the receipts from these being 13 per cent. The average fare collected per passenger at present is .88d. Last year's accounts show that the average cost per passenger was .75d., exactly 3 farthings. The profit is, therefore, only about one-eighth of a penny, which Mr. Young considers a narrow enough margin in a business of this kind. Investigation further shows, he says, that almost one-half of the penny passengers travel little more than a mile, or about the distance of two half-penny stages.

The immediate result, therefore, of doubling the half-penny stage, as is proposed, would be to transfer about 54,000,000 passengers from the penny to the half-penny fare, with the consequence—taking the past year's experience as a basis—that not only would the surplus of £100,000 be wiped out, but the tramways would actually be carried on at a loss. Mr. Young accordingly recommends no change in the present stages and fares.

The Great North of Scotland Railway Company is about to augment its suburban service by the introduction of a number of motor carriages. The intention is to improve the present suburban service by running on the railway at short intervals of time motor carriages capable of carrying from fifty to sixty passengers, and in connection with which additional stopping places will be provided for the convenience of passengers. Several English railway companies have already introduced this system for the purpose of improving and developing their suburban traffic; and the success which is understood to have crowned their efforts leads to the hope and belief that the enterprise of the Great North Company will be similarly rewarded.

An important project is on foot for the construction of electric tramways at Woking and a light railway connecting that populous neighborhood with Chobham, Windlesham and Bagshot. At present there are no facilities of any kind for giving cheap and ready access to this pleasant part of Surrey, which the scheme in question would open up for residential purposes, in addition to greatly benefiting the farmers and tradespeople. Railway and tramways would also furnish a direct means of access to a very extensive area of War Department land, valuable as a manœuvring ground. The promoters, who state that the required capital is already guaranteed, have secured the co-operation of the London & Southwestern Railway Company, with whose system the light line will connect at Woking and Bagshot. A suggested future extension of the scheme is the construction of another line through Send and Ripley to Effingham Junction. Public opinion throughout the district affected is said to be strongly in favor of the project, and a Board of Trade order will shortly be applied for.

Sir John Wolfe Barry has issued his award as umpire in the arbitration which has recently been held to determine the amount to be paid by the London County Council to the Metropolitan Electric Supply Company (Ltd.) for the compulsory acquisition by the council of the company's generating works at Sardinia Street, Lincoln's Inn-fields, made necessary by the construction of the new avenue from Holborn to the Strand.

The London Improvements Act, 1899, provided that, in addition to vesting in the new company a site of equivalent area to its present one, the council was to pay to the company a sum equal to the costs and expenses of erecting and fitting up a new generating station upon a new site with new plant of a capacity to generate and supply electrical energy to an output of not less than 4000 kw, and all expenses incurred in replacing, relaying, and alterating mains. The amount of the award is £183,150.

While the new electric tramways on the Tooting lines are proving a great success, some difficulty is being experienced in connection with the altered arrangements on the Streatham cable route. Pending the electrification of this line, the County Council decided to have certain of the new electric cars fitted with special apparatus, so that they could be run from the termini at the bridges to Kennington by means of electricity, and then over the existing route from Kennington to Streatham by cable. Doubts were freely expressed as to whether the cable was sufficiently strong to stand the extra strain of the new cars, which are much larger and heavier than the old ones, and these fears have since been justified. Of the twenty electric cars fitted for working on the combined systems about ten or fifteen have been running daily during the past two or three weeks, and observations go to prove that the added strain of a large number of cars would be too much for the cable. The original scheme for combining the cable and electrical systems is, therefore, to be abandoned, and it may be confidently expected that the conversion of the cable route to electricv traction will be pushed on as soon as possible. The conversion of the London County Council's tramways from horse to electric traction has been marked by a substantial increase in receipts. The last weekly return to hand—that for the week ended Aug. 22, a very wet week—gives the following figures:

	Week ended Aug. 22.	Corresponding week last year.
Mileage opened	39½	26½
Passengers carried	2,534,690	.....
Receipts	£10,487 18 6	£8,057 1 11
Aggregate for year (144 days)	207,489 7 11	177,462 12 11

The total increase in receipts as compared with the same week last year was £2,430 16s. 7d., which made an increased aggregate for the present year (144 days) of £30,026 15s. It is true that the mileage has increased, but that would not entirely account for the augmented receipts.

The northern main roads in Middlesex are in a state of partial chaos owing to operations in connection with the construction of electric tramways. The lines have been laid at North Finchley, and at Woodberry Down and Tottenham new rails are being laid to take the place of those used by the present horse system. The Board of Trade has sanctioned 15 miles, and the Light Railway Commissioners a further 26½ miles—the estimated cost of the 42 miles being £1,686,255. The Middlesex County Council's whole scheme would have given the county 150 miles of tramways, but the bulk of it was withdrawn or rejected. The equipment of the lines sanctioned is to be provided by the Metropolitan Electric Tramways, Ltd., and the Council is to receive 4 per cent on its outlay, and the company the same amount. After that the profits are to be divided.

The Bolton Corporation is making an interesting experiment at present by establishing a motor omnibus service to Darcy Lever, a little industrial suburb lying about 1½ miles from the centre of the town. It is understood that the cost of laying electric tram lines to Darcy Lever would prove so costly, owing to the difficult nature of the road—the village lies in a hollow—as to preclude the possibility of an electric tramcar service thereto proving remunerative.

Six members of the London Traffic Commission sailed for New York on Sept. 18 to investigate the systems of traction and transport in the United States. Their secretary, L. L. Macassey, sailed Aug. 28 to make the necessary arrangements.

The tenders sent in for the supply of the material of the Municipal Electric Tramway for Johannesburg, South Africa, have

been published. The tramway committee recommend the acceptance of the Brush Electrical Engineering Company's tender for grooved and Vignoles rails and fishplates of Belgian make at £74,549, with 2½ per cent discount. The British tenders for these articles were considerably higher.

Proposals have been made to the local authorities in favor of the introduction of trams into Upper Norwood. A canvas of the districts through which the proposed line would pass has been taken, and the returns show a majority of three to one in favor of the system being introduced. Demands will be made to the Croydon and Lambeth Councils urging the extension of the existing lines from Thornton Heath and Herne Hill to Upper Norwood, and from Herne Hill to the Crystal Palace. At present there is only a 'bus service between these places.

Now that the provisional order for the Fife electric power bill has been passed, and only awaits the Royal assent, consideration has been turned to the proposal of forming a company in Dunfermline, spoken of some time ago. This company was to have been constructed by business men in Dunfermline and district following on the notification of the establishment of the naval base at Rosyth. From inquiries made it has been ascertained that steps will be taken to form this company in the course of a month or so. The idea is to have a line of rails running from Dunfermline to St. Margaret's Hope, and probably other districts will be opened up.

Yielding to the desires of the Leeds Corporation Tramways committee, Councillor R. Alf. Smithson has withdrawn his resignation of the chairmanship of that body.

The report of the Liverpool Overhead Railway Company for the half year shows the following number of passengers carried during the first six months of 1903, as compared with the corresponding half year of 1902: First class (1902), 656,756; (1903), 759,180; second class (including tramways, 1902), 2,966,690; (1903), 3,334,703; workmen (special return tickets, 1902), 1,402,976; (1903), 1,420,116; total, 1902, 5,026,422; 1903, 5,514,089. Receipts from passenger traffic, £40,858 13s.; miscellaneous receipts and interest, £805 13s.; miscellaneous receipts and interest, £805 13s.—£41,664 6s.; less working expenses, £32,005 8s. 9d.; deduct interest on mortgage debentures, £3,800; add balance brought forward December 31, 1902, £4,013 8s. 7d.; less available for dividend, £9,872 5s. 10d. Referring to this report, the chairman explained that the directors proposed to pay a dividend of 5 per cent on the preference shares and 1¼ per cent on the ordinary shares, leaving £3,747 to be carried forward. It is also proposed to make a number of extensions.

In consequence of the heavy rains of last month the electrified portion of the District Railway was flooded in two places. The water partially submerged the running and negative rails. In spite of this, however, the track circuits of the Westinghouse automatic signals, with which this line is equipped, were not in any way affected, and the trains were signalled without a hitch.

A. C. S.

BROOKLYN POWER HOUSE DAMAGED BY FIRE

The power house of the Brooklyn Rapid Transit Company at Fifty-Second Street and First Avenue, Brooklyn, was the scene of a most peculiar and serious fire Saturday afternoon, Sept. 26. The fire originated in the cable tunnel near Fifty-Second Street, and is said to have been caused by defective insulation. This tunnel is extremely large, and runs from a point half way between the harbor up to Second Avenue. When the flames reached the power house they burst in and completely enveloped the machines in the center of the building, and soon communicated to the switchboards. The roof of the building, which is finished with yellow pine, next took fire, and it seemed that the entire building was doomed to destruction. Three alarms of fire were turned in. Practically all of the company's lines in South Brooklyn were crippled at once by the fire. Coney Island and the beaches suffered, as did also the "rush" hour service from New York. It is estimated that there were 20,000 people at the races at Gravesend, and it was fully three hours before provision could be made for handling this crowd. An official estimate places the extent of the damages at $6,700. Fortunately for the company, the fire did not prove as disastrous as was at first expected. Some of the electric trains on the elevated lines had to be withdrawn from service, but they were all restored early in the week.

The clubrooms of the Schenectady Railway Benefit Association at the Fuller Street station, Schenectady, N. Y., were formally opened on Thursday evening, Oct. 1. The opening address was by the president of the association, and was followed by a most entertaining vaudeville programme. The Schenectady Railway Benefit Association, as its name implies, is composed of employees of the Schenectady Railway Company.

FARES AND FARE PROTECTION*

BY JOHN F. OHMER

In the old horse car days, when fare collections were limited practically to one medium of exchange for rides, the conductor was placed in charge of his car with the understanding that, acting in the capacity of agent for the company, he was supposed to collect as many fares as possible, and to return to the company all collections made. At that time the conductor was placed solely upon his honor, and there was no connecting link between the hands of the conductor and the cashier for the company. Because of the lack of some material connecting link, suspicion on the part of companies was naturally aroused as to whether conductors were turning in to the company all fares collected, and the honest conductor was confronted with the uncertain proposition that although he would turn in absolutely each and every fare collected, there existed the uncertainty as to his morality because of the absence of the missing link, to which we previously referred. Subsequently the old portable bell punch was introduced, and it served its purpose for years. The introduction of the bell punch forced a change in the system, which taught conductors to settle upon the basis of fares collected, to one which compels the settlement upon the basis of fares registered, and, we believe, we can trace to this change the evil which has permeated the operation to the present day.

It was soon discovered by the unscrupulous conductor that to give a fare for each fare registered meant to him to retain a fare for each fare not registered, and with the portable machine carried upon his person he found it easy to collect fares, and to avoid registration, or to collect fares and register them at opportune times upon his own register, kept up his sleeve for his own peculiar benefit.

The introduction of electricity in recent years, the clamor by the general public for reduced fares and the universal transfer system, has forced upon railway companies, through municipal and interurban authorities, conditions never dreamt of by the pioneers in the business.

To prevent the use of duplicate punches by unscrupulous conductors, and to provide in a way some evidence on the part of the passenger that his fare was paid, the stationary clock register was introduced, but the system upon which it operates remained unchanged. The conductor is obliged to turn in only as many fares as he rings up.

The introduction of tickets, and, subsequently, the transfers, added complications, and increased the opportunities of dishonest conductors. If he registers cash, tickets or transfers together, and returns to the company a total number of either to correspond to the total number registered, he does his duty, and it matters not to him how he may be able to supply the abnormal quantity of tickets or transfers. If he collects two denominations of cash fares, it is left for him to determine how many of either kind has been collected.

In the attempt to supply a more reasonable way of accounting and checking conductors, the double register found its place upon many cars in the country. But the double register, being little more or less than two registers enclosed in one case, is operated upon the same principle as prevails with the single register, and the conductor is educated in the same old way, to settle upon the basis of fares registered instead of making settlement upon the same principle of turning over all collections.

To illustrate the force of this argument, we only allude to the operation with a double register upon one of the large lines in a prominent Ohio city. The company collects a 5-cent and a 3-cent cash fare, tickets, coupons and transfers. Its conductors sell and collect six tickets for 25 cents, also twenty school, or children's, tickets for 50 cents. The 5-cent and 3-cent cash fares, the six for 25 cents ticket, and the 2½-cent ticket are all counted together on one side of the register, the transfers and coupons together on the other side. The writer recently had occasion, with two adults and three children, to ride on one of the cars of this company. He gave as the medium of exchange for the six passengers one 5-cent cash fare, two six for 25 cents tickets, one 3-cent cash fare and two 2½-cent tickets. These six fares were promptly counted together on the same side of the register, and, of course, it was a most forcible reminder of how inadequate this process, and what a temptation it must be even to the honest man who must account to the company for six fares of four different kinds registered together. In making his settlement, is he not doing as expected, and can he not relieve his conscience by turning over fares of the four denominations in sufficient quantities, the total of which will equal the amount registered?

* Abstract of paper read at meeting of the Pennsylvania Street Railway Association, at Williamsport, Pa., Sept. 23, 1903.

Surprising as it may seem, this operation is no more absurd than to register cash fares and transfers together, or to register cash and omit the registration of transfers. If cash and transfers are registered together, it means for the company a settlement of fares in either class corresponding to the number registered, and in which case the conductor naturally makes paper go as far as possible, and the difference is made up in the cash fares. Many companies do not register transfers in order to avoid the substitutions of transfers for cash in settlement, and excuse themselves for the omission on the ground that transfers have no value. If they have no value, why are they taken as a medium of exchange for a ride, and does not the knowledge by the conductor of this position taken by the company encourage the wholesale and miscellaneous distribution of transfers, of which he is taught they have no value? Our observations lead us to the conclusion that where transfers are collected and not registered, it encourages the opportunity for the non-registration of cash fares. It makes it all the more difficult for the company to get a line on the unscrupulous operator.

We are now led up to that part of the operation on which the cashier presents himself. The conductor is employed to turn in fares collected, make out his report in his own way, and based on his register record. The cashier takes the conductor's report with the returns made, and it is common practice to call upon the conductor to pay the shortage of the difference between his returns and his own record taken from the register. He may have collected one hundred fares in excess of the number registered, turn in five, or six, or ten fares short, which is his privilege, expecting all the while to be called upon to pay 50 cents, the amount of his shortage from the excess collections of $5 and more. Some companies return overages, but the majority collect shortages and retain overages, and, as the conductor holds the key to the situation, and from his returns as compared to the register, knowing the amount of his overage, can only conclude that at best it is a case of conductor versus the company, and the conductor's estimation of the company for holding out his money can be none the less than the company's estimation of his own integrity. The cashier, standing between the conductor and treasurer, holds an unenviable position. He stands between the several conductors reporting from one register, and between all conductors reporting to him and the treasurer of the company. Upon this varied and uncertain quantity the foundations are laid upon which are built the records and statistics for the company.

We have, perhaps, consumed time which may seem unnecessary in reviewing and pointing out existing conditions, of which many or all of you are aware, but this review, when brought in contrast with an exposition of what the Ohmer register and system really mean, can only bring you to the better realization of what we have solved in working out this perplexing problem. Aside from the Ohmer fare register and system, little or no improvement has been made in thirty years. Railway companies are to-day using practically the same style of "counting machines" (so-called registers) which were used with one fare—when only a 5-cent fare was collected. The Ohmer register was created to meet existing conditions upon both city and country operations, and has enabled the companies to abandon the old, inaccurate system of bookkeeping on the cars by the conductor and the conductor's report. The register now makes the report. In addition it accomplishes the following:

1. It makes a separate registration for each fare collected, the different kinds of fares being registered separately.
2. It keeps a separate printed record of the collections of each conductor.
3. It shows a separate indicator for each kind of fares registered. The fares registered are simultaneously indicated at various places about the car; as the platform, on the inside of the partitions, in special compartments of the interurban cars, etc.
4. It makes a total registration of all fares, irrespective of the class.
5. It is easily and rapidly operated.
6. It indicates the direction in which the car is moving.
7. It prints the number of fares in each class for each half trip.
8. It prints the trip number.
9. It prints the month and day.
10. It prints the number of the register.
11. It prints the number of each conductor (and motorman, if desired), and shows the platform time he takes and leaves the car.
12. It fixes the work and responsibility of each conductor, and removes all occasion for disputes. From the register record it shows the various fares in detail which are collected upon interurban cars running over city lines.
13. It prints a duplicate or triplicate record, showing a summary of the day's business for each car, irrespective of the number of conductors who operate it. The duplicate or triplicate copies may go direct to the treasurer and auditor of the company.

With all this, it is so ingeniously contrived that it is always locked when not in service, and cannot be put into service until the conductor's badge number is first printed upon the statement enclosed in the register. It does the work of an adding machine, a printing press, a time clock and a cash register. In short, it is a marvel of ingenuity and mechanical skill, and with all, its construction is extremely simple. It is as valuable and indispensable for street car service as is the cash register for certain commercial enterprises.

In studying out the solution to this problem we did not lose sight of the fact that three interests must be considered: First, the company's interests; second, the public, and, third, the interests of the conductor, who is the instrument between the company and the riding public. No system could succeed which in its operation was antagonistic to the public, and the system which affords more or less protection to the public must naturally be in favor and grow in popularity. The indicator is to the passenger a visible receipt for the fare paid, and assures to him his right to destination. It insures to the passenger on an interurban line that he has not been charged in excess of the regular rates. If, however, a passenger should pay a 15-cent fare, and the conductor should register and indicate for a 10-cent payment, the passenger can have his alternative of two conclusions, either the conductor has charged in excess of the regular rate, or has charged the regular rate and receipted for a less amount, by which action it is implied that 5 cents of the 15-cent collection has been appropriated to himself. The moral force supporting the visible indicator for each fare paid will prevent conductors from registering inaccurately just as much as the indicator to a cash register compels the clerk to register the amount received.

The conductor is the acting agent of the company, and the responsibility of the company follows his acts, so that no matter what system is designed for the conductor, we must not lose sight of the fact that in its operation it must be designed for the company. To employ a conductor with the understanding that he is to collect all fares possible, and to turn over to the company all fares collected, and then in practice ask him to turn only a number of fares equal to the number registered, is working contrary to the natural laws, which can only result to the detriment of the company. That railway companies realize the import of this argument may not be disputed, but they have been forced to accept unwarranted conditions, because, until the introduction of the Ohmer register and system, there was no other method available.

Our system is devised to teach and educate conductors to act in the capacity of agent for the company, and as he formerly did before the advent of "counting machines," or registers of any kind. We tell him to count his cash before taking the car, and at the finish of his run to first take out the amount of money he had when taking the car, and turn over the balance to the company. In so doing, he can point with pride to the register record (over which he has no control) to back up his integrity. The honest conductor is delighted with the system which protects his own interests. The visible indicator, at the time he registers a fare, relieves from the passenger any suspicion of doubt the passenger may have as to his integrity. Having no books to keep, he is relieved from considerable mental work, and has the satisfaction of knowing that if an honest mistake has been made, it is practically the company's mistake, and it affects him only in his moral record. Our system provides that a record be kept for each man's work, rewarding to him good points for good work, and bad points, the number of which are measured by the number of inaccuracies by the conductor; in other words, he is put upon his morality, and the moral worth of every man should be measured by his moral record.

We contend that every man, woman and child should pass some medium of exchange to the conductor for the ride, and that there should be a separate reckoning or accounting for each made at the time. All this we do. With our system we teach and educate the conductor to turn in all fares of every denomination he has collected, and having given him mechanical means for keeping a record of all fares collected, his competency will be measured by the accuracy by which his record of fares is kept. It seems to be the universal system, which goes with all other counting machines, to have the conductor settle upon the basis of fares registered. In other words, with the old system, you say to the conductor, "Ring up all your fares, for unless rung up we don't get them." And your conductor says, "Each fare I get and don't register is my 'meat.'" With the old system, in some cases, the conductor is taught to register cash and paper together, and the conductor says, "Paper comes easier than money," and counts the paper first, then makes up the difference with money. You cannot add tickets, transfers and cash together, and get a result of one kind. It is as inconsistent with true principles just as an effort would be to add four and three together, and endeavor to get 6¾ or 7⅛. It is a physical impossibility. We say, "Get all your fares; give us

all you get, and your merit record will tell us your moral worth." With our system the conductor says, "All I get goes to the company."

At the end of each trip with your system conductor writes down the number of passengers carried. Our system prints with ink not only the number of passengers, but the medium of exchange paid by each. Your system, the spotter reports, conductor collected eighty fares, and registered forty. Conductor says, "I didn't," and proves it manipulating his trip sheet by the Bean system, and the company doesn't know who is the liar. Our system controls the trip sheet, and nails the liar. With your system passengers have no interest in the register. With our system the passenger gets his receipt from the register indicator. Your system makes conflict between the company and conductor—on the part of the company to see how many fares it can make him register, on the part of the conductor to omit registration. Your system leaves both conductors and company in doubt. Our system proves the work of the conductor, and backs up his inegrity. Your system works against nature, and breeds immorality. Our system, working with nature, teaches morals.

It has been the custom with manufacturers generally of registers to send them on trial wherever requested, and we have had a few demands from managers for machines sent on trial. With one exception since we are in business, we have refused sending registers out on trial for the simple reason that without proper knowledge of how the machines should be operated, mechanically and systematically, there would be little hope for success. We consider the mechanical operation of our registers second of importance to the system which it precedes, and it would be difficult to put in successful operation a system by those who have not given the subject sufficient study.

There has been some objection to our manner of putting out machines upon the rental basis, but after giving this matter due and careful consideration, it must be apparent that the register is very expensive to manufacture and market, and that if sold, the price must be put at a figure which might be considered prohibitive. The charges made by us have proved to be very inconsiderable compared to the advantages obtained, and, moreover, the question of cost should never be considered excepting in connection with what one receives for the outlay. The rental charge we make is but a fraction of a cent per hour for work you could not possibly buy in any other way for twenty times its cost. There can be no better illustration of this fact than referring to the cash registers, which sell for from $300 to $400 each, and are universally used by all classes of merchants—from the peanut vender and boot black, whose stock in trade consists of a blacking brush, a bottle of polish and a cash register—to hundreds of registers used by that Napoleon of all merchants, your own distinguished fellow-citizen, John Wanamaker, of Philadelphia.

THE NEW SYSTEM IN MEXICO CITY

The American capitalists interested in the Compania Mexicana de Traction (the Mexican Traction Company), recently organized for the purpose of constructing and operating an extensive electric railway system in Mexico City, met in New York last week for the purpose of increasing the financial resources of the enterprise and determining as to what rails, cars and power house equipment will be required for the initial installation. About 1000 tons of 85-lb. girder rails will be ordered at once, and the company will also be in the market for twenty 40-ft. cars, with four motor equipments of 56 hp each. The power house will have an initial capacity of 2000 hp. Westinghouse equipment will be installed. The company has acquired what are known as the Moylan, Garcia & Requima concessions, which permit of the building and working of about 100 miles of road, about 50 miles in the city and 50 miles in the suburbs. The company has also assumed control over the Empresa del Circuito de Banos, a horse road, 2 miles long, operating between Belvanera and Alberca, in the heart of the city. This line will be electrically converted at once. The company is incorporated under the Mexican laws. M. R. McAdoo, of New York, is president of the company. The other officers are Mexicans, but there is an American advisory board of directors, composed of Pittsburg capitalists. The directors are: James B. Oliver, Julius Bieler, Reuben Miller, Sr., James H. Park and Frank B. Smith. Mr. Oliver is president, and Mr. Bieler is treasurer. The chief engineer of the company is A. T. Montmorency, C. E., Mexico City. George C. Pierce, formerly of the Banos road, has been appointed superintendent and electrical engineer of the new company. Construction work will begin at once, and the system is expected to be in active operation within eighteen months.

STRIKE AT NEWARK, N. J.

There was a short-lived strike of the employees of the Public Service Corporation, of New Jersey, at Newark last week. The strike began late Thursday afternoon, Sept. 24, and was declared off at midnight, after the company had for a second time positively refused to comply with the demands of the local branch of the Amalgamated Association of Street Railway Employees of America. Except for the partial tying up of the lines during the time just mentioned there was no serious interruption of traffic. The order to strike was that the men, beginning at a certain hour, should, on completing their runs, turn in the company's property and quit work; and the plan seems to have been gradually to extend the tie-up to all of the company's lines. This would have resulted in cutting off street railway service in Jersey City, Hoboken, Newark, Paterson, Elizabeth, Montclair, the Oranges, Passaic, Bloomfield, Glen Ridge, Irvington, Arlington, Kearney, Harrison, Caldwell and other outlying villages.

The issues involved were clearly defined. They were, first of all, the recognition of the union; then a demand for a flat rate of 22 cents per hour, to replace a sliding scale of from 19 to 22 cents; again, the readjustment of hours so as to do away with "swing" runs, and, finally, the stopping of wholesale discharges of union men, which the men say have been going on for many weeks.

It seems that on Tuesday a conference was arranged between President McCarter, General Manager Wheatly and representatives of the employees, and that at this conference Mr. McCarter pointed out his utter inability to act until the question had been submitted to the directors. It was promised faithfully to consider the alleged grievances, but no hope was extended that the demands would be granted. At the meeting of the officers and directors of the company it was decided to ignore the demands of the men. To the ultimatum of the union the company replied that while the officers would be most willing to consider any grievances the employees might have as individuals, no organization would be recognized. Representatives of the employees as a whole, or any group of employees, would, it was stated, be received, but no representatives of a union would be given a hearing.

LARGE STEAM TURBINES FOR PENNSYLVANIA RAILROAD

As stated in the STREET RAILWAY JOURNAL of Sept. 12, an order for three 5500-kw steam turbines has been placed with the Westinghouse Machine Company, East Pittsburg, Pa., by Westinghouse, Church, Kerr & Company, acting as engineers and constructors for the Pennsylvania Railroad in connection with the New York terminal equipment.

These machines will form the initial installation in the new Long Island City power house, on which construction is just beginning, and which will serve the lines in the tunnels for the Hudson and East Rivers and the New York terminal at Thirty-second Street and Seventh Avenue, and also such part of the Long Island Railroad as is in process of conversion to electric traction.

The turbines will be of the Westinghouse horizontal, short-barrelled type, mounted upon a single bedplate, resulting in a particularly compact arrangement and great economy of floor space. They will have a capacity of approximately 7400 ehp each, and will drive 5500 kw, three-phase, alternating current generators operating in parallel. Their overload capacity will be over 11,000 hp, and each turbine will be provided with a bypass automatically controlled by the governor to accommodate abnormal fluctuations in load. This will also permit operation at full load non-condensing.

The turbine equipment will operate under conditions favorable to the attainment of high economy, viz., 200 lbs. steam pressure at the throttle, 28-in vacuum, and 175 degs. F. superheat.

The generator will be direct connected to the turbine shaft through a flexible coupling, each section of the unit having two bearings of ample proportion, thus avoiding shaft stresses. The three-phase winding will deliver current directly to the distribution system at 11,000 volts, no step-up transformers being employed. The machines will be separately excited, and will carry full load continuously at 100 per cent to 80 per cent power factor, with a rise in temperature of 35 degs. C., or 50 per cent overload for two hours with an increase in temperature rise of slightly over 50 per cent. Each turbo unit will thus be capable of delivering 8250 kw for reasonable intervals, and considerably in excess of this figure during momentary load fluctuations.

The entire equipment is to be delivered by July, 1904, one year from the date of contract. It is somewhat significant of the state of the turbine industry that eleven Westinghouse turbines of approximately the same size are under construction for heavy electric railway service, both in this country and abroad.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS MEETING

The opening meeting of the season and the first one at which the new president, Bion J. Arnold, presided, was held on Friday evening, Sept. 25, at the New York Academy of Medicine. President Arnold made a brief address, in which he outlined the policy of the present administration, and asked for the co-operation of the members in carrying on the work along the lines described. He referred to the splendid record of his immediate predecessor in office, and mentioned particularly the valuable work that had been done by the institute representatives in connection with the project for securing a permanent home for the engineering societies of New York.

The regular programme for the meeting comprised three papers on electro-hydraulics. The first was on "Efficient High-Pressure Water-Power Transmission Plant," by George J. Henry, Jr., and Joseph N. Le Conte, containing a description of the work done in Southern California by the Edison Electric Company, of Los Angeles. The second paper was on "Electric Motors for Centrifugal Pumps and Fans," by August J. Bowie, Jr., and the third was a brief contribution, entitled "A Suggested Hydraulic Unit," by Ralph Montague.

REPORT OF RECEIVERS OF WORCESTER & SOUTHBRIDGE COMPANY

John A. Hall and Charles M. Thayer, receivers of the Worcester & Southbridge Street Railway Company and the Worcester, Rochdale & Charlton Depot Street Railway Company, of Worcester, Mass., issued, on Sept. 19, a report on the conditions of those two roads and also of two properties connected with the roads in such a way that the receivers consider that they must all be considered together. These are Pinehurst Park, Auburn and Hotel Overlook, Charlton. The accounts of the four properties were not kept separate, and there were several transactions, the receivers say, which do not appear on any book, so that in a number of instances they were obliged to rely on oral information. The figures, however, they consider approximately correct.

The receivers say they have ascertained that the money that was paid for the real estate at Pinehurst and for the development of the park was raised on notes of the Worcester & Southbridge Street Railway Company, and, therefore, after certain debts incurred in the improvement of the property are paid, belongs to the road. The same condition, the receivers believe, exists in relation to Hotel Overlook. These two latter properties are in the hands of Hon. Rufus D. Dodge, appointed receiver on the petition of Messrs. Hall and Thayer.

The receivers say in conclusion:

"Of this balance ($305,536.04) it is estimated that $50,253.35 was used for interest payments, and $24,272.15 for operating expenses, leaving an amount $231,010.54, for which no vouchers are on file.

"In making up the above figures we have not caused a detailed inventory and valuation of the several properties to be made, but have figured the assets from vouchers and other evidence of payment, carrying out the amounts at their face values.

"The above figures seem to indicate the existence of either one or both of the following conditions:

"1. That a part of the authorized capital stock of the Worcester & Southbridge Street Railway Company was not paid for.

"2. That there have been expenditures of which there is no record.

"In other words, there are outstanding obligations of the company, including its capital stock, which amount to $231,010.54 more than the vouchers and evidences of payment which we have been able to find.

"We believe that both of the conditions above stated contribute to the shortage.

"Such proceedings will be taken, under the direction of the court, as will leave nothing undone to secure for the company the money and the property to which it is rightfully entitled. There is work being done on a plan of reorganization, and probably a proposition will be submitted to creditors, but owing to our inability to make a statement that is known to be complete, this may be somewhat delayed.

"This report has been submitted to Receiver Dodge, who approves the figures relating to Pinehurst and Overlook."

The report does not mention the name of Wilford A. Bailey, former treasurer of the road. In a statement following the publication of the report George A. Gaskill, attorney for Mr. Bailey, said his client feels that, when the opportunity is given him, he will be able to account for the apparent discrepancy in the accounts.

EXTENSIVE CUBAN TRACTION AND LIGHTING PROJECT

An extensive electric traction and lighting system is to be constructed in the southern part of Cuba, power to be derived from an hydraulic plant which will be the largest in that part of the world. The Cienfuegos, Palmira & Cruces Railroad & Electric Power Company has been organized for the purpose of building and operating both systems. The bulk of the capital will be furnished by Cubans. Bruno Diaz, a large Cuban cigar manufacturer, is president of the company. Cornelius C. Vermeule, of New York, is acting as consulting engineer.

The length of the road will be about 43 miles. Four and a half miles of track will be constructed in Cienfuegos—one of the most flourishing seaport towns in Cuba. The line will run from Cienfuegos to Caonao, thence over a private right of way to Palmira, Horringuero and Cruces. There will be a branch also over a private right of way from Caonao eastward 15 miles through Los Guaos to Cumanayagua. From the harbor of Cienfuegos to Caonao there will be a second line on a private right of way built to carry freight exclusively. The line will be standard gage, laid with 60-lb. rails.

The initial rolling stock will consist of four combination cars, 32 ft. over all, seating twenty-four persons, each operated by two 50-hp motors; four open passenger cars, 35 ft. 8 ins. over all, seating sixty passengers, each operated by two 50-hp motors; three closed passenger cars, length 27 ft. 8 ins. over all, seating twenty-four passengers, each operated by two 25-hp motors; three eight-bench open cars, 25 ft. over all, seating forty passengers, each operated by two 25-hp motors. Five express cars, measuring 21 ft. over all, each equipped with four 50-hp motors, and having a capacity of 20 tons, will be ordered also; twenty box eight-wheel freight cars, capacity 20 tons; a similar number of eight-wheel flat cars, capacity 20 tons; also sprinkler and repair cars.

The company will also generate energy for the purpose of lighting Cienfuegos—about 30,000 inhabitants—and the other towns mentioned, whose populations average about 8000 people. Power will be derived from the Falls of Hababanilla, which are known as the Niagara of Cuba, located about 26 miles from Cienfuegos. The voltage at which the energy will be transmitted has not yet been determined. The initial capacity of the plant will be 3000 hp.

MOVING PLATFORM SCHEME IN NEW YORK

The extensions committee of the Rapid Transit Commission has decided to recommend the immediate adoption of the plan to build a tunnel for moving platforms from the Brooklyn end of the Williamsburg Bridge to the Battery, Manhattan. The outlay will be about $8,000,000. The only elements of uncertainty in the scheme are now the Board of Aldermen and the Board of Estimate and Apportionment. The decision of the committee was reached after the receipt of a report from Chief Engineer William Barclay Parsons on the proposition made many months ago by Messrs. Schmidt and Gallatin, representing a syndicate interested in moving platforms. The bidding for the contract will be open, just as in the case of other tunnels, and the vote was to the effect that the subway should be used eventually for an electric railway in case by any chance the platform scheme should be found impracticable or inadequate.

An important part of the committee's resolution was the provision that the bidder must put up a bond equal to the amount of the bid, or aggregating about $8,000,000. It was stated by a rapid transit official that Schmidt & Gallatin were expected to secure the contract, in view of their superior equipment for doing the work. Among the backers of the company are said to be Cornelius Vanderbilt and Stuyvesant Fish.

Details of the plans recommended by Mr. Parsons were not made public, but it is known that he substituted for the route proposed by Schmidt & Gallatin the following: From the Brooklyn end of the Williamsburg Bridge to Delancy Street and the Bowery, and thence down Park Row, Nassau Street, Broad Street, and South Street to the Battery. The original plan of the syndicate was to run the line only down to Wall Street, and later there was a suggestion of following Broadway to the Battery, but this last, of course, was impossible in view of the Brooklyn extension of the subway system. If the Aldermen and Board of Estimate approve the route, as the committee expects them to do without delay, it is planned to start the tunnel work early next spring. Provided Schmidt & Gallatin do get the contract for their company under the terms they suggested they will have to carry passengers for 2 cents. At first they said they would rent a city-built tunnel and charge a 1-cent fare, but their last proposal was for themselves to build the subway for the city and then to charge 2 cents a ticket. They added that they would include platforms for the Brooklyn Bridge for a 2-cent fare.

SYRACUSE SERVICE APPRECIATED

The Post Standard, of Syracuse, takes occasion in announcing the meeting of the State Association to be held in that city next week, to record its appreciation of the excellent transportation facilities afforded the community by the local company. Editorially the Post Standard says:

"The situation prevailing in Syracuse is not only harmonious between municipal officials and the street railway companies as far as the general welfare and accommodation of the public are concerned, but the companies are vigilant in promptly improving their service to meet reasonable demands."

PROGRESS ON THE NEW YORK SUBWAY

A report upon the progress of the subway work has been made to the Rapid Transit Commissioners by Mr. Parsons, chief engineer, who has also made a brief report concerning method of construction. The work of excavation, including the work at Fort George and the Harlem tunnel, is 97 per cent completed, and practically all of the 3 per cent of incomplete work is at the two points just mentioned. South of One Hundred and Twenty-Fifth Street thirty days will see all the excavations completed. Of the construction 75 per cent is completed and installed. Fully three-fourths of the remaining 25 per cent is well in hand. The strike on the power house is what delayed work most. Tracks have been laid from Grand Street to Twenty-Third Street, and ballasted from Twenty-Third Street to Thirty-Third Street. From Forty-Seventh Street to Sixty-Fifth Street the tracks are ready for cars. Requisition has been made by the contractor for the payment of $941,000 for regular work to August 31 last, and for $177,148 for extra work covering a period of something more than a month.

FOUR-TRACK ELECTRIC RAILWAY BETWEEN PHILADELPHIA AND ATLANTIC CITY

Wilbur F. Sadler, Jr., the well-known electric railway promoter and operator, of Trenton, N. J., has completed plans for building a high-speed electric railway between Philadelphia and Atlantic City. Within the past few days he has announced that work will soon begin under the charter issued to the Delaware River & Atlantic Railroad Company on July 11, 1899. This charter has been kept alive through work done and an extension granted by the Legislature. More than $194,000 has been expended for the charter and construction work done to hold the charter, and it is understood that it stands Mr. Sadler and his associates in more than $200,000.

Work will be begun in Gloucester City and extend straight across New Jersey for 52 miles to Atlantic City. Four tracks are to be laid, two of which will be used for passenger and two for freight business. The freight tracks may also be used for fast express trains at certain hours of the day. It has not been definitely decided whether to use the third-rail system or overhead trolley, much depending upon the number of grade crossings encountered. L. C. Thompson, president of the Philadelphia & Western Railroad, who has been associated with Mr. Sadler for years in the electric railway business, told a representative of the Street Railway Journal that the form of construction will be decided soon. His opinion is that the overhead trolley will be adopted.

Large cars (exact type not yet decided) will be used, and they will be built for speeds of from 65 miles to 75 miles per hour. They will be equipped with the multiple-unit system of control, and the 52 miles between the cities will be covered in about 50 minutes, by express cars, and in about 1½ hours to 2 hours by accommodation cars or trains. The power house will be located midway between the two cities. The high-tension system of distribution will probably be installed, although the other Sadler plants are all direct current.

Three ferryboats will be operated between Gloucester City and Philadelphia, and passengers will be landed at a point midway between the Pennsylvania and Reading ferry terminals. The company has a title to the Philadelphia property, and has plans under way for the construction of ferryboats. At the Atlantic City end of the line rights have been secured which will enable the company to land passengers in the center of the city, it is said. The total cost of the road will be not less than $9,000,000. The rates of fare, etc., have not been decided upon, as yet, but will undoubtedly be much lower than the steam railroads. With the several lines mentioned and the Delaware Valley Traction Company in the hands of the Sadlers, and charters for lines in Philadelphia, the entire territory contiguous to Philadelphia will be covered with a network of electric railways.

TWO FIRES CRIPPLE PUGET SOUND ROADS

The transformer house of the Snoqualmie Falls Power Company was destroyed by fire Sept. 16. This house was located at Snoqualmie Falls and contained the step-up transformers for all the 33,000-volt transmission lines to Seattle and Tacoma supplied from the Snoqualmie Falls plant.

A short time after a big fire broke out in the top floor of the Post Street station of the Seattle Electric Company, where the storage battery cells were located.

The machinery on the lower floors was unharmed. The lead-lined wood tanks had the wood burned and the window casings were burned, but the battery was not so severely injured but that it can be put in service when the electrolyte (which was somewhat diluted by the fire department) is renewed. The loss of Snoqualmie power was felt the most by the Seattle-Tacoma interurban. Seattle service was not interrupted.

PERSONAL MENTION

MR. H. L. SMITH, superintendent of the Central Market Street Railway Company, of Columbus, Ohio, has resigned to become superintendent of the Columbus, Delaware & Marion Railway.

MR. CHARLES WASON, president of the Cleveland, Painesville & Eastern Railway Company, has returned from a tour around the world, covering a period of more than a year. He spent several months in Japan, and was much impressed with the industrial development in that country.

MR. H. S. WILGUS has been appointed principal assistant engineer, with complete charge of track and maintenance of way of the Brooklyn Rapid Transit Company. Mr. Wilgus was formeraly connected with the Pennsylvania Railroad, and is a brother of Mr. W. J. Wilgus, fourth vice-president of the New York Central & Hudson River Railroad.

MR. HOWARD ABEL has been appointed controller of the Brooklyn Rapid Transit Company in place of Mr. W. B. Longyear, who has resigned. Mr. Abel is an Englishman by birth, having been born in 1868, at Strenall, near York. After being connected with railroad and industrial enterprises in his native country, he came to the United States in 1890, and entered the employ of the Fox Solid Pressed Steel Company, at Joliet, Ill. Mr. Abel became connected with Mr. Charles T. Yerkes in 1893, and has been president of the Lake Street Elevated Railroad, and secretary and treasurer of the Northwestern Elevated Railroad and Union Loop, of Chicago. He has also been connected with Mr. Yerkes' London enterprises.

MR. FRED T. POMEROY, heretofore treasurer and general manager of the Cleveland & Southwestern Traction Company, of Cleveland, Ohio, has been elected to the presidency of that company in place of his father, A. H. Pomeroy, who retires from business on account of ill health. The former will continue to fill the position of general manager. The position of treasurer will be filled by Mr. F. L. Fuller, while Mr. J. O. Wilson, formerly general passenger agent, has been elected assistant treasurer. Nearly twenty years ago Mr. A. H. Pomeroy built a horse car line in Berea, Ohio, which in later years was extended to Cleveland and formed the nucleus for the now immense system of interurban roads controlled by the Pomeroy-Mandelbaum interests.

MR. S. W. CHILDS has just reached New York from Western Australia, where he went in 1901 to supervise the construction of the Kalgoorie electric railway for a London syndicate. The contractors for the work were J. G. White & Co., of London, and Mr. Childs represented the owners. After the line was completed Mr. Childs operated it for a short time as general manager. At the conclusion of the engagement his work had been so satisfactory to the citizens that he was tendered a public dinner. The Mayors of Kalgoorie and Boulder, the two cities connected by the line, were present at the banquet. Before its conclusion Mr. Childs was presented with an engrossed address testifying to the appreciation of the residents of the two cities of his courtesy and ability in carrying out the work in a way that was agreeable to all concerned. After leaving Kalgoorie, April 6, 1903, Mr. Childs visited New Zealand, Hong Kong, Japan and the Philippines. He intends to spend the winter in or near New York. Three years ago Mr. Childs built an electric road at Perth, Western Australia. He has also been engaged on electric construction in this country, the last work having been in connection with the Toledo & Monroe Electric Railway, some three years ago.

TABLE OF OPERATING STATISTICS

Notice.—These statistics will be carefully revised from month to month, upon information received from the companies direct, or from official sources. The table should be used in connection with our Financial Supplement "American Street Railway Investments," which contains the annual operating reports to the ends of the various financial years. Similar statistics in regard to roads not reporting are solicited by the editors. * Including taxes. † Deficit. *b* Including all properties.

Company	Period	Total Gross Earnings	Operating Expenses	Net Earnings	Deductions From Income	Net Income, Amount Available for Dividends
AKRON, O.						
Northern Ohio Tr. & Light Co	1 m., Aug. '03	97,538	48,268	49,271	22,127	27,145
	1 " " '02	84,340	42,191	42,149	16 904	25 245
	8 " " '03	581,584	307,971	273,614	178,057	95,558
	8 " " '02	484,407	268,141	216,266	132,059	84,207
ALBANY, N. Y.						
United Traction Co.	12 m., June '03	1,624,305	1,076,847	547,457	299,138	248,319
	12 " " '02	1,479,608	1,004,917	474,691	272,096	202,595
AURORA, ILL.						
Elgin, Aurora & Southern Traction Co.	2 m., Aug. '03	42,176	------	------	------	------
	1 " " '02	39,634	------	------	------	------
	8 " " '03	300,477	------	------	------	------
	8 " " '02	266,562	------	------	------	------
BINGHAMTON, N. Y.						
Binghamton St. Ry. Co.	1 m., Aug. '03	25,372	12,052	13,321	------	------
	1 " " '02	23 547	12,324	11,223	------	------
	2 " " '03	51 575	23,341	28,234	------	------
	2 " " '02	46,816	23,522	23,294	------	------
BROOKLYN, N. Y.						
Brooklyn R. T. Co	12m., June '03	13,557,814	7,931,079	5,626,735	4,870,338	756,397
	12 " " '02	12,788,168	8,209,397	4,578,771	4,559,878	18,893
BUFFALO, N. Y.						
International Tr. Co.	1 m., July '03	390,414	190,490	199,924	134 990	64 934
	1 " " '02	328,628	162,179	166,449	127,393	39,056
	2 " " '03	713,512	367,425	346,087	265,518	80,569
	2 " " '02	599,8 4	309,793	290,081	253,534	36,547
CHICAGO, ILL.						
Chicago & Milwaukee Elec. Ry. Co.	1 m., Aug. '03	30,465	8,746	21,719	------	------
	1 " " '02	25,530	7 221	18,309	------	------
	8 " " '03	153,715	57,116	96,600	------	------
	8 " " '02	128,060	52,859	75,201	------	------
Metropolitan Elevated Ry. Co	6 m., Aug. '03	1,006,981	------	------	------	------
	6 " " '02	950,959	------	------	------	------
CINCINNATI, O.						
Cincinnati, Newport & Covington Light & Traction Co	1 m., July '03	109,007	59,698	49,309	20,929	28,380
	1 " " '02	91,977	50,414	41,563	21,671	19 892
	8 " " '03	682,391	398,663	283 728	147,184	136,544
	8 " " '02	611,218	347,399	263,818	147,636	116,182
CLEVELAND, O.						
Cleveland & Southwestern Traction Co	1 m., Aug. '03	46,535	25,990	20,545	------	------
	8 " " '03	287,073	69,409	117,664	------	------
Cleveland, Painesville & Eastern R. R. Co	1 m., Aug. '03	24,044	13,377	10,665	------	------
	1 " " '02	24,787	12,823	11,964	------	------
	8 " " '03	141,862	81,036	60,828	------	------
	8 " " '02	132,498	73,463	59,035	------	------
DETROIT, MICH.						
Detroit United Ry *b*	1 m., Aug. '03	430,359	*245,180	185,179	84,167	101,012
	1 " " '02	402,043	*212,112	189,931	79,583	110,348
	8 " " '03	2,919,981	*1713881	1,206,100	659,554	546,546
	8 " " '02	2,613,020	*1463754	1,149,266	621, 960	527,306
DULUTH, MINN.						
Duluth Superior Traction Co	1 m., Aug. '03	57,880	27,309	30,572	10,865	19,707
	1 " " '02	51,457	26,505	24,952	9,671	15,282
	8 " " '03	413,684	228,947	184,737	83,253	101,484
	8 " " 02	349,496	183,903	165,592	77,200	88,393
FORT WORTH, TEX.						
Northern Texas Traction Co	1 m., Aug. '03	43,860	22,162	20,698	9,673	11,025
	8 " " '03	293,348	156,135	137,213	72,816	64,397
HAMILTON, O.						
The Cincinnati, Dayton & Toledo Trac. Co.	1 m., Aug. '03	56,545	26,277	30,267	16,137	14,130
	1 " " '02	49,301	24,483	24,819	16,280	8,539
	3 " " '03	154,678	76,186	78,493	48,291	30 202
	3 " " '02	140,412	68,156	72,256	48,990	23,266
HARRISBURG, PA.						
Central Pennsylvania Traction Co	1 m., Aug. '03	50,201	39,758	10,443	------	------
	1 " " '02	46,664	27,188	19,476	------	------
	8 " " '03	345,390	237,419	107,971	------	------
	8 " " '02	306,148	183,415	122,733	------	------
HAZLETON, PA.						
Lehigh Traction Co.	1 m., Aug. '03	14.807	7,209	7,598	------	------
	1 " " '02	7,686	4,320	3,366	------	------
	2 " " '03	29,284	13.180	16,104	------	------
	2 " " '02	14,856	9,583	5,274	------	------
HOUSTON, TEX.						
Houston Electric Co.	1 m., July '03	40,132	22 669	17,463	6,773	10,690
	1 " " '02	30,836	17,333	13,502	6,250	7,252
	2 " " '03	77,369	44,646	32,724	13,486	19,238
	2 " " '02	62,735	34,012	28,722	12,500	16,222
LIMA, O.						
Western Ohio Ry. Co.	1 m., Aug. '03	25,941	10,947	14,994	10,637	4,357
	2 " " '03	50,447	21,724	28,723	21,262	7,461
MILWAUKEE, WIS.						
Milwaukee El. Ry. & Lt. Co.	1 m., Aug. '03	265,915	128,806	137,109	74,440	62,669
	1 " " '02	243,345	112,540	130,805	68,677	62,128
	8 " " '03	1,973,091	993,021	980,069	574,271	405,799
	8 " " '02	1,755,350	835,772	919,578	526,219	393,359
MINNEAPOLIS, MINN.						
Twin City R. T. Co.	1 m., Aug. '03	365,466	155,554	209,912	60,937	148,974
	1 " " '02	323,534	137,969	185,564	60,233	135,331
	8 " " '03	2,648,591	1,241,964	1,406,627	487,193	919,434
	8 " " '02	2,327,426	1,060,709	1,266,716	470,500	796,216
MONTREAL, CAN.						
Montreal St. Ry. Co.	1 m., Aug. '03	211,8'6	109.159	102,657	21,415	81,242
	1 " " '02	199,405	100,086	99 319	22,950	76 368
	11 " " '03	1,999,994	1,218,969	781,025	210.779	570,247
	11 " " '02	1,843,241	1,040,946	802,295	187,177	615,117
OLEAN, N. Y.						
Olean Street Ry. Co	1 m., July '03	9,521	3,614	5,907	2,088	3,819
	1 " " '02	6,569	3,216	3,353	1,771	1,582
	2 " " '03	16,956	7,372	9,585	4,464	5,121
	2 " " '02	12,523	5,423	7,100	3,539	3,561
PHILADELPHIA, PA.						
American Railways	1 m., Aug. '03	144,209	------	------	------	------
	1 " " '02	125 289	------	------	------	------
	2 " " '03	287,246	------	------	------	------
	2 " " '02	245,579	------	------	------	------
Philadelphia Rapid Transit Co	12 " June '03	15,436,573	7,234,893	8,201,680	7,795.792	405,889
	12 " " '02	14,118,158	6,402,338	7,715,820	6,637,781	1,078,039
POTTSVILLE, PA.						
Pottsville Union Traction Co	1 m., Aug. '03	22,344	------	------	------	------
	1 " " '02	17,156	------	------	------	------
	8 " " '03	129 161	------	------	------	------
	8 " " '02	110,353	------	------	------	------
Pueblo Suburban Traction & Lighting Co	1 m., July '03	44,222	------	------	------	------
	7 " " '03	277,172	------	------	------	------
ROCHESTER, N. Y.						
Rochester Ry.	1 m., Aug. '03	117,607	57,108	60,550	25,942	34,558
	1 " " '02	102,420	52,168	50,252	25,063	25,189
	3 " " '03	338,670	164,721	173,950	77,485	96,464
	3 " " '02	292,038	148,888	143,150	74,674	68,476
ST. LOUIS, MO.						
St. Louis Transit Co.	1 m., Aug. '03	659,535	------	------	------	------
	1 " " '02	579,575	------	------	------	------
	8 " " '03	4 766,703	------	------	------	------
	8 " " '02	4,169,335	------	------	------	------
SAO PAULO, BRAZIL.						
Sao Paulo Tramway, Light & Power Co., Ltd	1 m., July '03	100,500	33,500	67,000	------	------
	1 " " '02	91,157	34,230	56,927	------	------
	7 " " '03	732,864	228,516	504,348	------	------
	7 " " '02	------	------	383,813	------	------
SEATTLE, WASH.						
Seattle Electric Co	1 m., July '03	184,931	123,713	61,150	23,064	38,086
	1 " " '02	157,838	108,245	49,593	19,699	29,894
	2 " " '03	360,444	241,327	119,117	47,117	72,001
	2 " " '02	309,155	219,577	91,579	41,256	50,323
TERRE HAUTE, IND.						
Terre Haute Elec. Co.	1 m., July '03	42 044	25,257	16,787	6.538	10,228
	1 " " '02	27,802	21,268	6,534	6,430	105
	2 " " '03	80,529	49,623	30,906	13,118	17,787
	2 " " '02	52,938	40,994	11,943	12,710	† 766
TOLEDO, O.						
Toledo Rys. & Lt. Co.	1 m., Aug. '03	150,515	76,231	74,284	41,571	32,713
	1 " " '02	138,642	69,889	68,753	38,899	29,854
	8 " " '03	1,075,918	552,937	522,981	325,432	197,549
	8 " " '02	941,419	484,587	456,832	303,787	153,045
Toledo, Bowling Green & Southern Trac. Co.	1 m., Aug. '03	28,364	17,051	11,314	5,625	5.689
	8 " " '03	188,478	117,200	71,278	45,000	26,278
Lake Shore Electric Ry. Co	1 m., Aug. '03	77,326	35,060	42,266	20,000	22,266
	1 " " '02	47,968	26,321	21,647	20,000	1,647
	8 " " '03	404,415	254,497	149,918	------	------
	8 " " '02	296,523	185,233	111,290	------	------
UTICA, N. Y.						
Utica & Mohawk Valley Ry. Co.	1 m., Aug. '03	73,261	------	------	------	------
	1 " " '02	62,489	------	------	------	------
YOUNGSTOWN, O.						
Youngstown - Sharon Railway & Light Co.	1 m., Aug. '03	45,961	*24,500	21,461	------	------
	8 " " '03	339,439	*201,395	138,045	------	------

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EDITORIAL NOTICE

Street railway news, and all information regarding changes of officers, new equipments, extensions, financial changes and new enterprises will be greatly appreciated for use in these columns.

All matter intended for publication must be received at our office not later than Tuesday morning of each week, in order to secure insertion in the current issue.

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114 Liberty Street, New York.

Mutual Benefit Organizations

The daily papers have been filled during the last six months with accounts of contests between labor and capital, but, for the most part, these troubles have been in industries outside of that of street railway transportation. We hear a great deal at present about the oppression of the employee by the large corporations and quite as much, if not more, in regard to the "right" of the employee to tell the owner of a property how he should conduct its affairs. In looking back on the history of the last five years in our own particular industry, however, there seems to us to have been much less of this senseless, wasteful and wicked struggle between capital and labor than in the past. Whether this has been due to the fact that men of a higher grade of intelligence are required in the operation of an electric road than under former horse car conditions, or whether a better idea of the rights of capital and the claims of labor exists now than formerly, it is not our purpose here to inquire. Whatever the cause it is certain that in the street railway industry the two necessary factors to mutual prosperity, the capitalist and the employee, understand each other's aims better than ever before, and each is more in harmony with the purposes of the other.

To our mind nothing can assist to this end more than that mutual esteem and feeling of comradeship which comes from personal contact between the manager and the men. It will be found that most industrial conflicts, possibly we might say most conflicts of all kinds, have arisen from a misunderstanding of the purposes and intentions of the one side by the other side. There is no reason why such a state of affairs should arise on a railroad property. The manager or owner who has made a success of a large road can only have done so if he possesses a broad mind and is capable of looking at affairs from all sides. On the other hand, the average employee is not unreasonable and is willing to accept any fair proposition if he understands it.

Probably as good an example of the kind of successful mutual benefit association as exists is that of the Metropolitan Street Railway Association, of New York. Some particulars of this association are given elsewhere in this issue, and are worthy of study by those who maintain that the natural attitude between labor and capital is that of antagonism. It is not antagonism but co-operation, for every important company realizes that it must pay a fair wage for services, and if this is done it is entitled to receive the best service which its employees can give.

Tragedy and Comedy in Chicago

Another terrible grade crossing accident in Chicago last week, in which a Wisconsin Central train wrecked a car of the Chicago Consolidated Traction Company at West Fifty-Second Avenue, resulted in the death of six men, all of them race track followers. As sad as was this accident, members of the legal profession in Chicago have had considerable quiet amusement over the sudden efforts of the public administrator to get appointed administrator of the estates of the six men who were killed. So great was the haste of this public official to perform his duty (?) that he did not even wait to learn the correct names of the victims, and later developments showed that five out of the six names given were incorrect. And why all this haste to secure the administration of the estates of six race track followers, whose visible assets consisted of nothing but the change found in their pockets? The cause of the alacrity was to be found in the petitions for appointment, each of which recited that the deceased left a personal estate of $10,000, consisting of rights of action against the Wisconsin Central Railway Company and the Chicago Consolidated Traction Company. In the next paragraph the petition states that the deceased left him surviving no widow, heirs at law, next of kin, or creditors in the State. The affidavit is startling in its outspoken intention of "milking" the railway companies, to say the least. The amusing part of the incident is that the public administrator in his haste failed to remember the law of Illinois is very explicit in making recovery for damages, in case of death, possible only where there is a widow or next of kin dependent for support on the deceased. To quote from Chapt. 70, Hurd's Revised Statutes of Illinois: "Amounts received in every such action shall be for the exclusive benefit of the widow and next of kin of such deceased." The administrator having

sworn that there was no widow or next of kin in any of the six cases, has effectually shut himself off from getting even a small taste of fees on that $60,000 which he himself didn't earn, and which no one else is entitled to. It is bad enough when shyster lawyers attempt to hold up corporations with damage suits, but when a public officer attempts in cold blood to follow this course it is infinitely worse. It looks as if the present incumbent was doing all in his power to perpetuate the unsavory odor of the office of public administrator in Cook County.

Seventh Avenue or Broadway?

The latest development in the controversy over the plans for the extension of the New York subway system is of more than passing importance, as it brings the discussion to the point where a decision must be made by the Rapid Transit Commission on two important questions; namely, will the Broadway spur south of Forty-Second Street be abandoned, or will deep-tunnel construction be substituted for the present method? It also suggests at once a reconsideration of the route for the subway through the shopping district, and gives prominence to the oft-repeated claims of Seventh Avenue as a better location for a West Side line.

Mr. Belmont's letter to the Rapid Transit Commission last week practically announced that the contractors for the present work would decline to undertake further extensions under restrictions lately imposed, and that they would not accept additional contracts according to the proposed new plan of construction. At the same time he offered to abandon the Broadway spur. This leaves the field open for the Broadway agitators who offered to build a deep tunnel themselves if the Interborough Construction Company refused to do so. Evidently Mr. Belmont would be satisfied to let them undertake this part of the work, and if the Commission can induce responsible contractors to accept the job the experiment will be made. The Interborough Company expresses a willingness to operate this portion of the system in conjunction with the rest of the underground lines, but it is not considered at all probable that it will be built; in fact, the chances are largely against it.

Under the circumstances the alternative offered the Commission is the substitution of Seventh Avenue for Broadway as a route connecting the upper and lower parts of the city by a West Side line. This plan has long been favored by many who are deeply interested in the development of the service for upper Manhattan, as they recognize the advantages of having the four-track system extend as far south as possible. Broadway is a narrow street for a great part of its length, being only 66 ft. wide through most of the portion under consideration, while it is not more than 75 ft. at any point along the proposed route. Some of the earlier rapid transit projects contemplated a four-track road under Broadway, but it was found that there was scarcely room for four tracks without allowing for the necessary stations. The Commission's plans have been made to conform with this condition, and they provide for only two tracks, involving the abandonment of express service, which is necessarily one of the chief advantages of the underground road. A two-track road under Broadway means only local trains, and would not give satisfactory rapid transit facilities to the people of Harlem.

Another objection is that the plan of constructing a subway under Broadway would not accomplish the best geographical distribution of the facilities for rapid transit. The Broadway extension of the underground road southerly from Forty-Second Street would, for a considerable part of its length, run substantially parallel to the subway already under construction. This arrangement would provide an East Side line and a central line, leaving the lower West Side of the city wholly without new rapid transit facilities in spite of the fact that there is an immense passenger traffic on existing surface and elevated railways on the West Side. Railroad men know that it is extremely difficult to modify the established habits of the public in transportation matters, and as a great proportion of the residents of upper New York use West Side lines in its daily journeys up and down town, it is necessary that some thoroughfare be selected on the West Side under which the subway might be built, if relief is to be afforded this rapidly growing part of the city. Even though the Broadway spur is built according to the present plans, another underground route for a four-track line will have to be provided for the West Side.

Briefly stated, the claims for the Seventh Avenue route are that the location is much more advantageous from a transportation standpoint, the road is wide enough to permit four tracks with stations to be built, the line would be much more direct and there would not be as many curves as in Broadway, thus permitting higher speeds. The present subway turns out of Seventh Avenue at Forty-Second Street and passes east to the Grand Central Station, where it turns south under Park Avenue. The line proposed for the West Side, south of Forty-Second Street, will continue down Seventh Avenue to Fourteenth Street, then east to Fifth Avenue, and down Fifth Avenue and West Broadway to the Battery. This would take in the dry goods district below Bleecker Street, penetrate the office-building and financial center below Chambers Street, and would be but a block away from the Sixth Avenue shopping district. Cars of a Seventh Avenue subway would deliver passengers at the station of the Pennsylvania Railroad at Thirty-Third Street without transfer, while a Broadway underground line would make it necessary to transfer passengers at Thirty-Fourth Street.

Another feature that should not be lost sight of is the greatly increasing congestion of Broadway throughout the shopping and theater district. It must be apparent that another great avenue of trade will eventually develop in that section, and that the opening of the subway system, the Pennsylvania tunnel and the North River tunnel to Jersey City will make this necessity felt very much earlier than it would otherwise with the ordinary growth of the population of Manhattan Island. Seventh Avenue is a broad thoroughfare, well adapted for a fine retail street, and, it is pointed out, should be selected as the route for the principal West Side underground railway.

Suggestion for Street Railway Associations

The Pennsylvania Street Railway Association at its last meeting introduced an innovation in the form of a "Question Box," which proved a very valuable feature, and might be adopted with advantage by other associations. No claim is made for originality, but the Pennsylvania organization certainly demonstrated the fact that the idea, when properly worked out, could be made one of the most instructive and interesting parts of the programme. With the larger organizations some modifications would doubtless be desirable; for instance, it would not be necessary to prepare so many questions as were included in the list sent out by the Pennsylvania Association, and, in fact, it would not be desirable to do so. Replies from all or a fair representation of the companies in the American Street Railway Association would form a very valuable compendium of American practice on any problem in street railway operation or management. With a very large list of questions it will readily be seen that it would be impra-

ticable to digest all this matter properly and intelligently at one meeting.

A division might be made of the subjects to be considered at the national meetings; for instance, those pertaining to management and operating problems might be discussed by the American Street Railway Association, while the mechanical and electrical features could be left for the "Master Mechanics," as the new organization is commonly termed. It would be carrying out the idea formulated at the Saratoga Convention of the latter body which resolved itself into an "experience meeting" on more than one occasion, and would be much more to the liking of the members than the preparation of long papers upon set subjects. A short paragraph on each topic selected for consideration could be gotten from men who would not under any circumstances write a long communication, especially when it is known that those occupying similar positions with other companies would do the same thing. A little pride, some curiosity and a willingness to exchange information would prompt them to contribute to a symposium of this kind; they would feel as if they were talking among themselves, and, what is of far more importance to most of them, it would require very little time.

Street railway men in all departments are very busy; they haven't time to write long papers, and, besides, very few of them have the inclination to do so. They have plenty of ideas; their experience is valuable, and they will answer questions freely. Right here the "Question Box" comes in as a very valuable adjunct. We do not wish to be understood as advocating the elimination of papers from the programme. They form an essential feature of every convention of this character and are indispensable; but we do believe that in the experience of the Pennsylvania convention last month the national and State organizations may find a valuable suggestion which may be adopted with advantage to their members, and under the direction of capable and zealous committees or secretaries this feature may be developed into a very important factor in awakening and maintaining interest in their work.

Measures for Preventing a Strike

The Public Service Corporation, of New Jersey, averted a strike in its railway department last month by taking vigorous measures to meet every contingency and being prepared for the continuance of the service in spite of any defection in the ranks of the employees. The conditions which confronted the management were exceptional. In the first place, the present owners have been in physical control of the property less than six months, and as the system is a very extensive one, including the city, suburban and interurban service of Newark, Jersey City, Hoboken, Paterson, Elizabeth, Plainfield and other important points in that vicinity, it was necessary to take great precautions to protect the property in all these places as well as the lines extending through the intervening country. The trouble arose over the demands of agitators, who had secured admission to the ranks of the workmen for the purpose of organizing a union and precipitating a strike. The company had granted an increase of wages to the conductors and motormen within sixty days, but in spite of this the agitation for a further advance was continued, and the familiar demand was made for recognition of the union. This the company positively refused to consider, and immediately took steps to protect its interests.

The company has 2500 conductors and motormen on its payroll, and requires the constant services of 1950 men to cover the regular runs according to the schedules. To fill their places on short notice is no easy task, especially when the service is liable to be fraught with danger to the newcomers, and consequently the first step that was taken was to organize a recruiting department to supply new men for the operation of the cars. Before the crisis was reached the company had 1500 experienced motormen and conductors ready to take the places of any of the old employees who might go out on strike.

Realizing that the men would not yield their places quietly in a struggle of this kind, the management also made provision for the protection of the property. At all the depots board fences, 10 ft. high, were built with three strands of barbed wire on the top, and a large number of armed guards were secured to defend the power houses, depots, shops and car houses against any concerted attack. Bunks were arranged in the depots and supplied with mattresses, blankets, etc., so that the men required at each depot could be housed, fed and cared for properly while there was any danger of rioting and intimidation. A commissary department was next organized and completely equipped, and ample provision was made for the comfort as well as the safety of the employees while the trouble should last.

In addition to the regular emergency service twenty-nine new patrol wagons were secured and manned by emergency crews. They were fully equipped for line service and for removing obstacles on the right of way. These wagons were distributed over the system so that each depot had one patrol wagon with a crew of five men in addition to the regular contingent. Precautions were likewise taken against the shutting down of the power plants, new crews being engaged and held in readiness to take the places of the old forces, should the latter determine to aid the motormen and conductors by joining in a sympathetic strike.

As has been mentioned, the service of this company is not confined to the cities, but includes the operation of suburban and interurban lines, and consequently a considerable mileage is through the Jersey meadows and country districts. One of the measures deemed necessary for keeping these connecting lines open and in order to ensure the safe operation of cars between cities was to mow down the high grass alongside the tracks on all lines crossing the meadows, so that the men would not be subject to attacks from ambush.

The effect of these precautions, which were not concealed from the men, was evident, and that they made a profound impression was shown by the reluctance of the older and more conservative employees to engage in any strife or contention against the company. A careful canvass of the situation satisfied the management that only a comparatively small proportion of the men were really in favor of carrying the matter to extremes, and this view was sustained by the result. When the issue was submitted to a vote a very significant feature was developed in the fact that out of 2500 conductors and motormen on the company's pay rolls only 891 were members of the union, and of these 667 voted against a strike and 224 in favor of it—less than 10 per cent of the employees affected being responsible for the trouble, annoyance and expense involved.

Two facts stand out prominently in this experience; namely, the efficacy of a prompt, vigorous and determined policy on the part of the management in preparing for every emergency, and the exaggerated ideas generally entertained of the influence and numerical strength of the men who precipitate these disturbances. The present case is a fair example of the policy which governs labor unions generally, wherein a relatively insignificant number of hot-headed, noisy agitators lead or drive their associates into difficulties.

DENVER TRAMWAY SYSTEM

The new power station of the Denver Tramway Power Company, on the South Platte River, that is now nearing completion, includes every reasonable precaution to insure the continuous operation of the plant, yet unnecessary and expensive

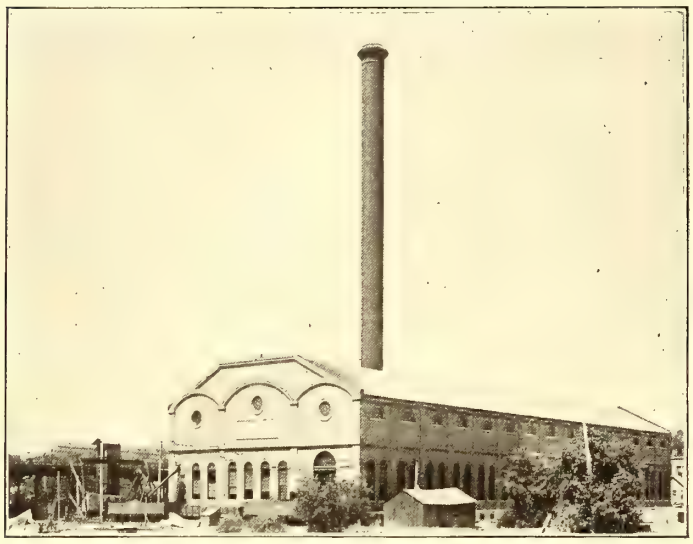


FIG. 1.—EXTERIOR OF MAIN POWER HOUSE

duplication of steam and electrical equipment has not been made. Previous to the erection of this station the Denver City Tramway Company, which receives its power from the Denver Tramway Power Company, was operating its system from five separate power houses located in different parts of the city. These old stations have all been abandoned now with the exception of one on Blake Street, in the east end of the city, which has a capacity of 1400 kw, and which will be operated as a reserve or auxiliary station after the new plant is finished.

The new station, as may be seen from Fig. 1, is a substantial

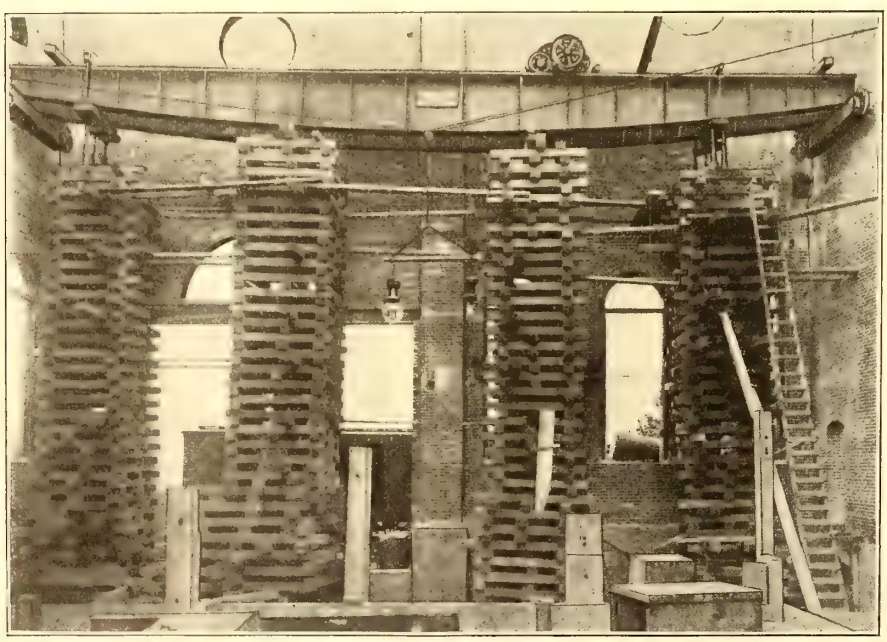


FIG. 3.—RAISING 25-TON CRANE IN ENGINE ROOM BY MEANS OF CRIBS AND JACKS

and well proportioned brick building. It is divided longitudinally by a partition wall into a boiler room, 38 ft. 6 ins. x 283 ft. 6 ins., and an engine room 58 ft. 2 ins. x 283 ft. 6 ins. Adjoining the boiler room on the west is a pump and coal house, 39 ft. wide and 38 ft. long.

CONSTRUCTION DETAILS

The foundations of the building rest on piling driven from 8 ft. to 16 ft. to bed rock. The pile driver used was operated by an electric motor, as shown in Fig. 2. On the piles was laid a footing course of concrete, 6 ft. wide and 2 ft. thick, and

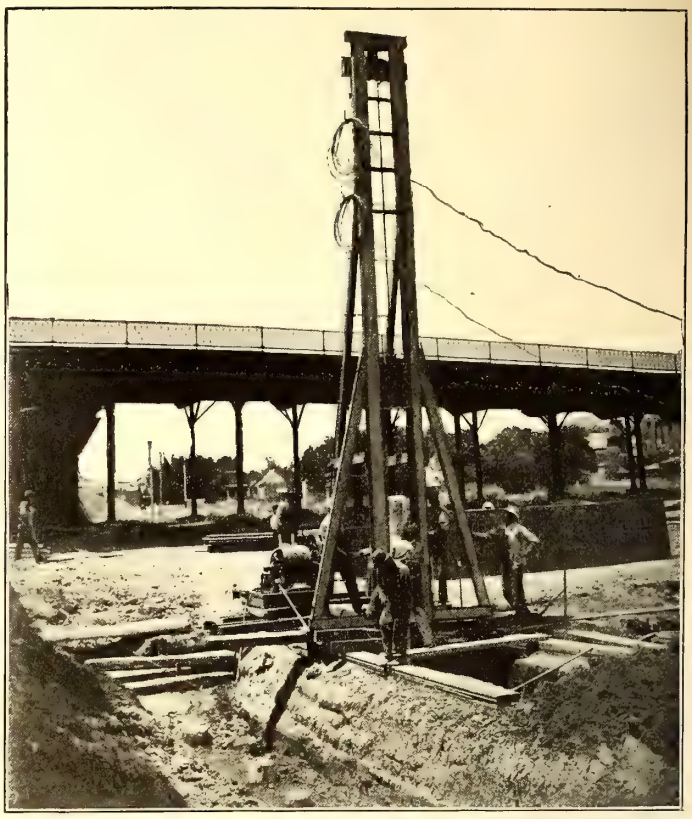


FIG. 2.—ELECTRICALLY-DRIVEN PILE DRIVER USED IN FOUNDATION WORK

another course 4 ft. wide and 1 ft. thick. The concrete foundation walls, 2 ft. wide and 11 ft. high, were then laid, and topped by a water table of concrete 9 ins. thick and 12 ins. wide. From the water table the brick walls rise; they are 17 ins. in thickness and are built of boulder pressed brick throughout.

The walls every 19 ft. are strengthened by 3 ft. x 4 ft. pilasters, on which rest the iron roof trusses. There are two roof ridges, one over the boiler room and one over the engine room, each supported by a separate set of trusses. The partition wall is 21 ins. in thickness, and carries the inner ends of both sets of trusses. It is strengthened on the engine room side with pilasters. The roof was covered by the Western Elaterite Roofing Company, of Denver. On the inner slopes of each roof are skylights for lighting the engine and boiler rooms. All floors are formed on steel girders with concrete top, the economizer floor above the boilers resting on iron plates imbedded in the walls. There is a clear height of 24 ft. in the boiler room and 41 ft. in the engine room. Spanning the engine room is a 25-ton Whiting traveling hand-power crane. The method used in raising this crane to position by jacks and cribs is shown in Fig. 3.

COAL HOUSE

The basement walls of the pump and coal house are 24 ft. deep, and are carried down to bed rock. The walls are 52 ft. high above the basement floor, and are surmounted by a flat roof. The addition is divided into two rooms, as shown in the plan, Fig. 4. The outside room will be devoted to the receiving of coal. In the basement will be a hopper bin with a capacity of 90 tons of coal. The coal hopper cars of the Denver &

Northwestern Railway, described in the STREET RAILWAY JOURNAL of Aug. 1, 1903, will be run into the building above this bin, and will discharge directly into it. The coal will then pass through an electrically-driven coal crusher and be carried by a cross conveyor to the longitudinal coal and ash conveyor in the boiler room, for distribution to the individual boiler bins.

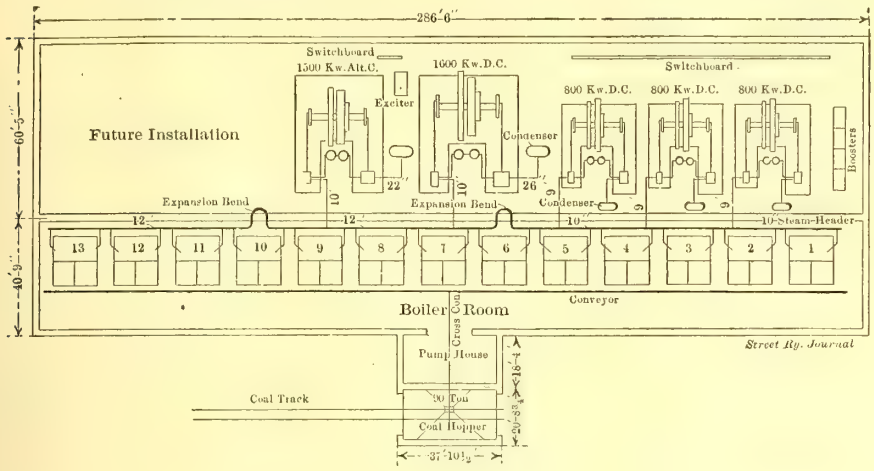


FIG. 4.—PLAN OF POWER PLANT

Above the track and connected by means of another cross conveyor with the longitudinal conveyor in the boiler room is an ash bin with a capacity of 30 tons of ashes, or two car loads. The coal and ash cross conveyors each have a capacity of 40 tons per hour. After the coal cars are emptied they will be filled with ashes from above and run on through the annex onto a switchback track outside the building, so that a practically continuous reception of coal and removal of ashes may be provided for. Awaiting the completion of the coal house a temporary track has been built along one side of the boiler room, and coal is being temporarily unloaded through the windows, as shown in Fig. 15.

The plant is now using more than 100 tons of lignite coal a day, 40 tons of which is the Leyden coal, that is brought in by electric dump-cars over the tracks of the Denver & Northwestern Railway. An average of three analyses of this Leyden coal, made by L. L. Summers, gives the following percentages: Moisture, 16.6; volatile matter, 31.26; fixed carbon, 48.92; ash, 3.22. The company pays $1.41 a ton for the Northern Colorado lignite coal that it has been using, but expects to bring the cost of the Leyden coal down to $1.00 or less when the workings at the mines are fully opened and the coal-

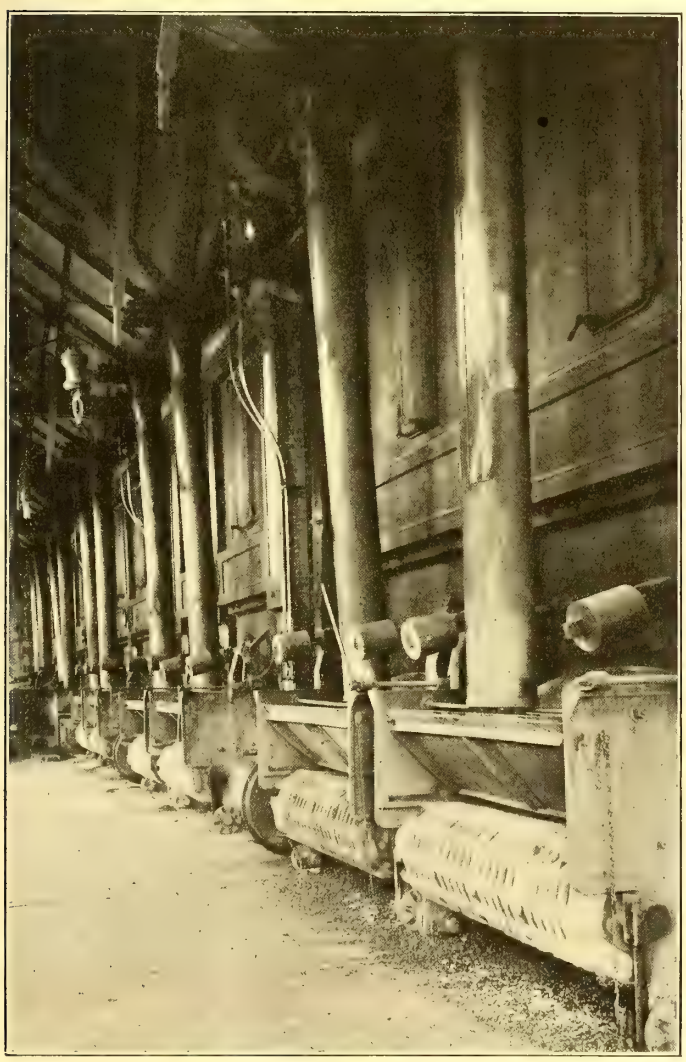


FIG. 5.—BOILER ROOM

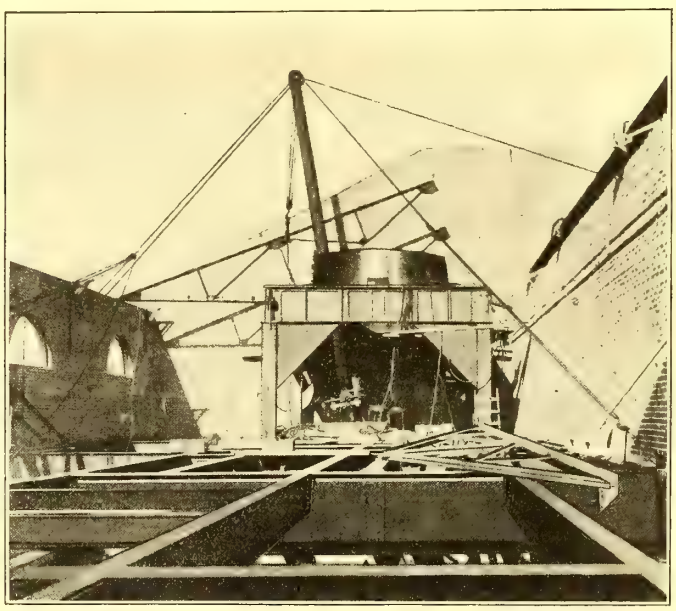


FIG. 6.—METHOD OF SUPPORTING STEEL STACK

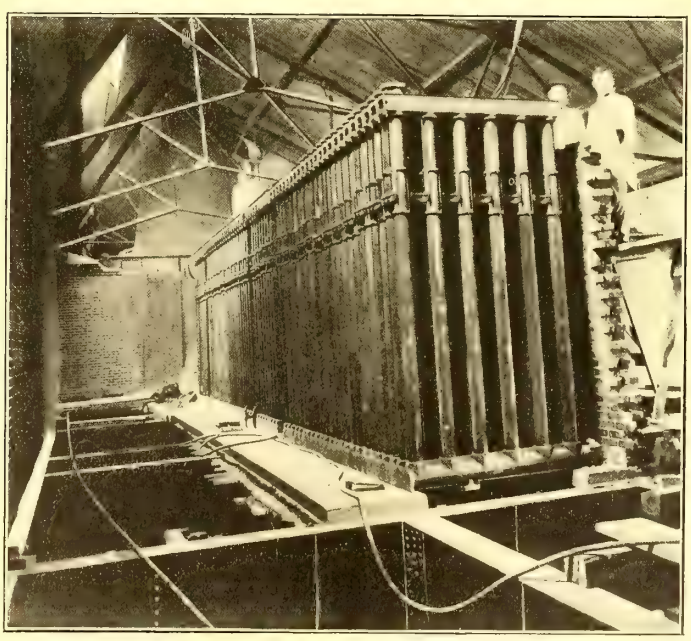


FIG. 7.—INSTALLING ECONOMIZER

handling facilities at the station, which are now being installed, are completed.

BOILER EQUIPMENT

There are thirteen 450-hp Stirling water-tube boilers, with a heating surface of 4500 sq. ft. each. They carry a pressure of

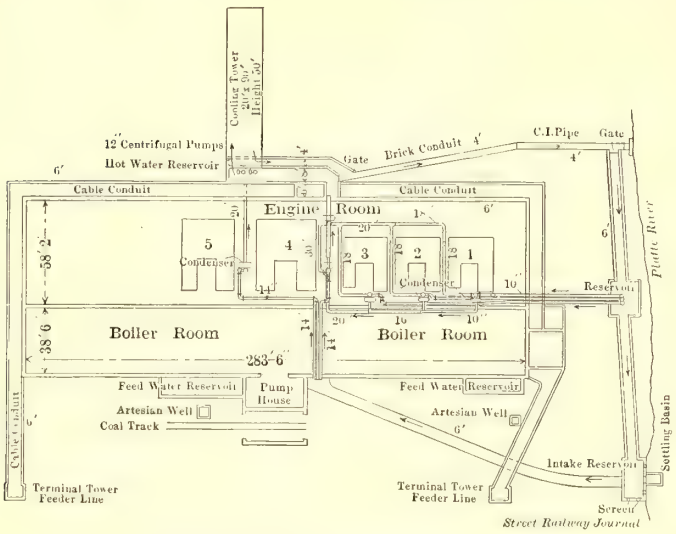


FIG. 8.—PLAN OF CONDENSER SYSTEM

175 lbs., being tested at 300 lbs., and are equipped with Stirling superheaters of the Niclause pattern for supplying 110 degs. of superheat. The station is located on the bank of the South Platte River, a stream that is apt to carry high water in the spring, and the boiler room has been built so that the fires of the boilers will be 7 ft. above high water mark. Fig. 5 shows the five boilers in the older portion of the boiler room. These boilers are set on solid concrete foundations, while the new boilers rest on foundations of hard brick laid in cement mortar. Chain grates are used, and coal is fed to the hoppers of the stokers through pendulum chutes from the bins above. There are thirteen of these bins, and their total storage capacity is 1000 tons. They are made of sheet steel with 5-16-in. steel angle corners and stiffeners.

Running above the coal bins and under the boilers is a longitudinal conveyor, 700 ft. long, with a capacity of 40 tons per hour. This conveyor and the coal and ash cross conveyors in the coal house are of the McCaslin overlapping gravity bucket type, manufactured by the John A. Mead Company, of New York city.

CHIMNEY AND MECHANICAL DRAFT

Natural draft is provided by a steel stack 11 ft. in diameter, having a height of 240 ft. above ground, and 230 ft. above the grates. The method of supporting the stack above the boilers with steel girders and columns is shown in Fig. 6, which is a reproduction of a photograph taken during construction. The stack is built of Otis steel, double-riveted, varying in thickness from ½ in. to ¼ in., and is lined to a height of 40 ft. with fire-brick.

Mechanical draft is used as an auxiliary, and is furnished by three Sturtevant steel-plate fans, driven by 55-hp motors connected in series. These fans discharge through three 25-ft. stacks, 6 ft., 8 ft. and 9 ft. in diameter respectively.

FUEL ECONOMIZERS

Four fuel economizers, manufactured by the Green Fuel Economizer Company, of Matteawan, N. Y., are installed above the boilers. Two contain forty-eight sections each, and the other two comprise seventy-two sections each. Fig. 7 is a view of one of the large economizers before it was bricked in. This picture also shows the method of lighting the space above the boilers by the roof skylights.

BOILER FEED

The space in the pump and coal house adjoining the boiler room will be used for boiler-feed pumps and air compressors. The equipment of pumps comprises two Knowles 10-in. x 5-in. x 10-in., one Snow 10-in. x 8-in. x 12-in., and one Smith-Vaile triplex 10-in. x 5-in. x 12-in. A 10-in. x 12-in. x 14-in. triplex pump is to be installed later. These pumps and the other steam auxiliaries exhaust through a Bundy closed feed-water heater into open feed-water reservoirs outside the boiler room, as indicated in Fig. 8. These tanks are built of concrete, the one at the corner of the building being 8 ft. wide, 44 ft. long and 10 ft. deep, and the other one 10 ft. wide, 48 ft. long and 14 ft. deep. Together they have a capacity of over 60,000 gals. of

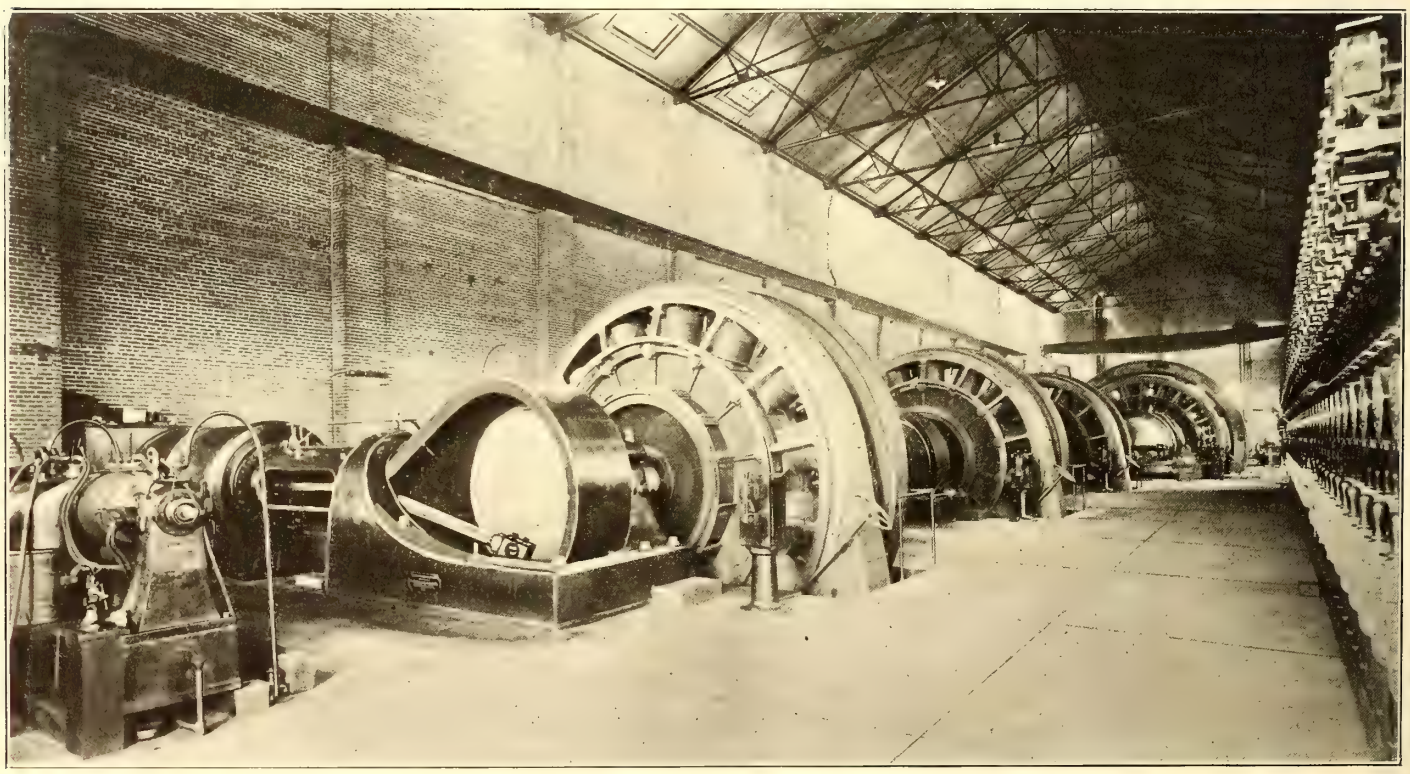
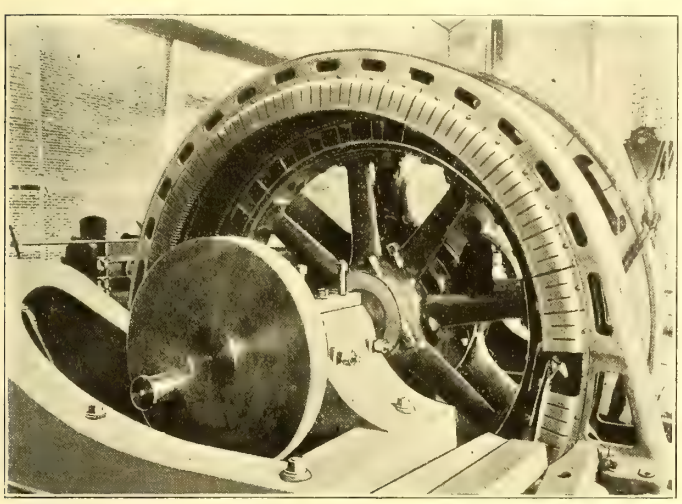
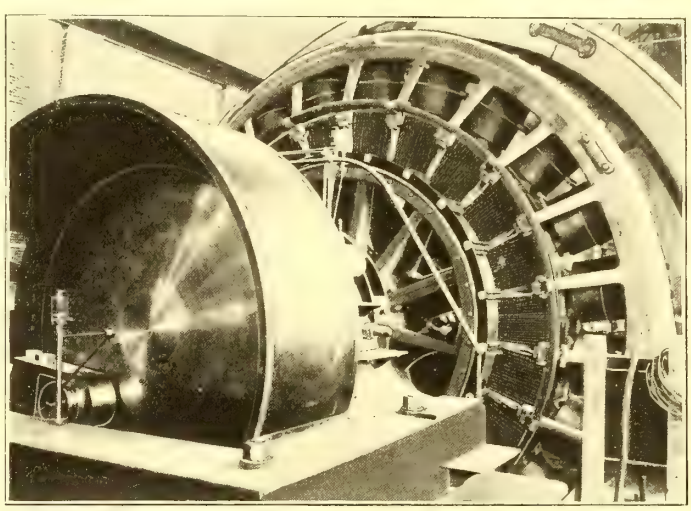


FIG. 9.—GENERAL VIEW OF ENGINE ROOM

water. Near each tank is an artesian well 700 ft. deep, from which water is pumped for this supply by an air lift, at the rate of 75 gals. per minute. For this air lift a Norwalk and a Laidlaw-Dunn-Gordon compressor are installed, with respective capacities of 254 cu. ft. and 127 cu. ft. a minute.

The exhaust from the auxiliaries after passing through the heater reaches these tanks at 110 degs., and heats the water to about 80 degs., at which temperature the water is forced by the pumps through the water side of the heater to the economizers. The water enters the economizers at about 150 degs., and goes to the boilers at from 275 degs. to 280 degs. The tanks feed to the pumps by gravity. By this method the highest efficiency is obtained from the heat of the auxiliary exhaust and of the escaping flue gases. None of the engine exhaust is used in this connection, as jet condensers are employed. The use of artesian water for the boilers is necessary as the river water is not at all suitable and the city water is expensive and also unfit. An excellent grade of water is obtained from the wells, there being a very small quantity of suspended matter in it. The water forms no scale whatever, some of the boilers having been run for over fifteen months without a sign of scale. Only a greasy coating has been noticed.





FIGS. 10 AND 11.—1600-KW DIRECT CURRENT AND 1500-KW ALTERNATING CURRENT UNITS BEING INSTALLED

STEAM PIPING AND FITTINGS

Steam from five of the boilers is taken into a 10-in. header and from the eight new boilers into a 12-in. header, connections being made with the engines by 9-in. and 10-in. pipes, as shown in Fig. 4. Expansion in the main header, which amounts to about 9 ins. in 280 ft., is taken care of by two vertical U-bends with 5-ft. radius, 11-ft. centers, 15 ft. high above the center of the header. Extra heavy wrought-iron pipe is used throughout with flange fittings and corrugated copper gaskets. The pipe and all live-steam fittings were supplied by the Crane Company, while some Chapman and Jenkins fittings are used on the other piping. A 4-in. auxiliary header with two horizontal U-bends is used for the pumps. All pipe is covered with sponge-felt, supplied by the H. W. Johns-Manville Company, of New York.

ENGINES AND GENERATORS

There are five generating units installed in the engine room, as shown in Fig. 9. The first three engines are of the Greene-Wheelock cross-compound type, equipped with Hill valves. Each engine is rated normally at 1300 hp, with a maximum rating of 2000 hp, and has cylinder dimensions of 22 ins. and 52 ins. x 48 ins. Directly connected to each of these engines and turning at 100 r. p. m. is an 800-kw, 575-volt General Electric direct-current railway generator.

The engine designated as No. 4 in the plan, Fig. 4, and shown in Fig. 10, is a cross-compound Allis-Corliss engine with cylinders 32 ins. and 68 ins. in diameter and a 60-in. stroke. This engine has a speed of 75 r. p. m., and is rated normally at 2700 hp, with a guarantee for carrying a 50 per cent overload continuously. It is directly conected to a 1600-kw, 575-volt General Electric direct-current railway generator.

The fifth engine, Fig. 11, which is now being installed, is of the Allis-Corliss type, and is similar to No. 4, except that its normal rating is 2400 hp and its cylinder dimensions 30 ins. and 60 ins. x 48 ins., with a speed of 94 r. p. m. This engine will drive a 1500-kw, thirty-two-pole, revolving field General Electric alternator, that will generate a 2300-volt, 25-cycle, three-phase current for use in transmitting power to sub-stations.

All the engines rest on solid concrete foundations, made of the best Dyckerhoff-Hemmoor cement. In forming the foundation for the 1600-kw direct-current unit 800 barrels of cement were used. Bundy oil separators are used on all the engines. Each Greene-Wheelock engine is equipped with an automatic electric stop, manufactured by the Consolidated Engine Stop Company, of Waterbury, Conn., which automatically closes the throttle valve when the speed exceeds the normal rate. The device is also controlled by a push-button on the generator panel of the switchboard.

CONDENSER SYSTEM

A very complete and somewhat unusual system has been adopted for condensing the exhaust from the engines and for cooling the condensing water, the supply being taken from the South Platte River. Admiralty jet condensers have been adopted, the three used for the three Greene-Wheelock engines being of the Worthington type, and having a capacity each of 20,000 lbs. of steam per hour. For each of the two large engines a Prescott condenser is being installed, each with a capacity of 60,000 lbs. of steam per hour. A third Prescott condenser of the same size will also be installed and connected so that it may be used on engine No. 4, or on the smaller engines, namely, Nos. 1, 2 and 3. Much trouble has been experienced heretofore, when the river was muddy, with the sand cutting out the small condensers. The new arrangement, with one large condenser constantly in reserve, will provide against any possibility of shut down from sand troubles. The design of condenser wells, conduits, etc., to be described below, will also tend to increase the reliability and efficiency of the station.

The plan of the condenser water system is shown in Fig. 8. An in-take reservoir, 12 ft. wide and 24 ft. long, is carried down 24 ft. to bed rock, and is provided with screens on the river side and on one end through which water enters from the adjoining sand formation. A settling basin, 8 ft. x 5 ft., adjoins the reservoir, and is also carried down to bed rock. Water that is drawn directly from the river has a chance to settle in this basin, and is then carried into the in-take reservoir through a

4-ft. x 4-ft. gate. A centrifugal pump with a capacity of 2500 gals. per minute, will pump the sand and sediment from the basin into the river.

From this reservoir the water flows naturally through a concrete conduit, 6 ft. wide and 14 ft. high, resting on bed rock, to the west side of the boiler room basement. From that point three 14-in. pipes carry the condensing water to the engine room, two going to the condensers of engines Nos. 4 and 5, the third pipe being in reserve for a future engine. The small condensers used for engines Nos. 1, 2 and 3 are connected separately by 10-in. pipes with a 14-ft. x 14-ft. reservoir, as indicated in the plan.

The discharge from these three small condensers is carried through a pipe increasing in size from 10 ins. to 20 ins., and it empties into a 30-in. pipe that also receives the discharge of the large condenser for engine No. 4 and the reserve condenser when it is used. This reserve condenser is connected directly with the small condensers by means of 16-in. pipes through an 18-in. and 20-in. header, as indicated on the plan. The 30-in. pipe and a 20-in. pipe from condenser No. 5 empty into an open hot-water reservoir outside the building, that is 8 ft. wide and 10 ft. deep. Frim this reservoir the hot water may be raised by centrifugal pumps to the cooling tower and discharged into a 4-ft. brick conduit and cast-iron pipe, or by opening a gate may pass directly into the 4-ft. pipe. In this pipe the water flows by gravity to the river or may be diverted by a gate into a 6-ft. conduit to the reservoir connecting with the small condensers, and from there it runs to the in-take reservoir, thus completing the circuit. By this arrangement when the river water is clean and suitable for condenser purposes the cooling tower may be cut out and the water allowed to discharge directly into the river. In case the sand and dirt in the river water makes it unsuitable for condensing purposes the cooling tower may be brought into service and the same water circulated continuously. The condenser system has a capacity of 10,000 gals. of water a minute, and can be equipped to handle 15,000 gals. a minute.

The cooling tower is Mr. Summer's invention and has a capacity of 15,000 gals. of water a minute. It is shown in detail in Fig. 12. The tower is 50 ft. high and has ground dimensions of 20 ft. x 90 ft. Across the lower portion of the tower and staggered in position are arranged over 300 planks. They are set 6 ins. apart, with 8-in. vertical spaces. Each plank consists virtually of nine ¾-in. x 6 in. wooden strips, fastened with end and intermediate 2-in. x 4-in. cross pieces, so that five of the strips form the top of the plank and four the bottom, as shown in Fig. 12. Two-inch pieces are provided between the strips and the top and bottom spaces are staggered.

The hot water from the condensers is raised to the top of the tower, and, falling onto the planks, is broken up into fine spray by the time it drops from plank to plank and reaches the bottom. The hot water entering at the top heats the air in that portion of the tower and thus creates a natural upward draft, cold air entering at the bottom and passing up through the descending water spray. The water thus passes out at the bottom of the tower comparatively cold. The tower is built entirely of wood, except the covering for the sides, which consists of corrugated iron. The two 12-in. centrifugal pumps that will be used to force the water to the top of the tower will be electrically driven, and each will have a capacity of 4500 gals. per minute.

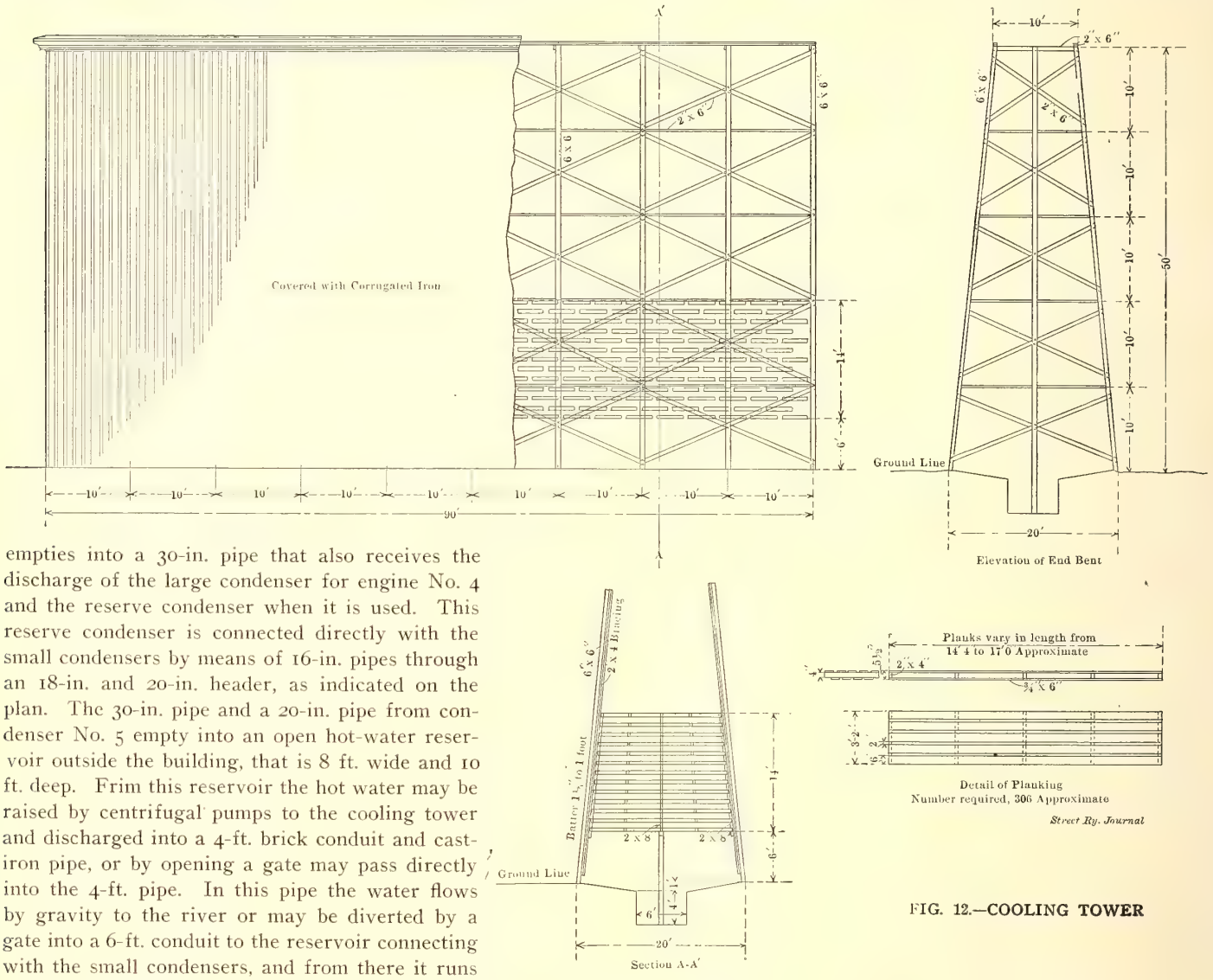


FIG. 12.—COOLING TOWER

The power house is constructed with ample water drains, all leading to a sump below the pump house from which the drainage is pumped into the river by a 2500-gal. centrifugal pump. No special attention has to be paid to what becomes of any water used in washing out boilers, etc., or in cleaning in the engine room, as it all flows quickly through concrete and tile ducts to the pump-house sump.

DIRECT-CURRENT SWITCHBOARD

The direct-current switchboard, Fig. 13, is built of black enameled slate, and consists of forty-two feeder panels, four generator panels and three station panels. The equipment for each feeder panel includes a 1200-amp., type-MK circuit-breaker, ground detector lamps, a 1000-amp. ammeter and a single-pole, single-throw quick-break 1000-amp. switch. Each

of the generator panels is equipped with a type-CF circuit breaker, voltmeter, ammeter, single-pole, single-throw switch, rheostat and field switch. On the panels for generators Nos. 1, 2 and 3 are push-buttons for operating the electric engine stops. Two of the station panels are provided with ammeters and Thomson recording wattmeters for registering the total output of the station, and the third station panel is equipped for controlling the station auxiliaries. The negative and positive leads are separated as widely as possible on the switchboard, the generator panels being all negative and the feeder panels all positive, with a positive switch brought out to the equalizer stand at the generator. The ground return is connected to the generator bus. The Karas Electric Company, of Chicago, built the switchboard and supplied all the switches and bus-bars, the latter being of especially heavy construction. Weston instruments are used, and the circuit breakers are General Electric. Fig. 14 is a rear view of the switchboard and illustrates its simplicity of construction.

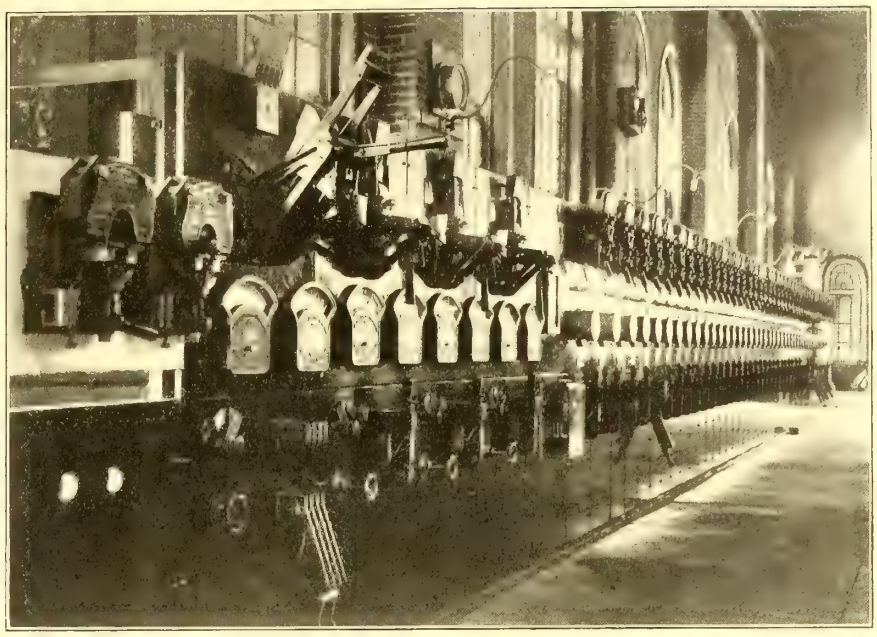


FIG. 13.—SWITCHBOARD IN POWER HOUSE

FEEDER DISTRIBUTION

All feeders are protected by lightning arresters grounded to copper plates bedded in coke. The feeders are carried in lead-covered cable through an underground conduit to the overhead feeder lines. This cable conduit extends around three sides of the power station, as shown in Fig. 8, and is built of concrete, 6 ft. wide and 7 ft. deep, with expanded metal and concrete top on a level with the ground. The conduit begins and ends at terminal towers, from which are run the overhead feeder lines. In the conduits the lead cables are supported from 4-in. x 6-in. beams imbedded in the side walls. The towers are formed by four 50-ft. cedar poles, set at the corners of an 8-ft. square, and concreted up to the height of the water table of the power house. The towers are roofed over and sided with corrugated iron, and a ladder on the inside gives access to the top. Fig. 15 is an exterior view of the station, and shows the farther tower completed and the poles set for the other one.

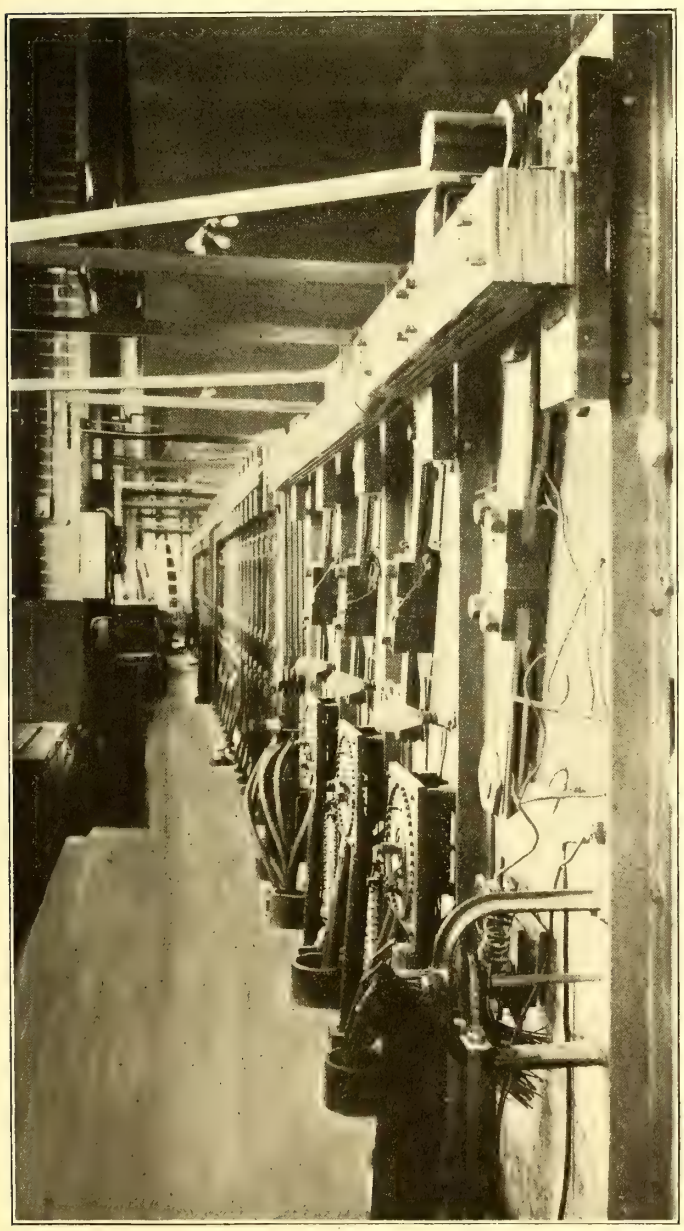


FIG. 14.—BACK OF SWITCHBOARD

On each side at the top of the tower are set four heavy beams, one above the other. The feeder lines are dead-ended at these beams by connection to ¾-in. bolts, which pass through and are headed on the opposite side of the beam. Near the bolt a half connection is made to each feeder, and the connecting wire is carried down the tower on porcelain knob insulators to the level of the water table, where connection is made with the lead cable. Each beam or cross-arm has room for six feeder connections, and the four beams thus give a capacity for twenty-four feeders on each side of the tower. Everything in the cable tower is covered with P. & B. paint, and no opportunity is given for arcing.

At present the feeders extending in both directions from the towers have a total copper equivalent of 18,637,000 circ. mils. There are ten 800,000 circ. mil aluminum cables included in this estimate. A turn in one of the lines is illustrated in the foreground of Fig. 15, the method used being typical of the tramway company's practice for heavy feeder lines. The wires on each side are dead-ended on Brooklyn strain insulators and jumper connections made between the two sides. The strain insulators are fastened to ¾-in. eye bolts, which pass through two 4-in. x 6-in. cross-arms, one on each side of the pole. On the opposite side of each back arm two eye bolts, which also pass through both arms, are connected to strain insulators for guying the pole. In this way no live wires are carried to the pole and everything is thoroughly protected by strain insulators. The cross-arms are supported by a ¾-in. bolt, which passes through the pole. The details of this double cross-arm are shown in Fig. 16. Where a full turn is not made and where a double cross-arm is necessary the construction shown in Fig.

17 is used, the porcelain knob insulators being held in position by 5/8-in. bolts and being protected overhead by a 2½-in. x ¼-in. iron strip.

HIGH-TENSION TRANSMISSION TO ROTARY SUB-STATIONS

As some of the feeder lines have to carry current a distance of 6 miles or 8 miles, and the Arvada-Leyden line of the Denver & Northwestern is about 14 miles long, it has been necessary to use boosters, and three 300-amp. Thomson-Houston machines have been employed for this purpose. Even this provision has not been sufficient to keep up the voltage at distant points, and, therefore, it was decided to install a high-tension alternating-current transmission system with rotary converter sub-stations to distribute direct current at the points of heavy load. For this purpose the 1500-kw, three-phase, 2300-volt alternator, already mentioned, was installed. The alternator is excited by a motor-driven exciter consisting of a 45-hp, 550-volt direct-current motor, driving a 30-kw, 125-volt generator. The switchboard comprises two generator and three feeder panels, equipped with the necessary switches and instruments for handling the alternating current.

One high-tension feeder line has been built from the power house to a sub-station installed at the South Broadway shops, about 24,000 ft. distant. Transmission will be made directly at 2300 volts, the generator voltage, over three 300,000 circ. mil cables. These heavy cables are used so that in case of failure of the alternating current supply at any time they may be quickly connected to the direct-current switchboard and used as 550-volt direct-current feeder lines. The Broadway sub-station equipment will consist of seven 185-kw, oil-cooled transformers, one being for reserve transforming from 2300 volts to 365 volts, and two 500-kw rotary converters, each with a rating of 50 per cent overload for two hours. This sub-station will feed directly into the Broadway, Myrtle Hill and Fremont lines, and will improve the service in the entire southern part of the city greatly.

The second high-tension feeder line will be carried out to Arvada to feed the Denver & Northwestern road. It is probable that current will be carried at 2300 volts to Berkeley, at the city limits, where a transformer station will be installed. This latter will step-up the line voltage to 26,400 volts for transmission to a rotary converter sub-station at Arvada or some other point on the Denver & Northwestern line. When the branch line is built to Golden, 9 miles from Arvada, another rotary station will be placed near its terminal. A branch of the Arvada-Leyden line from Arvada to Boulder of 20 miles, is also contemplated, and when that is completed it will be operated by two rotary sub-stations.

A third transmission line will be carried at 2300 volts to the east side of the city in the vicinity of City Park, where a rotary sub-station will help in carrying the heavy loads that are frequent in that locality. The transformers and rotary converter apparatus for all of these sub-stations will be of the General Electric Company's manufacture.

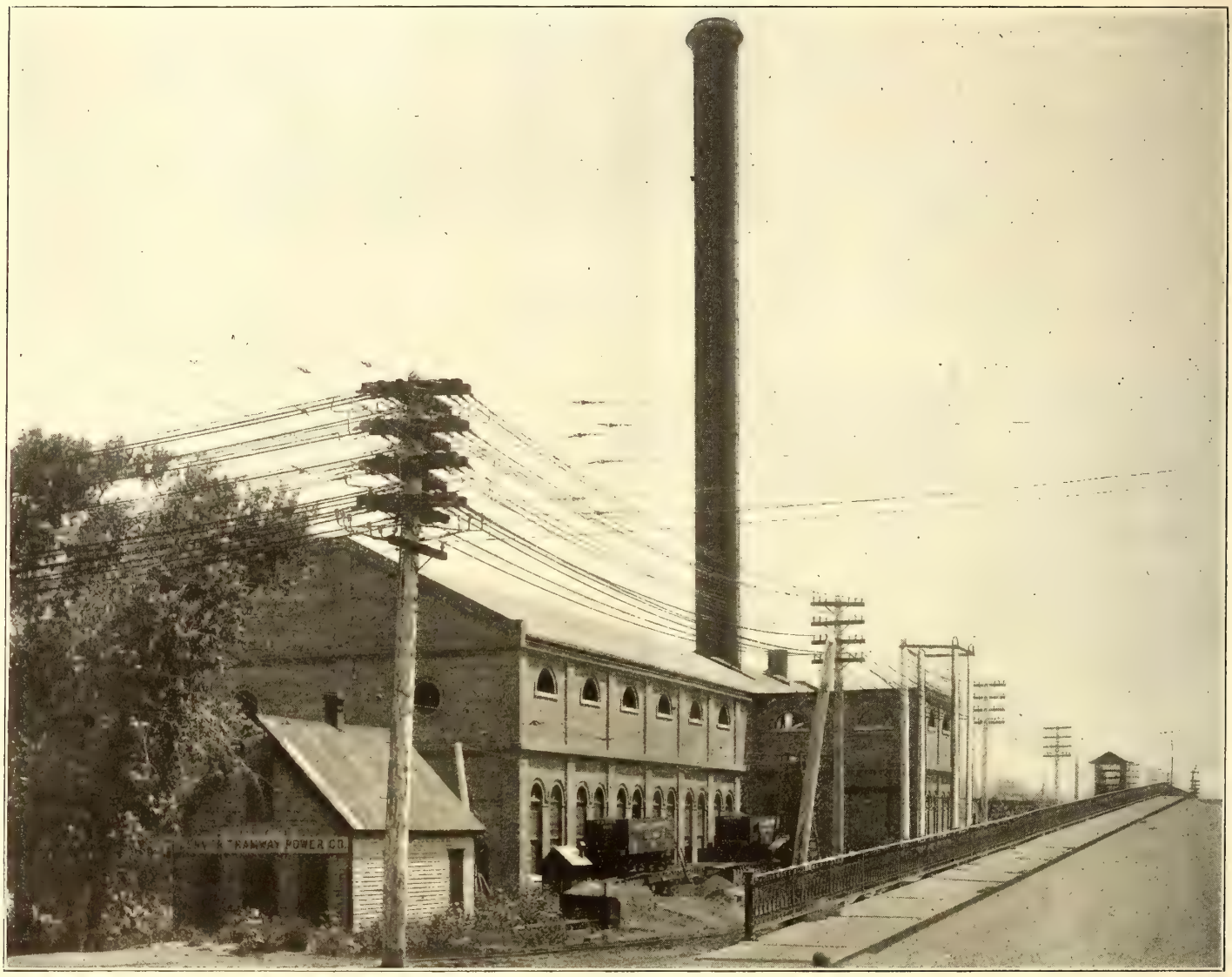


FIG. 15.—EXTERIOR OF POWER HOUSE, SHOWING COAL CARS, PUMP AND COAL HOUSE AND FEEDER LINES

POLE WORK

One of the heavy feeder lines from the new Denver Tramway power station is carried across the South Platte River and over

the railroad tracks in the lower part of the city on the Sixteenth Street steel viaduct. The cables are carried on porcelain knob insulators under the portion of the bridge occupied by the car tracks, where they are secure and out of the way. At the ends where the cables are carried to the poles they are dead-ended on strain insulators, as at the pole shown in Fig. 15.

In order not to bore into the steel girders of the bridge for the support of the trolley poles, a special construction

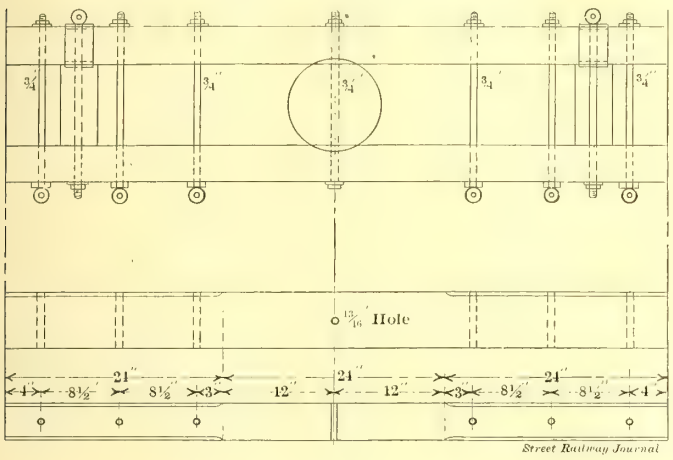


FIG. 16

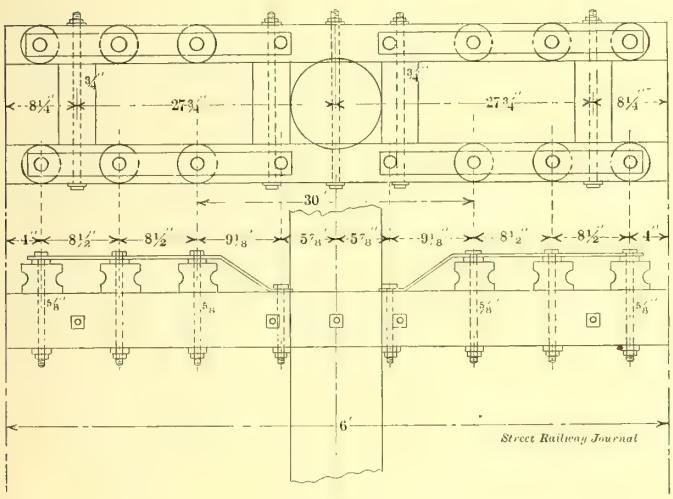


FIG. 17

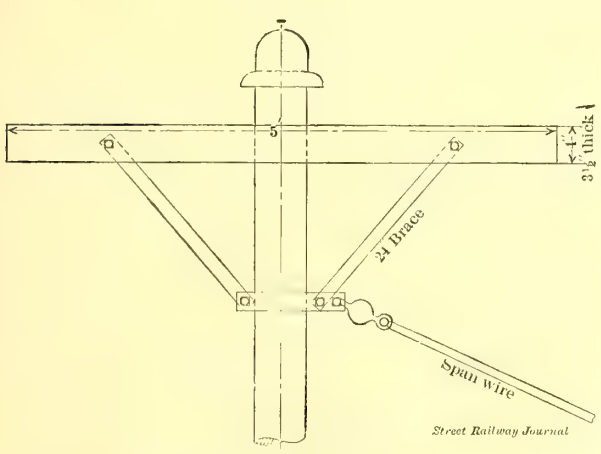


FIG. 20

CROSS-ARMS AND FIXTURES FOR FEEDER LINE POLES

was adopted, as shown in Fig. 18. An iron plate, ½ in. thick and 8 ins. wide, was bent at one end so as to clamp over the foot of

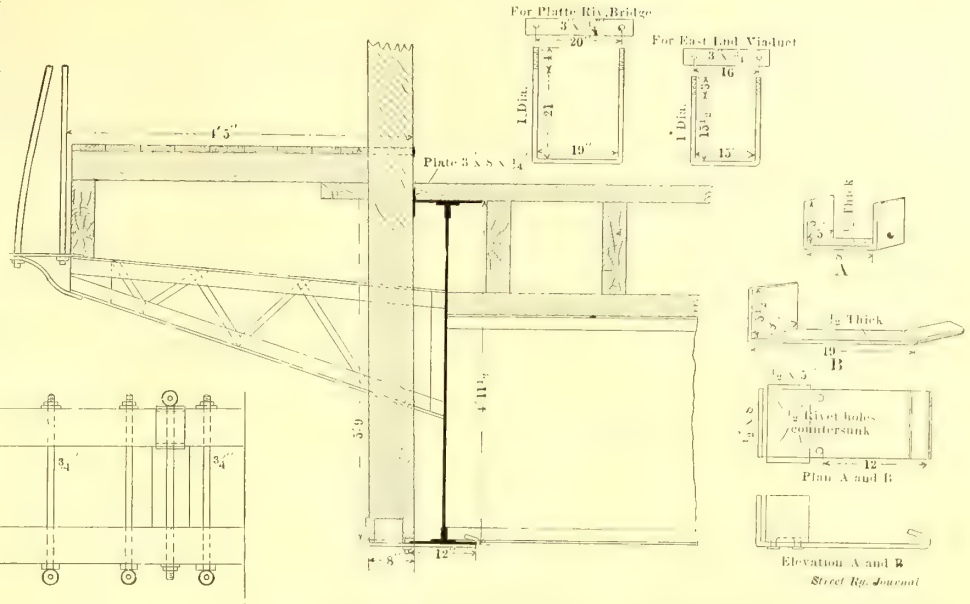


FIG. 18.—POLE SUPPORT ON SIXTEENTH STREET VIADUCT

the girder, and at the other end was turned up at right angles for a distance of 5½ ins. At right angles to the horizontal portion of this piece was riveted a 5-in. x ½-in. iron strip, its ends being also turned up for a distance of 5 ins., as shown in the drawing. Into the socket formed by the three upright pieces is set the bottom of the pole, which is supported 5 ft. 9 ins. above by the plank sidewalk through which it passes. The 8-in. strip passing under the girder is fastened to it on the pole

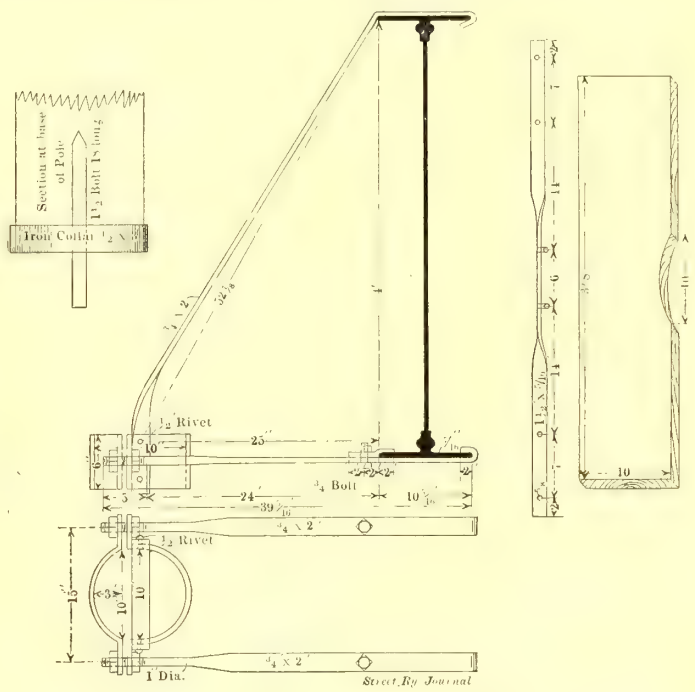


FIG. 19.—POLE SUPPORT ON LARIMER STREET VIADUCT

side by means of two ¾-in. angle-bolts. The pole is bolted, or screwed, to the turned-up portions of the cross strip. By this construction no holes are made in the steel plate girder and no nails are driven into the bridge. The pole is set securely and can be easily replaced on the removal of four bolts or lag screws.

A somewhat different pole support is used on the Larimer Street viaduct, illustrated in Fig. 19. This is not a public bridge, so there was no sidewalk to use in supporting the poles. The construction consists of two ¾-in. x 2-in. iron strips clamped to the base of the girder on one end, and screwed into the ends of a split-iron collar at the other end. This collar is supported from the top of the girder by another ¾-in. x 2-in.

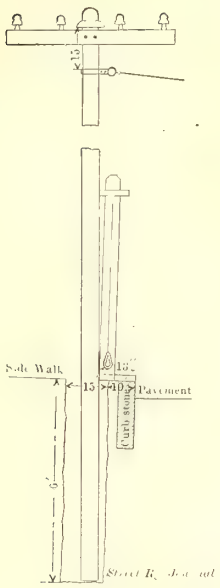


FIG. 21.—DEVICE FOR SETTING IRON TROLLEY POLES

strip, which passes under the collar and thus forms a seat for the pole.

The standard method of cross-arm and span-wire support adopted for iron trolley poles is shown in Fig. 20. Two 24-in. braces, made of ¼-in. x 1½-in. iron, are bolted to the cross-arm at their upper ends, and to a split collar surrounding the poles at their lower ends. The collar is extended on one side, and has an extra hole, into which is bolted the strain insulator that supports the span wire.

Fig. 21 illustrates the device employed by the line department to give the iron poles the proper inclination from the vertical and also to set the pole the proper distance, that is, 13 ins. from the inside edge of the curbstone. The device is provided with a plumb line so that the men may know when it is vertical.

When the cable lines in Denver were changed over for electric operation two years ago, it was necessary to set a large number of trolley poles in as short a space of time as possible. The ordinary methods of setting poles failing to satisfy the requirements of the tramway officials, the special pole-raising wagon, shown in Figs. 22 and 23, was constructed. The wagon is made with a steel frame, on which are mounted two windlasses for raising the wooden mast arm of the wagon, and with it the pole to be set. Fig. 23 shows the wagon as used in setting a pole on Seventeenth Street, in front of the new Equitable Building. This pole-raising apparatus is regularly used by the line department and has been found to be of great service.

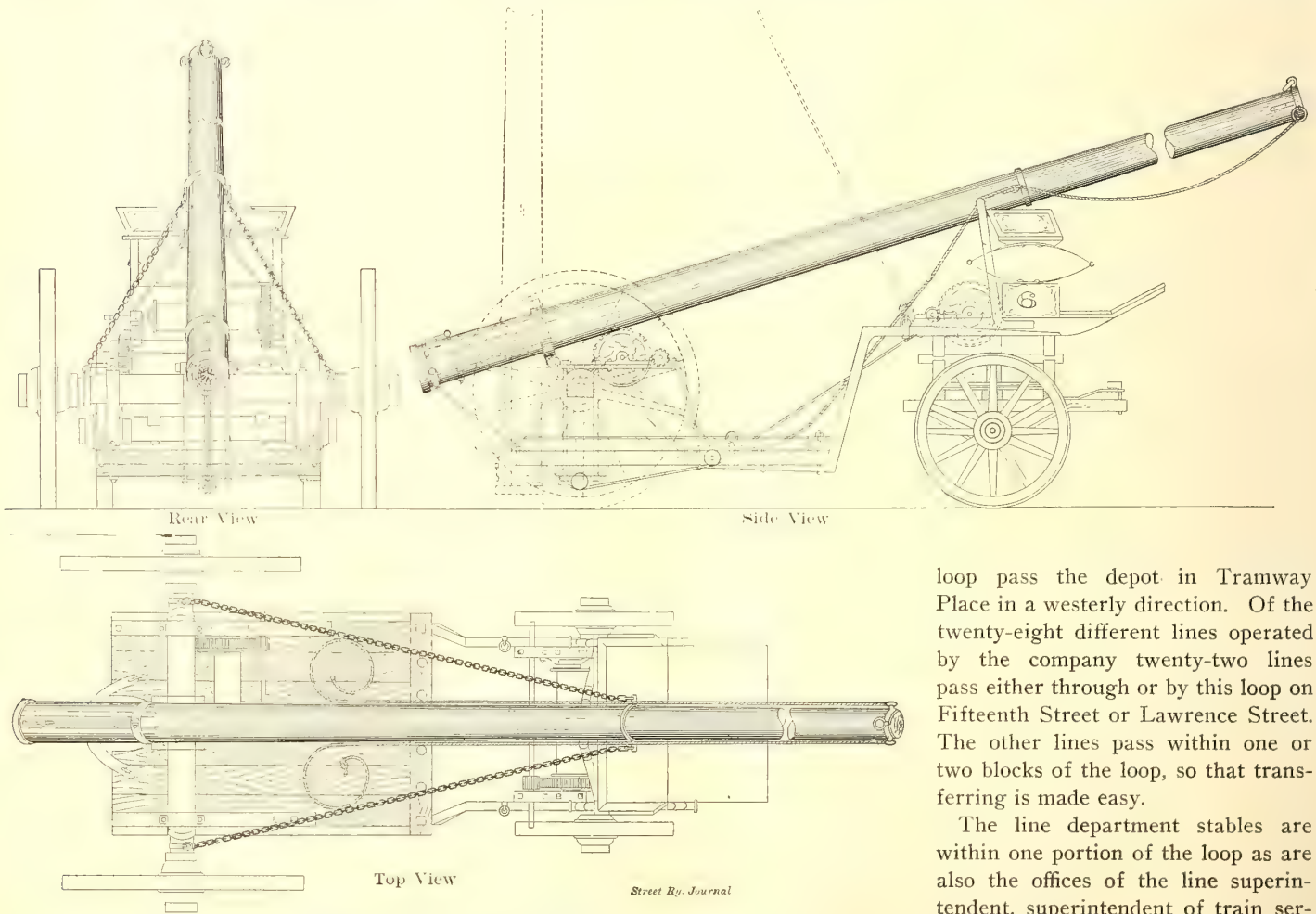


FIG. 22.—POLE SETTING WAGON

PERMANENT RECORDS OF OVERHEAD WORK

A very complete system of permanent records is kept by the line department of all overhead work in the city. The block drawings on cross-section paper that are used by the track department are marked every time any change is made in the overhead equipment. A specimen sheet embracing fifteen blocks of the line, known to the line department as the Fifteenth Street line, and including the downtown loop, is reproduced in Fig. 24. It will be noticed that each pole is numbered and marked if of iron. All feed taps are indicated as well as section insulators, dead ends and new wire put up. Besides this map record the line superintendent keeps a book in which is recorded all new work installed and repairs made. Whenever any trouble occurs on a line, by reference to these records, accurate information is obtained of the existing conditions before the trouble, and orders to the line foreman for the necessary repairs can be made quickly and correctly.

DOWNTOWN LOOP

The possession of a downtown loop, such as that of the Denver City Tramway Company, might be envied by other city systems laid out on a radial plan. A plan of this loop is shown in Fig. 25. The loop is really a double one, inclosing the two quarter blocks between Lawrence Street and Arapahoe Street on the west side of Fifteenth Street. Double tracks are placed on the outer portions of the loop, and all cars going through the loop pass the depot in Tramway Place in a westerly direction. Of the twenty-eight different lines operated by the company twenty-two lines pass either through or by this loop on Fifteenth Street or Lawrence Street. The other lines pass within one or two blocks of the loop, so that transferring is made easy.

The line department stables are within one portion of the loop as are also the offices of the line superintendent, superintendent of train service, chief despatcher and chief surgeon. Until very recently all the general offices were located in the same building, but being cramped for room and conveniences they were moved early in July to the new Majestic Building, on Broadway, where a whole floor is occupied by offices of the president, general manager, secretary, auditor, purchasing agent, claim agent and engineering department.

Returning to a further consideration of the loop it is interest-

ing to note that a spare car is kept in constant readiness on the dead track to take the place of any disabled car. It is planned to keep a line or work car on this dead track nearly all the time for emergency work.

FACILITIES FOR HANDLING LARGE CROWDS

Denver has come to be known as a tourist city, and the street railway system plays an important part in the entertainment of visitors. The tramway company owns no place of amusement, but through its excellent service assists materially in the support of three or four private parks. The most popular of these is Elitch's Gardens, where high-class stock companies play in a well-appointed theater during the summer months. Before the close of each play the superintendent's office is informed of the approximate attendance, and enough cars are banked on a loop beyond the gardens to handle the crowds at the end of the performance.

Similar arrangements are made for handling large crowds in a short space of time at the baseball grounds, the Driving Park and City Park. As many as forty-two cars have been used in transporting the crowd at the close of a baseball game, while provision was made for banking eighty cars at the City Park during the Christian Endeavor convention in July. At City Park during the summer months band concerts and moving



FIG. 23.—POLE SETTING WAGON

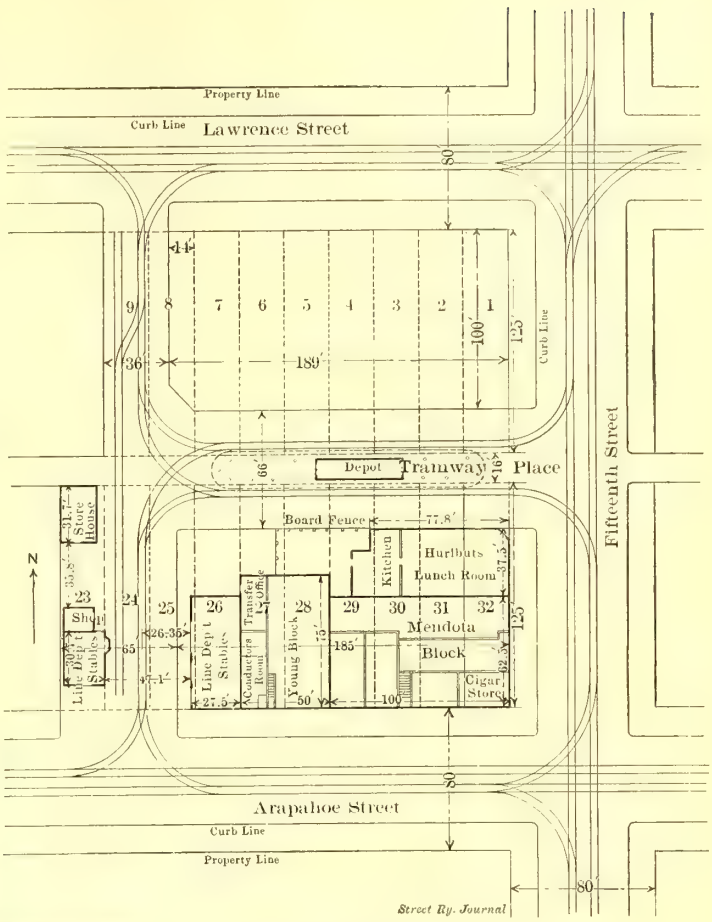


FIG. 25.—PLAN OF LOOP

picture entertainments are supported liberally by the tramway company.

There are a large number of invalids in Denver to whom an out-door life is necessary, and they patronize largely the street cars, some individuals riding for hours during the day and as long as the cars run at night. This, together with the fact that the amusement parks are located on the outskirts of the city itself, is spread over a large area, tends to make the passenger traffic high as compared with the systems of Eastern cities. The population of Denver is now estimated at between 160,000 and 180,000, and there is hardly a day that the tramway company does not move the population once at least during the twenty-four hours of service. On last Memorial

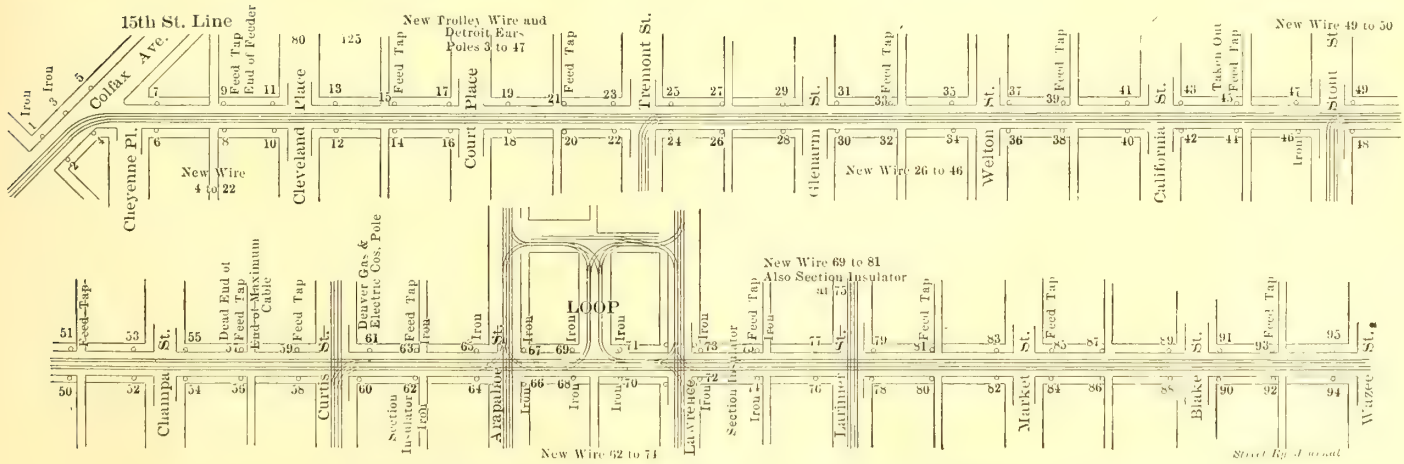


FIG. 24.—SPECIMEN SHEET OF PERMANENT RECORD OF OVERHEAD WORK

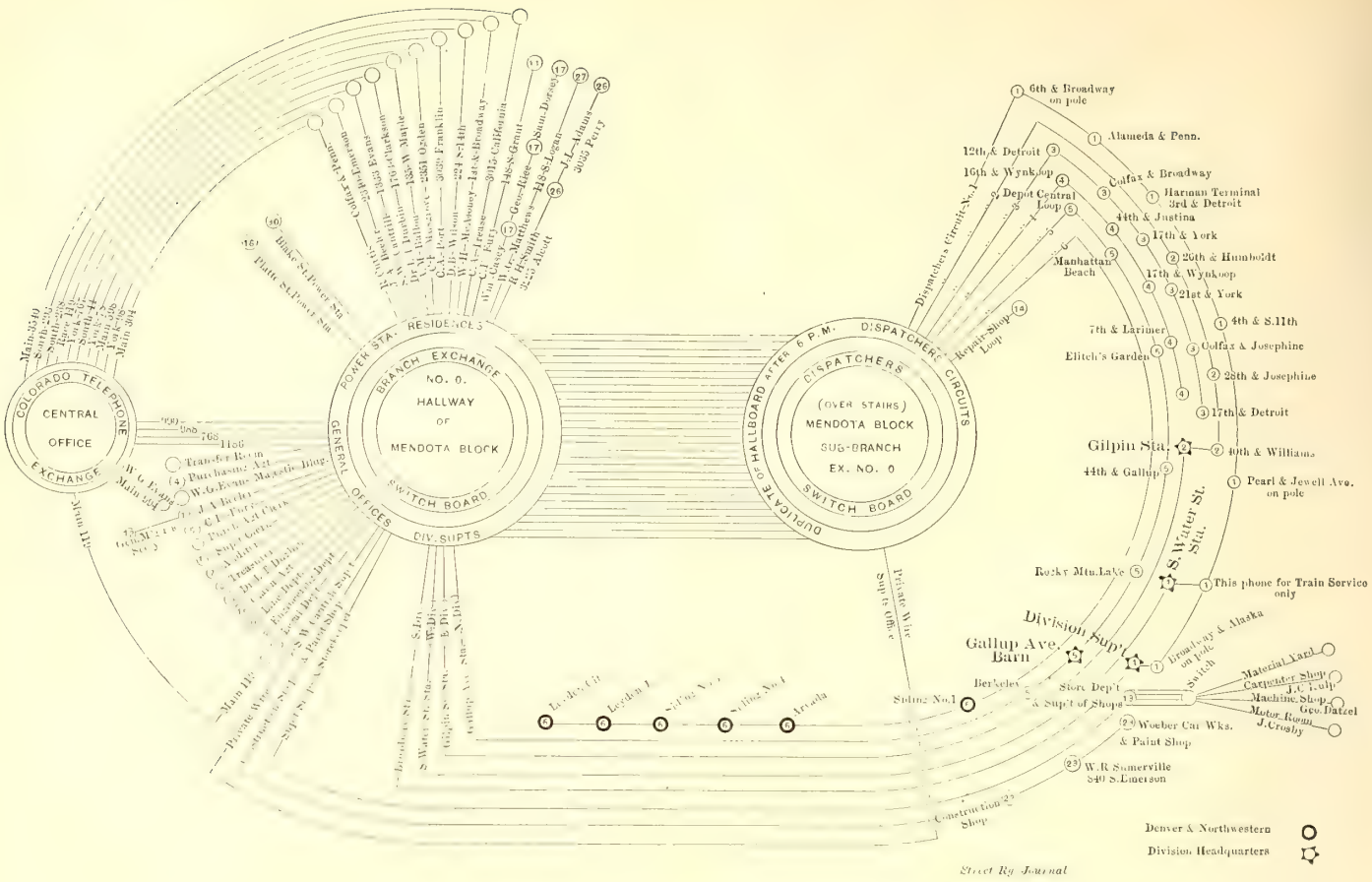


FIG. 26. TELEPHONE AND DESPATCHING SYSTEM

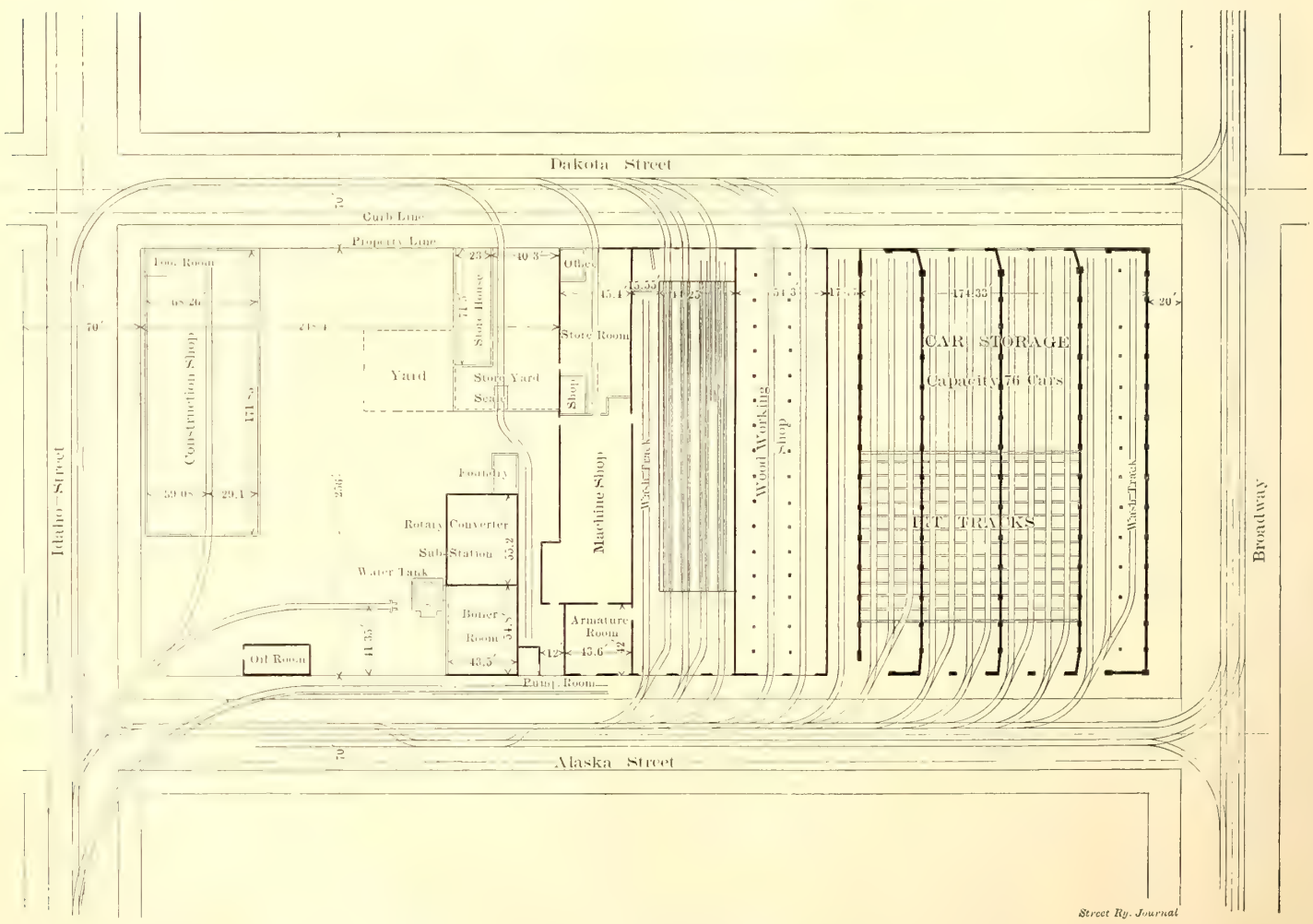


FIG. 27.—PLANS FOR SHOPS AND CAR HOUSE

Day the company carried 200,000 people, while its highest record was made on the Fourth of July, when a total of 281,000 passengers was carried.

DESPATCHING SYSTEM

As has been stated in these columns the Denver City Tramway Company, through its constituent companies, was a pioneer in the adoption of a telephone train despatching system for the handling of its cars. The system has been extended from time to time to take care of the growth of the lines, and now two operators are required. As shown by the accompanying diagram, Fig. 26, there are six circuits connected with the despatcher's switchboard in the office in the downtown loop. On five of these circuits there are located thirty-one stations, while the sixth circuit takes care of the new Denver & Northwestern line, with six stations. The instruments and switchboard equipment are furnished by the Colorado Telephone Company, which also supplies service to the tramway company's office through a private branch exchange. After 6 p. m. there are not apt to be many calls on the branch exchange, so the connections of that board are switched over to a duplicate board in the despatcher's office, and all calls during the night are handled by the despatcher. All cars are operated from the despatcher's office, including special cars and work trains. In case of delay on any part of the system the cars can be properly spaced through this means, thus doing away with the bunching. All lightning or other trouble on the line that comes within the conductor's observation is reported to the despatcher, who notifies the proper official. A private wire connects the superintendent's office with the despatcher, so that in case of serious trouble or any unusual incident the latter may receive his instructions promptly.

LOW PERCENTAGE OF DAMAGE CLAIMS

The Denver system has a very low record for expenditures paid out in damage claims. During 1902 the company paid on the average only 2 per cent of its gross earnings for damage claims, and during the present year this figure has been brought down gradually, month by month, until it reached 1.2 per cent in June, the lowest in the history of the system. This low record is due to a combination of circumstances, such as an efficient corps of trainmen, careful train despatching, a good claim department and an efficient general management and operation.

EXTENSIONS AND IMPROVEMENTS

The tramway company has extended two of its lines during the last four months and has also pursued a general policy of improving its track and overhead work throughout the city. A mile and a half of new track has been laid as a part of a new Washington Park line in the southern part of the city, the construction consisting of 65-lb., 60-ft. steel T-rail, laid on Texas heart-pine ties. The extension is single track and completes a line 5½ miles in length from the loop. Another extension of 1⅜ miles has been made on East Thirty-Fourth Avenue, and is known as the North Capitol Hill line. This line consists of 1½ miles of track, and the new locality reached is given a 15-minute service.

On South Broadway a double track has been put in for 1½ miles, and on the Argo line the double track has been extended for a mile. The West Twenty-Ninth Avenue line has been reconstructed, the double track being extended, and 2 miles of light 35-lb. rail being replaced by 65-lb. rail. A mile of light rail on the West Thirty-Eighth Avenue line has similarly been replaced, and half a mile of the Berkeley line has been reconstructed. On Seventeenth Avenue the city changed the grade and curbing and surfaced the street with gravel, so the double track was lowered 2½ ft. for two blocks, the old cable track removed and replaced by 72-lb. rail in 62-ft. lengths. Before winter 1¼ miles of new track will be laid on South Downing Avenue for the new Washington Park line, the construction including a new steel truss bridge over Cherry Creek.



FIG 28.—SPECIAL WORK FOR NEW CAR HOUSE; POLE RAISING EQUIPMENT

STANDARD TRACK CONSTRUCTION

The result of all these extensions and improvements is that out of a total trackage of 148 miles the company has in service only 15 miles of 30-lb. and 35-lb. rail. The standard rail adopted for all paved streets is a 72-lb. 6-in. T-rail, laid in 60-ft. and 62-ft. lengths. This rail was first designed in 1892 by John A. Beeler, now vice-president and general manager of the company, but at that time chief engineer of the Denver Tramway Company and the Metropolitan Railway Company. The rail was designed to do away with the old chair construction, and is to-day what is used, with slight modifications, throughout the country. The adoption of the rail in Denver has been advantageous for the local system as shown by the good wearing qualities of the track, compared with records of other cities where side-bearing grooved rails are used.

For unpaved streets the tramway company uses a 65-lb. A. S. C. E. section T-rail laid in 60-ft. lengths. All rails are laid on Texas heart-pine ties, 6 ins. x 8 ins. x 6½ ft., laid 21 ins. center to center. The ties are laid on a gravel ballast, 8 ins. deep, and the space between ties is filled with gravel to a depth of 6 ins., except in paved streets, where concrete is used. In preparing the trench for the tie care is taken that the ground is settled, it being usually flushed with water and rolled. All ties are first shovel-tamped from end to end, and then a man goes over each tie with an iron tamping bar. All track is laid in cool weather with tight joints, as it is found the joints give out much sooner if expansion is allowed for. The rails are painted with asphaltic paint, as the soil in Denver is impregnated with alkalies and mineral salts, and the paint retards indefinitely any corrosion or electrolysis. With the construction here described it is estimated that the 72-lb. rails will last thirty years, the ties being renewed every six years or seven years.

MUTUAL AID ASSOCIATION AND PENSION DEPARTMENT

In the Street Railway Journal of June 13, 1903, the plans were published for the mutual aid and pension benefits that were about to be adopted by the Denver City Tramway Company, and the preliminary rules were printed in full. On July 1 the rules were put into effect by the incorporation, under the laws of the State of Colorado, of the Tramway Mutual Aid Association and the adoption of articles of association, by-laws and contract with the Denver City Tramway Company. The management of the association is vested in a board of trustees, made up of nine members, five of whom are officials of the tramway company and four are employees. The benefits to the men are greater than could be derived from any insurance company, as a maximum premium of $12 a year entitles the members beneficiary to $1,000 in case of death, while a sick benefit of $6 a week is also provided for. The company agrees to pay 25 per cent of the amount of contributions by the members, and pays all current expenses and makes up any deficiencies that may arise in the fund. Out of 700 employees of those eligible 500 have become members of the aid association, this number including practically all of the trainmen.

The pension department is entirely separate from the aid association, and is purely voluntary on the part of the company, its control being vested in three officers of the company.

NEW CAR SHOPS

Plans are under way for the enlargement of the company's Broadway shops and car house. The work will include the extension of some of the present buildings and the erection of a new fourteen-track car house, 256 ft. long and 175 ft. wide, with a car-storage capacity of seventy-six cars. The buildings will be connected with a straight track on Alaska Street by twelve curves, laid with 35-ft. and 50-ft. radii. The proposed plan for the shops and car houses is shown in Fig. 27. A view of the special work, embracing the first five curves, is illustrated by Fig. 28. This view also shows the special pole-raising wagon in use on the new overhead work. Fig. 29 is a view in the construction shop, and shows how a piece of special work is laid out and formed.

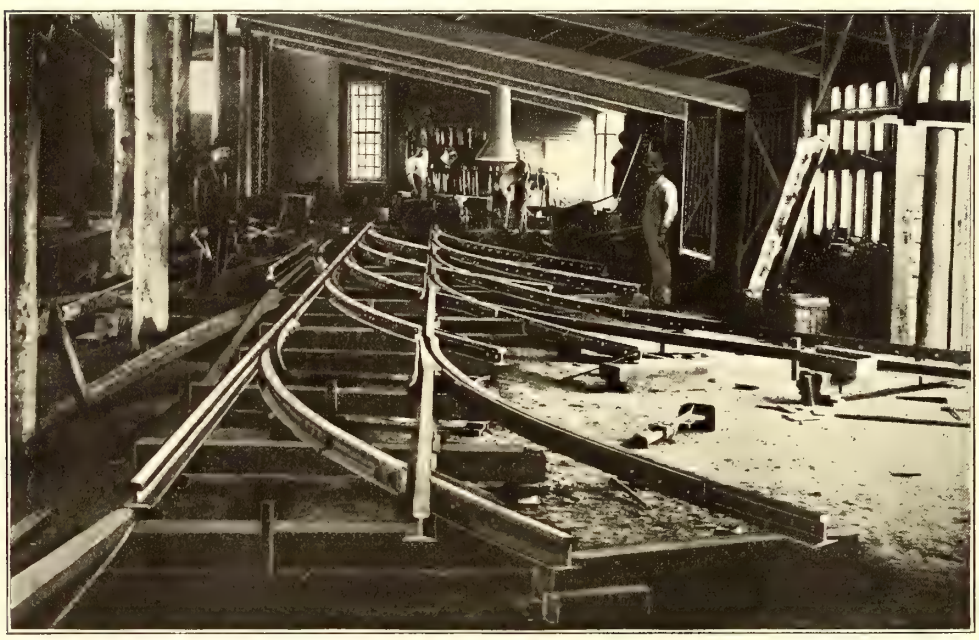


FIG. 29.—LAYING OUT SPECIAL WORK IN CONSTRUCTION SHOP

NEW ROAD OPENED IN WESTERN PENNSYLVANIA

The Pittsburg & Charleroi line of the Pittsburg Railways Company has just been placed in regular operation. It is 27½ miles long from West Liberty, and extends out in a direct line through Castle Shannon and Finleyville to Monongahela, Charleroi and other towns along the Monongahela River. The present route is from Liberty Street and Eleventh Street, to Smithfield Street, to Carson Street, to Brownsville Avenue, to Washington Avenue, Pittsburg, along the old Mt. Lebanon Road to Castle Shannon, to Bethel Road, Library, Finleyville, Mingo Falls, Riverview, Black Diamond, Lock No. 4, Charleroi and to Allenport, which is 35 miles from the Pittsburg Union Station.

On the long stretches through the country the cars run on a single track, but grading has been done on another track which will be put down when business warrants. Already the indications are that the traffic will be very large. The tracks, except on the streets of the towns through which the line passes, run on private right of way, and there are but few grade crossings. Eighty-pound rails have been used, and the road has been thoroughly ballasted. The cars are of the regular double-truck interurban type, equipped with four 56-hp motors. The maximum grade is 6 per cent. Between Castle Shannon and Allenport are twenty-five steel and stone bridges, one of which is 165 ft. high.

The operation of the line at present is divided into three parts. One is from Union Station to Castle Shannon, another from Castle Shannon to Riverview, and the third from Riverview to Allenport.

Power is generated at Rankin and transmitted at 15,000 volts to sub-stations at Riverview, Library and Charleroi. At these sub-stations the voltage is reduced to 550, at which potential it is fed to the line. Each sub-station is equipped with a battery and two rotary converters, in addition to the step-down transformers. A steel car house is now being erected at Charleroi. It will be 220 ft. x 80 ft.

NOT A "JIM CROW" LINE

The North Jacksonville Electric Railway, recently placed in operation at Jacksonville, Fla., stands unique among street railways in the United States. Most of the owners of the road are well-known colored citizens, and the cars are managed by colored motormen and conductors. The story of the opening of the road says that no sooner had the first car arrived at the end of the road than it was packed with colored people.

ECONOMIC CONSIDERATIONS DETERMINING THE MAGNITUDE AND DETAILS OF A PROPOSED ROAD*

Among the most important and trying economic questions relating to the design, construction and operation of high-speed electric railways reaching well out of the congested centers of population, which the designing and managing engineers are called upon to decide, are those relating to the character of construction and equipment to be adopted, and the character and kind of service to be given.

These considerations may be stated as follows:

1. Number of tracks to be installed.
2. Speed, headway and size of the train units.
3. Weight of rails and characteristics as affecting costs of ties, ballast, block system and other details of permanent way.
4. Character of rolling stock and power stations and transmission system, together with the location and number and character of the passenger stations.

All of the foregoing are functions of the estimated gross earnings of the proposed installation. The earnings must be taken as the starting point. At the present time the plans of some proposed systems appear to indicate a tendency, in some instances, to do too much. There appears to be in some cases a lack of appreciation of the proper relations which should maintain between fixed charges and the estimated gross receipts. In some cases which I have investigated the fixed charges upon installations, as proposed, equal 40 per cent to 50 per cent of the estimated gross receipts, a margin far too close for safety. For the cases of a number of the higher class steam roads in operation the fixed charges are found to vary between 20 per cent and 30 per cent of their actual receipts. On account of the demonstrated ability of electric systems to develop business more rapidly than their steam predecessors the above ratio of the steam lines may at times be exceeded in such cases where the estimated earnings have been conservatively made by experienced engineers. It is always best, however, to keep on the safe side and let the earnings, after the proposed system is operating, do something toward augmenting the installation. If this latter course be followed it is safe to say that the officers and stockholders of the company will not have nearly as many sleepless nights as they otherwise may have should they too ambitiously "reach out and lead." In addition, there will probably be less doing in the receivership and absorbing and reorganization business.

Generally speaking, the idea should be to install no more tracks than can be kept busy safely and satisfactorily, taking care of the business in sight and which apparently will accrue from the first few years of development on account of the increased or improved facilities proposed to be given.

In applying the foregoing statement the question of speed must never be lost sight of. Relatively high speed, being the raison d' etre for these roads, must be maintained. Again, in attempting to get as much out of a pair of tracks (single-track roads being out of the question) as possible, it must not be lost sight of that while the capacity of a given installation with a given schedule speed can be increased by gradually adding train units up to a certain point, a limit will be reached, after which, on account of the headway requirements, any increase in the number of units will necessitate a reduction of the schedule speed, and if carried far enough the carrying capacity will be actually reduced. Any material reduction of schedule speed will probably also cause a loss of traffic. If a schedule speed of 30 m. p. h. has been determined upon as that which will be required for a given territory, the idea should be to ascertain the maximum capacity of say two tracks for the proposed road when operating at that schedule speed. If it be ascertained that the two tracks will not be sufficient, at the determined schedule, to carry the maximum estimated business, then a third track, to be used for express trains going one way during the morning and the other way in the evening, should be estimated upon. It will generally be found that wherever a third track is warranted the conditions will generally admit of the small additional outlay required for a fourth track. The additional costs are those required for the relatively slight additional graduation (earth and rock work) and the additional rails, ties and ballast, and the labor of installation. In cases of supplying the suburbs of cities as New York, Boston, Paris, London, Berlin, Chicago and San Francisco, and similar cities, it will generally be a question of determining whether two tracks or four tracks should be installed, and the safe and conservative solution will always be arrived at by considering the comparative ratio of the different fixed charges which two, three or four tracks will impose to the probable gross receipts, estimating the gross receipts for the conditions which will exist when the road commences operation. In some instances, where a rapid growth and development is apparent, as about New York city and London, such future development must be allowed for in the original design. As an illustration of such comparisons I shall assume a set of conditions about as they will be found to arise as follows:

Suppose the estimated gross receipts of a proposed road are $900,000 per annum. Suppose, furthermore, that a two-track road could be installed to do this business for $5,000,000, and that a four-track road would cost $6,000,000. The fixed charges for the two-track road, at 5 per cent, will be $250,000 per year, while on the same basis those for the four-track road will be $300,000. The annual operating expenses, taxes and insurance would be about $500,000 for the conditions assumed for the two-track road, leaving for the two-track road $400,000 for fixed charges, etc. Deducting the $250,000 fixed charges of the two-track road would leave $150,000 annually to be applied to unforeseen contingencies, betterments and the sinking fund account.

If we assume that we will run approximately the same number of train units between the termini daily for the four-track road at the start, the operating costs will be about the same. In order to justify such an assumption it would, of course, be necessary to reduce slightly the schedule of the two-track road, which can at times be done.

For the case of the four-track road we will then have left, after deducting, say, $525,000 for the annual cost of operation, taxes and insurance, the sum of $375,000 for fixed charges, etc. If we now deduct the fixed charges of $300,000 we have left $75,000 for unforeseen contingencies, bad times, betterments and sinking fund, a margin which is somewhat too small for the solid comfort of the bondholders and the stockholders, especially that of the stockholders. In fact, an enterprise starting upon its career upon the last basis might well be called a "receiver's delight," a "reorganizer's joy," or a "stockholder's obsequies" installation. A four-track installation for the case we have assumed would only be justified where a great immediate development along the line of the road was apparent. Even then the engineer should prepare statements of both conditions, as above outlined, and submit them to the bankers or underwriters so that they will have full knowledge of the relative conditions and contingencies.

The development of large cities and the consequent apparent exceeding of the capacity limits of some existing rapid transit or urban rapid transit systems has offered opportunity for much lay, semi-professional, and even so-called engineering criticism of the shortsightedness of the originators of such transportation systems in not installing more tracks at the time of the original construction. If such critics will investigate they will ascertain that, generally speaking, such roads have been hard pressed for many years to make ends meet, and that they are

* From advance proofs of "Electric Railway Economics," by W. C. Gotshall, published by the McGraw Publishing Company. Copyrighted, 1903, by the McGraw Publishing Company, New York.

only now reaping their hard-earned fruits. A little thought will also show that had such systems at the outset provided installations adequate to do the business they are now receiving, they would certainly, in years past, have suffered financial difficulties to state it mildly. As a general rule promoters and financiers are fairly healthy, and in cases where they are not entirely so there are other and milder means than that of placing large amounts of money in relatively certain jeopardy, by reaching out and leading, of recruiting their exhausted energies. So much for the permanent way.

It is apparent that the matter of schedule speeds, as related to costs of operation, is not generally understood.

The schedule speed may be a large factor in determining the commercial success or failure of an enterprise. As an illustration, by referring to the table below, we see that the watt-hours per ton-mile, allowing a stop every 2 miles, required for a 40-m. p. h. schedule, are 142, while for a 35-m. p. h. schedule there are required about 99 watt-hours per ton-mile. If we assume, as an average, a road 30 miles long, over which are made 100 round trips per day, with cars weighing 45 tons each, and assuming a loss of 25 per cent between the motors and the main power station switchboard, and taking the cost of energy at $.006 per kilowatt-hour we have

Distance Between Stops		Watt Hours per Ton-mile for Schedule Speeds of					
		40 Miles per Hr.	35 Miles per Hr.	30 Miles per Hr.	25 Miles per Hr.	20 Miles per Hr.	15 Miles per Hr.
Miles	Feet						
3	15,840	110	80	78	65	53	40
2½	13,200	121	90	83	74	54	40
2	10,560	142	99	86	80	60	41
1½	7,920	....	123	95	85	68	43
1	5,280	....	....	128	90	74	50
½	2,640	....	....	....	145	119	56
¼	1,320	....	....	....	....	....	120
Train friction in pounds per ton.		35	30	27.5	25	20	15

The braking effort or retardation is taken at 150 lbs. per ton.

The stops are taken at 15 seconds each, except in the case of the 15-mile per hour schedule, where 10 seconds is taken.

The foregoing figures are for cases of approximately level and approximately straight roads.

For a schedule of 40 miles per hour the speed attained will be between 60 miles and 65 miles per hour. A schedule of 25 miles will require speeds of from 40 miles to 50 miles per hour, etc.

The rate of acceleration for the long runs varies from 75 lbs. to 110 lbs. per ton, going as high as 210 lbs. per ton for short runs.

The foregoing applies to single car units. If units of more than one car be used, the friction in pounds per ton will decrease and with it will also decrease the energy consumption in watt hours per ton mile.

Some of the places have been left blank on account of the impracticability, with existing apparatus, of making some of the high schedules with the short distances between stops assumed in the table.

The figures are for the energy required at the motors.

$$\frac{100 \times 30 \times 2 \times 45 \times 0.006 \times 365 \times 142}{0.75 \times 1000} = \$111,952.80$$

as the cost of operating the 40-m. p. h. schedule with single car units and

$$\frac{100 \times 30 \times 2 \times 45 \times 0.006 \times 365 \times 99}{0.75 \times 1000} = \$78,051.60$$

at the cost of operating the 35-m. p. h. schedule with single units.

The difference between these costs is $33,901.20, which, at 5 per cent is the interest on $678,024. For a road 30 miles in length the time between termini for the 35-mile schedule would be 51.4 minutes, while the time for the 40-mile schedule would be 45 minutes; a difference per trip of 6.4 minutes.

The very best materials and construction only should be employed for the permanent way and the rolling stock, as it is only by so doing that the maximum safety can be assured to the traveling public, which must always predominate in considering costs of construction. Accidents are always costly, as are also conditions of uncertain operation and delays. The public will not patronize a road upon which accidents are frequent or whereon uncertainty of operation or delay is at all marked. Inferior permanent way and rolling stock is, therefore, equivalent to burning the candle at both ends on account of the natural reduction of receipts, for the reasons stated above, and the additional increase of operating and maintenance costs, which always maintain on poorly engineered and poorly installed railways.

Regarding the determination of the details of the passenger stations, it is needless to say that the location of the stations may have a material influence upon the business which the road will do, depending upon whether the stations are located so as to render them easy of access or otherwise. The matters of the general design, size, finish and specific details of the station will have to be determined separately for each case.

In designing stations, however, the object should be to provide stations whereon the annual aggregate salaries of ticket sellers and attendants will be a minimum. If ticket offices be placed along each side of the roadway at each station this will not be the case. The stations between the tracks on some elevated systems, known as "island stations," are examples of minimum operation and maintenance cost idea. About half the annual attendance is required for such stations as compared with those on each side of the tracks. The objection sometimes urged against the "island station" system is that people who are so disposed can ride back and forth any number of times after paying a single fare.

In connection with the development of the engineering details of a road with which the writer has been connected, the tracks of which will be upon a private right of way throughout, and furthermore, upon earth or rock cuts or fills, he devised and recommended the following station plan:

Wherever the roadway is on an embankment and above the grade of the streets, the station is to be constructed by providing under the roadway and approximately at right angles to the tracks, a passageway or tunnel extending entirely across and under the railroad roadway and 50 ft. or more, as may be required, in width. The width of this passageway would, of course, be along the length of the tracks. In the center of this passageway is to be one ticket office, provided with proper approaches, from each side of the roadway; and inside of and beyond the ticket office are to be waiting rooms, etc., and the stairs ascending to the island platforms between the tracks. This underground passageway is to be of the concrete-steel construction. Where the tracks are in a cut, at station locations, and consequently beneath the surface of the streets, the design provided for a concrete-steel structure over and entirely across the tracks, wherein is located one ticket office, as before, with waiting rooms, etc., inside the ticket office, and stairs descending to the island platforms. Stations of this kind are worth about $8,000 each.

It is evident that the same plan can readily be used for a two-track road.

Where a high-speed electric railway crosses a public highway or other railroad, either above or below the grade of the other road, the design of such a crossing, especially where it is below, and consists of a subway of greater or less length, may exercise considerable effect upon the subsequent cost of operation of the system, as it may determine the limiting length of the cars where trains are used. In the first place, a high-speed electric road should be designed throughout as to permit of the operation of any of the cars now used by steam railroads. There is, however, another reason of essentially an economic kind. As an illustration, suppose that upon a given road it has

been found that on account of the dimensions of part of the subways it will not be possible to use a car more than 40 ft. in length, and that train units of three such cars will be required. It is apparent that train units consisting of two 60-ft. cars would carry the same number of people as the three 40-ft. cars, and, allowing one conductor or guard per car, at an operating cost of one man per train unit less. It is easy to see that if train units be operated for any considerable part of the day, the length of the cars becomes a most important consideration and economic factor of the subsequent costs of operation. Mistakes of the kind have occurred and are now practically the cause of considerable additional fixed costs of operation, which could have been avoided had such apparently small details been given that thorough and competent consideration at the outset which their economic importance demands.

The marvelous activity for some years past in the various branches of electric railroading and kindred engineering and financial enterprises has required the frequent retention of engineers and experts for the purposes of making investigations, reports and recommendations. Some of these reports are remarkable for what they do not contain. When a banker, financier or investor employs an engineer to make a report it appears to me that, while he may be interested to know existing conditions, and the statistics showing results from roads approximately similar to the proposed enterprise he may have in hand, he is essentially trying to find out "what to do." That is, shall he reorganize an existing company, and if so, how much money will be required to do it, and for what, and what will be the commercial and economic result of such reorganization and outlay, and what will be the best plan of reorganization? Or, if it be a new enterprise, the question simply is: Shall he "go in" and is it "a good safe thing?" and if so, why?

Engineers or experts in making reports often appear to forget or ignore the fact that the essential value of their reports lie in the conclusions, and a brief statement of the bases for these conclusions. The body of a report may contain as much statistical detail and general data as may be required to pad out the document to make its outward appearance justify the fee, but the client, upon receiving the document, will generally search the index for that part of the report giving the conclusions, and the bases therefor. Often the search is in vain.

Among some reports which have recently been submitted to me for analysis was one consisting of ninety-seven pages of legal cap size paper, and literally bristling with statistics, etc., but which did not contain one positive conclusion or recommendation. The expressions "it would appear" and "it seems," which have so long and so faithfully served the members of the legal profession, have no business in the vocabulary of men representing themselves as railway engineers or experts.

TOURING CARS IN CLEVELAND

The Cleveland Electric Railway Company is evidently finding the plan of operating touring cars a success, for five trips are now run daily. A fare of 25 cents is charged for each trip, which lasts two hours. The routes followed are different for four of the five trips, and four extra trips are made on Sunday. The excursions have been well advertised this summer, and have been patronized by residents as well as strangers in the city. The season was advertised to close Sept. 25, but the popularity of the car has been so great that its trips will be continued indefinitely.

The story comes from Dayton (Ohio) that a 60-lb. pig, which had become entangled in the fender of a Dayton & Xenia car while out in the country, was carried into the city unnoticed. The accuracy of this story cannot be vouched for.

CURTIS STEAM TURBINE*

BY AUSTIN R. DODGE.

The Curtis turbine, in addition to nozzles delivering steam at high velocity to a single wheel, has also stationary vanes which redirect the steam discharged at considerable velocity from the first wheel, due to the relatively low bucket speed, into the second wheel. The velocity of the jet leaving the nozzle is about 2000 ft. per second, about half the velocity of the De Laval under the same conditions of exhaust pressure, while the peripheral speed of the vanes in the Curtis is proportionally much less, about 400 ft. per second, instead of 1200 ft. per second. By this process of fractional abstraction the speed of



CURTIS TURBINE IN NEWPORT STATION OF THE NEWPORT & FALL RIVER STREET RAILROAD COMPANY

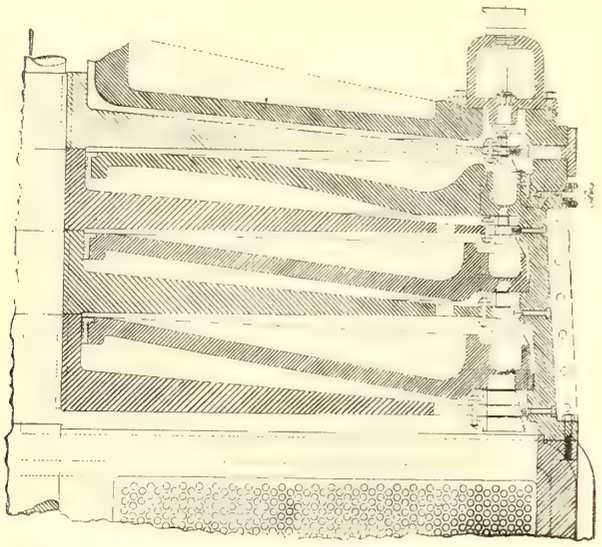
revolving vanes need not be excessive to secure maximum economy; in other words, to bring the direction of the jet discharged from the last set of vanes parallel to the shaft, as shown in the velocity diagram. With this high steam velocity only a minimum of revolving vanes are necessary, and they rotate in steam which has a lower density, due to the considerable drop in pressure from one stage to the next. There is a large clearance between outer wall of revolving vanes and the shell, reducing friction due to water of condensation. End thrust is eliminated, as there is abundant opportunity for the pressure to equalize on each side of the revolving discs, and the entrance and discharge angles of the vanes are the same.

In the larger sizes of the Curtis type the shaft is vertical and floats on oil under sufficient pressure to balance the weight of the revolving element, which rises a few thousandths of an inch until the clearance is sufficient to permit the discharge of the oil delivered at the center of the supporting block. That there is no end thrust in this turbine is shown by the fact that the oil pressure necessary to float the revolving element does not change under any condition of load. This vertical arrangement affords great compactness and greater uniformity of expansion due to heat.

The clearance between stationary and moving parts has proven thoroughly commercial, as shown in several months' operation of vertical 500-kw units. In cases in which the oil pressure has failed in the vertical type of this unit during the use of a temporary belt-driven oil pump, there has been no damage to the revolving or stationary vanes. Any contact which may occur is due to the lifting of the revolving element owing to formation of ridges on the step bearing surface. The weight of the revolving element, therefore, tends to neutralize any tendency to injury. As the vanes are less in width than the metal from which they are cut, nothing more serious hap-

* Abstract of paper read before the New England Cotton Manufacturers' Association.

pens than a polishing of the solid part of the wheels. Even the step bearing blocks can be faced off and used again. When using the standard direct-driven oil pump a failure of oil supply to the step bearing is highly improbable.



ASSEMBLY OF 5000-KW FOUR-STAGE TURBINE

The 500-kw type has two sets of nozzles, each delivering steam to a set of three revolving dics, carrying the canes, which are machined from the solid disc. Governing is effected by operating a series of valves which control the admission of steam to the nozzles on the first stage. This insures a constant velocity in the first stage nozzles, while the pressure in the first stage diminishes with the steam flow until at no load it is nearly equal to the vacuum in the second stage, a desirable condition, as it reduces the density of the steam in which the first stage wheels rotate, and renders unnecessary adjustment of the valve controlling the second stage nozzles.

As to the first cost of a Curtis turbine installation, the machine requires only 7 per cent of the floor space taken by a horizontal cross-compound engine of the same capacity, and the cost of foundations in about the same proportion favors the turbine. The weight is from 15 per cent to 25 per cent that of the engine. There is no wear with a moderate amount of superheat resulting from the action of the steam jet on the vanes, even at a velocity of 2500 ft. per second, as shown by long continued tests.

One of the great advantages of a turbine is due to the entire absence of internal lubrication. Consequently, the condensed steam can be returned to the boilers, saving the cost of oil and feed water, often 10 per cent the cost of fuel. As no boiler scale is formed while using the same feed water continuously, tube cleaning is unnecessary and the boilers are maintained at the highest efficiency without withdrawal from service.

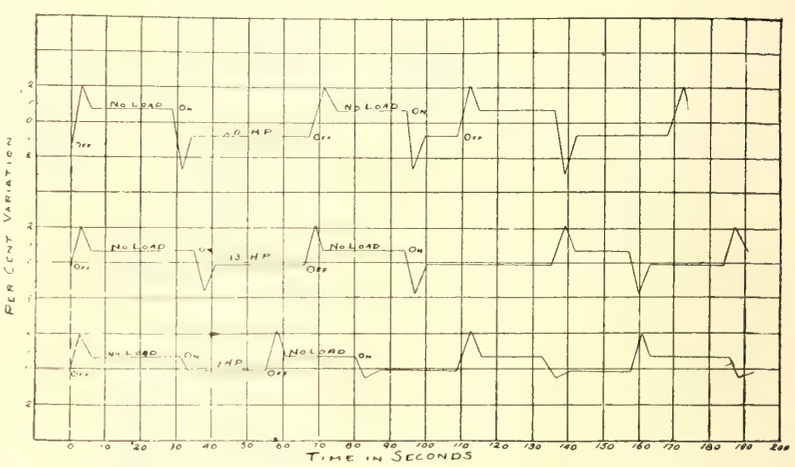
It is estimated that the saving in attendance charges will average 25 per cent on the entire station pay roll. A turbine having but one moving part requires no adjustment, unlike a reciprocating engine with a large number of moving parts, which must be carefully inspected at frequent intervals by a skilled engineer. The economy, therefore, remains constant, which is not true of a reciprocating engine.

A turbine has a large amount of stored energy in its revolving parts, and is, therefore, well adapted for work requiring close regulation. The variation in speed of the larger units is within 2 per cent, when the load is varied from no load to full load. Fly-wheels are not required on any type, as the driving force is always transmitted without angular variation; a desirable condition when generators are operated in parallel.

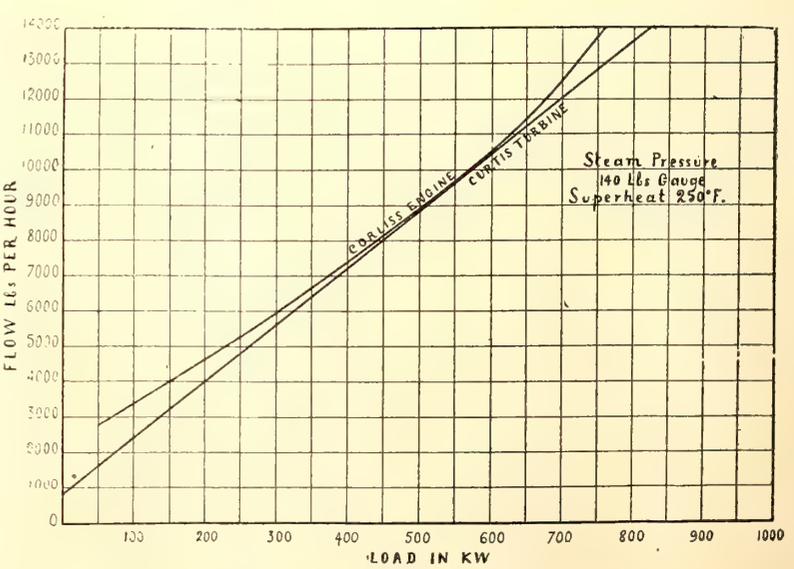
The absence of internal lubrication permits a high degree of superheat. In the Newport plant the superheat of the turbine has been raised to 250 degs. F. without increasing the temperature of any part of the revolving wheels or surrounding casing, except the admission valves. The conditions in an engine operating at this high temperature would not be as favorable. Actual experience in commercial operation has shown that water carried over from the boilers in large quantities does no injury to any part of the turbine, a serious condition when engines are in use.

The first vertical turbine engine to be installed in this country was at Newport, R. I., and is illustrated herewith. The station is arranged for four turbines, two of which have been put in service. Comparison with a Corliss cross-compound condensing engine of similar capacity under the same conditions of pressure and superheat was made, assuming the engine to have the same full-load economy. Few engines of this capacity, even when new, can show as high efficiency at full load. The curves clearly indicate the saving afforded in steam by installing a turbine when operating at light loads and overloads.

The motors required to operate the circulating and air pumps for the condenser are driven from the turbine generator, and this power, about 20 kw, is included in the output of the machine. Analysis of the velocities obtained indicate that this result from the first vertical unit will be materially reduced. Lighting, railway and arc load are all carried on the same unit



CURVES SHOWING REGULATION OF 20-HP CURTIS TURBINE 3000 R.P.M., WITH SUDDEN CHANGES OF LOAD



CURVES OF STEAM FLOW AND OUTPUT, 500-KW UNITS, ASSUMING SAME EFFICIENCY AT FULL LOAD

without difficulty. Minor troubles have developed, but no more than with every radically new device, and these have in turn been corrected as rapidly as possible under commercial operation.

Similar plants have been installed at Scranton, Pa., Dover, N. H., and within the last year orders have increased to such an extent that 200,000 hp of Curtis turbines are under contract. A 600-kw horizontal unit has been in continuous service at Schenectady for two years, operating for two periods of about four weeks each without a single shut-down.

A 1500-kw Curtis unit is in successful operation at Port Huron, Mich., carrying a mixed load of motor power, railway and lighting. This turbine has the standard clearance of .03 in. to .05 in. between stationary and moving parts, and can be started cold and brought up to full speed in half an hour. It is easily brought into synchronism with other three-phase generators driven by cross-compound engines. One 800-hp Russell and one 500-hp Ball, both tandem-compound engines, also one 500-hp Westinghouse cross-compound engine, all condensing, have heretofore carried the load, about 750 kw, requiring two 500-hp and one 250-hp Sterling boilers. With the turbine alone carrying the same load, one of the 500-hp boilers is cut out.

A 5000-kw Curtis turbine has recently been installed at the Commonwealth station, Chicago, where provision has been made for fourteen similar units. This machine, the first of its size, has been operated continuously for several periods of eight hours each on a water rheostat load of 5000 kw, and will shortly be put in commercial service. On account of water leaks around the condenser tubes no reliable economy tests have yet been made.

The Pennsylvania Railroad Company will make an effort to capture some of the local business between Indianapolis and Richmond. Since the opening of the interurban line the local business has decreased to such an extent that the local passenger trains have hardly made expenses. The first step in the fight proposed against the interurban line was taken when the railroad offered a rate of 45 cents from Cambridge City and return for the James Whitcomb Riley entertainment held a short time ago. The interurban fare is 50 cents.

DESTRUCTIVE HURRICANE IN SOUTHERN NEW JERSEY

On Sept. 16 one of the most severe wind storms ever experienced in Southern New Jersey completely demolished the new car house and power house of the Atlantic City & Suburban Railway Company at Pleasantville, N. J. The lines from Atlantic City to Pleasantville were completed but a few days before the storm, and, unfortunately, only one of the seven new Brill cars (semi-convertible and Narragansett) was running. The other cars were standing in the car house when the wind blew in the walls, and lifted the heavy slate roof and the supporting girders and dropped the mass upon the cars. A remarkable feature of the wreck was that not a car was injured below the roof, not even to the springing of a side post. Several other cars were to be shipped from the Brill works a few days previously; luckily they were delayed, and thus escaped. Other fortunate circumstances were that the Custodis chimney stack remained standing, the machinery in the power house was not seriously damaged, and, above all, no lives were lost.



CAR HOUSE AT PLEASANTVILLE, N. J., WRECKED BY WIND STORM

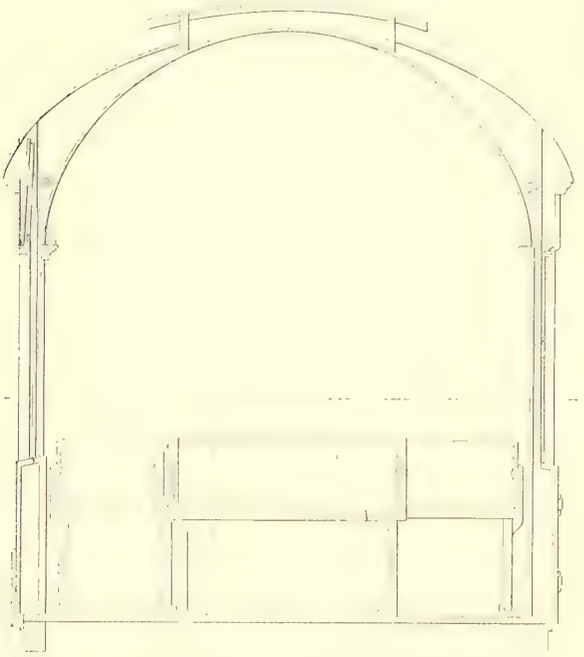
The work of removing the wreckage has been rapidly pushed forward, and within a few days cars were running on the lines. The damaged cars have been sent back to the builders for the roof repairs, there being no convenient place on the lines to carry on such work. It is planned to have the new buildings of more substantial construction.

ANOTHER TRANSFER DODGE

A clever dodge to defraud the company by manipulating transfers has been discovered by the Cincinnati Traction Company. On the back of one of the transfers recently turned in there was pasted a small piece of paper which was almost a perfect match in color of the transfer itself. On close examination it was discovered that there was something wrong with the ticket. A critical examination was made, and it was seen that the transfer had been punched for two different dates. At the back of one punch the slip of paper was pasted, while it was seen that the punch cuts from the second punch had been cleverly pasted in the hole where the paper was pasted so as to add to the deception.

NEW CONVERTIBLE CAR

The accompanying cut represents a vertical cross-section of a novel convertible car which has recently been designed by Henry W. Covert, of Waterford, N. Y. This type embodies horizontally swinging doors for closing the lower portions of the openings between the vertical side posts, vertically sliding panels for the upper portions, and a seating arrangement which permits the seating capacity to be varied as occasion requires.



VERTICAL CROSS SECTION OF CONVERTIBLE CAR

By the use of the swinging doors the handling of the movable parts is facilitated, and the overweighting of the upper part of the car avoided. In the illustration herewith the side doors on both sides are shown closed, and two panels lowered on one side and raised to the pocket on the other.

The floor and roof are connected by side posts, which form the usual openings for the entrance and exit of passengers. From the lintel downwardly about half-way to the floor these side openings extend from post to post, and are adapted to be closed by glazed panels, which are movable along grooves in the posts. In the present type each side opening is equipped with two panels, which can be moved upwardly along the slideway grooves and deflected into a storage pocket subjacent to the car roof.

Below the space closed by the sliding panels the car body is provided with side wall sections built around the respective posts, with side openings of equal width between them. Each side opening can be closed by the door hinged along the vertical edge of the corresponding wall section. This door is not only adapted to swing horizontally across the neighboring opening to close the same, but also outwardly against the side wall section, to which it is hinged, when desired to leave the opening unobstructed for passengers. All side doors are provided with a locking device, which permits all the doors on one side to be locked or unlocked simultaneously. Each door is also furnished with an auxiliary arrangement for separate operation.

The whole arrangement is very flexible, permitting the use of any known forms of locking, laterally-movable doors and vertically-movable panels.

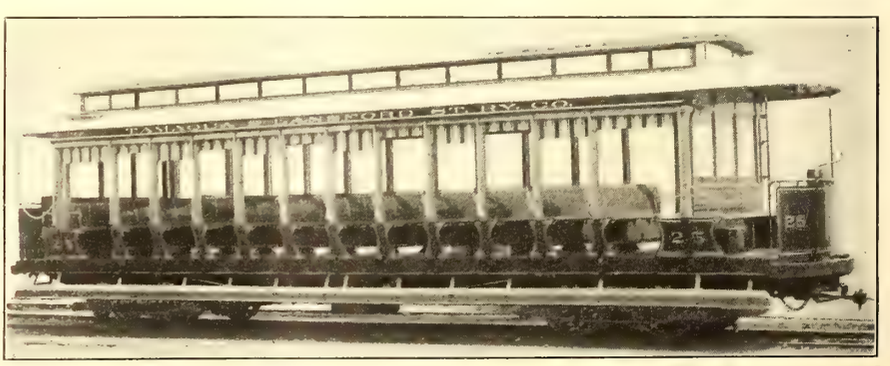
In the bottom of the storage pocket is provided a separate recess or socket adapted to receive the lower end of the panel last entering the pocket, said panel being the lower one used to close the side opening. The sockets do not extend to the full width of the pocket, but are formed to leave along the end wall of the pocket an outwardly and downwardly inclined surface for receiving and supporting the lower edge of the upper panel. The corner portions of the lower panel are cut away to adapt them to enter the socket whereby the lower panel, when deflected into the pocket and seated in the sockets, is not only prevented from being displaced by car vibration but also serves to prevent the displacement of the other panel

The car is provided with a sliding door at each end. The doorways are arranged diagonally opposite, each adjacent to the side wall of the car, whereby passengers may quickly enter or leave the car when the side openings are closed. A novel reversible seating construction permits the formation of an unobstructed aisle along either side of the car in line with one of the end openings. This construction comprises a row of stationary seats, each of less width than the interior of the car, arranged along the longitudinal middle of the car, and in telescopic relation with each of said stationary seats a pair of extension seats at the opposite ends. The arrangement is such that when the extension seats are forced in on one side to make an aisle the opposite extension seats are automatically forced out. When necessary, however, both end seats can be extended to increase seating capacity. Stationary seats may also be provided in the corners not used for doorways. Another form of seating construction makes it possible to obstruct lower portions of one or more side openings whenever it is considered undesirable to have passengers use the side entrances.

The car is also fitted with roller curtains for temporarily closing side openings, ventilating arrangements and other auxiliary devices used in car building.

NARRAGANSETT CARS FOR TAMAQUA & LANSFORD STREET RAILWAY COMPANY

The Tamaqua & Lansford Street Railway Company has recently purchased from the J. G. Brill Company three fifteen-bench "Narragansett" cars as an addition to its equipment of the five Brill combination passenger and smoking cars which were described in the Street Railway Journal of March 7. The popular amusement park, situated midway between Tamaqua and Lansford, is owned by the company, and it has been found necessary to have open cars, which will facilitate handling the large crowds attracted to the park. The scenery along the lines is mountainous and picturesque, and the large number of passengers carried make the trip for the pleasure of the ride.



FIFTEEN-BENCH NARRAGANSETT CAR FOR TAMAQUA & LANSFORD STREET RAILWAY COMPANY

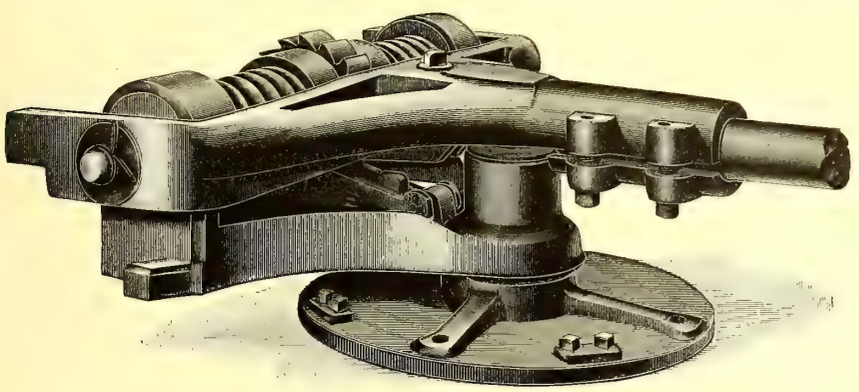
The particular feature of the cars consists of Z-bar sills with an upper step in the sill, thereby providing a double step without increasing the over-all width of the car and that

of a standard single-step double-truck car. Metal brackets, firmly bolted to the sills, form sockets for the posts and bases for the round corner seat end panels. This arrangement affords a firm seating for the posts, and strengthens the entire superstructure. The advantage of the double step is that the running board, or lower step, is brought to within 16 ins. of the rail head. From the running board to the sill step is 13 ins., and from the sill step to the car floor 7½ ins.

The length of the car over the crown pieces is 40 ft. 4⅜ ins.; from center of corner posts over crown pieces, 4 ft.; width over sills, 7 ft. 9½ ins.; sweep of posts, 5 ins.; from center to center of posts, 2 ft. 6 ins.; thickness of corner posts, 3⅝ ins., and of side posts, 2¾ ins. Interiors are finished in cherry and ash, with ceilings of decorated birch. Sand-boxes, alarm gongs, angle-iron bumpers, draw-bars and brake handles are among the patented specialties with which the cars are equipped. The cars are mounted on 27-G trucks with 4-ft. wheel base, 33¼-in. diameter of wheels and 4-in. diameter axles. Each truck is equipped with two 35-hp motors. The weight of a car and trucks with motors is 36,850 lbs.

BALL-BEARING TROLLEY BASE

The W. R. Garton Company, of Chicago, has recently taken the Western sales agency for the Parker ball-bearing trolley



BALL-BEARING TROLLEY STAND

base. This base is said to have some very meritorious features which are radically different from anything else of the kind ever placed on the market before, and numerous tests have been made to prove the claims of the inventor. The accompanying illustration sets forth the construction, which is very simple but strong. Being ball bearing this base readily adapts itself to the lateral qualities of the line and the wide range of the tension springs permits constant contact between the wheel and the wire. This is not possible with a trolley base which is not sensitive to rapid and fluctuating changes. The springs from which the tension is gained work in the reverse direction to the ordinary coil spring, so that the limit of the utility of the spring is not gaged by its binding on its spindle. The adjustment of tension is very simple and quickly attained. The trolley base is stated to be from 1½ ins. to 2 ins. lower than any other now on the market. This permits of going under very low viaducts, etc., with ease, giving better contact with the wire because better tension is maintained. The springs under these conditions are longer lived than under other methods of producing spring pressure.

VISIT OF THE ROYAL COMMISSION ON LONDON TRAFFIC

The members of the Royal Commission on London Traffic, who are visiting this country, reached New York Sept. 26, on the Arabic, and spent the following week in New York studying the subject of its transportation facilities. The principal object of the Commission in visiting this country is to study the practical working conditions of traffic commissions in this country, and to report on this subject at the coming session of Parliament. At present there is no one body in London corresponding with the Rapid Transit Boards of Boston and New York city, and all proposals for electric railway franchises are considered individually by Parliament. It has been proposed that if such a board should be constituted, dealing exclusively with the routes of proposed rapid transit and surface lines in London, a more harmonious development of the entire city transportation system could be secured than with the present mode of procedure. This is a subject on which the present Commission will render a report.

The board has been taking testimony in London on this subject for five or six months previous to the visit to this country, and consisted of Sir David Miller Barbour, K. C. S. I., K. C. M. G. (chairman); the Right Hon. Earl Cawdor, the Right Hon. Viscount Cobham, the Right Hon. Lord Ribblesdale, the Right Hon. Sir Joseph Cockfield Dimsdale, Bart., K. C. V. O., M. P.; Sir John Poynder Bickson-Poynder, Bart., D. S. O., M. P.; Sir Robert Threshie Reid, G. C. M. G., K. C., M. P.; Sir John Wolfe Wolfe-Barry, K. C. B., F. R. S.; Sir Francis John Stephens Hopwood, K. C. B., C. M. G.; Sir George Christopher Trout Bartley, K. C. B., M. P.; Charles Stewart Murdoch, Esq., C. B.; Felix Schuster, Esq.; George Stegmann Gibb, Esq.; Lynden Macassey, Esq., secretary.

Only seven members of the Commission, including the secretary, are visiting this country. While in New York their sessions were held at the Waldorf-Astoria, and H. H. Vreeland, William Barclay Parsons and B. J. Arnold were among those whose testimony was presented. The Commission has been in Boston during the present week and will probably visit Philadelphia and possibly Chicago before the return to England on Oct. 16.

ELATERITE ROOFING

A roofing material is being put on the market by the Western Elaterite Roofing Company, of Denver, Col., which is made of elaterite, a mineral rubber composition rich in hydro-carbon, which does not dry, harden or crack, and is said to be virtually indestructible. The roofing is made with a foundation of two layers of cloth, a canvas center and cloth top, and it has a mica surface and paper back. The grade used for flat and steep roofs weighs 65 lbs. per square, and is put up in rolls sufficient for covering 100 sq. ft. of surface. The manufacturer asserts that the roofing is proof against water, steam, acid, rust and wind; is a perfect non-conductor of heat, cold and electricity, and is not injured by expansion or contraction. It is a protection against fire, resisting cinders, etc., and is a finished product, needing no painting or sanding. No coal tar or pitch is used in its composition.

The material is especially adapted for the roofing of business blocks, factories, smelters, mine buildings, power stations, warehouses, chemical works, and is used by railroad companies for car sheds, round houses and car shops. For seven years elaterite has been used extensively throughout the Western States, and is said to have withstood many severe tests. The power station of the Denver Tramway Power Company is roofed with it, and it has been used satisfactorily on railroad and street cars. The Denver City Tramway Company has also adopted this material for roofing all its shops, power houses, etc., and two of the large Colorado steam railroads use it on their passenger cars and cabooses. A lighter grade is made for use in place of iron, on the sides of buildings, such as mills and warehouses, and it is thus extensively used at Cripple Creek, Col., Deadwood, N. D., and in other important mining camps of the West.

NEW YORK STATE STREET RAILWAY CONVENTION

The twenty-first annual convention of the Street Railway Association of the State of New York was held at Syracuse, on Tuesday and Wednesday, Oct. 6 and 7. The conventions of this Association are always well attended and characterized by the excellent papers presented and the large amount of business done. If possible, however, this record was surpassed by the Syracuse Convention. The sessions were held in the Common Council Chamber, in the City Hall, which had been loaned to the Association for the purpose, as a mark of the high esteem in which Mr. Connette, the general manager of the Syracuse Rapid Transit Railway Company, is held in Syracuse. The headquarters of the Association were at the Yates Hotel. A full account of the Syracuse Convention will be published next week, but a brief summary is given below.

Following the meeting of the executive committee the first session of the convention proper was opened at the Common Council Chamber, in the City Hall, at 10:30 o'clock Tuesday morning, with about fifty delegates in attendance. The visitors were welcomed by Mayor Kline, and President Rogers then read his annual report, which will be found on another page of this issue. The report of the executive committee and that of the treasurer were submitted, both of which showed the Association to be in a very favorable condition. Communications were received from the Syracuse Museum of Fine Arts, inviting the delegates to visit that institution, and from the Central New York Telephone Company, giving the delegates the privileges of long-distance service during the convention. Votes of thanks were passed for these courtesies.

The convention then proceeded to the consideration of the papers, the first to be presented being on "The Use and Abuse of Transfers," by John E. Duffy, superintendent of the Syracuse Rapid Transit Railway Company. The next paper was by Dr. John J. Moorehead, of the Interurban Street Railway Company, of New York, entitled "Methods of Discovering Fraudulent Claims for Injury," and another paper along similar lines on "Physical Examination in Accident Cases," by W. A. Dibbs, of New York. The last paper to be read at the morning session was by C. E. Parsons, of Glens Falls, on "Hydraulics in Connection with Street Railway Operation."

The afternoon session was opened by the presentation of a paper on "Track Construction and Maintenance," by T. Wilson, of the International Railway Company, of Buffalo. This paper was followed by one on "Power Transmission for Interurban Lines," by J. B. Storer, of Syracuse. After the discussion on this paper, F. J. Pearsall, secretary of the Railroad Branch of the Young Men's Christian Association, delivered an address on the work of the Association among street railway companies. Mr. Pearsall referred to the work in Rochester and Binghamton. In the discussion on this subject, Mr. Nicholl, of Rochester, and Mr. Clark, of Binghamton, addressed the convention, describing the Young Men's Christian Association work in their own cities.

The closing session of the Association was held Wednesday morning. The first paper read was on "Despatcher's Duties and Electric Signals," by Orlando W. Hart, of Fall River. This was followed by a paper on "Crossings of Steam and Electric Railways," by Charles R. Barnes, expert of the State Railroad Commission. The discussion on the following topics was then introduced by the gentlemen named below: "Standard Equipment for Interurban Service," by C. Loomis Allen, of Utica; "Car Despatching," by E. R. Wilcoxson, of Rochester; "Interurban Ticketing," by J. E. Stephenson, of Buffalo; "Traffic Arrangements with Other Interurban Lines," T. J. Nicholl, of Rochester. A paper to form part of the discussion, "Development of Freight and Express Service," and prepared by E. F. Seixas, of St. Catherines, Ont., was presented in the absence of Mr. Seixas.

The report of the nominating committee was then in order, and contained as president of the Association the name of G. Tracy Rogers, who has been president of the Association for the past nine years. Mr. Rogers, however, stated in a graceful speech that it would be impossible for him to accept the nomination owing to the press of private business. Mr. Ely, of Buffalo, then, in behalf of the Association, paid a very high tribute to Mr. Rogers' valuable services to the organization during the period which he has been connected with it. He stated that the thanks of the Association were due Mr. Rogers, and suggested that engrossed resolutions, testifying to the high esteem of the Association for Mr. Rogers for the services which he has rendered to it, be presented to him. He also suggested a similar set of resolutions for Mr. Robinson, who also retired from the office of secretary and treasurer of the Association, after occupying that position for a long term of years. Officers for the ensuing year were then elected as follows:

President, E. G. Connette, of Syracuse.

First vice-president, A. B. Colvin, of Glens Falls.

Second vice-president, J. L. Heins, of Brooklyn.

Secretary and treasurer, W. W. Cole, of Elmira.

Executive committee, C. L. Allen, of Utica; B. B. Nostrand, Jr., of Peekskill; W. H. Pouch, of Newburgh, and J. H. Pardee, of Canandaigua.

The social entertainment of the Association and its guests was provided by the hosts of the Association, the railway companies in Syracuse, and were most heartily enjoyed. On Tuesday, a committee of ladies met the visiting ladies at the parlors of the Yates Hotel, and took them to Onondaga Valley, where a very attractive luncheon was served. They were then driven in tally-ho coaches through the Indian reservation and to Green Lake Park. The party consisted of about thirty ladies with two or three gentlemen, and returned to the hotel about 5:30 in the evening. On Wednesday morning the ladies were entertained by a trolley ride to Edwards Falls, over the line of the Syracuse & Suburban Railway, and on Wednesday afternoon joined the delegates and other attendants at the convention in a trip over the Auburn & Syracuse Electric Railway to Skaneateles, where they embarked on the steamboat for a trip on Skaneateles Lake. A luncheon was served about 6 o'clock at Long Branch, on the line of the Syracuse, Lakeside & Baldwinsville Railway, after which there was music and dancing until the guests were obliged to leave to take the trains home.

The hosts at Syracuse, who were the Syracuse Rapid Transit Railway Company, the Syracuse, Lakeside & Baldwinsville Railway Company, the Syracuse & Suburban Railway Company and the Auburn & Syracuse Electric Railway Company, spared no pains or expense to entertain all of the visitors during their two days' visit in Syracuse, and succeeded in making the visit to the city one of the most enjoyable in the annals of the Association.

The banquet of the Association was held on the evening of Wednesday, Oct. 7, at the Yates. The large dining room of this hotel and the individual tables were very attractively decorated, and the dinner was an excellent one and was well served. The toastmaster was Charles L. Stone, of Syracuse, and the toasts were as follows: "Introductory," President G. Tracy Rogers; "The City of Syracuse," Hon. Jay B. Kline, Mayor of the city; "The State of New York," Hon. Frank Hiscock, of Syracuse, formerly United States Senator from New York; "Electric Railways and Their Future," Herbert H. Vreeland; "Useful Workers," Hon. Peter B. McLennan, of the New York State Supreme Court; "My Paradoxical Relations; Legislation vs. Street Railways," Hon. John T. Smith, of the committee on railroads; "New York State Commerce," W. Caryl Ely; "The Ladies," J. M. Wakeman; "The Supplyman," E. J. Lawless.

SOME OF THE PAPERS AT THE SYRACUSE CONVENTION

PRESIDENT'S ADDRESS

BY G. TRACY ROGERS

Nine years have passed since we met in annual convention in this, the "Central City," of the Empire State. The wonderful changes which we see in the street railway construction, equipment and service, and the cordial relations which I understand exist between the public, the city officials and the street railroad in this beautiful and thrifty city, fostered and solidified within that time, illustrate the results achieved by courage, capital, diplomacy and good management.

The year past has been one of general thrift and prosperity. This is most fortunate, as otherwise the smaller and interurban roads would have suffered equally with the other factors of summer life whose prosperity has been injured by the unseasonable summer weather. The results for both have been most disastrous and are to be deplored. I wish to congratulate the roads of the State upon their handsome gain in gross receipts, made under the existing circumstances. The electric roads of the State continue to improve the conditions of life, and are a power for public benefit. They continue to work changes in the sociological, moral and financial growth, a factor in producing the present prosperous condition of our people.

I believe that the most liberal and fair-minded man realizes what we are doing, and to a degree understands the difficulties and appreciates the many obstacles which have to be overcome in our construction, operation and in every department of our work, also in our relations with the public. Wherever the rails of an electric railroad go, there follows increased population and prosperity; therefore, the people who build and operate these roads are entitled to a fair return upon their investments, and an adequate recompense for their services.

Any movement tending to hamper or obstruct the completion and extension of electric railroad transportation facilities is a serious menace to the general public good, the merchant, and especially the owner of real estate in outlying districts.

The enterprise of railroad extension must have the hearty co-operation and good will of the people along the route, as the short-sighted policy of placing obstacles in the way of street railway development, or of imposing serious restrictions and impracticable regulations for operation, will result in the abandonment of many projects from the completion of which the entire community would reap valuable and substantial benefits.

The most poorly constructed electric railroad, operated in the most shiftless way, would not willingly be dispensed with by the community which it serves, even inefficiently.

The electric railroad, if not seriously hampered, and with a fair amount of encouragement, is bound to progress, as it will give the best system of urban and interurban transportation that the world has ever known; therefore, its progress must not be retarded. Its growth should be carefully fostered, regulated and guided, but it should not be limited and circumscribed with useless restrictions and conditions.

The State of New York has been far behind many of the sister States in the construction of interurban electric railroads, and until a comparatively recent date, inactivity in this particular has prevailed, but the present extensive, thorough, and I might say perfect character of the interurban construction now under way, particularly in the central portion of our State, will soon place us foremost in the matter of electric interurban transportation facilities. The builders of the numerous roads recently constructed and now in process of construction although tardy, will be able to take advantage of the experience and mistakes of others, thereby working out a material benefit which will redound to the traveling public, as well as those investing in the properties.

Considerable attention is being paid to the light freight and local express business on interurban roads. I think this a desirable step, not only for profit, but because of the material assistance in developing the territory through which smaller roads operate. The interurban proposition to-day in all of its departments is worthy of our most careful thought and consideration. Its problems are still new, and contain many questions which must be worked out by careful thought and experience.

The evolution of equipment, track construction and the power station; the development of power transmission; the introduction of the rotary converter; the third rail and the multiple-unit system of control, have given great impetus to the interurban road.

What the steam turbine has in store for us remains to be seen, but from present indications, I judge that there is still another surprise for us through its introduction. No doubt the 500-volt system will remain standard for some years to come, especially for city systems, but we hope that in the near future the inventor will solve the questions before us and introduce more economical power for use upon our interurban roads. It may be that the next step in this great development of power will be the perfection of the present experimental use of the alternating-current motor upon the cars.

I am informed that the inventor will have the alternating-current motor in actual use within the year. I am also informed that this motor is constructed to operate with a direct current as well as an alternating current. This will be of great advantage to provincial cities operating both urban and interurban lines.

It is to be hoped that the American Railway Mechanical and Electrical Association will work out for us a system of standardization. There is nothing more important or deserving of more thoughtful attention at this time than this question. While we are working to this end on our individual properties, a general standardization plan should be perfected, which would greatly cheapen maintenance and improve the practical operation, as well as assist in transporting our patrons with a greater degree of safety and economy.

I have each year called your attention to the fact that we are carrying the United States mail at a rate which does not pay actual expenses. It is to be hoped that the committee appointed by the American Street Railway Association will succeed in obtaining an increase in the rate.

It is often suggested by the public press that the street railroads are making a vast amount of money out of the streets, to the exclusion of the citizens who are being deprived of their rights, but these self same men are never ready to come forward with their money to invest in this character of valuable franchises. Someone must furnish the intelligence and the capital to improve the streets, which were primarily intended for transportation purposes. While the majority of the franchises of our State are perpetual, this title does not prevent an arbitrary and rigorous supervision of all details of construction and operation by the State Railroad Commission or the local authorities.

I believe it to be of great benefit to any property to be in close touch with local officials, and if the securities are placed locally the integrity of the enterprise is assured; thereby it will be much easier to obtain the local legislation absolutely necessary, insuring a more sympathetic co-operation of the public which we serve.

I am pleased to note that the once much mooted question of municipal ownership of street railroads is one which has been finally settled adversely in the minds of the American people. They full well appreciate what municipal ownership of street railroads would mean under our system of politics. The American citizen has learned that it is safest to keep the transportation facilities of our cities out of local political control.

In the Greater City of New York the street railways have progressed rapidly in the construction of the improvements indicated in my last address, but no new construction propositions of interest and importance have been advanced. The city is resting meantime awaiting the completion of the underground subway, and to determine its effect both upon the growth of the city at large and the present transportation facilities. It is to be regretted that the delays of the last year, caused by strikes and inability to procure machinery, will prevent the completion of this great improvement as early as anticipated.

The lease of the elevated lines to the subway operating company is another step in the line of consolidation of railroad interests which has been so noticeable during the last five years.

A subject which is of the greatest interest to cities, affecting especially at present those of the first class, and which will undoubtedly affect the other cities of the State, is the status of the law under which the public, upon paying a fare of 5 cents, demands a transfer as well as a retransfer upon the lines of a system. The extent to which the net earnings are diminished by this obligation will at once be recognized as serious and militating against the best interests of street railways. Its effect is shown by the reduction of the average fare on roads in Manhattan Island to 3.46 cents, and on roads in the boroughs of Bronx and Westchester to 2.64 cents, and the evidence that 30 per cent of all payers of fare request a transfer ticket. While the issuance of transfer tickets, in my opinion, is of great value to the companies and undoubtedly increases their income, the law under which transfers were first given has been so construed as to make it optional with a passenger as to what point and upon what lines

he would ride, thus depriving the company of the exercise of the discretion which is vested in its board of directors to operate their road for the best interests of the public.

This condition, overburdening as it does some lines and preventing the distribution of traffic upon others, which reach substantially the same point of destination, rapidly wearing out the equipment, militates, in my opinion, strongly against the best interests of street railway companies and of the public itself.

While I am not prepared at this moment to recommend in what particulars a change should be made in the present methods, I am of the opinion that this paramount question of importance should receive our full and complete consideration.

The transportation facilities of the various railroads of the city of New York, as well as those of the other large cities of the State, were taxed beyond their capacity during the holiday season of last year. As an outgrowth of this condition of affairs, and in pursuance of the clamor of public and press, hearings were held by the State Railroad Commission, at which numerous reform societies and individuals appeared and were heard, offering suggestions for relief and proposing ordinances or laws for facilitating transportation, some of which suggestions were partially feasible, others utterly impossible and impracticable. Later the congestion receded and the transportation situation resumed its normal condition, but not until the reform societies and individuals above referred to had studied the situation and discovered the many insurmountable embarrassments and obstacles which the managers of the various transportation companies daily encountered. There is no question as to the probable honest intent and purpose of the societies and individuals who seek to revolutionize transportation methods, but it is generally attempted with no knowledge of the true conditions of the situation as it exists, and uniformly without any experience, consequently unreasonable demands are made and impracticable suggestions for relief offered.

Legislation pertaining to street railroads, owing to the evolution and rapid growth and development of the business, occupies a prominent place in State legislative matters, therefore it has become necessary to modify and amend somewhat the existing street railway laws enacted during the days of horse car operation to properly meet the present-day requirements of financiering, construction, operation and maintenance of the great network of street railroads throughout the State of New York, also to afford proper protection to investors and adequate facilities for prospective development. Unfortunately there has been an apparent disposition on the part of the public and press in certain quarters to attack vigorously all legislative bills pertaining in any way to street railways or their operation; oftentimes without even inquiring into the merits, necessity or intent of the proposed law. This condition of affairs has developed until now the introduction of a street railroad measure in either branch of the State Legislature is the signal for an unwarranted attack, arising, I think, from a misunderstanding or misinterpretation of the true text of the proposed measure, rather than from a desire to do the street railway interests of the State an irreparable injustice. Street railroads are entitled to the same consideration at the hands of the Legislature as accorded to an individual, firm, or any other corporation, particularly in view of the fact that they are a prominent factor in the building up and broadening out of the territory through which they operate, and when they ask for legislation, special or general, their motives or honesty should not be impugned or questioned, at least until the proposed legislation is thoroughly investigated and understood.

The street surface railroad laws of the State of New York are at present in a somewhat chaotic and decidedly ambiguous condition, owing to the general character of a number of the most important sections which affect both steam and street railroads in a manner that it is almost impossible to draw the line of distinction. This is due to the fact that at the time the laws were enacted the steam railroad interests of the State were paramount, those of the street surface railroads being entirely subordinate and not seriously affected by the laws, as they were governed largely and almost entirely by local municipal acts. It would be much more advantageous to all parties concerned and prevent misunderstandings, misinterpretation and endless litigation if the street railroad laws were properly codified and made applicable to street railroads in plain, certain and decisive terms.

The street railway interests of the State of New York are large and rapidly growing. Millions upon millions of dollars are already invested in transportation enterprises by the public; millions more are required to complete the necessary growth and development, particularly the much-needed interurban construction, which is comparatively in its infancy in New York State. In order to interest capital in street railway enterprises, adequate, just and equitable protection is necessary, and must be afforded by shaping laws, both local and State, to that end.

We, in asking for legislation, either local or State, make no mistake in frankly and clearly setting forth the necessity and reasons for the required legislation, as well as what we hope to accomplish thereby.

It is often the case that men elected to make our local and State laws have conceived the idea that it is their duty to oppose any request that we may make. Those very men, after careful observation and upon becoming more fully acquainted with the true situation, appreciate the difficulties that we experience and the struggles we are necessarily making to meet the requirements of the exacting public, and to build up the territory through which we operate.

We also make no mistakes in taking State or city officials and the public into our confidence, as we must have their co-operation. The evolution of the street railway from the tramway to the electric railway has been so rapid and startling that the public has become so suspicious and apprehensive that its rights will be imposed upon that it is difficult to obtain necessary legislation to meet the changes.

The injustice of being denied the privilege of carrying negligence actions to the Court of Appeals is an unwarranted discrimination without reason or justice. Legislation modifying the present law in this respect should be secured if possible. Last year I called your attention to the injustice of the present law whereby a negligence action can be brought any time within three years from the date of accident without giving notice. An effort was made again last winter (without success) to have the law amended, giving the individual and the corporation the same consideration that is now given municipalities, whereby notice is required of an accident. The Association should again make a determined effort to have this law placed on the statute books, thereby to a degree stemming the tide of unjust speculative litigation with which we are almost daily confronted.

I also call your attention to the condemnation law affecting our rights to condemn easements of abutting property owners in the streets of cities. I feel that this is an important question which merits your thoughtful consideration.

For a number of years we have been confronted in the Legislature with a proposed mortgage tax bill taxing our corporation mortgage. I consider it imperative to remind you of the disaster which would befall us in event the proposed law should be enacted. The street railroads are bearing, in the way of taxation, all the burdens that should be imposed upon them.

The percentage of net income paid in taxes by the street railways of the State as shown by the last annual report of the State Board of Railroad Commissioners for the year ending June 30, 1902, was 35 per cent—when the Ford franchise tax bill was passed it was 28 per cent. This percentage does not include the amount of the Ford franchise tax which was assessed for 1902, but not paid by the large companies for that year, they claiming the law to be unconstitutional, but the Court of Appeals has since declared it constitutional, and the amount assessed against these companies for that year must be paid and added to the above percentage, which will very materially increase the above rate.

Of the ninety-nine operating roads of this State for that year but eleven paid dividends, three of these being in New York city. Of the remaining eight dividend-paying roads three showed a deficit after so doing.

The percentage of gross earnings paid for taxes during the year 1902 for the maintenance of State, local and municipal government was 5 2-10 per cent. It would seem from the above figures that we are now paying our share of the tax. Should a law be passed taxing our mortgages it would seriously affect the sale of our securities, which would result in retarding the future development of street railroads throughout our State, which development, if uninterrupted, would materially increase the assessed valuation of real estate to an extent which would largely offset the expected revenue to be derived by the enactment of a law taxing our mortgages.

I do not believe that the State of New York can afford to enact any law that will in any way thwart or retard the prospective great development of street railroads, particularly the interurban service.

It is time to enter an emphatic protest against the policy of imposing every year some new burden of taxation upon public service corporations for the purpose of reducing and ultimately abolishing the annual State tax levy. If the Legislature is able to make reckless appropriations from a State treasury swollen by the tributes annually extorted from public service and other corporations, and still the members of the Legislature can go back to their constituents with a reduced State tax levy, the people may be deceived for a time, but the policy is essentially vicious, and must inevitably lead to ruinous results. Extravagance and corruption will be encouraged, and the sense of official responsi-

bility for the expenditure of the people's money will be destroyed. Ultimately the people will learn that excessive taxation distributes itself and that every citizen must bear his share of the burden of public extravagance. If street railroad service is to be extended and improved the people who travel and whose property is transported must ultimately pay for the extension and improvements. Rates of fare and freight must increase burdens of taxation or else the public accommodations must be correspondingly reduced. Street railroad corporations are limited to their 5-cent fares, and they cannot maintain, improve and extend their railroads if their resources for such purposes are to be exhausted by increased taxation.

Even if all the State taxes should be paid by the corporations, the various municipalities would receive no direct benefit therefrom, and would inevitably seek to imitate the example of the State by demanding that corporations should also bear a larger proportion of the heavier burden of local taxation. The next step would be legislation requiring additional payment by public-service corporations into treasuries, based on percentages of gross receipts or other similar devices, which would prevent all further extensions, betterments or improvements either of roadbed or equipment so earnestly desired by the public and demanded by the press, and in most instances would mean receiverships and the loss of savings invested by the public in street railroad securities. Such legislation would not interfere with State expenditures, and would present a very seductive appearance to legislators, who would still be able to keep up the false pretense of reducing the taxes of their constituents while encouraging a more elaborate municipal expenditure.

I have called your attention to the unjust discrimination in the State franchise tax law, whereby we are taxed 1 per cent of our gross earnings and other public-serving corporations pay but one-half of 1 per cent. An effort should be made to correct this injustice.

The committee on rules of this Association is to be congratulated upon its splendid work. No greater indorsement can be had than the action of the American Street Railway Association in adopting the code prepared by our committee without change. I understand that the committee is to report on the rules governing interurban service at this meeting.

The discussion at the recent meeting of the American Street Railway Association upon Mr. Vreeland's paper, "Right of Way," brought out some most excellent ideas, which I believe we should attempt to put into actual practice in this State. I think we should follow President Ely's example and request our respective school superintendents to set aside a few moments each week in instructing the children of our cchools as to the rules of the highway. If that plan could be adopted we would later on have people upon our streets familiar with the common rules and laws governing the use of the highway by pedestrians and drivers of vehicles. If people could be taught to cross the street at crossings it would save a vast amount of time, also prevent confusion and accidents.

I understand that the accidents on the roads of this State are on the decrease. I believe this result is largely due to the fact that people are becoming used to the electric car and familiar with the dangers, together with the greater experience of and the increased care taken by our motormen. An effort should be put forth, I believe, to have ordinances enacted giving proper regulations to the passage over public ways and streets and regulating the operation of trucks and other heavy vehicles as far as possible and practicable. Every facility should be afforded by the local authorities to regulate the use of the street and assist in promoting rapid transit. The question as to whether a car should stop on the near or far side of the street is being agitated to some extent. I believe that stopping cars on the near side in cities where the streets are paved would effect a great saving in time and accidents.

The pleasant relations existing between the employers and employees of the roads of this State is a matter of congratulation. This situation is largely due to the application and practice of the sentiments expressed at these meetings and the encouraging and assisting of the mutual benefit associations and in maintaining the club and reading rooms connected with our roads. It is our duty to make the life and lot of our employees as comfortable as possible; we should go out of our way to do this, also showing true personal interest in their future welfare, and if possible assist them to better their position in life, thereby creating a sympathetic and harmonious co-operation as well as loyalty to the service, and faithfulness in the performance of their duties.

Proper discipline promotes manliness and candor. Just and considerate discipline cannot help but command the respect of employees. Courtesy and civility on the part of the employees to the public will make the road popular and will tend to eliminate the annoying occurrences which often arise between them and the exacting public, and thereby reflecting credit upon the management.

The success of the management of a road is largely in having loyal, enthusiastic and efficient co-workers in all departments, and it is the duty of the management to encourage breadth of thought and personal interest in all employees, thus broadening the ideas and interest of the co-worker and teaching him to think. The more closely we can have employees identified with the development and prosperity of the roads, the more efficient and ambitious they will be to rise from the ranks. To every such employee a helping hand should be extended.

The plan so successfully worked out by the steam railroads, through their R. R. Y. M. C. A. is a plan well worthy of our consideration. A suggestion has been made that the steam and electric railroads work together in this laudable departure.

The large attendance of supply men at these meetings is most gratifying, as they always add interest to the occasion. The annual meeting with the men with whom we deal, and the pleasant interchange of social relations must necessarily prove of benefit to the interests we both represent.

I feel that the Association is greatly indebted to the supply men and representatives of the press, who have for years attended our State conventions. For a number of years they were an important factor in keeping the Association together. It was largely through their efforts that new members were induced to join. Nine years ago, in this city, when I was honored by being elected your president, there were but twelve street railway men present, outside of the local representation, and at Rochester the year preceding, but eleven. At Rochester there were twenty-seven supply men and representatives of the press in attendance, and at Syracuse thirty-three. The purpose of the meetings at that time seemed to be to spend a few hours in pleasure seeking, the actual business of the Association being of secondary importance.

I cannot refrain from alluding to the great changes which have been brought about in the growth and usefulness of this Association, which are due to the hearty interest taken in its future and usefulness by all its members and officers. I have had occasion to call upon you many times, and have always found you ready to respond promptly and with hearty interest in the work required. I have but to refer to the printed reports of our meetings to show the influence and benefit to the great interests in this State which we represent. I feel that the good this Association can do is but just begun, and when, not long ago, one hour was all that was required to perform the business of the convention, the full day and one-half is now insufficient to perform the work of the Association and discuss the many questions of importance to us, all of which are brought up for consideration.

At one time it was very difficult to obtain papers to be presented, and still more difficult to provoke a frank discussion on them. Now the time allowed is insufficient.

I feel it my duty to call your attention to the splendid work of the executive committee; these men, representing large interests and having great responsibilities, have always been ready to spend their time and money and to travel across the State in the interest of the Association.

In closing, I bespeak an even wider and more important work for the Association in the future, which result can only be attained by a continuance of the same hearty support and co-operation of the individual members accorded the officials and executive committee in the past. The Association has demonstrated that it is an important factor in the development and protection of the business interests which we represent, and its usefulness should be increased and perpetuated.

THE USE AND ABUSE OF TRANSFERS

BY JOHN E. DUFFY, OF SYRACUSE

When asked by the president of this Association to prepare a paper to be read at this convention upon "Transfers, Their Use and Abuse," hesitation was made in giving consent, feeling that this subject, of so much importance, should be dealt with by some one with a wider experience than is to be found in the city of Syracuse; and, in presenting this paper, no claim is made that the conditions enumerated and met with in this city are applicable to any other locality, but, as the general laws governing the right of passengers to ride between any two points in a city in this State, where a line has received a franchise under the laws of 1884, or the railroad laws now existing, a discussion of the general practice cannot help but prove to be useful and beneficial. It is not always possible to give all passengers a continuous ride covering all points of the compass in every city or village, and, therefore, the use of the transfer ticket has come into existence. Whenever it is possible, it should be the duty of the manager in routing the lines to arrange them so that as large a percentage of its pa-

trons should have the benefit of a continuous passage as is possible from the standpoint of economical operation.

There is, perhaps, no part of the successful operation of a street railway that has caused the management more thought and worry than the adoption of a transfer system that would prove satisfactory to its patrons, and not leave loop holes that could be taken advantage of by those who think it is no sin or crime to beat a corporation. It may be a disputed fact that the giving of transfers by railway companies to complete a passenger's journey from one point to another point on its system has not proven beneficial. But, in a large majority of cases, the adoption of such a system has been highly beneficial to the receipts of the company adopting it. To such a large extent has the practice been followed that most of the street railways of this State, and generally throughout the United States have, from year to year, extended such privileges very liberally and the management of one of the largest systems in this country has stated that in his opinion there is nothing, since the adoption of electric traction as motive power, that has done more to increase its receipts than the giving of transfers.

Riding on the street cars in cities of moderate size is a habit to be acquired and the more attractive the habit can be made the larger proportions it will assume. Managers are to-day providing parks, pleasure resorts, summer theatres, beautiful cars and everything that will tend to stimulate travel and attract passengers, and the transfer is one of the reasonable privileges that companies intend to give their patrons. They are only trying to provide that the passenger shall not be permitted to ride back toward the starting point of his trip for a single fare.

The transfer, under legal requirements, and from the standpoint of the company presenting it, is not intended to be a "stop-over" ticket, but to be used for a continuous passage from one point to another point on its lines, not reached by the car on which the passenger's journey began. It is only proper that reasonable rules for its use may be made but too often, in trying to enforce such rules, the manager finds that it is more perfect in theory than in practice. Nevertheless, as attraction of passengers to your cars is the first consideration, the impositions practiced on the part of the public are put up with.

The ideal system of transferring would involve a station through which all cars would pass. This system would prevent a large number of the general abuses that are now practiced. As it is impracticable in a large majority of cases the plan of street transferring is the one in general use. It is sometimes a problem to provide for the congestion that this causes at more important points of transfer, and, especially is this true in the large cities at what are known as the rush hours. But as the transportation of passengers is the business of a railway company, it is generally cared for successfully. One of the troublesome questions with which the manager has to deal in this connection is involved in the collection of the fares on the large cars that are constantly being added to the service of all roads. With the collection of cash fares, making change, etc., the transfer ticket should be simplified, so that the conductor can see at a glance what it is. Do not make it so complicated that an examination of it to see that it is good takes up so much time that the conductor will lose in the meantime three or four fares that he might have collected while looking at it. Have all of the spaces that are to be punched and inspected as large as they can be. The daily dated transfer has helped much in this respect, and different colors for different directions are another change to be commended.

The registration or non-registration of transfers is a debatable question, and one on which all managers do not agree.

One of the most general forms of abuse practiced by passengers is the over-staying of the time limit. When this is done intentionally the passenger invariably claims that the transfer has been received within the proper time, and that conductor, who issued it, punched it improperly. Another abuse is that the people living between parallel lines coming toward the center of the city, come in on one line, get a transfer back on the other line, stop over and do their shopping, returning home for a single fare. Another is the abuse by clerks, and others returning from meals, who obtain a transfer to the line on which a brother clerk rides, and he, in turn, coming back, obtains a transfer for use of succeeding clerk. This is practiced in some places.

Another is the obtaining of transfers by passengers who have no use for them, and the giving of them to newsboys or saloons, who, in turn, distribute them to persons who are not entitled to their use.

The liberal giving of transfers has, to a very large extent, aided in increasing the business of the system with which the writer is connected. The lines of this company may be compared to the spokes of a wheel, radiating out from a common center to all points of the compass. A large number of the lines parallel each other for long distances, or converge together at the outer ends, and, in other cases, start from the same point at outer extremities and come together again at the common center. In some cases it has been necessary to prevent abuse to make closed lines of them as far as the use of the transfer is concerned. In other cases it has been necessary to make the last junction point the transfer point, instead of the first point of intersection, as is commonly the case; but, it is possible for a passenger to go from any one point in the city to a point distant in any other part of the city for a single fare.

The Stedman time limit is used and is lived up to as close as possible, although great care is taken before ejecting a passenger from the car on account of non-payment of fare because the time limit on transfer has expired. This is done on account of the liability of error of the issuing conductor, and this, in one or two instances, was proven on trial of cases brought against the company, to be the case. Here it might be said that there is a wide difference of opinion among passengers as to the time limit on the transfer being of any account. Many claim that the transfer is good any time within the twenty-four hours in which it was issued, and this opinion causes a great number of disputes between passengers and conductors.

On account of the size of our road, conductors punch the date on the transfer, and, we have found that there is a liability of error in this way. Conductors are required to place the transfers collected on each trip in an envelope and deposit such envelope in a box provided for that purpose at the common center, where all cars pass. Collections of the envelopes through the day are made at regular intervals, and are turned in to the auditing department to be checked by clerks, whose duty this is, with the trip card of conductor to show that the number called for by the trip card has been turned in. The transfers are also checked for sequence of time, to show that conductors have issued them properly, according to serial number. All spoiled and unused transfers are turned in at the close of the day's work with their cash to the receiver. Transfers short in envelope, punched wrong date, or no date are charged to the conductor the same as register shortage. To these and all other errors in punching of transfer, the conductor's attention is called.

Transfers are registered on single registers the same as cash fares. On double registers transfers are registered on one side and cash fares and tickets on the other side.

It is shown by our reports that one passenger in five rides upon a transfer. This is a yearly average.

The traffic in transfers by employees is a trouble that we have not experienced to a very great extent, and gross abuse of transfer privileges are generally called to the attention of the officials of the company by the conductors, to be remedied where possible.

In conclusion, it may be said that the transfer is here to stay, and companies while desiring to be as liberal as is consistent with good busines policy, must adopt such measures as will prevent them from being imposed upon too generally. This has happened in several cases, notably by systematic robbing practiced by conductors and accomplices in some of the large cities, the forging of tickets, as practiced in another city. The manager must therefore ever keep a watchful eye on this important branch of his business, because, as the volume of busines increases, new difficulties will have to be met with by those in charge who must handle the problem according to the local conditions. The public know that they are entitled to certain privileges after they have paid a fare, but are hard to satisfy as to how far those privileges extend. Some believe that the laws are made exclusively to fit their side of the case; that the corporations have no right to restrict those privileges in any way; that they can ask for a transfer at any time throughout their trip, get off at any place they desire, stay as long as they want to, and then board any car that comes along and be carried to their destination. On the part of the railway companies there does not seem to be any concerted effort to find out how far the laws fit their side of the case, but they go on from year to year, satisfied because their business has increased, and hoping that the public will be contented. But experience has shown that, regardless of how much is given, the public will ask for more and rail at the hard-heartedness of public corporations if nothing more is given.

INTERURBAN TICKETING

BY J. E. STEPHENSON, OF BUFFALO

I realize that my subject, 'Interurban Ticketing," is one that has been the object of experiment ever since the trolley started its way across our country, and that varying conditions, increasing extensions and later exigencies, which will arise as electric roads become more and more the means of interurban communication,

must keep the subject always before us for later improvements and developments.

So I shall commence by saying that I freely confess that I have not learned to write as far as my subject shall no doubt eventually lead, but I have put together those principles which seem to take us as far as the subject has been developed.

Traffic on an electric line is so widely at variance with that on the steam roads, that the subject of dealing with it is distinctly in a class by itself, and the problems which it presents must be worked out on entirely different lines.

To begin with, every electric car is at once a passenger coach and a moving ticket office. Its conductor is both a conductor and a ticket agent; and its stations are on every street corner, at each highway crossing, and indeed almost anywhere along the line. With this uncertainty of stations it is easily seen that systems in vogue on steam railroads cannot be applied to electric interurban lines.

In addition to this phase of the question, there is the likelihood

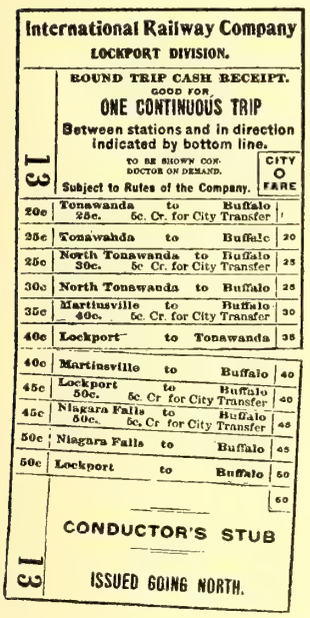


FIG. 1

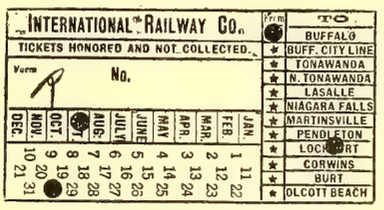


FIG. 2

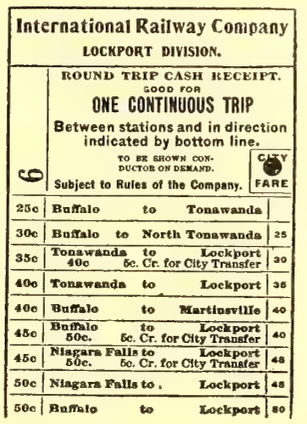


FIG. 3

FORMS OF INTERURBAN TICKETS

that interurban cars will operate over different systems, so that the conductor must be familiar with and meet the regulations of the local lines over which he runs. In short, he may be forced to meet the requirements of several different lines in the operation of his run, and must meet the need of the city, as well as of the rural traffic. He must know lines of the city as well as the regular city conductor. He must know the transfer points, the prominent places, and, in short, be a sort of a directory. He must operate his car, seeing that passengers board and alight safely; he must collect his fares; he must sell tickets to the passengers between scores of points. Round trip fare tickets between all the separate stations, one-way fares, cash fares, transfers, etc., all must be handled in accounting, and he must carry a full supply of tickets in order to meet the demands of traffic. He must keep his own books, make his own reports, and the heavier the traffic, the heavier will become his duties. Then, after his day's work is done, its entire detail must be gone over again in the auditing department, and the checking must balance.

So any system which shall be most simple, efficient and satisfactory, should appeal to every interurban passenger agent and officer.

I have for some time devoted much attention to this subject, and in that period many of the systems in vogue have come under my notice. In each of them I have seen efforts to attain a greater simplicity and efficiency of the scheme of interurban ticketing, and I present to you my personal conclusions on a system of ticketing which, I believe, is carefully surrounded by safeguards, and which at the same time is simple and easy of operation.

The system here presented, with a few minor variations, is not entirely new, but, I believe, with the exception of a few interurban lines in the West, is very little known. As a verbal description would fail of its purpose, I have had it prepared and printed in such a manner as to bring out its salient points, and the illustrations accompanying this article will serve to assist in its description, the tickets here represented being reduced to two-thirds regular size.

Fig. 1 shows the form of round-trip ticket carried by conductors and which is furnished to them from the station in books of 100 neatly bound and convenient to carry, a separate book being used for each direction. On this form is shown the various stations between which a ticket may be issued. On collection of round-trip fare from passenger, the conductor separates the ticket in the place indicating on the portion handed to passenger the reading of ticket for the return trip; thus, the ticket shown herewith is partially detached, showing passenger's half is good for trip on return journey, "Lockport to Tonawanda." The conductor's stub indicates by index the value of ticket so issued, and the passenger's fare is recorded on the cash register. It being the custom on the majority of interurban roads to allow free transfer to and from the city system, Fig. 2 shows method of taking account of interurban passengers carried on city cars. A printed slip is furnished to conductors of the city lines on which is indicated the various stations to which passengers may be ticketed, and on presentation of ticket, this form is issued by city conductor and punched to show stations between which passenger is traveling, together with the date of the transaction, record of the number of ticket presented being entered on the face of the form, which is remitted to the company in lieu of the passenger's fare. A place being provided on the through ticket, the city conductor at the same time records by a punch mark that the passenger's ticket has been honored for city fare, and, therefore, will not be honored again except for a ride on the interurban car from the junction point to the passenger's destination. Fig. 3 shows the return portion of ticket thus treated.

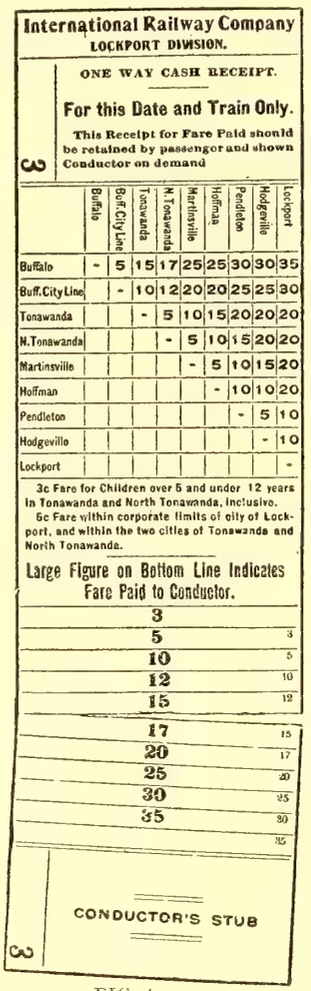


FIG. 4

In the case of a passenger boarding a city car and desiring a ticket through to an interurban point, the conductor collects only the city fare, transferring the passenger to the interurban car. Credit for this transfer is allowed to the passenger by the conductor furnishing him a ticket at 5 cents less than the tariff rate, a place being provided on the round trip ticket for such fares.

A form of receipt or ticket for one-way cash fares collected is shown in Fig. 4. This form is arranged in a similar manner to the round trip tickets before described.

In addition to the various figures representing amounts of cash fare collected on the road, the company's passenger tariff of one-way rates is printed and is a guide both to passengers and conductors as to the proper collection of fare. Fig. 4 shows the cash receipt partially separated to indicate the receipt for 15-cent fare.

This system of interurban tickets lends itself easily to the methods of the average interurban road in ticket accounting. The tickets may be reported by conductors on every trip or on their sheet showing ticket transactions for the entire day. This can be left to the requirements of the accounting department.

I do not assume to say that the system of ticketing which I have described is the best, or that other systems which I may never have seen have not equal merit; but my opinion as to the strong points of this method is, as I said, formed after a careful study of all ticketing plans that have come to my notice.

DESPATCHER'S DUTIES, AND ELECTRIC SIGNALS

BY ORLANDO W. HART, OF FALL RIVER, MASS.

The system known as train despatching, which is practiced on nearly all the steam railroads in the United States and Canada, has, for its chief aim, the safe operation of trains along a single-track line and the fixing of their meeting points.

On double track the despatcher's duties amount to little more than keeping apart the regulars and the extras, except in case of accident or other interruption to one or both tracks, which would make it necessary to move trains in an opposite direction from that given by schedule. Then the despatcher's responsibilities are far greater than under any ordinary conditions presented by single-track operation.

Electric railways, except in a few instances, have not the advantage of manned stations along the line, with telegraphic communication with the depatcher's office, as is the case with the steam roads. They are also at a disadvantage owing to the large number of operating units and the fast schedules maintained on their urban and interurban divisions.

By the use of the modern high-power telephone instruments and lines it is possible, by the use of verbal orders, to derive from a despatcher's office all the advantages now obtained by the use of the telegraph; but on most railways it would be impracticable to keep in operation the telegraph stations, consequently some system of signals should be installed and maintained enabling the despatcher to set an order signal at any desired point or telephone station along the line, and to receive an "answer back" or reply from the station so operated, which would be characteristic of itself, recording the same, together with the date, hour and minute of the operation, on an instrument in the office provided for the purpose.

All movements should be simple and automatic in their action and positive in reply, but in no case should the "answer back" be received until after the signal is at "full danger" and locked in that position.

Only one signal should be operated at a time, but so arranged that in case of the setting of two or more signals two or more movements of the office instrument should be made and their replies recorded. By the use of such a system all the advantages of the manned stations could be obtained, together with the additional advantage of its being always on duty.

Any system of signals which will bring about these results is of vital importance when set at special meeting points, either as a safeguard on crews forgetting orders which have been given, or in case of a car or train whose right of track having been overlooked, and is running ahead of a car whose rights have been restricted by orders. And, lastly, the important factor of operation enabling the despatcher to correct a blunder should one be made should not be forgotten. While this course is seldom necessary its importance is apparent, as an accident is generally the result.

The combination of this system of signalling with the telephone puts every car, train and crew in the direct charge and control of the despatcher. The operation of the road, or the respective division thereof, will then be reduced to the one man on duty, through whom all operating orders should be sent.

The importance of the despatcher is second to that of no official of the road. He must be strictly temperate, of quick, sound judgment, a cool, clear head and of unquestioned ability. He must have a thorough knowledge of the road, the running time of cars, the ability of the crews and how much dependence to place in them. In fact, all the minute details of everything connected with the operation of cars and the character of the road must be known to him, but especially the time-tables and schedules.

All persons must recognize his authority, and his alone. All matters concerning time-tables and rights under existing schedules should be his regardless of opinion.

A despatcher's duties are to keep the road operating as near the running time given in the time-tables as possible, and when cars are "on time" there is little for him to do. As soon as a car becomes "off-time" or late it is necessary for the despatcher to take control of this car and govern its movements, properly restricting its right of track, and then moving up other cars against it. In this way he can keep the road "on time," making the already late car later if necessary, but holding all other cars to the time-table as nearly as possible. Otherwise his entire schedule becomes upset and the road late. At these times complete control must be had of all "extras," so they may be handled with due regard to the schedule.

He must daily test his instruments and signals and report to the superintendent any defects or interruptions that exist or have existed, and what measures have been taken for repairs. He must report all facts concerning employees disobeying orders or disregarding the rules of his department, and order the removal of such men, pending investigation, should he deem such a course necessary. He must construct all orders, keeping in a book provided for the purpose an exact copy of the same, and in addition he should keep a train sheet, showing all the operations of the day, and then filed away for future reference.

A despatcher can be held responsible only so far as his orders and authority go, and any accident that may occur generally is traced to carelessness on the part of the despatcher and the two men at fault.

The weak point in all systems of order despatching is that it provides little or no check on the employee, and when important movements are entrusted to them, either singly or doubly, if they blunder, the error results in disaster without chance of detection. Human agents err, and the despatcher's system is devised so as to keep a check on the employee. If no mistakes were made by them no system would be necessary. But as it is, a system is needed which will reduce the liability of making blunders, and by demanding of the employee a full knowledge of the system, there is a chance of correcting the error as soon as made. The efficiency of the system is dependent upon the rapidity and surety with which it corrects the mistakes made by the employees.

Time is an important subject to be considered in the operation of railways by the despatcher system, and one to which little or no attention is often paid. No employee should be allowed to carry a watch that will not run correctly within thirty seconds a week. A certificate of the condition and reliability of their watches should be furnished the despatcher on regular blanks intended for that purpose, and signed by the jeweler appointed by the company, and who shall be officially known as the inspector of time. Standard railroad time should be adopted, and main regulators or master clocks should only be used for comparison by the men. The steam railroad rule governing the daily registration of any variation should be strictly adhered to and adopted. All cars should be run according to schedule unless superseded by special orders from the desptacher.

An order from the despatcher takes precedence always, and upon arrival of the car at the point designated in the order the car falls back on its schedule rights, unless the order be renewed or extended. A special order is never considered to mean more than it expresses, and must not be used as rights not fully and distinctly expressed in them. Crews having special orders against a certain car must be governed strictly by their orders and rights, as against all other cars not specified. All cars running as extras or work cars under special orders are considered "wild," and their rights are only to the extent of their orders.

Whether written or verbal train orders are given or received established forms should always be adhered to when possible, and orders must be so constructed as to admit of but one interpretation, and given in the same words to all employees affected by them.

Having given an outline of the system it will be well to give an example of a movement made by a despatcher using the telephone and signal system previously described.

Should it become necessary to make a new meeting point for two cars, we will say, for example, at station No. 6, the despatcher, by the use of the signal system, sets a signal at station No. 4 and No. 6, for it is his purpose to operate only on the side of safety and use the double order system of orders. The replies having been received that both signals are at danger, the despatcher must, by order, hold all other cars at these points until he hears the call from the crew having the right of track. The motormen, seeing the signals at danger or against them, will stop the car, and the conductor will go to the telephone station and call the despatcher's office; on receiving a reply, will say: "Smith and Jones, eastbound, station No. 6, signal set." This being the crew holding the rights of track, the despatcher gives this order: "Smith and Jones, eastbound, will meet Hughes and Wheeler, westbound, at station No. 5." This message is repeated by Jones, and if correct he is given orders to have Smith, the motorman, repeat the message as he heard it; this is done, and if not repeated correctly, Smith is again given the order till he has it correct. He must then listen on the line till he receives the O. K. from the despatcher. Should he hear the order given to the Hughes and Wheeler crew he must note carefully the message, and should any mistakes be made immediately call attention to the fact.

The message sent to Hughes and Wheeler, at station No. 4, should be in the exact words that it was given to the Smith and Jones crew. The O. K. in any case is given by the despatcher in this manner: "Smith and Jones O. K.; restore the signal." Both crews now having the O. K. they can proceed to the new passing point. As a precautionary measure the despatcher may now set the signal at station No. 5, and the first car arriving at the station will call the office, and the despatcher asks for information regarding the other car. Upon its arrival being given, the time is noted on the train sheet and orders given to restore the signal.

Unless new orders are given at this point the cars now continue on their schedule.

In the transmission of telephonic messages giving orders for

the movement of cars, it is best to use a slow, distinct monotone, with no special stress on any part of the message, but making the whole message of the same importance.

No variation from the original wording of the message can be allowed when repeated by an employee, but it must tally, word for word, with the written order in the order book; then it will come from all repeating it in precisely the same language as given.

It would be useless to discuss the subject of electric block signalling systems, as applied to trolley lines, and used alone as an operating measure, for none of the systems now shown possess the first principals of a safe device. No signal should be used as a running measure wherein any wire or part necessary for the operation of the signal can be disconnected or broken without the signal coming immediately to danger. A signal that does not do this is not worthy of even a moment's consideration.

At best an electric signalling device, dependent for its means of operation on either the car or crew, should not be used as an absolute running signal, but only as a cautionary measure. Experience has proved this, and it matters not if some roads who have used such signals have never had an accident by their use. The time will come when too much dependence will be placed on them and serious results will follow.

It would, no doubt, be very beneficial to the subject in question if the managers of the various railways of the country employing despatchers would, during the coming winter months, send their despatchers to a convention, held for the purpose of discussing the question of safe operation under the train order system, and also for adopting a set of rules and forms for the government of all the companies represented. Such an association should be permanent from year to year, and the members can make such amendments to the rules adopted as they may deem advisable.

HYDRAULICS IN CONNECTION WITH STREET RAILWAY OPERATION

BY C. E. PARSONS, OF GLENS FALLS

Before the possibilities of the electric railway were recognized, nearly all of the accessible water-powers of the country had been developed for use in various arts and industries. So when the demands for cheap transportation increased it became necessary to find immediate means for supplying energy, and steam seemed to be the only available source. Railways were projected, built, and operated in a few months' time, and, although the cost of energy by steam was high, there seemed to be no other means of getting a quick return on the capital invested. To-day the engineer, with his knowledge of what may be done in electrical transmission and conversion, recognizes that water-powers are much the most important factors by which the cost of electrical energy may be reduced.

The new hydro-electric development at Spier Falls on the Hudson River is to play a most important part in the operation of the street railways in the eastern part of the State. Some of the features of this plant, and of the one at Mechanicsville, together with their various transmission systems, give an idea of what may be done in reducing the cost of energy as used for electric traction.

Within the last year a complete cystem of connecting railways has been put in operation in the Hudson and Mohawk Valleys, and lines now run from Gloversville in the west, to Albany and Hudson in the east and south, and Lake George on the north, while all of the intervening cities have the benefit of the most modern electric railway engineering and construction. Six different railway systems are located within a radius of 45 miles of the Spier Falls plant. The Hudson Valley Railway connects Albany and Warrensburg and the adjoining villages. The Ballston Terminal Railway connects the various manufacturing villages in the vicinity of Ballston. The United Traction Company's lines are located in Albany, Troy and vicinity. The Albany & Hudson Railway's third-rail system covers the territory from Albany south to Hudson. The Schenectady Railway Company operates lines between Schenectady, Albany and Troy, and has nearly completed a line to Ballston and Saratoga. The Fonda, Johnstown & Gloversville Railroad covers 34 miles of territory between Gloversville and Schenectady.

Three of these systems are now using power from Spier Falls and Mechanicsville. The Hudson Valley Railway is connected with the Glens Falls transmission line at Glens Falls. The voltage on this line is 20,000, and part of the current is used in rotaries at this point. The remainder is transmitted over the company's high-tension lines, located on the right of way to the Wilton substation. The 18-mile line from Saratoga to Glens Falls is supplied from the rotaries at this station. The railway company has a complete system of high-tension lines, and connections may be made with very little additional copper, so that the whole 125 miles of line may be operated from Spier Falls. The United Traction Company of Albany is under contract to take 6000 hp. at its sub-stations in Watervliet and Albany, and a large part of this power is now being supplied. The Schenectady Railway Company is receiving power over three separate transmission lines. Two are from the Mechanicsville plant at 10,000 volts, and one from Spier Falls at 30,000 volts. These lines reach sub-stations at Latham's Corners on the Troy branch, Colonie on the Albany branch, and the Dock Street station in Schenectady. The railway company also has a 10,000-volt transmission system connected to its steam plant.

With the prospect of so much of the energy being used from Spier Falls for railway purposes, it became of the utmost importance that a reliable and constant supply should be assured. The one object which of all others has been kept in view since the very inception of this water-power development was to so build that the supply of power would never fail.

One of the first questions to be decided in a water-power plant is the size of the units, both of wheels and of generators. The Spier Falls plant is laid out with four more generators than can be run in extreme low water. This gives a spare set of generators during the low-water months, and provides for the sale of 30 per cent more power during the eight months of the year when the supply is abundant. Another feature which also applies to most plants is that of the construction of storage reservoirs to regulate the flow during the summer months. It is easier to provide for additional units to be supplied from this storage, while the first part of the plant is under construction, than at some future time, when foundations would have to be put in with the aid of coffer dams. The additional cost of the masonry and rock work for spare units is small, as compared with the expense of a shut-down, if future extensions are found to be desirable.

In regard to the question of the comparative size of water-wheels and generators there seems to be a difference of opinion among designing engineers, and at first consideration it might seem as if there were no necessity for a wheel much larger than the generator. The Spier Falls wheels are built to develop 40 per cent more power than the rated capacity of the generators, and the wisdom of such construction has already been demonstrated in the following manner. It became necessary, in order to fill power contracts, to start the generators before the dam was carried to its full height, and the wheels are now operated under a 64-ft., instead of an 80-ft., head. Because of their large capacity they are able to maintain the speed and develop the full rated power of the generators, although the head is 20 per cent less than that for which the wheels were designed.

The protection of the canal and forebay is a most important feature, and a thorough study of existing plants was made before the present layout was adopted. The canal and intake rack run parallel with the river, and the racks are made continuous, with ample space behind them. This gives a larger rack surface, and the velocity being correspondingly less, there is not so great a tendency for drift wood to choke the water supply. This arrangement allows the larger pieces of wood to be floated down the face of the racks, and over the waste way at the end, instead of lifting them out bodily. A practice which should be avoided where feasible, is that of placing the intake square across the current. If this is done heavy projecting piers must be built to take the ice thrust in times of high water.

The plant at Mechanicsville, unfortunately, has this arrangement, and there was serious trouble with the ice almost every year, until a series of ice breakers was built diagonally across the river. In order to facilitate the making of repairs on the hydraulic equipment, and to enable any part of the system to be laid up without interrupting service, a series of grooves for stop logs was arranged, both for the canal head gates and for the gates in front of the penstocks, and any of the gates may now be repaired or replaced without affecting the others.

The question of the governing of a plant is one to which altogether too little attention is usually given. It is impossible to attain accurate speed regulation with the best governor that can be built, unless due consideration has been given to the principles upon which depends the speed of a water-wheel. The function of a governor is to vary the energy delivered to the wheel as the generator load changes, and this can be satisfactorily done only when the gates and gate rigging are so designed that they will respond quickly to the governing mechanism. The limitation of speed control is that imposed by the inertia of the water, and to obtain good governing the one most essential thing is for the water column to respond promptly to the varying aperture of the gates. It is to the water column, therefore, that attention should be given from the moment the plant is begun, if the accurate

speed control which is now demanded is to be obtained. The shorter the penstock, the sharper the downward pitch, and the less the velocity, the better on the whole will be the regulation.

It must be remembered also that the water column does not end at the gate; and long and contracted draft tubes and shallow tail races may have a serious effect on the governing, even if the work above the wheel is correctly planned. Frequent cause of disaster is the sudden and dangerous rise of pressure in the penstock, due to sudden closing of the gates, and there seem to be but two practical methods of eliminating this danger. Standpipes are effective if properly built, but are expensive and a source of trouble in cold climates. The problem seems to be solved at Spier Falls by the use of Lombard relief valves. They are easily adjusted, open and close quickly and have a discharge area large enough to afford ample protection. As a result of a study of the foregoing priciples and of the adoption of the most modern governors, the regulation of the Spier Falls plant is very satisfactory.

The switchboard is another part of the system which needs to be carefully studied if shut-downs are to be reduced to a minimum, and the one at Spier Falls is to be modern in every respect. It will be possible to put any one of the ten machines on any one of the eight outgoing circuits, by means of the small controlling switches on the operating board in the center of the station. Consequently in case of trouble with the generators, there will be no delay in changing. The transmission lines are all to be built in duplicate, and two separate pole lines, running through different sections of the country, will reach the larger centers of power distribution.

There is a great deal of scepticism among railway managers in the East, as to the reliability of water-power as applied to electric traction. This is largely due to the fact that designing engineers have not given the proper study to their hydro-electric developments, and numerous shut-downs and poor regulation have caused the more conservative to withhold their approval. From the results which will be attained in the Spier Falls plant, and in other modern plants of this character, under construction, it seems safe to predict that water-power will be as reliable as steam, with the additional advantage of a saving of 50 per cent in the cost of energy.

NOTES ON SOME OF THE EXHIBITS

The National Car Wheel Company, of Pittsburg, was represented by Charles L. Jackson, of New York.

The interest of the National Electric Company, of Milwaukee, was well taken care of by H. W. Ransom, J. T. Cunningham and Robert Long.

The Sherwin-Williams Company was represented by F. A. Elmquist, of Cleveland.

William B. McVicker, of New York, was present at the convention in the interests of the Dearborn Drug & Chemical Company, of Chicago.

The interest of the Taylor Truck Company, of Troy, N. Y., was well looked after by Frank M. Nicholl.

The Lorain Steel Company was represented by H. C. Evans, of the New York office.

R. W. Conant, of Cambridge, Mass., was on hand at the convention, exhibiting his motor and bond testing instruments.

The Cornell Manufacturing Company, of Syracuse, N. Y., exhibited, for the first time at a convention, its new automatic trolley switch. This switch was shown in the lobby of the Yates, as well as in actual operation in the overhead construction of the Syracuse Rapid Transit Company, on the corner of James Street and Manlius Street. This corner is one of the most difficult and troublesome to the overhead material of the company. The switch has been in operation there for some months, and since its installation no trouble has been experienced in keeping the trolley on the wire. The switch possesses a movable tongue, or rather a double tongue, to carry the trolley wheel from the branch wire to the main wire, the tongue being automatically moved into position by the trolley wheel.

The Pittsburg Reduction Company was represented by Safford R. Colby, manager New York office, and W. R. Darby.

The Lumen Bearing Company, of Buffalo, N. Y., was represented by Edward P. Sharp, manager of the street railway department.

The John A. Roebling's Sons Company was represented by Marston R. Cockey and G. W. Swan, both of New York.

The American Steel & Wire Company was represented by A. G. Greenberg, of Worcester, Mass., and F. A. Keyes, of the New York office.

The presence at Syracuse of E. J. Lawless, of New York, and Thomas F. Carey, of Boston, was appreciated by the many friends of the John Stephenson Company.

The H. W. Johns-Manville Company, of New York and Milwaukee, had in attendance at the convention J. W. Perry, manager of the electrical department.

The Curtain Supply Company, of Chicago, had as its representative at the convention its general sales agent, A. L. Whipple, of New York.

N. M. Garland, the New York agent of the Ohio Brass Company, attended the convention in the interests of his company.

The New Process Raw Hide Company, of Syracuse, N. Y., was represented by its vice-president, T. G. Meachem.

The Keefer Car Switch Company, of Albany, N. Y., had as its representatives J. W. Keefer and D. H. Keefer. One of the company's switches was installed on the corner of West Genesee and Salina Streets. Many of the delegates to the convention inspected the operation of the switch and made comments in its favor.

The Consolidated Car Heating Company, of Albany, N. Y., was represented by Cornell S. Hawley and S. B. Keys, of the New York office.

The Crouse-Hinds Electric Company, of Syracuse, N. Y., had a very neat exhibit, in the writing room of the Yates, of the various specialties manufactured by this company. The booth was decorated by Norbitt specialties extensively used in the decoration of street railway parks. The new arc headlight recently perfected and placed on the market by this company was exhibited in full operation. The well-known Syracuse changeable headlight, junction boxes and heavy switches were also on exhibition. The company was represented by its president, H. B. Crouse.

The American Automatic Switch Company, of New York, had on exhibition a model automatic switch. The company was represented by H. N. Powers.

The Duff Manufacturing Company, of Pittsburg, had as representative at Syracuse George A. Edgin, who entertained the friends of the company in room 84 of the Yates, where some Barrett jacks were on exhibition.

Heywood Brothers & Wakefield Company, of Wakefield, Mass., was represented by its New York sales agent, Bertram Berry.

The Ohmer Fare Register Company, of Dayton, Ohio, was represented at the convention by C. W. Ketterman, who exhibited the Ohmer Register in room 185 of the Yates.

The O. M. Edwards Company, of Syracuse, N. Y., had a very neat and extensive exhibit in the writing-room of the Yates. All types of this company's patent window fixtures for railroad cars, and its automatic trap-door for vestibules of Pullman cars, were shown. The newly patented window fixture for opening and closing windows in closed street cars, as well as the improved new type of Hartshorn roller for curtains in open or closed cars, were also exhibited. The company was represented by Messrs. O. M. Edwards, J. E. Simons and G. G. Norris.

The Continuous Rail-Joint Company, of Newark, N. J., was represented at the convention by B. M. Barr, of the New York office, and W. A. Chapman, of the Boston office. This company had a very neat exhibit of the well-known continuous rail-joint.

The Van Dorn & Dutton Company, and the Van Dorn-Elliott Electric Company, of Cleveland, Ohio, were represented at the convention by W. A. Dutton, treasurer of the company.

The Brady Brass Company, of New York, was represented at Syracuse by its president, Daniel M. Brady.

The interests of the Columbia Machine Works and Malleable Iron Company, of Brooklyn, N. Y., were ably looked after by Second Vice-President W. R. Kerschner.

The Bemis Car Truck Company, of New York, was represented by Eugene McKernan. A neat model of one of the company's medium heavy trucks was exhibited in the rotunda of the Yates. There are embodied in this truck many excellent features which ought to appeal strongly to managers who are looking for a truck which will stand up under the severe conditions of heavy suburban and interurban service.

The Westinghouse Traction Brake Company was represented at the convention by J. R. Ellicott, C. R. Ellicott and George E. Baker.

The interests of the Westinghouse Electric & Manufacturing Company were looked after by Paul T. Brady, S. B. Storer and J. D. Mickle, of the Syracuse office of the Westinghouse Company.

J. W. High, of New York, took good care of the friends of the Pantasote Company at the convention.

The Rochester Car Wheel Works was represented by E. H. Chapin.

The Peckham Manufacturing Company, of New York, was represented by its second vice-president, E. G. Long. A complete and handsome catalogue of the various types of trucks built by the Peckham Company was distributed among the delegates at Syracuse.

J. H. Stedman, of Rochester, N. Y., attended the convention in the interest of his own business, as well as that of the Ohmer Fare Register Company, of Dayton, Ohio.

The L. Plant Iron Works, of Syracuse, N. Y., had on exhibition several types of brake-shoes, which it is manufacturing for street railway service. L. Plant took care of the interest of the company at the convention.

George M. Haskell, New England agent of the J. G. Brill Company, was present at the convention in the interests of his company.

The General Electric Company had as representatives at the convention, J. J. Mahoney, H. Greer and A. B. Babson, of the New York office; W. Gibson Carey and J. G. Barry of Schenectady; H. H. Crowell, of Syracuse, and J. C. Calisch, of Buffalo.

The Standard Underground Cable Company displayed a very interesting exhibit of its manufactured goods, including bare, weatherproof and rubber-covered wire, and the many styles of aerial, underground and submarine cables, of which the company is one of the largest manufacturers in this country. One of the company's large new plants has been devoted almost exclusively to the manufacture of trolley and weatherproof feed wire for railway use, and is now engaged in turning out some of the largest orders for these materials that have been awarded this year. The company was represented by H. P. Kimball, of the New York sales office.

NEW STREET CAR REGULATIONS FOR BOSTON

The Massachusetts Railroad Commissioners have ordered that Boston's regulations regarding the running of street cars be changed to comply with the following:

1. In approaching any public or private way intersecting that in which the railway is located the speed of the car must be reduced to such a rate as will make it possible to stop it immediately.
2. In rounding curves the speed of the car must be reduced to meeting the condition of limited vision of railway and highway.
3. Before taking any heavy descending grade the speed of a car must be so reduced as to test the working of the brakes.
4. Where the railway lies within a highway and is close to a narrow traveled road, the speed of the car must be reduced to meet this condition whenever such road is in rightful use by others.
5. Where the railway occupies a portion of the traveled road the absence of any exclusive right of way on the part of the car makes it necessary that its speed be from time to time so restricted as to permit others to safely exercise their common right to a reasonable use of the road.

LORAIN STEEL COMPANY'S CLAIMS ADMITTED

The controversy between the Town Council of Wolverhampton, England, and the advocates of the Lorain surface contact system has resulted in a substantial victory for the Lorain Steel Company. As reported in the Street Railway Journal, of July 4, the Council had refused to reimburse the company in full, alleging that it had not carried out the promises made as to efficiency and economy. The company naturally declined to admit the unreasonable assertions made by some of the Council members, but expressed its willingness to arbitrate. A sub-committee, appointed to investigate the matter, presented a report which was very favorable to the Lorain Steel Company, and from which it appeared that the corporation had offered the company £15,000 for the tramway. This offer was rejected, as were also several others. The company finally sent a communication to the Council requesting payment in accordance with the contract, the entire amount being about £25,000. The sub-committee recommended the acceptance of this proposition, but was voted down.

At a later meeting Alderman Mander, chairman of the tramways committee, stated that the company was willing to accept £22,000 and install a number of new contact boxes. He also presented some figures in favor of accepting the company's offer, and said that the installation of the new boxes would result in an additional saving of £530 per annum. Although some members opposed these statements, the Council finally acceded to the company's terms by a large majority.

President C. H. Shattuck, of the Parkersburg, Marietta & Interurban Railway Company, of Marietta, Ohio, has issued an appeal through the newspapers requesting parents to exercise care in permitting children to play on the streets traversed by the company's lines. Employees have personally visited many of the homes and requested parents to forbid their children to play on the tracks.

ANNUAL CONVENTION OF THE MASSACHUSETTS STREET RAILWAY ASSOCIATION

At the annual meeting of the Massachusetts Street Railway Association, held at Young's Hotel, Boston, Sept. 9, 1903, the following officers were elected: President, Edward P. Shaw, of Newburyport; first vice-president, Francis H. Dewey, of Worcester; second vice-president, Robert S. Goff, of Fall River; treasurer, Fred H. Smith, of Quincy; secretary, Charles S. Clark, of Boston; executive committee, the president, vice-presidents and H. H. Crapo, of New Bedford; P. F. Sullivan, of Lowell; W. S. Loomis, of Holyoke; W. W. Sargent, of Fitchburg, and R. T. Laffin, of Worcester. The following were elected auditing committee: Charles F. Grosvenor, of Palmer; George W. Cook, of Springfield, and H. C. Page, of Pittsfield.

A REAL TROLLEY GUIDE

Since May 15, 1903, the Electric Print, of Trenton, N. J., has issued regularly as a monthly publication a handbook of electric railway trips in New Jersey, Pennsylvania and Delaware that, for completeness as to the details of the service given, the operating schedules and the rates of fare, is superior to guides that are much more pretentious. No attempt has been made to make it a literary production, and no pictures are given of places of interest in the territory covered. Instead, all this is displaced by information that the tourist needs in order to travel with the maximum of comfort. At the very beginning of the book, and where it is most needed, is a summary of the trips now possible within the territory which the guide covers. Following this is a detailed schedule of the service between New York and Philadelphia. The number of changes, time cars leave, their time of arriving at their destination, the fare, the frequency of the cars and the time the last car leaves are given in a tabular form that can be readily interpreted. Supplementing this is descriptive matter that details the entire route between the cities. Similar details and tables are also given of the routes between Philadelphia and Reading and the Lehigh and Wyoming Valleys. Of the trips of which details are given, but that do not warrant time tables, are many into and between Pennsylvania towns, also into Delaware. Trips in New Jersey that may be taken as side issues to the New York-Philadelphia trip are also given. The guide is closed with tables of places reached by trolley from Philadelphia and from Trenton, with details of the time, fare and distance from these cities. It is a guide that guides, and should be in the possession of all persons having occasion to use the electric railways within the territory it covers.

TEACHERS BECOME MOTORMEN AND CONDUCTORS

The lot of the country school teacher—perhaps it should be said the lot of the school commissioner—seems to be particularly hard just now in the vicinity of Springfield, Ohio, for complaint has been entered by the superintendent of the township schools that low salaries have caused the teachers in these townships to give up teaching, thus making it impossible to open the schools this season. The teachers who deserted the country and their positions are said to have become motormen and conductors of city street cars. Now, as between the village school marm, who falls a victim to Cupid's darts and deserts her profession in the middle of the school year to become the helpmate of some prosperous farmer's son, just returned from college, and the hardy young rustic who deserts his profession for a place on an electric car, the school authorities are certainly in a bad predicament. But the question is how to cope with the situation. Increase the pay of the teacher is at once the cry. But hold! That won't help the situation very much, either. Granting that the authorities could increase the pay, it seems improbable that the desire of the country youth to break away from home associations could be overcome, and that the susceptibility of the young women to the darts of Cupid could be reduced by this means. Some will, perhaps, suggest that a Guizot is needed to address to the community another such touching letter on schools and their influences that the tide of desertion may be effectually stopped. It is not so many years since the famous Frenchman lived, but there has been such a change in political conditions. What do we of the present day care for the service that will find its ultimate reward in heaven? No, that isn't sacrilege. We are simply, as Punch would say, looking out for ourselves. If deserting school teaching for a position on an electric car is going to add materially to our earthly lot, why we are just sordid enough to become motormen. And if poor school teachers become good motormen, the community at large and the street railway companies will be benefited, although it may be hard on the school commissioners at first.

SEVENTH ANNUAL MEETING OF THE METROPOLITAN STREET RAILWAY ASSOCIATION

The seventh annual meeting of the Metropolitan Street Railway Association was held at Carnegie Hall, New York, on Oct. 3, 1903. This association is a mutual benefit organization, composed of employees of the Metropolitan Street Railway Company, and of the Interurban Street Railway Company, and is one of the most successful, as well as the largest organization of its kind in the world. The initiation fee to members is $1.00, and the dues are 50 cents a month. For this a member of the association receives free medical attendance, medicine at cost, and one-half his wages while sick. He also has a life insurance of $300, a pension when superannuated, depending, in amount, upon the length of time he has been in the service of the company; use for himself and his family of the library of the association, use of its club rooms, and other privileges. The expense of all of these are not defrayed by the association itself, as certain of them, as, for instance, a bed in St. Vincent's Hospital, have been donated by the president individually, while others, like the pensions, are given by the company. In addition to the receipts from initiation and dues, the association, under a State statute, is the recipient of the amount received for the sale of unclaimed property found on the cars.

The financial statement of the organization distributed at the annual meeting shows among other statistics that the association has paid out, during the year, sick expenses and death claims to the amount of $26,439, and up to date $111,280. The association has a fund invested of $15,000 and cash on hand of $16,244.

The annual meeting is by no means devoted entirely to a report of the finances of the association. A vaudeville entertainment is given, and the families, as well as the members, are invited to it. Carnegie Hall was crowded on the evening of Oct. 3, and among those present were a number of invited guests, who witnessed an excellent programme, rendered by performers from a number of the city theaters. At the opening of the meeting the president of the association, H. H. Vreeland, made an address, reviewing the work of the association, and as it outlines so well the scope of the association a portion of it is given below.

MR. VREELAND'S ADDRESS

We have met so frequently during the past year that there is little which is new that I can say in connection with the growth and work of the association and my relations with you men, but the meeting this year has a special significance, first, because this is the tenth anniversary of my connection with this property, and, secondly, because ten years ago a little group of thirty or forty men, of whom I was one, laid the foundation for this, the most successful mutual association of its kind in the world. I shall not go over the many detail benefits which I think have accrued to us as an outgrowth of this association, but simply wish to mention one or two salient points in connection with it. The principal things which I had in mind at the time of the organization of the association, were, first, medical attention and financial assistance for sick and disabled members; second, a death benefit fund; third, social and educational opportunities; fourth, establishing a pension fund. From time to time during the past ten years of the association's history, as circumstances and financial conditions warranted, these various benefits have been established. The first three on the part of the association, and the last by the railroad company by whom we are employed.

Referring to the pension system in combination with the association, from the time a man enters the service of the company, until the time of his death, he is properly cared for, the pension system stepping in where the association leaves off when a man becomes incapacitated for active labor. It has also been made a rule that all of the lighter grades of work, such as transfer agents, janitors, watchmen, etc., are reserved for men in the service of the company who, either on account of age or injury, have become incapacitated for the more active service. This is in direct contrast with the system in vogue years ago, when influence had much to do with the placing of men in these positions, employees of many years of service being forced out with no means of support.

As an illustration of the workings of the pension system, an employee with an annual salary of $900, who receives 40 per cent of that average salary through pensions, would receive $360 per year. This is the interest, at 4 per cent, on $9,000, a sum which a man living in a thrifty manner would be unlikely to save during his active service.

During the earlier years of the association, many financial and operating men connected with large systems of street railways, considered an association of this character as useless and sentimental. These same men are now forced to admit that there were many other features in such an association, and they are now attempting to do this very thing which they condemned a few years ago. The relations with their employees not having been satisfactory, adjustments of questions have been conducted by outside influence, causing friction and ill-feeling between employees and the management, with resulting ills to all concerned. Whatever we have done in the way of settlements of differences has been between ourselves in a friendly way and has resulted satisfactorily to all concerned. The employees of our system stand to-day in the matter of wages, hours of service, relations with officers and heads of departments, in as good, if not better, position than the employees of any other street railway system in the world. All this has been accomplished through the understanding that has been the result of personal contact with the officers and operating heads of departments through the medium of association work.

Since we last met I have traveled far and seen many properties like ours devoted to the public service, and I am proud to tell you that nowhere had I occasion to feel but flattered by the contrast which naturally comes to mind under these circumstances. Nowhere, and I investigated public service corporations under three different forms of government and twenty odd forms of management, was there anything like the conditions under which we exist. You know there is nothing more general than the impression that the other fellow's job is easier and pleasanter than the one we have, but we generally find on investigation the other fellow has troubles of his own which make ours easier to bear. We have done our own work of combining for mutual benefit, and we are not the object of patronage for any one. We own, as an investment, an interest in the property we operate, and we help each other from our own resources, and this is as it should be, for on no other plan can men secure that mutual respect which is the very foundation of confidence.

NEW TRANSFER ARRANGEMENT IN CLEVELAND

The Cleveland Electric Railway Company has promulgated a new rule, which it is hoped will circumvent those who have been taking unfair advantage of the universal transfer put into operation when the local Cleveland companies were consolidated. Heretofore transfers have been issued to passengers approaching transfer points, and they have been given without question, whether the passenger paid fare or presented a transfer. The new rule, which went into effect Oct. 1, compels the passenger to ask for the desired transfer when he pays his fare. There is no hard and fast rule relative to giving a transfer on a transfer, when a passenger desires to go in one continuous direction, but a transfer which will enable a passenger to return in the direction from which he came is refused.

PROCEEDINGS OF THE TWELFTH ANNUAL CONVENTION OF THE PENNSYLVANIA STREET RAILWAY ASSOCIATION

On Sept. 23 the Pennsylvania Street Railway Association began its twelfth annual convention. The sessions were held in the ballroom of the Park Hotel, Williamsport, Pa., and were attended by a large number of street railway and supply men.

The convention was called to order by President Ernest H. Davis, who also introduced Hon. John F. Laedlein, Mayor of Williamsport. Mayor Laedlein welcomed the delegates and briefly reviewed the good points of Williamsport. He was followed by President Davis, who, after responding to the Mayor's welcome, took up the regular work of the convention. He laid particular stress upon the question box idea, and expressed the hope that through the hearty co-operation of the members the question box would prove of valuable assistance to street railway men. In referring to the development of interurban railways President Davis said that their construction in the past had been greatly hindered, owing to unnecessary restrictions in the present State laws, and called upon the members to use their utmost influence to secure more favorable legislation for interurban railways.

The afternoon session was devoted to the reading of and discussion on John F. Ohmer's paper entitled "Fares and Fare Protection," which was published in the Street Railway Journal of Oct. 3. In the evening the delegates enjoyed a smoker at the Park Hotel. The following day over seventy delegates took a pleasant trip, in three special coaches, to Eagles Mere, via the Reading, Williamsport & North Branch Railroad.

The election of officers resulted as follows: President, F. B. Musser, general manager, superintendent and purchasing agent of the Harrisburg Traction Company; secretary, C. H. Smith (re-elected), superintendent and purchasing agent of the Lebanon Valley Street Railway Company; treasurer, William H. Lanius (re-elected), president of the York County Traction Company.

FINANCIAL INTELLIGENCE

Wall Street, Oct. 7, 1903.

The Money Market

On the whole the money market is currently described as somewhat easier than a fortnight ago. This description applies, however, to the surface tendency rather than to the market's real position. Liquidation on the Stock Exchange has freed a certain amount of capital which was not available two weeks ago; from Sept. 12 to last Saturday there was a total shrinkage of over $13,000,000 in loans of the Clearing-House banks. In addition to this the government has redeemed some $4,500,000 of the 5 per cent bonds under the recent offer, and the greater part of this sum having found its way to New York, has kept the Sub-Treasury a debtor, where a little while ago it was a creditor in the local market. Finally the extreme delay in the harvesting of the crops is making itself felt in an exceptionally slow movement of currency to the interior. Shipments were heavier last week than they were the fortnight before, but their volume still fell considerably short of a year ago. As a result of these several causes, local bank reserves have been remarkably well preserved, and time money rates have softened a trifle. But it must be observed that each of these factors mentioned as prominent during the last two weeks, is likely to be only temporary. Selling in the stock market has come to a halt, and no further loan contraction on this account can be expected. The Treasury bond disbursements have admittedly fallen below expectations, and even now are slackening. As for the interior cash movement nobody supposes for a moment that the outgo will not soon reach its customary large proportions. There is little prospect of gold imports this autumn, because, even with increasing exports of cotton and grain, our market will have to repay a number of foreign loans which mature during the next few months. The conclusion is, therefore, that while anything like the crisis of a year ago is extremely improbable, bank reserves from now on are likely to decline very steadily, and money rates to work higher. Call money is a trifle stiffer, at an average of 3 per cent. Sixty-day discounts are quoted at 5¼ to 5½ per cent, with 5½ per cent nominally asked for four months' loans.

The Stock Market

The stock market has gone through another feverish period during the last two weeks, with several days of rather severe decline, which was scarcely less disturbing than the dark days of July and August. Nobody now pretends to find an explanation for the liquidation that has occurred in anything else than the necessities of the sellers. There is no doubt that certain wealthy holders have had to let go some of their standard investments in order to protect themselves against obligations incurred in the numerous flotations of new capital during the last few years. They have been compelled to throw over their stocks regardless of price; consequently it is urged that market quotations cannot be considered a fair measure of intrinsic values as ordinarily determined by conditions outside of the stock exchange. This, however, is not the only element of weakness in the situation. The urgent needs of those who have sold the stocks are only half the story. What is of equal importance is the reluctance of the investors of the country to come in and buy. Investment capital is unquestionably timid. It is fearful lest the great decline in security prices during the past year represents something more than a speculative crisis, lest it portends a season of general trade depression which would bring with it decreasing earnings, reduction of dividends, and a consequent lowering of real investment values. This uncertainty, widespread as it has now become, prevents any substantial improvement in the general market. The business situation, as a whole, presents few evidences of a retrograde movement. In the iron trade there has been considerable falling off, and reports from other industries are that business is slackening. But such measures as bank clearings and railroad earnings, which are usually the most accurate guides to the state of trade in general, are holding well above last year's corresponding level, and it is impossible to believe that this favorable comparison could be made if a really serious reaction were in progress. The future is uncertain, to be sure, but the main point is that there is no better ground for pessimistic than for optimistic predictions. The waiting attitude assumed by the stock market is, however, the most sensible one under the circumstances. It is doubtful if the standard stocks can go much lower than they are now, even if liquidation were to be renewed, but, on the other hand, so long as genuine investment buying is scarce, and the larger interests cautious, there is nothing upon which to base any substantial operations for the rise.

During the general collapse in the market of ten days ago the local traction stocks were as weak as any other group. All of them reached new low prices for the season. Metropolitan was driven down below 100, and Brooklyn Rapid Transit below 30, which means the lowest that they have ever sold since the time previous to the boom of 1898-1902. There is a persistent rumor that most of the selling of the traction shares came from one or two capitalists whose reputation in street railway affairs is international. This version is corroborated from so many different sources that it is impossible to believe that it has no good foundation. Manhattan went off with the others, but has rallied much more readily, and altogether has given a very good account of itself. The investment absorption of this issue is steadier than, perhaps, in any other active stock in the market. Brooklyn Rapid Transit has suffered probably unjustly from some disagreeable reports concerning the financial position of one of the most active speculative interests in the property. There certainly has been very little attempt made to support the stock.

Philadelphia

The market for traction shares in Philadelphia has borne its part in the general speculative liquidation of the period. The leading stocks have, as a rule, reached bottom figures again, and in one or two instances have made new low records for the season. Philadelphia Company common declined from 38½ to 36 a week ago Monday, this being the lowest that the stock has ever sold. It rallied sharply on the succeeding days, getting back to 38⅝ ex-dividend, then dropped back again to 37⅜. The preferred held steady at 43¾. Union Traction broke from 44 to 40⅞, recovered to 43, then sold off to 42¾. Philadelphia Rapid Transit dropped from 13¾ to 11, then rallied to 12½. Philadelphia Traction suffered less than any of the group, with a decline from 94½ to 93½, and a recovery to 94. American Railways sold down from 43 to 42, and up again to 42¼. The selling in all these stocks had little reference to individual properties; it reflected merely the exigencies of people who were forced to sell on account of general market conditions. Other traction sales in Philadelphia included Consolidated of New Jersey at 60, Hestonville Passenger preferred at 73, and Fairmount Park Transportation, fifty shares of which sold at 20, a loss of six points from the last previous sale.

Chicago

In most instances the recent fluctuations in the Chicago market have represented a changing about of quotations rather than variations in the relative strength of the buying and selling. To illustrate this it may be observed that South Side Elevated declined last week from 95 to 90¼ on transactions of only 80 shares, while the very next transaction was the sale of 20 shares at 95 again. In the same way it took only a few scattering offerings to depress Metropolitan Elevated common from 18 to 17, and only a single purchase to carry it back to 19. Metropolitan preferred dropped 2 points from 55 to 53, establishing a new low record for the season. Traffic on all the elevated lines during September showed moderate gains over the same month of last year. These ranged from an increase of 7 per cent on the South Side, to a little more than ½ per cent on the Lake Street. September was the best month, altogether, for the year, with the exception of June. The reorganization committee of the Lake Street Elevated is supposed to have finally arranged the main outlines of its plan, and to be ready to present them to the public at an early date. The stock has changed hands during the last two weeks between 4½ and 5. It is stated that the whole affairs of the Union Traction Company will now be taken up very shortly by Judge Grosscup and the receivers of the company. The subjects now under discussion are, the reorganization of the company, including the disposition of the North and West Chicago lines, negotiation with the city officials on the franchise proposition, ways and means of raising sufficient money to carry on the work of improvement, and, finally, what permits shall be secured from the city for necessary repairs. Scattering sales have been reported in Union Traction preferred at 32, West Chicago at 52, North Chicago at 95, Northwestern Elevated from 17 down to 16, and back to 16¾, and City Railway from 170 to 167¾, to 170 again.

Other Traction Securities

All of the Boston traction specialties lost heavily during the severe declines of ten days ago. Massachusetts Electric common made a new low figure at 17½, but when the later recovery set in it rallied very rapidly to 21. The preferred stock was much less excited, both on the decline and on the subsequent advance. It went as low as 77 and as high as 78. Boston Elevated fell from 136½ to 135, but recovered to 137. West End common got down to 88¼, then rallied to 89, the preferred changed hands at 108 to 109. In Baltimore the feature of the recent dealings has been the extreme weakness in United Railways issues. Both the stock and the bonds made new bottom figures for the season. The stock went down from 10 to 8⅝, but later rallied to 9¾. The general mortgage 4s were driven down from 89¼ to 89⅞, but have since regained more than this loss; they sold yesterday at 90⅜. The income bonds were relatively the weakest of the three. They dropped from 61⅜ to 58¾, rallied to 60¼, and fell again to 59⅛. The break in all of these has been due entirely to the general market demoralization. Other Baltimore sales include Philadelphia Company's 5s at 108⅜, Atlanta Consolidated Street Railway 5s at 101, Norfolk Street Railway 5s at 105½, Newport News & Old Point Comfort 5s at 100, North Baltimore Traction 5s at 116, Virginia Electric Railway debentures at 85, and Anacostia & Potomac 5s at 92. On the New York curb particular interest was aroused by the remarkable fluctuations in Interborough Rapid Transit stock. The decline in these shares from 97 to 81 was associated with the demonstration against the other local traction issues on the floor of the stock exchange. One rather credible report had it that a loan in which Interborough stock formed a part of the security was hastily sold out, and that this was the explanation for the extreme decline. The shares rallied nearly 7 points from their lowest, getting back to 87⅞, but they soon fell off again to 83. Other curb sales for the two weeks comprise, American Light & Traction preferred at 90, St. Louis Transit from 17½ to 17. Washington Traction 4s at 72¼ and 72, and Brooklyn Rapid Transit 4s from 77½ down to 76 and back again to 77½.

Security Quotations

The following table shows the present bid quotations for the leading traction stocks, and the active bonds, as compared with last week:

	Closing Bid	
	Sept. 22	Oct. 6
American Railways	43	42
Aurora, Elgin & Chicago	a20	a17
Boston Elevated	137	135
Brooklyn Rapid Transit	37¼	33⅛
Chicago City	170	170
Chicago Union Traction (common)	4½	4
Chicago Union Traction (preferred)	30	30
Cleveland Electric	a70¾	60
Consolidated Traction of New Jersey	60	59
Consolidated Traction of New Jersey 5s	104½	104¼
Detroit United	65¼	64
Elgin, Aurora & Southern	a42	a42
Lake Shore Electric	—	a7
Lake Street Elevated	5¾	4¼
Manhattan Railway	132½	130½
Masachusetts Electric Cos. (common)	19	20
Massachusetts Electric Cos. (preferred)	78	77½
Metropolitan Elevated, Chicago (common)	18	18
Metropolitan Elevated, Chicago (preferred)	53	53
Metropolitan Street	112	105
New Orleans (common)	10	9¾
New Orleans Railways (preferred)	30	30
North American	75	71
Northern Ohio Traction & Light	15	15⅛
Philadelphia Rapid Transit	13½	12
Philadelphia Traction	94½	94
St. Louis Transit (common)	17	15¼
South Side Elevated (Chicago)	94	90
Syracuse Rapid Transit	—	—
Syracuse Rapid Transit (preferred)	—	—
Third Avenue	108	105
Toledo Railway & Light	20	17¼
Twin City, Minneapolis (common)	—	86
Union Traction (Philadelphia)	43¾	42½
United Railways, St. Louis (preferred)	65	62

a Asked. b Last sale. * Ex-dividend. † $10 paid.

Iron and Steel

Yesterday's cut in the Steel common dividend, and the report of the heavy decrease in the company's earnings in the last three months, afford the most conclusive evidence of the extent and importance of the recent reaction in the iron industry. This falling off in the profits of the leading concern is largely, no doubt, due to the tie-up in the building trades in New York city this last summer, and in so far as this is true the decrease may prove to be only temporary. Yet, making all allowance for this explanation, yesterday's developments must be considered as the first positive check upon the prosperity of business in general, and the steel trade in particular, of which the public has been apprised.

Conditions otherwise in the iron market are substantially the same as they were two weeks ago. The drift continues toward lower prices for pig iron, and, in fact, a fresh reduction of 50 cents a ton was reported in the leading grades only yesterday. It now remains to be seen how successful the attempts to restrict production recently inaugurated will be. That there is at present an over supply, although not a particularly large one, is generally admitted. As for iron and steel manufactures, the labor troubles have been, and still are, the most adverse factor. But another unfavorable influence, the importance of which can scarcely be over-estimated, is the necessity on the part of the railroads to curtail their improvements and extensions, because of their inability to borrow the requisite capital on advantageous terms. Quotations are as follows: Bessemer pig $16.85 per ton, Bessemer steel $27, steel rails $28.

Metals

Quotations for the leading metals are as follows: Copper 13½ cents, tin 26 cents, lead 4½ cents, and spelter 6 cents.

REPORT OF THE RAILWAYS COMPANY GENERAL

The report of the operations of the Railways Company General for the fiscal year ending June 30, as made public at the annual meeting of the company last week, compares with 1902 as follows:

	1903	1902
Income interest on bonds subsidiary companies, etc.	$75,532	$24,618
Expenses (salaries, rents and taxes)	7,445	6,748
Net profit	$68,087	$17,869

The profit and loss balance as of July 1, 1902, was $17,869, and as of June 30, 1903, $85,957.

Balance sheet as of June 30, 1903:

ASSETS

Cash	$30,076
Due from subsidiary companies	108,419
Bond of subsidiary companies	593,132
Capital stock of subsidiary companies	256,090
Other securities owned	120,825
Sundry underwritings	183,865
Furniture and fixtures, etc.	4,366
Capital stocks of Railways Company General in hands of W. W. Gibbs and George S. Graham, trustees	34,000
Unpaid stock subscriptions	28,000
Total	$1,358,677

LIABILITIES

Capital stock		$1,200,000
Due to banks and bankers on company's notes.	$231,719	
Less loans upon collateral	159,000	72,719
Profit and loss		85,957
Total		$1,358,677

During the year it was considered wise to move the offices of the company to the city of New York, where the principal interests of the country are now concentrated. President Dick said:

"With the exception of Michigan Traction, the net results of the subsidiary trolley lines have been unsatisfactory; however, the Railways Company General has been compelled to advance $72,036 to the Michigan Traction Company for improvements and extensions. Some of these improvements and extensions have been made voluntarily, and others under coercion by the city of Kalamazoo. The outlook for the Michigan Traction Company seems to warrant a considerable increase in net earnings."

Mail boxes have been placed on the street cars in Chattanooga, Tenn., and a street railway mail service inaugurated. A special arrangement is provided in this mail service for special delivery letters, such letters being immediately taken in charge at the transfer station by a messenger boy.

RAILWAY PROFIT SHARING IN BRITISH COLUMBIA

Coincident with the declaration of its regular annual dividend a few weeks ago, the British Columbia Electric Railway Company placed in operation the liberal system of profit-sharing, details of which were announced in the STREET RAILWAY JOURNAL of Aug. 30, 1902. Every man in the employ of the company in Vancouver, New Westminster and Victoria received $25, that amount being each man's share of one-third of the surplus remaining after payment of the regular 4 per cent dividend to stockholders. The total amount disbursed to the employees was $7,600, and the officers hope that next year the amount will be even larger.

This profit-sharing scheme was introduced by J. Buntzen, general manager of the company. Upon his recent return from an extended trip to England and his old home in Denmark the employees of the company gave an elaborate dinner in his honor. On that occasion Mr. Buntzen pleasantly surprised his men by announcing the amount of the bonus, which has just been paid.

ANNUAL REPORT OF THE SOUTH SIDE ELEVATED

The report of the South Side Elevated Railway Company, of Chicago, for the year ending June 30, 1903, has just been made public. The report shows that gross earnings increased $136,796, while the operating expenses increased $95,915. The increase in net earnings was $40,881. There was a decrease in fixed charges of $26,647. The increase in surplus was $73,066. The balance sheet gives an increase of $110,000 in bonds outstanding. This, however, is due to the deposit of $110,000 of the company's bonds with the city government as a guaranty in respect of the Englewood extension ordinance. No additional bonds have been sold during the year. Maintenance charges were the largest in the history of the road, and $50,000 was charged off for depreciation. Details of the report follow:

EARNINGS AND EXPENSES

Year ending June 30—	1903	1902
Whole number passengers	30,074,457	27,188,965
Average daily	82,396	74,490
Earnings—		
Passenger	$1,503,723	$1,359,448
Advertising, etc.	41,398	48,877
Gross	$1,545,121	$1,408,325
Expenses—		
Maintenance way	$64,298	$59,062
Maintenance equipment	122,867	102,598
Conducting transportation	388,730	346,397
Loop rent and expenses	196,019	179,170
General	84,213	72,985
Total	$856,127	$760,212
Net earnings	688,994	648,113
Other income	9,922	4,384
Total income	$698,916	$652,497
Charges—		
Bond interest	$33,750	$33,750
Taxes	66,845	94,168
Depreciation	50,000	50,000
Miscellaneous	676	....
Total	$151,271	$177,918
Balance for stock	547,645	474,579
Dividends	412,952	412,952
Surplus	$134,693	$61,627
Per cent expenses to gross (including loop)	56.9	54.0

The balance sheet, as of June 30, 1903, shows:

ASSETS

	1903	1902
Cost road and equipment	$11,999,518	$11,804,908
Stocks owned	92,400	92,390
Cost and current account	28,475	66,323
Materials and supplies	23,357	20,791
Other assets	170,316	12,034
	$12,314,066	$11,996,246

LIABILITIES

Capital stock	$10,323,800	$10,323,800
Funded debt	860,000	750,000
Various accounts	177,709	104,582
Profit and loss	952,557	817,864
	$12,314,066	$11,996,246

GROUND BROKEN FOR THREE-CENT LINES IN CLEVELAND

Ground was broken last week on Denison Avenue, Cleveland, for the first of the long-promised 3-cent fare lines promoted by the People's Street Railway Company. Building materials have been distributed along the route, and the company has about a dozen men at work, in charge of Thomas Powers, formerly in the construction department of the Cleveland City Railway Company. The route over which the company holds a franchise is an isolated one, at the extreme southern end of the city, and in itself could not be made to pay with any rate of fare. Mayor Johnson has secured the passage of another ordinance providing for a 3-cent line on Rhodes Avenue, and extending onto Denison Avenue. This is over a portion of the same route as the one on which the company is now building. It is claimed that this grant was secured so that in case the company was stopped by injunction on one street it could go ahead on the other. Ordinances have also been proposed for three more routes in various parts of the city. Mayor Johnson announces that he is advising the promoters to move cautiously, as he claims to foresee an injunction suit. He suggested that it would not be wise to place material in the streets until the old company has taken some action. Thus far the Cleveland Electric Railway has made no attempt to enjoin the work, and it is generally believed that the Mayor is disappointed at this.

CHICAGO ELEVATED TRAFFIC AND THE INFLUENCE OF UNIVERSAL TRANSFERS

Figures on the traffic of three Chicago elevated railroads for the first nine months of 1903, as compared with the first nine months of 1902, seem to show that the adoption of universal transfers over the lines of the Chicago Union Traction Company has considerably reduced the natural increase of travel on the elevated roads. This is especially noticeable on the Metropolitan Elevated, where the increase of travel has been nothing like that on the South Side Elevated. The same influence has also been felt, but it has been less marked, on the Northwestern Elevated. The Northwestern Elevated does not cover as large a territory as the Metropolitan.

The following are the figures referred to, showing number of passengers carried, by months:

	1903	1902	Inc.	P. C.
METROPOLITAN ELEVATED.				
January	112,171	98,029	14,742	15.03
February	116,090	100,466	15,624	15.55
March	116,176	105,512	11,204	10.61
April	117,597	109,246	8,351	7.64
May	109,330	105,799	3,531	3.34
June	111,613	101,734	9,870	9.70
July	102,057	97,929	4,128	4.22
August	102,971	100,099	2,872	3.00
September	112,933	104,751	3,242	2.95
SOUTH SIDE ELEVATED				
January	86,637	79,154	7,483	9.45
February	88,516	79,386	9,130	11.50
March	87,989	80,318	7,671	9.56
April	87,553	81,009	6,544	8.08
May	82,884	76,063	6,821	8.97
June	85,262	76,449	8,813	11.53
July	76,236	70,767	5,469	7.73
August	72,646	68,334	4,312	6.30
September	81,887	76,572	5,315	6.94
NORTHWESTERN ELEVATED				
January	68,206	62,010	6,256	10.00
February	69,885	64,760	5,125	7.91
March	70,070	65,362	4,708	7.22
April	71,340	65,430	5,910	9.03
May	66,990	63,199	3,791	6.00
June	66,571	60,813	5,758	9.47
July	59,393	56,110	3,283	5.85
August	60,093	57,942	2,182	3.60
September	68,107	63,950	4,157	6.50

BRAZILIAN TRACTION PROJECT

An electric traction system is to be built between the city of Rio Janeiro and Nictheroy, once the capital city of Brazil. The length of the road will be about 5 miles. It will be a metric gage line. Dr. Carlos Cesar de Oliveira Sampaio and Antoni Julio de Oliveira Sampaio have secured the concession for the construction and operation of the system. Among the provisions of the franchise is the exemption from import duties of the materials, etc., for the construction of the road and for the first three years of its working.

WATERBURY REPUDIATES "LABOR"

Waterbury, Conn., has justly repudiated at the polls the element that terrorized the community in the recent street railway strike, and by so doing will unquestionably regain some of its former prestige. The population of the city is 50,000, and up to the time of the declaration of the strike last winter there had always existed between labor and capital the most cordial relations. When the labor agitator made his appearance harmony disappeared. The boycott was resorted to when it was seen that the strike was a failure, and the prosecution of the public was carried to such an extent that peace and comfort within the confines of the city became unknown. The memorable Sunday riots, the murderous assault on a car in the suburbs, are too well remembered even to need recital here. The nominees for Mayor were men whose theories and environments were as far as possible removed each from the other. The Democratic candidate was a man of high repute, but a radical of the radicals. A strong unionist, and one of the leaders of the Economic League, his following more than the man was feared. The Republican candidate, a prominent officer of the American Brass Company, was a man of the ultra-conservative type. Pitted against each other, therefore, were the extremes of each party. With the terrors of the despotism of unionism fresh in their minds, the voters of the city went to the polls and did their duty. Overwhelmingly they voted for a return to the conditions that obtained previous to the present administration.

CHICAGO TRACTION MATTERS

Now that the Chicago City Council vacation is over some action regarding franchise matters is hoped for soon. Judge Peter S. Grosscup, of the United States Circuit Court, under whose direction the receivers of the Chicago Union Traction Company are acting, was recently made a tempting offer to retire from the bench and argue the merger cases of the Northern Securities Company. Judge Grosscup returned to Chicago last week and in response to the many interested inquiries regarding his future movements gave out an interview to the Chicago press, which is of interest, because of the light it throws on his attitude toward the Chicago franchise question. The judge said:

"About six weeks ago some men who are interested in the merger cases came out from New York, and while here asked me if I would argue those cases in the Supreme Court. I told them that to do so would require my resignation. I have considered the whole matter carefully, and as a result have determined not to resign.

"I have some conscience on the subject of accepting office, and believe that when one takes office it ought not to be laid aside merely to subserve a personal interest. I have a great desire to practice law again, and, as a mere lawyer, would like, of course, to argue the merger cases, for they will be historical—the greatest in consequence and interest since the insular cases. But I have got to a place in the traction situation where I could not lay it down without injury, I fear, to the interests committed to my care.

"Those interests are twofold—the interests of the public, whose servants the traction companies are, and of the investors, whose property the traction interest is. I believe the Mayor and the Common Council wish to bring about an honorable adjustment of these interests. I feel that I can help them as against any unjust or exorbitant demand on the part of the companies, and as against any purpose in any quarter to take property without compensation.

"I sought neither of these responsibilities, but having acquired them in the performance of my duties I do not feel that I can, for mere personal advantage, run away from them. The meanest man is the one who won't stay by his duties when they get him into a tight place.

"Then, there is another reason more general than the last, which has influenced me. It grows out of my relation to what is called the trust problem. Personally, I believe in combinations of capital. I believe that they are here to stay, and, properly controlled, will help rather than hurt the public interests. But the time has come to insist that corporations of every character be honestly organized and honestly managed and controlled, and I think I have done something toward creating a public sentiment in that direction, and back of everything I have done—more than anything else in getting me the public ear—has been the moral weight of my judgeship. To lay it aside now would seem like surrendering opportunity to dollars.

"My wish—and as far as I can control affairs, my purpose—is to bring about an immediate solution of the traction problem. If there be no immediate solution, the fault will not be here."

According to Edwin Burritt Smith, special counsel for the city of Chicago, publication of the plan for the City Railway franchise is not possible until about October 10. All the questions have been agreed on practically, except the greatest problem—that of rate of compensation to the city. There are no former figures as a basis and among the data to be considered are operating expenses now and in the future, fixed charges, etc.

"In the main," said Mr. Smith, "we believe Mr. B. J. Arnold's figures are substantially correct. No exact offer of compensation rate has been yet made on either side, and we are approaching the subject slowly."

Discussion of public ownership of the street railways was the feature of the City Council meeting Monday, Oct. 5. A petition from the Municipal Ownership Delegate Convention, said to contain 60,000 names, and favoring an ordinance providing for submission of the Mueller act to popular vote, was referred to the committee on local transportation. The Aldermen were urged not to pass street railroad franchises until the Mueller act had been submitted to a referendum at the next city election.

ANOTHER NEW RECORD ON THE ZOSSEN LINE

A special press cable, dated Berlin, Oct. 6, says that an electric car on the Marienfelde-Zossen experimental line reached a speed of 125 4-5 m. p. h. that day, or a kilometer more than the highest previous record. The machinery and roadbed were unimpaired, so the cable says, and the engineers are determined to try for still higher speeds, and venture the opinion that they will be able to attain the rate of 140 m. p. h. The new record was made by the car used in the previous tests, but the information at hand says that another car of somewhat different equipment as to motors and transformers has been built for additional high-speed tests. The statement is made that while the engineers do not believe a speed of 125 miles is practicable at present on the State railroads, they are prepared to recommend a speed of 93 miles an hour between Berlin and Hamburg.

STRIKE THREATENED IN CHICAGO

A crisis in the relations of the Chicago City Railway Company and its union employees which may result in a strike was reached Monday, Oct. 5, when General Manager McCullough refused the demands of a delegation of employees headed by President William D. Mahon, president of the Amalgamated Association of Street Railway Employees of America. The men demanded an increase of pay for men in the electric train departments, a reduction in hours for the car house and repair men, and the employment of only union men. Decisive action on the matter will be taken by the employees on Saturday evening, Oct. 10, when a special meeting will be held to vote on the question of ordering a strike.

NEW BRIDGE TRAFFIC PLAN TRIED IN NEW YORK

A fifty-four minutes' test, Tuesday, Oct. 6, on the Brooklyn Bridge of what is known as the Poulson plan to relieve the congestion of the trolley car patrons at the Manhattan terminus and minimize the peril of crossing four loops failed to convince officials of the Department of Bridges and of the Brooklyn Rapid Transit Company that it was practicable in "rush hours." Neils Poulson, the author of the plan, who is president of the Hecla Iron Works, said after the test that he was not satisfied with it, because neither the motormen nor the public had been properly drilled to make it successful and that other trials would be had.

Mr. Poulson's scheme of relief was to utilize all available space at the bridge entrance, to have a single loop track at the extreme western end of the surface car terminus, to unload the cars in groups of five on the north track, and to load them on the south track, also in groups of five, and to have no passenger leave or board the cars on the loop. The test was under existing conditions, but the plan contemplates the raising of the single loop so that passengers leaving and taking cars shall pass under the loop from and to the groups of five, and that proper exit and boarding platforms shall be constructed. It was planned that during the trial no vehicles should use the north and south roadways, and that passengers from and to the elevated trains and promenades should not cross the loop, but use the extreme western stairways.

At the point of arrival, where the cars made groups of five as they came up single, were five trolley inspectors, one for each car. At the point of departure were as many inspectors. Mr. Poulson controlled a gong, which, when sounded, started ten cars, five at the arrival point and five at the starting point. The dead cars moved round the loop 10 ft. apart. The first starting car speeded so as to open up a "spacing" headway. The test summarized resulted as follows:

First cars were started on afternoon schedule time, 160 to the hour, for half an hour. Employees worked in good faith, getting 85 cars through, or at the rate of 170 to the hour, without a hitch. Then "extras" were switched on to make up a "rush-hour" condition. In 24 minutes 100 were got through, or at the rate of about 117 in half an hour instead of 140, and the north track was blocked to the entrance on the Brooklyn side. Then the trial was called off, and the usual afternoon schedule resumed.

THE CRAWFORDSVILLE CASE

Judge Baker, of the United States Federal Court, adjudged Attorneys Harding and Johnson, President Townsend and Contractor Wise, of the Indianapolis & Northwestern Traction Company, not guilty of contempt of court in the Crawfordsville, Ind., franchise case, but held that the company had violated a restraining order of the Montgomery Circuit Court in putting down its tracks in the city. The court decreed that the defendants should pay the costs of the suit, and pay to the Consolidated Traction Company $200 for expenses brought about through the contempt proceedings, also that the Indianapolis & Northwestern take up its tracks in case the suit now pending against it by the Consolidated Company for possession of the streets should go against it. The case will now be tried on its merits. The Council of Crawfordsville first granted a franchise to the Indianapolis & Northwestern Company. This franchise was accepted and a bond filed with the city clerk. Subsequently the Council abrogated this franchise, and granted a franchise exclusively to the Consolidated Company. Which of these franchises is to stand is the question for the court to determine.

PUBLIC SERVICE EMPLOYEES VOTE AGAINST STRIKE

The announcement was made on Friday, Oct. 2, in Newark, that the employees of the Public Service Corporation, controlling the street railway lines in Newark, Jersey City, Paterson, Hoboken and surrounding country, had voted overwhelmingly against a strike on the company's system. Seventy-five per cent of the votes cast in Essex, Passaic, Hudson and Union counties were against the proposed strike, and less than 10 per cent of the entire number of motormen and conductors employed voted for the strike; that is, out of 2500 men on the pay rolls 224 voted for going on strike. The agitation for a strike has been prevalent for some time, and finally ended in the decision just recorded.

STREET RAILWAY PATENTS

UNITED STATES PATENTS ISSUED SEPT. 21, 1903.

[This department is conducted by W. A. Rosenbaum, patent attorney, Room No. 1203-7 Nassau-Beekman Building, New York.]

739,364. Maximum Traction Truck; Charles F. Uebelacker, Kingston, N. Y. App. filed Aug. 25, 1898. Embodies, among other features, a center-bearing swing-bolster and a two-part slide attached to the car body and the truck, and arranged to guide the swing of the truck under the car body, and to bring the pivotal center of the truck in close proximity to the axle of the driving wheels.

739,386. Automatic Sanding Device; Will F. Cady, Harrison Valley, Pa. App. filed June 16, 1903. Means for automatically opening the sand valve when the car is started or stopped.

739,518. Railway Block Signaling System; Herbert B. Taylor, Newark, N. J. App. filed Aug. 2, 1901. Relates to details of a track circuit system.

739,582. Street Car; John A. Brill, Philadelphia, Pa. App. filed April 17, 1903. The side sills in an "open" car comprise two parallel strips of metal which are held in position and separated by means of hangers, which support an intermediate step and the running board.

739,588. Electric Braking; Frank E. Case, Schenectady, N. Y. App. filed July 6, 1900. As the speed of the vehicle decreases, the magnetization of the brake-actuating devices can be reduced without reducing the current generated by the motors under momentum by a corresponding amount.

739,605. Brake-Shoe; Harry Jones, Mahwah, N. J. App. filed Oct. 9, 1902. The brake-shoe is provided with a malleable wire skeleton hook for attaching it to the brake-head.

739,632. Trolley Catcher and Replacer; James V. Ainsworth, Los Angeles, Cal. App. filed Jan. 22, 1903. Details.

739,742. Street Railway Switch; George W. Thompson, Pittsburg, Pa. App. filed Dec. 2, 1902. Comprises, in connection with a pivoted switch tongue, a cable which is connected to the tongue and is extended over pulleys suitably arranged in the roadbed and pivotally connected at one end to a trip located adjacent to one of the rails, and adapted to be actuated by the car wheel.

739,749. Switch-Operating Mechanism; Zachariah L. Trainham and Harry E. Eastman, Richmond, Va. App. filed April 16, 1903. Consists in providing a pivoted disc having a curved slot therein, within which is mounted the end of a link connected to a bell-crank lever, one arm of which projects above the roadbed, and is adapted to be depressed by suitable mechanism on the car.

739,771. Car Truck; Walter S. Adams, Philadelphia, Pa. App. filed June 21, 1902. A car truck having a frame and axle-box pedestals provided with inwardly extending lugs, upwardly-arched semi-elliptic springs, supported by the lugs, links resting upon the semi-elliptic springs and adapted to have longitudinal and transverse swing, and a bolster pivotally supported by the links.

739,772. Car Truck; Walter S. Adams, Philadelphia, Pa. App. filed June 21, 1902. Consists of a frame with pedestals, perforated lugs projecting inwardly from the pedestals, swing-links supported by the perforated lugs and semi-elliptic springs engaging the links.

739,794. Semi-Convertible Car; Warren M. Smith, Borough of Prospect Park, Pa. App. filed May 13, 1903. An improved construction whereby either one or both of the upper and lower sashes of each window of the car may be lowered completely below the window-sill.

739,799. Arm Rest for Semi-Convertible or Other Cars; Samuel M. Curwen, Philadelphia, Pa. App. filed April 17, 1903. In a semi-convertible car in which the window-sills are very low, an arm rest is secured to the panel in such a manner as not to interfere with the sash locks.

739,800. Car Truck; Walter S. Adams, Philadelphia, Pa. App. filed June 21, 1902. Consists of side frames provided with axle-box pedestals, semi-elliptic springs links and spring supports for the links on the pedestals for supporting the semi-elliptic springs, and a bolster rigidly attached to the semi-elliptic springs.

739,801. Car Truck; Walter S. Adams, Philadelphia, Pa. App. filed June 21, 1902. Means connected with the frame for supporting longitudinally thereof a plurality of arched semi-elliptic springs, links pivoted to the arches of the springs, and a bolster pivoted to the lower extremities of the links.

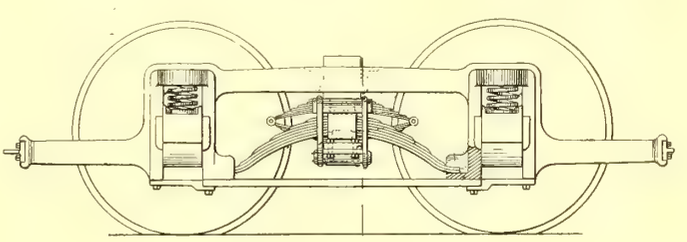
739,802. Car Truck; John A. Brill and Walter S. Adams, Philadelphia, Pa. App. filed June 7, 1901. An equalizing bar supported by the journal boxes, a truck side frame, and springs interposed between the extended ends of the equalizing bar and side frame and resting on said equalizing bar.

739,803. Sand-Box for Railway Cars or the Like; Henry E. Haddock, Philadelphia, Pa. App. filed Jan. 14, 1903. Details of construction.

UNITED STATES PATENTS ISSUED SEPT. 29, 1903

739,816. Contact Stud and Fixing for Use with Surface Contact Systems of Electric Traction; Benjamin H. Bedell, London, England. App. filed May 12, 1903. A stud composed of magnetic material having a switch-piece electrically connected therewith, also composed of magnetic material, and suspended at the lower end of the stud, and an electrical conductor supported on a series of insulators which are adapted to revolve on pins.

739,819. Electrical Tramway or Railway Rail; Henry M. Bigwood and Horace Bigwood, Wolverhampton, England. App. filed April 14, 1903. The tread and web of the rail are separate pieces,



PATENT NO. 739,771

and a bonding plate is inserted between the two parts at the joints of the rail lengths.

739,899. Marginal Protecting Strip for Pavements; Daniel Mullen and Andres A. Mullen, New York, N. Y. App. filed Sept. 24, 1901. A metallic protecting strip arranged adjacent to car rails, and means for anchoring the same.

740,037. Trolley; Jacob M. Olinger, Vienna Crossroads, Ohio. App. filed Aug. 1, 1903. Details.

740,074. Multiple-Control System for Railway Vehicles or Trains; Louis M. Aspinwall, Wilkinsburg, Pa. App. filed Feb. 6, 1903. An electro-pneumatic controlling system, the main object being to provide means for insuring automatic step by step operation of each controller.

740,081. Means for Diminishing, Deadening and Preventing Sound; Henry W. Blair, Manchester, N. H. App. filed Sept. 29, 1896. A casing for the motor having a lining of non-sound-conducting material.

740,105. Trolley-Restoring Device; Charles W. Dowling, Newark, Ohio. App. filed Jan. 31, 1903. Details.

740,129. Fender for Cars; John Haskins, Boston, Mass. App.

filed Feb. 21, 1903. Comprises a main and auxiliary platform, the main platform being hinged to the frame and to the auxiliary platform, and the auxiliary platform being movable lengthwise of the frame.

740,134. Lift Guard for Trams; Walter Hirt, Breslau, Germany. App. filed Nov. 7, 1902. A series of loops of cane or similar elastic material arranged across the front of the car.

740,144. Trolley Pole; Phineas F. King, Cleveland, Ohio. App. filed Aug. 23, 1902. A rachet segment and pawl at the trolley base for locking the pole at the inclined position in case the wheel leaves the wire.

740,205. Trolley Wire Crossing; Oliver Vanorman, Los Angeles, Cal. App. filed June 2, 1903. Two members pivoted together, each having oppositely disposed arms, the arms having channels for the reception of feed wires.

740,272. Trolley-Pole Controller; Charles Harter, South Pasadena, Cal. App. filed July 9, 1903. The trolley pole is controlled by pneumatic cylinders mounted at the base.

740,279. Switch-Operating Mechanism; Oliver D. Hunt, Columbus, Ohio. App. filed Jan. 19, 1903. Details of construction.

740,299. Life-Saving Device for Vehicles; Kenneth Mooring, Rockland, Ohio. App. filed June 2, 1903. A frame attached to the car and inclining downward from the buffer, a receiving platform having its inner end movable and its outer end pivoted between the inclined frame, a catching net having the members of its lower end slotted to receive the movable end of the receiving and tilting platform, and a pair of guard rails connected to the car, and to the front end of the fender.

740,313. Trolley Catcher; Charles B. Robertson, Ottumwa, Ia. App. filed Dec. 13, 1902. Details of a pawl and ratchet and spring drum controller.

740,356. Switch-Tongue Operating Mechanism; Harry A. Earl, Cleveland, Ohio. App. filed Feb. 20, 1903. Details of construction.

740,375. Motorman's Valve for Air Brakes; John Shourek, Pittsburg, Pa. App. filed Dec. 22, 1902. Means for automatically operating the gong-ringing mechanism and the sand-applying mechanism when the brake is applied.

ENGINEERING SOCIETIES

A meeting of the Franklin Institute was held at the hall of the Institute, in Philadelphia, on Thursday evening, Oct. 8. Mr. W. E. Harrington, general manager of the Camden & Suburban Railway Company, of Camden, N. J., will present a paper entitled: "Rail Bonds." Several additional brief communications are expected.

PERSONAL MENTION

MR. JOHN H. PARDEE, who has been manager of the Ontario Light & Traction Company since its organization, several years ago, has been appointed manager of the new Rochester & Eastern Rapid Railway, of Rochester, N. Y.

MR. FRANK O. NOURSE, purchasing agent of the Appleyard syndicate, at Columbus, has resigned, to take effect Nov. 1. It is understood Mr. Nourse has accepted a very good position with a railway supply house in the East.

MR. L. H. WHEELOCK, superintendent of the Amherst & Sunderland Street Railway, of Amherst, Mass., has been appointed superintendent of the Claremont Street Railway, of Claremont, N H. He will be superintendent of both roads.

MR. GRANT R. BUCHANAN, formerly chief train despatcher of the Lake Shore Electric Railway, of Cleveland, Ohio, has been appointed superintendent of the Cleveland division of that company.

MR. A. G. HEGGEM, who has been for several years general superintendent of the Russell Engine Company, of Massillon, Ohio, has resigned his position, and after Nov. 1 will open an office in Kansas City, Mo., from which to conduct a general engineering business.

MR. JERE C. HUTCHINS, president of the Detroit United Railways Company, of Detroit, Mich., has returned from Europe, and is now in active charge of the property. Mr. Henry A. Everett, who has been in charge of the property during Mr. Hutchins' absence, has returned to his home in Cleveland.

MR. CHARLES E. DRESSER, treasurer of the Waltham Street Railway Company, of Waltham, Mass., died in Boston Tuesday, Sept. 29. His death was unexpected, and was caused by fatty degeneration of the heart, from which disease he had suffered for some time. He was seriously ill but an hour when death came. Mr. Dresser was born at Lee, Mass., thirty-eight years ago, and was unmarried.

MR. A. J. CASSATT, president of the Pennsylvania Railroad Company, has resigned as third vice-president of the Public Service Corporation of New Jersey, because, it is said, of the pressure of other business. Mr. A. B. Carleton, formerly president of the United Electric Company, has been elected as his successor.

MR. MAXWELL E. NASH, formerly superintendent and claim agent of the Milford & Uxbridge Street Railway, of Milford, Mass., has been appointed assistant superintendent of the Boston & Worcester Street Railway, having charge of the operation of cars on the line between White's corner, Fayville and Hudson. Mr. Nash left Milford last May and went to Porto Rico.

MR. W. H. ZIMMERMAN, who for the past two years has been on the engineering staff of the Arnold Electric Power Station Company, of Chicago, has been appointed general manager of the De Kalb-Sycamore Electric Company. This company now operates 6 miles of road between De Kalb and Sycamore, and central station plants in both towns. Rights of way have been obtained for extensions in the direction of Belvidere, Ill.

MR. E. W. GOSS, retiring general manager of the Milford & Uxbridge Street Railway Company, of Milford, Mass., was presented with a beautiful diamond stud a few evenings ago by the employees of the company, as a token of appreciation. Mr. Goss has decided not to take up the active management of another property until he has had a thorough rest. He will soon start for Florida, where he expects to spend the winter with his family.

MR. W. F. BRYCE, JR., has been designated by the Virginia Passenger & Power Company, of Richmond, Va., to take charge of the transportation department of the Petersburg lines. Chief Engineer of the Railway Department Mr. Calvin Whitely will take charge of the roadway and tracks, and Mechanical and Electrical Engineer Mr. George H. Whitfield will have charge of the wires and mechanical portion of the line. Mr. Harvell will still remain as superintendent, but will be chiefly engaged in looking after the work on the power plant.

MR. GEORGE T. BISHOP has assumed the presidency of the Eastern Ohio Traction Company, of Cleveland, Ohio, succeeding Mr. H. Clark Ford, who resigned recently. It is the intention of the company thoroughly to rebuild the Chagrin Falls division of the road. Mr. Bishop states there is no truth in the published report that he is to succeed Mr. R. L. Andrews as general manager of the company. Mr. Andrews is general manager of the Youngstown & Southern Railway, but he will continue to have charge of the affairs of the Eastern Ohio Company.

MR. J. V. DOZAL, of Mexico City, Mex., former attaché of the Mexican Legation in Washington, sailed for home a few days ago, after visiting Baltimore and Pittsburg. While here Mr. Dozal arranged contracts for rolling stock for the new railway from Zimatlan to Oaxaca, the corporate name of which is the Ferrocarril Urbano y Agrico de Oaxaca. He stated that part of the line is to be equipped with a third-rail system if present plans of the company mature. Engineers are now surveying the property of the Alcasia Development Company located 12 miles south of Cananea, State of Sonora in the Ajo Mountains, where it is purposed to construct a large electric power plant, the machinery for which Mr. Dozal has arranged to be supplied by several firms in the United States.

MR. ALEXANDER CLARK, for the past twenty years one of the leading practicing lawyers at the Chicago bar, and a resident of Evanston, died very suddenly Sunday morning, Sept. 27, at Antioch, Ill., where he had gone in the interest of the Chicago & Milwaukee Electric Railway. Over-exertion in hastening to catch a train is supposed to have brought on heart failure. In his twenty-two years of practice at the bar in Chicago Mr. Clark had come to be recognized as one of the ablest lawyers in his line in the city. For years he had been the legal adviser and representative of several large corporations. He was, at the time of his death, one of the attorneys for the Union Traction Company, the Union Elevated Loop Company, the Chicago & Milwaukee Electric Railroad, and the Waukegan & North Shore Electric Railway. Aside from his business connections, Mr. Clark was prominent as a promoter of public enterprises. It was due to his efforts that the Evanston electric extension to the Union Traction system was accomplished in 1894. The Union Elevated Loop, in the downtown district, also represented the fruit of his services. Mr. Clark is survived by a wife and two children.

INDEXED

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114 Liberty Street, New York.

The Convention of the New York State Street Railway Association

The convention of the New York State Street Railway Association is one of the annual events which the street railway managers of the State anticipate with interest, and, we assume, look back upon with pride. They certainly are entitled to feel proud of the excellent work of the Association because its yearly meetings are productive of valuable papers and discussions which undoubtedly have contributed greatly to the advance of the science of electric railroading.

The Syracuse Convention last week was no exception to the rule which has hitherto prevailed in regard to these meetings. A total of eleven written papers were presented at the meeting, and, in addition, some of the addresses on important subjects of topical discussion were of a length and character which entitle them to be ranked with a written discussion on the subject treated. The Association has the active support of the majority of the principal roads of the State, several of which showed their interest in the meetings by being represented at Syracuse by eight or ten of their most prominent officials.

Although the period of the meeting was confined to two days, the social features of the convention were by no means sacrificed to the business sessions. The Syracuse railway companies were most hospitable in their entertainment of the delegates and other attendants at the convention, and although the business sessions were held both in the morning and in the afternoon of Oct. 6, the banquet Tuesday evening, the excursion to Skaneateles Wednesday afternoon, and the excursions provided for the ladies on Oct. 6 and on the morning of Oct. 7 gave ample time for relaxation and amusement.

Those who observe the results of the Association as evinced at its annual meetings should not assume that these results represent the work of a few days or weeks only. The convention is simply one outward evidence extending over two days of the enthusiasm in the Association throughout the year of its principal members. A meeting of this kind means a large amount of preliminary and extended effort on the part of the officials of the organization, of the gentlemen who presented papers, of the committees who report, and of the hosts of the Association who prepared the entertainment, and too much credit cannot be given to all of them for the results attained. The value to the street railway interests of the State of having an active body of this kind organized for mutual benefit and support can hardly be over-estimated. Possibly some of the same results could be secured without the annual meeting, but we doubt very much whether the same enthusiasm for cooperation would exist among the members if the annual convention, with the opportunity which its provides for mutual acquaintance and discussion, were minimized or omitted. It would be difficult to enumerate all of the benefits to be derived from an association of this kind, but it is safe to say that without it the important report of the committee on rules, one of the greatest benefits which the Association has conferred upon the interests of the State, would never have been formulated and adopted, and that there would have been a much greater amount of unwise legislation, which, under the present conditions, has been prevented by the submission at Albany of evidence of the effect which such legislation would have upon the development of electric railways in the State.

We expect to discuss individually several of the papers presented at the Syracuse meeting in this and the next one or two succeeding issues of this paper, so that it will not be necessary to refer to them further in this connection.

We congratulate the Association upon the election of Mr. Connette as its presiding officer during the coming year. Both Mr. Connette and Mr. Cole, the newly-elected secretary and treasurer of the Association, have been prominent members of the State Association and of the National Association for a number of years, and none are held in higher esteem. We look forward during their management to a continuation of the prosperity which has marked the administration of President Rogers during the last nine years, and are confident that they and the other incoming new officers and executive committee of the Association will have the same cordial support and cooperation of the other members which has characterized the history of the Association in the past.

President Rogers' Resignation

In looking back upon the history of the New York State Street Railway Association during the last nine years, President Rogers must feel a large sense of personal satisfaction over the condition of the Association and the results of his ad-

ministration. When first elected to the presidency, nine years ago, the association, while a most useful one to its members, was not characterized by the same enthusiasm and prestige as at present. The number of companies at the Syracuse convention in 1894, at which Mr. Rogers was first elected president, was twelve, with the same number of visiting delegates, while only three papers were presented. Since that date President Rogers has succeeded in demonstrating to every street railway interest in the State the importance of an association of this kind, and he retires from office leaving the organization in the most prosperous condition. Two features introduced by him, so far as the meetings are concerned, undoubtedly added greatly to the interest and value of these gatherings. One is the annual address presented by the president, which summarizes the progress made in the State by the street railways during the preceding year. These addresses are the best summaries with which we are acquainted of the important events of any State during the year. They not only have a present interest in outlining to the members the events which affect their properties favorably or unfavorably, but they also constitute a fund of information of ever-increasing historical value as time elapses. The other feature introduced by Mr. Rogers at the annual meetings was the elimination of the long papers and the presentation in their stead of a larger number of short papers or addresses on practical subjects by different members of the Association. The result of this policy has been to interest a great many members of the Association, to produce discussions on a large number of topics and impart an eminently practical character to the meetings. We regret that the pressure of private business has compelled Mr. Rogers to resign his office as president of the Association, but in doing so he can have the satisfaction of looking back upon a work well performed, and also in relinquishing the duties to such competent hands as those of Mr. Connette.

In referring to the past work of the Association we must also congratulate the body upon having secured and retained the services of H. A. Robinson as secretary and treasurer for so long a period. We believe that all of the members of the Association realize that the work of this office involves a large personal sacrifice of time and energy, and this has been particularly true in the present instance owing to the very responsible duties of Mr. Robinson as head of the legal department of the Metropolitan Street Railway Company. Nevertheless, Mr. Robinson has attended all of the meetings of the Association, has conducted its business with the same ability and success which has characterized his important legal duties, and through his department has contributed a number of valuable papers on this branch of street railway operation.

Tickets and Transfers

Two interesting papers were submitted at the Syracuse Convention by John E. Duffy, of Syracuse, on the "Use and Abuse of Transfers," and J. E. Stephenson, of Buffalo, on "Interurban Ticketing." Both writers emphasized the importance of adopting a system that would involve as few complications as possible, and they called attention to the fact that the duties and responsibilities of a conductor of an electric car were far greater and more numerous than those of the man in charge of a steam passenger train. Mr. Stephenson put the case concisely when he said that an electric car was at once a passenger coach and a moving ticket office, that its conductor was both a conductor and a ticket agent, that its stations were on every street corner, at each highway crossing, and, indeed, almost anywhere along the line. On interurban railways passing through two or more cities the requirements are even more numerous and exacting than in city service, for the conductor must be familiar with the city as well as the rural traffic. He must know the transfer points, the prominent places in the cities, and such other information as may be required by patrons. Consequently, it should be the aim of every manager to adopt the most simple, efficient and satisfactory ticket and transfer system, especially for interurban work.

Mr. Duffy's paper naturally treated more particularly of city service, and he also made a strong appeal for simplicity, both on behalf of the conductor and the public, as it was the surest means to secure higher efficiency in the service. He warned managers not to make transfers so complicated that their examination, when presented, would take so much time that the conductor would lose in the meantime three or four fares that he might have collected. Generally speaking, it is admitted that the transfer has proven advantageous to the company as well as to the passengers, and like most street railway men who have had practical experience in this matter, Mr. Duffy recognizes the importance of extending the system as much as possible, and at the same time guarding against the abuse of these privileges by the public. He points out that the public knows that it is entitled to certain privileges upon payment of fare, but it is hard to satisfy as to how far these privileges extend. It is suggested that concerted action might be taken on the part of the railway companies to have the courts define exactly their rights and those of the public under the law, as experience has shown that regardless of how much is given the public will demand more with the ever-increasing use of the street railway lines. Up to the present time the companies have been satisfied with the knowledge that their business has been increased by the adoption of the transfer, and very few, if any, of them have found out whether they are receiving an equitable portion of the advantages.

The Treatment of Accident Cases

One of the most interesting and fruitful topics discussed at the Syracuse Convention was that in relation to the treatment of accidents from a legal and medical standpoint, represented by the papers of Mr. Dibbs and Dr. Moorehead, of the Interurban Street Railway Company, of New York. So far as we can recall, this is the first convention at which the accident question has been discussed from the standpoint of the physician, a somewhat surprising fact, because the legal department of all railway companies is almost wholly dependent upon a medical examination for competent knowledge of the actual injuries received by a claimant, and most of the large companies have organized a medical staff consisting of one or more physicians. The fact that this topic has not been taken up more thoroughly at previous conventions is undoubtedly due to the reason that an exact discussion of it by a physician would involve a knowledge of medical affairs and definitions which is not possessed by those outside the profession. Nevertheless, Dr. Moorehead succeeded in outlining in a clear and untechnical way the advantages of the medical examination, and his paper in conjunction with that of Mr. Dibbs, which discussed the same subject from the standpoint of the claim department, form a series of treatises which are worthy the earnest consideration of those railways whose accident account is of considerable magnitude.

If a medical diagnosis is difficult of comprehension by the ordinary layman, what must it be to the average juryman, especially when the medical experts on both sides disagree as

to the cause or results of the injury upon which the jurymen are called upon to assess the monetary damages? This is especially the case when one or both sides, intentionally or unintentionally, define their views and base their conclusions on premises which can only be understood by an expert. Experience has shown that in cases of this kind, the only solution is a compromise verdict, independent entirely of the justice in the case.

While ordinary surgical cases are difficult enough to adjust, damage cases for personal injuries are often complicated by those effects, which Dr. Moorehead classes in general as nervous prostration or neurasthenia. To what extent this trouble is caused by the injury itself and to what extent by inheritance, previous shock, the attitude of mind of the patient himself, or other outside cause, even the actual physical condition of an injured person with neurotic tendencies, are very serious problems to members of the medical profession themselves, and the reference of such cases to an absolutely unqualified jury, no matter how well-intentioned they may be, is almost certain to carry injustice with it. Such damage claims can be properly adjudicated only by a selected body of experts, and if this was done the mystery which surrounds the conflict of medical evidence in personal injury cases would largely pass away.

Incidentally, in this connection, the system described by Dr. Moorehead in examining cases of this kind in the course of his duty, and some of the benefits derived therefrom, are worthy of most careful consideration.

Train Despatching on Electric Roads

The discussion on this topic at the Syracuse Convention recognized the lack of uniformity in the methods employed, and freely criticised the defects in the systems that have been commonly introduced in electric interurban service. The Association showed a commendable spirit in recommending this subject to the special consideration of the committee on rules, expressing the wish that a standard system might be evolved. This action followed a suggestion contained in Mr. Hart's paper, that in view of the widely differing practice in electric signaling a convention of despatchers be held during the coming winter for the purpose of discussing the question of safe operation under the train order system and also for adopting a set of rules and forms for the government of all the companies represented. Such an association, it is needless to say, might be productive of many improvements in existing systems and might tend to institute reforms in the methods employed on many roads, especially if working in conjunction with the State or national body. The principal advantage, of course, would be in the exchange of ideas among practical men of this department, which eventually ought to develop the groundwork for a standard system of signaling, especially adapted to electric railway operation, subject to such modifications as would be necessary to meet local conditions.

Two papers were read before the convention, and both were highly commended in the debate that followed. Mr. Hart, in his paper entitled "Despatchers' Duties and Electric Signals," devoted considerable attention to the importance of the despatcher because of the dependence placed upon him for the safe operation of the road. The author dismisses the consideration of electric block signals, as applied to trolley lines, and used alone as an operating measure, with the statement that they do not possess the first principles of a safe device. He declared that no signal should be used as a running measure that does not provide, in case of any break or disarrangement, for the signal going immediately to "danger," and he disapproves of the use of any device as an absolute running signal which depends for its means of operation on either the car or crew.

Mr. Wilcoxen's contribution on "Interurban Train Despaching" is interesting and valuable as an expert opinion on the several systems of signaling in vogue and because it contains a description of a practical installation in everyday commercial service. He admits that an automatic block signalling system in conjunction with an efficient telegraph system would be an ideal situation, but he contends that this is not to be expected, as the cost would be prohibitive, and either one of these factors of itself, it is pointed out, would not be satisfactorily applicable to electric railroading. Mr. Wilcoxen looks with disfavor upon the telegraph and block signal systems because the first requires a larger force and much greater expenditure of money than the electric interurbans are in position to pay, and the second cannot be depended upon solely owing to atmospheric conditions and mechanical defects. Mr. Wilcoxen declares that provision must be made for other methods of controlling the operation of trains when the electric block system is out of order. For these and other obvious reasons the telephone is regarded with general favor for this class of work. The system used on the Rochester & Sodus Bay division of the Rochester Railway System is described in detail, and its advantages enumerated.

The interest manifested in this subject by the delegates throughout the discussion is indicative of the growing importance attached to it by managers of interurban properties, and the action of the convention can be accepted as assurance of an earnest desire to solve the problems involved.

Pegging Up the Record

Not only have the experiments at Zossen already reached and passed the allotted 125 m. p. h. speed, precisely as we predicted in our issue of Oct. 3, but they are going on toward the new and magnificent objective of 140 m. p. h. Whether this will be reached or not remains to be seen, but we are inclined to think it will. A new stage of strain on the track may be reached at the increased speeds which may call a halt, and there may be trouble encountered from the call for large output at the increased frequency demanded, but the outlook upon the whole is good. An amusing feature of the press reports of the tests is the grave statement that the lives of those on the car were heavily insured. If this is correct it indicates that the German insurance companies are not worrying much about the dangers of high speed unless they are permitted to operate on a far less conservative basis than American companies, which we hardly think is the case. The result of the work thus far has been a well-won victory against Father Time—won by careful investigation and persistent effort. We know of no other case in which a great engineering problem has been thus attacked by the united efforts of a great group of engineers, backed by a syndicate organized for the especial purpose of solving it. This is the sort of combination that can do great things for the world's industry. It is no trust for the purpose of limiting production and squeezing the consumer, no merger for the purpose of attaching a fictitious value to worthless securities, but a united and deliberate effort on the part of the captains and pilots of industry to find a new channel for the world's communications. We rejoice in the success of the undertaking and earnestly hope that no unexpected difficulty will arise in the extension of the work beyond the limits originally assigned. It has been a great work magnificently carried out.

PROCEEDINGS OF THE SYRACUSE CONVENTION

The twenty-first annual meeting of the Street Railway Association of the State of New York, was held at the City Hall, in the city of Syracuse, N. Y., Oct. 6 and 7, 1903.

The meeting was called to order by President G. Tracy Rogers, of the Association, at 10:35 a. m. After the secretary, Henry A. Robinson, had called the roll, the president introduced to the members of the convention Mayor Jay B. Kline, of Syracuse, who welcomed the delegates to the city of Syracuse.

The president then delivered his annual address, which was published on page 703 of last week's issue. Secretary Robinson then read the reports of the secretary and treasurer, which were approved. The secretary then read a communication from Professor George F. Comfort, inviting the members of the Association to visit the Museum of Fine Arts, and another from the Central New York Telephone & Telegraph Company tendering to the Association the use of its service during the convention.

On motion, duly seconded, it was voted to extend the thanks of the Association to Professor Comfort and to the officers of the telephone and telegraph company for their kindness.

The President—The first paper will be Mr. Duffy's, on "Transfers, Their Use and Abuse." (This paper was published last week on page 705.)

Mr. Rockwell—There is one part of that paper to which I would like to take exception, and that is the statement that the transfer has come to stay. I would like to see it abolished altogether. It is the most burdensome thing that has been imposed upon railroad companies. I would rather give the passengers a 4-cent fare and abolish the transfers altogether. They charge for transfers in Philadelphia, and I don't know why it can't be done in other places.

Mr. Cole—In Elmira the demand for transfers is probably greater than that in any other city of its size. Every other passenger calls for a transfer; 50 per cent of the travel upon the road is upon transfers, so that we have had to take the question up very carefully. I think one point that might be brought up is the consideration of a standard method throughout the State of the use and handling of transfers, in order to educate the public up to their proper use. To-day there are hardly any two roads using similar transfer punching systems or having transfers that look at all alike, so that the people in using them don't know how to see whether they are punched right or not. One of the sources of kicks from the public is that they claim that the transfers have not been issued properly, and it has been the occasion of several law suits. I think there is no question that the use of transfers has effected an increase of riding in cities of the third class. Take our own city, for instance. A few years ago there were very few transfers given, but after the consolidation of all the lines there was inaugurated a general transfer system, and it had the effect largely to increase our receipts—about 22 per cent for that one year. So I do not think the transfers are entirely an evil. The evil comes from the abuse and improper handling of them. If the misuse of transfers could be done away with I think there is no question that their use would lead up to a great increase in our receipts.

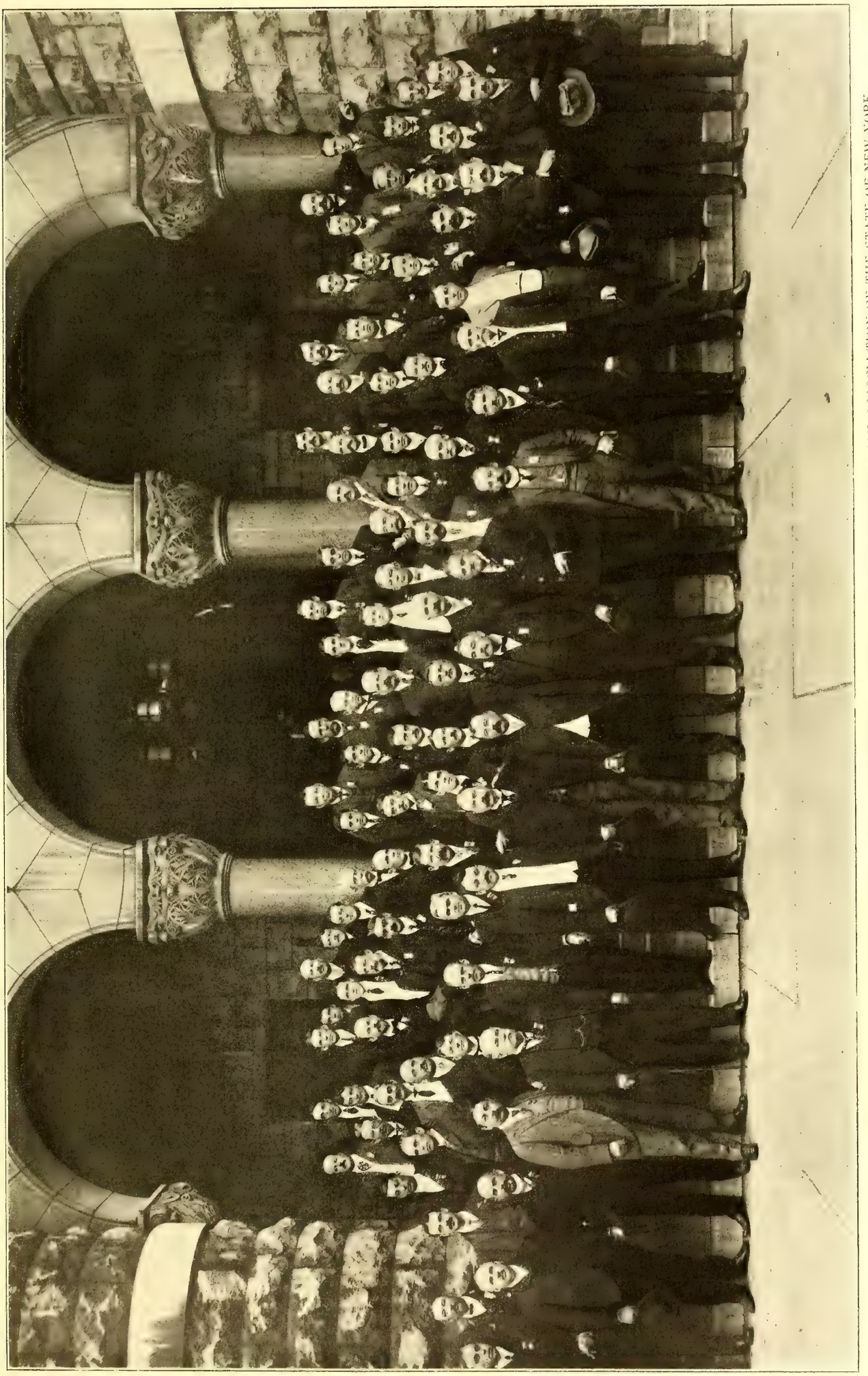
The President—Have you any objection to telling the convention what the results of your law suits were?

Mr. Cole—In each case we have won. In fact we have never lost a law suit in eleven years in Elmira. I understood you to ask in reference to test cases on the use of transfers. The contest was on the time limit, and the company was upheld in insisting upon the time limit.

Mr. Nicholl—The experience of the reader of the paper in Syracuse is very much the same as that which we have had in Rochester. I must say that I would very gladly, in some respects, do away with the transfer altogether, and, as the gentleman has remarked, accept a cheaper fare. But I don't believe that would quite remedy the trouble. I really think that the liberal use of transfers will increase our receipts. We have got to educate the people, especially in a city of the lay-out of Rochester, where it is very easy to walk anywhere and find the center, and I presume the same thing is true in Syracuse. In such cases I think we want to make it as easy as possible for people to ride. In our city the increase has not been very great in the use of transfers. It has kept at about 30 per cent, I think, ever since the use of transfers was adopted. I am very much in favor of what Mr. Cole says, that there should be some action taken in the way of standardizing transfers. I can see, however, many difficulties in that respect, because all cities are not laid out the same and would require different forms of transfers. But at the same time I think there might be something done to educate the people to the use of a certain form of transfer, so that there would be no mistake, and a conductor going from one road to another would understand the system easily without receiving fresh instructions.

Mr. Mitten—I hardly think we can look for the doing away of the transfer system, because in the way that lines are laid out and built in cities of the size of ours, it would create a clamor for the different operation of the lines, or with the majority of the passengers it would become very unpopular. Such a change would make the expense of operation very much greater on cross-town lines or lines which do not directly reach the center of the city, and the residences thereon would be very hard to rent, for the reason that the people would be obliged to pay two fares to get to or from their homes. For this reason we would find a condition of quite high rents in localities reached with one fare, and houses going begging on the lines where two fares were demanded. That would be against the interest of the railway company. We now endeavor, in Buffalo, to use the transfers as a method of building up the newer districts, and as soon as the volume of transfer passengers becomes great enough we endeavor to run such lines of cars directly to the center of the city. If we should cut out the transfer system it would be a great many years before those districts became paying portions of our system. Personally, I believe in the transfer to an extent, and where there is the issue of a transfer upon a transfer, if it is confined to pleasure travel, I don't think its effect upon the earnings will become very detrimental. If the passenger can go to his place of business or his objective point, and by the payment of one fare can procure a transfer which will take him home on the return trip, then, of course, you have lost a fare. But with us, where belt lines are becoming quite popular, if our passenger in an effort to beat the company leaves his home to go to an outlying district and rides around a belt line, then takes a transfer and riding around the entire distance, transfers home, he is getting a pleasure ride; he is acquiring the habit, and we have got his 5 cents. I don't think we lose in those cases. So that while the transfer is not a unmixed blessing, I think it can be used to our advantage.

Mr. Rockwell—I am perfectly willing to agree with all that the gentleman says in regard to building up suburban property through the use of transfers. But let us look into the matter a little farther. When I suggested making a universal 4-cent fare I did not mean that you should charge 4 cents for your average riders; each fare would remain the same 5-cent fare. But I should use something similar to that used in Philadelphia, which is the interchangeable or exchange ticket. That



OFFICERS, DELEGATES AND VISITORS IN ATTENDANCE AT THE TWENTY-FIRST MEETING OF THE STREET RAILWAY ASSOCIATION OF THE STATE OF NEW YORK, AT SYRACUSE, OCT. 6 AND 7, 1903

exchange ticket is sold for 3 cents extra and is practically a transfer. In going to work in the morning the passenger buys an exchange ticket, paying, we will say for example, 8 cents, as it is in Philadelphia. That exchange ticket is good for a transfer if the passenger wants to use it that day. Fifty per cent, I think it is safe to say, of the regular riders in Philadelphia don't want a transfer; they don't want to go on another line; but they buy the exchange ticket just the same, and that ticket is good at any time, just the same as though bought from the ticket office. The passenger accumulates those tickets. Every time he gets on a car, if he hasn't got an exchange ticket in his pocket he buys one, and he accumulates them in that way. Then, when he wants to ride again if he doesn't happen to have an exchange ticket he pays his fare. If you can obliterate the transfer I am satisfied that you are going to increase your gross receipts, provided it does not do the harm which Mr. Mitten suggests to suburban property. I admit that is an important point. But I don't see why it cannot be worked out. Local conditions have always got to be taken into consideration. The same rule would not apply in Rochester and in Buffalo and in New York. The local conditions have got to be always worked out by the local management, and each can work out a transfer system of his own in the shape of an exchange.

Mr. Cole—I would like to ask some gentleman in regard to ringing up transfers, whether they find that they have any difficulty or greater loss in ringing transfers up than those who don't ring them up. I think that is a point that is of considerable interest in handling transfers.

It was stated in answer to the president's inquiry that in Buffalo and Rochester transfers are rung up, but in Utica and New York city they are not.

Mr. Cole—I would like to ask Mr. Allen how his inspectors can tell whether the correct number is registered? Suppose a conductor has twenty passengers, five of whom are riding on transfers, and should only ring up fifteen fares, how can the inspector tell which are cash fares and which are transfers?

Mr. Root—Our inspection force is instructed to pay no attention to the comparative number of people in the cars and the number on the register. Any one familiar with New York and the conditions under which we operate, will know the number of short rides we have and will immediately recognize the impossibility of trying to reconcile the number of people recorded on the register and the number of people in the car. It is not at all an unusual occurrence to have a car on Broadway start at Bowling Green and go up to Wall Street and have twenty-four or twenty-five on the clock and only have four or five in the car, the distance from the Bowling Green to Wall Street being probably half a mile. And that condition, to not so exaggerated an extent, prevails all over New York, or at least on the island of Manhattan; so that with very few exceptions on isolated portions of the road it is impossible to reconcile the number of fares on the clock with the number of passengers on the car. Like a great many others we are very strongly against the ringing up of transfers. We have followed the matter up very closely in all its relations, and we don't consider that the company is defrauded to any material extent in the use of the transfer system. I might add that we are using now on the average about 550,000 transfers a day.

Mr. Clark—I think that a very important point bearing upon the question of whether transfers are a good thing in connection with the operation of a railroad, particularly in provincial or smaller cities, is their use in connection with pleasure resorts. In the city of Binghamton we have had a practical experience both ways. Our franchises are of such early date that we are not required by them to issue transfers. For a number of years we operated without the issuance of transfers. In the meantime we established pleasure resorts in connection with our lines, which are a very prominent factor in our earnings, particularly during the summer months. We found that it was an absolute necessity to issue transfers in order properly to maintain the resorts. There was an unjust discrimination arising in this respect. Parties might live possibly a mile from the resort and be obliged to use two lines, and be charged 10 cents (or, if you please, 6 cents or 8 cents, as some gentleman has suggested). Such a state of affairs would lead them to believe that it was for their best interest to stay at home. Therefore, we have found that the issue of transfers in Binghamton has stimulated our traffic, particularly during the summer months, from 20 per cent to 30 per cent, and we don't believe that we could maintain or operate the two pleasure resorts that are controlled and operated by the Binghamton Railroad Company were it not for the transfer system. That the privilege is abused frequently and repeatedly there is no question. The only thing we can do is to keep the closest watch possible. I quite agree with Mr. Cole and Mr. Nicholl that if a standard form could be agreed upon it would be advantageous to the railroads, but I firmly believe that the transfer is one of the modern street car conveniences that the public has a right to expect and that the roads in their own interest should maintain.

Mr. Allen—I think Mr. Root answered Mr. Cole's question, Mr. President. With us in Utica (it being a very small town) we don't register the transfer; we treat it as of no value. The inspector's duty is to tell what transpires on a car, not to make any comparison of the condition of the register with the number of passengers, except to tell what the condition of that register is and what passengers are on the car. We take the transfers from the conductor each trip. Of course, he has his envelope in which he encloses his transfers, and in comparing the conductor's statement the inspector's statement must be taken into account. We are firm believers in transfers. We do everything we possibly can to urge the people to use them. We have increased our receipts very materially since the use of transfers has been inaugurated upon the system. I would like to ask if there is a member of this Association who has tried the use of transfers who would now withdraw them if he could?

The President—You have heard the question, gentlemen. Is there any man who has tried the use of transfers who would like to abandon it? There seems to be no response.

I will ask Mr. Allen one question. You told me recently of having 4-cent fares. Have you 4-cent fares now?

Mr. Allen—We had until recently a nickel fare, but we placed on sale six tickets for a quarter on Dec. 1, 1902.

Mr. Root—It may be of some interest to the convention, although a little aside from the question, to know that the Interurban Street Railway Company of New York about six months or eight months ago obtained a very satisfactory contract with an advertising concern for advertising on the back of transfer tickets. We have a contract now which more than pays us for the price of the tickets, which is quite material where the number runs up to 200,000,000. And it has a secondary value, in that it makes it much more difficult—practically impossible—for the tickets to be duplicated by any outside parties, as has occurred in other cities. No ticket is gotten up that cannot be duplicated; but with the advertising matter on the back of it it is made very difficult, because no one knows until the ticket is presented for that day what the advertising is to be, as it is changed every day.

The President—If there is no more discussion on this paper we will hear Dr. Moorehead, of New York, on the topic, "The Physical Examination from the Physician's Standpoint." This paper is published elsewhere in this issue.

Mr. Almy, of New York—It seems to me there are two or three things that Dr. Moorehead did not touch upon along this line. I speak from the standpoint of the lawyer, and I would like to present two or three points that seem to me to need attention. In the first place, it has been my experience that a

doctor who makes a physical examination for a railroad company, and is employed by the company, is always open to the suspicion of being biased. It is, therefore, not always wise for a railroad company to put the examining physician upon the stand. His testimony in the case seems to me to be the smallest element of the value of a physical examination. But you find that when a lawyer goes into court with the papers in a case, the first thing he looks at is the physical examination, because there he finds the patient's first version of how the accident occurred, not in legal form, but what he has told the physician about how the accident occurred. You get his version. So many times in the trial of these cases we find that the few words that the patient has said to the physician about how the accident occurred give a clue whereby his testimony can be broken down absolutely. Again, they very often make admissions to the physician, which, when brought to their attention, cannot be denied. They haven't mentioned to the other lawyer that they told the physician certain things, and very often you will find an instance where you can win a case on admissions made about the circumstances of the injury or something that happened at the time. I remember a case where an old Irishman was suing a railroad company, and in the course of the examination the physician found an old break in his arm, and he said to him that the arm was broken years before. The patient said: "How do you know?" The doctor replied, "I know it was." The patient then said, "Yes; it was broken twenty-eight years ago, in Ireland." For the moment I think the old man had forgotten that. He went on the stand and swore that the crookedness of that arm and the fact that it had been useless for nearly a year and a half were due to a bruise received on it just above the elbow. When faced by that physician and put back on the stand after the physician had testified, he admitted the statement, and we won the case. That was a serious case, and one which, if it had not been for that admission, I am satisfied would have been lost.

There is another thing to which Dr. Moorehead referred to a limited extent. A lawyer going into a case wants to know in the first place what the injury really is, in order to carry on his case. Another thing; if you have a physician who has examined the patient and you know that what he tells you is right, you can depend on it and go as far as you like. I know of a case in Brooklyn only last year where three reputable physicians, supposed to be experts along their line in New York city, went on the stand and testified that a man had a heart murmur, and that it was the result of a bruise received upon the chest in a collision, by reason of being thrown upon the seat in front of him in an open car. We had a physician who examined that man—a physician in whom we had confidence, and he said positively that there was no such thing, that there was no heart murmur. It came to issue in court, and the judge said that he thought the case was particularly a case where doctors disagreed, and that we ought to have some person who had no interest in the case examine it. There were three eminent experts on one side, on the plaintiff's side, and there was a doctor on the defendant's side who had examined the man and knew what was or was not the matter with him. Of course, we consented to the suggestion of the judge in a minute. A doctor was called, and examined him at the order of the court; he didn't see either side and didn't know what he was examining for except that he was to examine his heart. He came directly from the examination and went on the stand, and nobody had said a word to him. He said there was no heart murmur. The result of that was that we won that case, because they were putting up a fraudulent proposition. So where doctors disagree, if you have got a man that you can depend on, you can take any kind of chances.

In the line of the thumb illustration, I saw a case one time where the plaintiff claimed that she could not shut her hand, and the doctor said she could shut it. So when the doctor was on the stand he was asked that question, and he said that she could shut it. The patient was brought up, and the doctor shut the hand. Now, you wouldn't dare take chances like that unless you had a physical examination and knew absolutely what the situation was. Therefore, I think, from the lawyer's standpoint, for the purpose of preperation and for the purpose of the trial of cases of that kind, that there is no one element in the investigation of an accident that is so valuable as a physical examination of the claimant. (Applause.)

The President—The next paper is along the same line, "Physical Examinations in Accident Cases," by W. A. Dibbs, of New York. This paper appears elsewhere in this issue.

Mr. Cole—I would like to ask Mr. Dibbs a question. Take a case where the company's physician has attended a case of, we will say for instance, compound fracture of the elbow or wrist, in a comparatively aged person, and the wrist or elbow after it has been treated is stiff. Has anyone ever known of a suit being brought against the company and an attempt made to prove that there was improper treatment on the part of the physician?

Mr. Dibbs—We don't allow physicians to attend the cases all the way through. They simply conduct an examination for the purpose of adjustment or disposal of the case.

Mr. Danforth—I hardly think I can add much to the very able papers on the subject of medical examinations. The practice in our city of Rochester is to employ not one physician but a number; we distribute our work around among the reputable physicians of the city. Our physicians in these cases do not attend the injured party but simply make examinations.

The President—What is your experience, Mr. Allen?

Mr. Allen—The same that Mr. Danforth has just described, with this exception (and I presume our practice in that regard is governed by the fact that Utica is a small town), our physician looks after the injured party or attends to him until recovery.

The President—Let us hear from some of the smaller roads. What is your experience, Mr. Smith?

Mr. Smith—We don't have any accidents in Fishkill, so we have no occasion to employ physicians.

The President—If there is no more discussion of either of these papers we will listen to Mr. Parsons, of Glens Falls, in regard to "Hydraulics in Connection with Street Railway Operation." This paper was published on page 709 last week.

Mr. Clark—I would like to inquire into the advisability or the non-advisability of labeling poles for high-power transmission wires with danger signals, and what the legal status of the proposition is.

Mr. Parsons—I am not prepared to say in regard to the legal status. We label all our high-tension wires dangerous where they go through villages. Usually where 20,000 volts or 30,000 volts are used the danger signal is put up.

The President—What is the custom in the Western part of the State, Mr. Mitten?

Mr. Mitten—We have not labeled ours. We only go through very small hamlets and on what is practically a private right of way. The wires pass the streets only at highway crossings.

Mr. Danforth—Our line passes largely along private way. The poles are not labeled except where the line passes through a small hamlet.

On motion, duly seconded and carried, an adjournment was taken until 2 o'clock p. m.

TUESDAY AFTERNOON'S SESSION

The President—The first paper to be read will be Mr. Wilson's, on "Track Construction and Maintenance." This paper is printed on another page.

Mr. Cole—I would like to ask how long do you allow your cement to set before you begin to run your cars over it, after you have graded on the side?

Mr. Wilson—Seventy-two hours.

Mr. Pouch—Might I ask Mr. Wilson if he has any trouble with snow and ice?

Mr. Wilson—We haven't noticed any. We haven't any Trilby rails.

Mr. Danforth—The city of Rochester has a considerable mileage of Trilby rails. Within the city 25 per cent of the total mileage is of the T-rail, laid at the side of the street, outside of the curb. We find the greatest trouble with the Trilby rail in connection with snow and ice. The conditions in Northern New York, and particularly the Western part, is that during the winter we have a great deal of very damp weather and wet snow. This snow falling on a grooved rail packs readily and fills the groove and causes considerable difficulty in operating. The best rail for the operation of cars in our section of the State, of course, is the T-rail. We have not attempted to use the T-rail in paved streets, excepting cross streets. I should quite agree with Mr. Wilson in limiting the use of the T-rail to small towns or in streets where there is extremely light traffic. I see no objection to the use of the T-rail, particularly the Shanghai 6-in. rail, in brick-paved streets, residence streets, where there is very light or almost no teaming. Mr. Wilson has brought out convincingly the danger of using the T-rail in a street where there is a heavy vehicular traffic. As I have said, we have T-rail on 25 per cent of our tracks, but it is so situated that we are not bothered with teams.

Mr. Lewis (of Schenectady)—Mr. Wilson's experience in track work and my own have been so nearly along parallel lines that I do not imagine that I would voice any sentiment in regard to track construction or building essentially different from those which he has already expressed. I think it is true that the question of track construction is becoming very important. I don't think it has had attached to it in the past the importance that it should have had; but I think the necessity of having a better roadbed than has been had in very many instances is being recognized. I have had a chance lately to witness some very fine track construction showing all the essentials of a good track which Mr. Wilson spoke of until it got to the bottom of the ties. The roadbed and track from the ties up, or from the bottom of the ties up, was as good as could be put in, but it was laid on mud. It seems to me strange that such things as that are done in this day of electric railroading. I believe with Mr. Wilson that concrete construction is absolutely essential in paved streets for this reason: In open track work, where the joints can easily be gotten to at any time of the year, flexibility is correct theoretically and practically. But when it is not possible to get at the joints a construction must be used which will make the joints practically indestructible. Now, if a road is so small that it cannot afford to put in electric or welded joints, it should use the very best type of mechanical joint, such as a bridge joint of some kind. There are several good examples of bridge joints in the market, among them the joint of which Mr. Wilson speaks as being used in Philadelphia. I think that is perhaps one of the very best mechanical joints which is in the power of a small road to have. An electric welding plant is expensive. I don't suppose any railroad company in the country to-day owns one, but there are some roads which do own a cast-welding plant. But the day of the old girder rail-joint, the old fish-plate, the ordinary joint, which is not a bridge joint, is past; just as distinctly past in open T-rail work as it is in girder work. We should at least have a bridge joint if we can't get something better. There is no question in my mind about the matter of paving around the T-rail. I have passed through the same experience that Mr. Wilson speaks of. A T-rail in paved streets is not to be thought of for permanent work.

There is one thing I have had in mind since the Saratoga Convention. I don't know just how much the managers of electric railways are interested in it, but I have felt considerably interested in it and want to mention it. There is a new association in the electrical field, the American Railway Mechanical and Electrical Association. It has been organized by the master mechanics and electrical engineers, but it does not take in the extremely important question of roadbed construction and maintenance. I tried to interest some of the mechanical and electrical engineers in it, but I didn't have much encouragement. I talked afterward with some managers of railways and found more encouragement. But I believe that the parent association is so taken up with questions of policy and management that the matter of track construction and maintenance, which is of such great importance with our present heavy cars, will not receive proper attention and discussion. It must be taken up by those who are practically concerned with it—the engineers. The organizations of different railway officials, owing to the difference in the management of different roads, overlap each other. Some departments embrace both operation and track work; some have the mechanical department in the track work, and some the electrical department in the track work. So there is no clear-cut distinction as far as the engineering and mechanical part are concerned. But there is quite a clear-cut distinction between the management and all the engineering questions proper. It would seem to me that if track construction and maintenance are going to receive proper attention and be systematically discussed and standards adopted it must be by some association which takes up particularly engineering topics. I thought, perhaps, I might interest some one at least in that question, so that topics embraced in practical railway construction could be taken up in the Association and the scope widened. I believe if the engineers were interested in it perhaps the scope of the present Association could be changed so it could be taken up. There are these questions of standard track construction, standard construction of rail, the depth of throat, width of throat, and special work of various kinds for suburban, interurban and city tracks. More than that there is the matter of interurban roads which nearly every large city has or will have. Nearly every large system has an interurban proposition; the work which has been done on many of those lines has been far from creditable, and there is a good deal to be discussed along those lines. I, for one, would be very much pleased, indeed, to see the engineering association of the street railway companies embrace in its scope the question of track construction and maintenance.

I just happen to think of one more thing that Mr. Wilson spoke of, and that was the ballasting. We are building some track from Troy to Schenectady, and nowhere are we putting less than a foot of ballast under our ties. On our Albany road we are putting in a foot of crushed stone. That crushed stone costs us less, perhaps, than it would in many locations, because we have our own quarry and plant for crushing. We are putting crushed stone under the track. We think the conditions of the traffic warrant it, and the maintenance will be sufficiently less to justify it. On our other interurban propositions we are putting in a foot of gravel, as good as we can get.

Mr. Wilson—Before we leave the question of snow and ice on the Trilby rail I would like to hear from some one connected with the Metropolitan, which, perhaps, has more of the Trilby rail than any other company in the country.

Mr. Starrett—The climatic conditions in New York city are widely different from those which obtain in other parts of New York State, especially in the Northern and central parts. We do not look for the trouble that we should expect in this vicinity, and practically don't get it. There are only a few days in the year when we have snow enough to appreciably affect the Trilby rail. We, in fact, don't have as much trouble with the groove in the Trilby rail as we used to have with the rail which was formerly laid, which was a semi-grooved rail. That rail used to fill up with mud, and in the winter with snow, so that we had to run a scraping car or digger over the road to clean it out. We rarely do that with the Trilby rail. The de-

sign of the groove in the Trilby rail is such that it is practically self-cleaning—that is, if used with the proper flange on the wheel; but in order to be at all self-cleaning the proper flange must be used with it.

Mr. Allen—On interurban work we have tried to follow as nearly as we could the type of construction that has been used on large steam roads in the past few years. We have made great efforts to secure a roadbed on the Utica & Mohawk Valley that was properly drained. Our roadbed for more than 90 miles out of our 114 miles is constructed on private right of way. Passing, as we do, through a valley and on the hillside, we have encountered some difficulties in the way of drainage that would seem to be hard to overcome. We have constructed on the uphill side of our roadway a series of two ditches; one near the line of the right of way, just within the right of way, which receives the water that comes from the hillside; and from this outer ditch it is conducted to and through and under the roadbed and under the track structure. About 4½ ft. outside of the end of the ties on the hillside we have constructed still another ditch, which gathers what water falls on the right of way and would overflow the outer ditch. Drainage may not seem to be a very important problem to some interurban roads, but with us it is different. Our road being at practically the summit of the Mohawk Valley, in the watershed of Lake Ontario and of the Mohawk River and Hudson River, we have an enormous rainfall. In fact, the records show that the rainfall at the Little Falls station is considerably greater than it is at Syracuse or Oswego. The question of drainage structures beneath our roadbed is, consequently, one with which we have taken a great deal of pains. Our culverts throughout are built of concrete, and are, as we believe, sufficient to take care of all the drainage. Our roadbed is made of the excavated material which we have found in the cuts. On top of this roadbed we have placed 8 ins. of gravel or crushed stone ballast. Upon the crushed stone ballast we have laid oak or long-leaf yellow pine ties, spaced from 18 ins. to 2 ft. centers, depending upon their proximity to joints. The rail we have used has been the A. S. C. E. standard 80-lb. T-rail, in 30-ft. lengths, and supported by one or the other of two types of bridge joints. We have used the Weber and the Continuous joint. We have had the greater portion of this road in operation somewhat over a year. Our cost of maintenance has varied, as the quality of the gravel under the track structure has varied. I believe that if we had the roadbed to build over again, instead of spending the labor and energy we have in placing the gravel which we have found and which has been accessible to our work trains, we would pay the additional cost of putting broken stone under the track structure. The first cost of crushed stone would be, perhaps, 25 per cent greater, but the cost of maintenance would be considerably less.

Mr. Mather—In our Auburn & Syracuse road the part that has cost the most in maintenance from Skaneateles to Syracuse has been the stone part. I think in the first year or two more work will have to be put on that to get it into a good road, but afterward I admit it will outlast the gravel. But the gravel that we have on about 7 miles of the distance from Syracuse to Skaneateles has lasted very well; it has kept up under heavy traffic. More curiously still, the 60-lb. rail laid three years ago from Skaneateles to Auburn has not cost during that time over $400 for maintenance for the entire 7 miles. In the 60-lb. rail one can notice more flexibility of the track itself than with a 70-lb. rail; but the rigidity of the 70-lb. rail is all that we desire. I have my own opinions, of course, about the weight of rails. I don't object to the use of a 100-lb. rail, if one can get it, but I would rather put the money into about a 70-lb. or a 75-lb., or even an 80-lb. rail, which is ample for all the requirements of interurban traffic. Given sufficient ballast, a well-drained road, and plenty of ties, I would rather accept the lighter rail. I think too much importance is attached to the weight of the rail. I notice the first thing the financial companies ask about is the weight of the rail. If a rail will break in the distance between the ties its utility as a carrier is ended. One cannot expect that throughout a 30-ft. rail there will be no deflection. From the foundation to the top of the tie is, in my opinion, the important part. Any neglect there will certainly redound to excessive cost of maintenance of track. I would very much rather, personally, take a light rail (say 50 lbs.) with plenty of ties and plenty of ballast, and put the roadbed down as it ought to be put down, and guarantee a better track than with a 90-lb. rail, with fence-posts for ties, spaced 4 ft. or 5 ft., as many early roads were built, and without ballast. Rock ballast is undoubtedly, once it is settled, the very best that can be obtained. I would have it crushed not to exceed 1½ ins. I would, to a certain extent (depending on the nature of the rock), have it screened, so as to get the most perfect drainage. But an important thing to be considered in laying a new roadbed with rock ballast is that the ties in one or two places may rest on the edge of a stone. A car running over that tie will disturb the stone, and the tie certainly will go down. I think the experience of all railroad builders would be that no amount of tamping will put a stone-ballasted road in as good shape or order as the more compact gravel-ballasted road would be in at the same time; but I think at the end of three years the advantage will be very much in favor of the stone ballast.

So far as our city traffic in Auburn is concerned, we have been unable to use concrete, not having had the means. The road is too small to go into very expensive construction. We have found that 6 ins. of crushed stone, thoroughly rolled, and with gravel on top, gave the best results. In laying this track care should be taken that nothing be done during wet weather, and that the roadbed be allowed to be dry before the superstructure was put on. We have had some of this track down for eight years, and I don't think in probably 9½ miles of girder rail construction we have nine low joints. It has stood wonderfully well. The earth was very rigidly packed at the bottom, part of it being old macadam, and had been built for a great many years. Auburn has well-macadamized streets. We had a magnificent base to work on. That, with the precaution of packing the earth and our foundation stone well into this has had practically the same result as if concrete had been used. There has been no possibility for that stone to shift in any way, and to all intents and purposes it was concrete. In a great many places the streets have since been repaved, and in only one or two places has the foundation been able to steal away from the ties and leave any hollow, and that was over bridges, where we couldn't help it. We have had some thought of filling that up with concrete, but we haven't done it. The brick paving has gone over it. We filled it in with crushed stone the last time it was paved, and since then have had very little trouble, but that is only a comparatively short time. That is about our experience in ballasting.

We are all very much in love with the T-rail construction. For our projected road from Rochester to Syracuse we have secured through all the villages the right to lay T-rails, and at Fairport we have put in about ½ mile of 70-lb. T-rails. That is the only construction we have on the Rochester, Syracuse & Eastern at present. We have very carefully looked after the foundation and have put in specially made brick. Teams are able to drive, even with 1-in. tires, upon the track. It allows a 1-in. tire to go in exactly ⅝ in., and as far as vehicular traffic is concerned it is far ahead of any other rail. Whether it will last under that traffic or not I do not know. I have not had experience. I have no doubt that Mr. Wilson's observation will be ours, probably, except that we have through those villages very light traffic compared with what he speaks of. But we are in hopes that we shall be spared the taking up

of that pavement for some years. In Auburn we have about 2 miles of such rails (in macadamized streets), and the maintenance of that, although it is only a 45-lb. rail, has been comparatively light. The maintenance of the macadam has been very light indeed, but, unfortunately, for the purpose of illustration, it is on Seymour Street, a street that is not much affected by heavy traffic. We have, unfortunately, for illustration, no T-rail in any street that is heavily affected. On the brick pavement the tram rail does not seem to have worn at any particular point, other than on the head, but there is not much traffic, and we have had the brick pavement in there for the last eight years. There is no point in that pavement that has shown any particular wear. Still, the outside of the girder rail would be as susceptible to wear as the inside of the T-rail. I am quite sure that under heavy traffic there would be the chance that Mr. Wilson speaks of, of wearing a rut that would be objectionable for vehicular traffic, and probably dangerous. But we feel in our interurban building that we desire as much T-rail construction as possible, and in the villages I think we can maintain it to the satisfaction of all parties.

The President—I would like to ask if anybody has used to any extent the 60-ft. length T-rail?

Mr. Mather—We have used it, and at a place that is especially dangerous for expansion, since it is in a rock cut and the reflection from the rocks surrounding it raises the temperature to a very great extent. When I saw it in construction in the winter time I was very much afraid the first thing we would have to do in the spring would be to relay it, but there hasn't been even there that objection. That is between Skaneateles and Syracuse. But on the 60-lb., 60-ft. length from Skaneateles to Auburn the first two years that we operated it we had two places that sun kinked. There were two each year, and, rather to my astonishment, in each case it has been on the top of a hill, not in the hollow. All we have done for it has been to slack off six or eight joints on each side and throw the rail in place, and we have had no returns of the trouble. This year I don't know of any place where there has been a sun kink on the entire line, and the rails are all in 60-ft. lengths.

The President—Then, do you recommend the 60-ft. length?

Mr. Mather—My practice has been largely before this on steam roads. From a steam road point of view I don't like the 60-ft. rail. From the point of view of bonding I think I do. I think as long as no danger shows in it we shall continue to use the 60-ft. length, for the sole reason that it is more easily bonded. I don't know that it affords any better riding. I have not noticed that. But we have a pretty fair riding track.

Mr. Nicholl—We have 34 miles out of 38 miles on our Sodus Bay line laid with 60-ft., 60-lb. T-rails. The superintendent of that division is present.

The President—I would like to ask him his experience.

Mr. Wilcoxen—We use the 60-ft. rail on the Rochester & Sodus Bay division, and we found that it ran about three or four or five joints very nicely. Then we would get an opening all the way from ½ in. to an inch, sometimes breaking the bolts right off. We haven't had any trouble outside of that.

Mr. Wilson—The Lockport division of the International Railway for a distance of about 32 miles is entirely laid with 85-lb. rails in 60-ft. lengths, with the exception of about 2 miles. We had some trouble at the curves because they were not fully filled up to the top of the ties and sufficient shoulder given. But since that work has been done we have had no trouble on account of expansion or contraction.

The President—Then do you recommend that length of rail?

Mr. Wilson—I do; on account of the bonding and the joints.

Mr. Rockwell—There are 22 miles on the Lakeside road laid with 60-ft., 56-lb. rails from beginning to end. For trolley road work I wouldn't use anything else.

Mr. Wilson—I would say that the American Society of Civil Engineers has recommended 33-ft. lengths. Of course, they probably had in mind steam railway practice.

The President—That is the steam railroad standard, isn't it?

Mr. Wilson—Yes.

Mr. Lewis—Mr. Wilson speaks of the rail on the Lockport line and the difficulty he has had. I remember distinctly the trouble we had when I was in Buffalo. It occurred in a section of road a mile or two outside of Lockport. The track was laid in the middle of the winter and laid with very tight joints, and the contraction sheared the bolts in some places in the winter time, and in the summer time the expansion threw some of the joints out of line. We easily overcame the difficulty, and I don't think that there has been any serious difficulty since.

The President—What is your judgment about it?

Mr. Lewis—Decidedly in favor of the 60-ft. rail. I don't think there can be any question at all with reference to rails laid in city streets which are paved. I think that has been demonstrated. And I think that very much better bonding can be got by laying a 60-ft. rail in open track work.

Mr. Mather—There is one other thing that I have in mind that may not be generally known. As the section of the rail increases the expansion may be disregarded. A light rail will expand more per foot of track than a heavy rail. That is accounted for by the fact that the entire section of a light rail may heat up from the sun's rays, clear to the center of the metal, while in a heavier section there is always a part which remains cool and does not expand so much. The result is, the expansion of an 80-lb. rail will not be so great as with a 60-lb. rail, yet it is the 60 lbs. that I have given my experience with.

The President—I have heard all kinds of woods mentioned for ties except chestnut. We have with us a great deal of chestnut. Have any of you used chestnut.

A delegate whose name was not stated replied that his road had used a great deal of chestnut.

Mr. Clark—I would like to ask Mr. Wilson if one of the plans he advocates for the drainage of the ordinary gravel-ballasted interurban or outlying track (and how far it is practicable and advantageous, if at all) is to leave the tie exposed in accomplishing the drainage?

Mr. Wilson—I think that by following steam railroad practice on our suburban roads we can get very fair drainage. By that I mean the giving of a slant to the roadbed, so that the water will drain from the center into the ditches. On city work we lay a drain tile on each side of our track. It is a 4-in. tile, and is connected into the sewer.

The President—If there is no farther discussion we will now take up the time which has been allotted for discussion of the Railway Young Men's Christian Association work. F. J. Pearsall, of New York, is with us and will address us.

Mr. Pearsall—There are two topics that I noted in the list of topics sent me by your president that it seems to me are intimately related. They are "Reading and Club Rooms for Employees," and "How Can We Increase the Efficiency of Employees?" One of the significant developments of recent years has been an increasing recognition of two things on the part of employers and men. One is that the way a man spends his time when off duty has a direct relation to the efficiency of his service when on duty. If I am correct, it is this to no small extent that justifies this Association in devoting some time to the consideration of a topic of this kind. The second significant thing is a recognition on the part of employers that their full duty is not done when the employee is given his wages. That was emphasized most happily by your president this morning, when, in his opening address he said, "It is our duty to make the life and lot of our employees as comfortable as possible; we should even go out of our way to do this."

Now, in connection with the opening of club rooms and reading-rooms for men, we have in mind more than merely the occupation of the men's leisure time. In connection with some

of the work which has been done among the street railway men of the State (and as to which in a few minutes I am going to ask a statement to be made by two gentlemen who are members of your organization) there is more than merely the filling in of the time by games. There is the giving of those men an opportunity to have a bed in a convenient place. I learned quite recently in connection with one street railway company in the State which is operating a reading-room, that some of the men got in from their runs late at night, and being unable to get the last car out, living far out in the suburbs, from necessity, on account of small rents, and unable to walk the distance home, they have spent every night in the car house, sleeping on the seats of the cars, as in this particular case, or in other cases sleeping on wooden benches in the reading-room, and getting up in the morning in that condition to go to work. That was the best they were able to do. I am glad that there is under consideration in that particular city a plan for the introduction of dormitories in addition to reading-rooms and game rooms.

It was thirty-one years ago that the first Railroad Young Men's Christian Association was organized, and that was in Cleveland. The growth of the organization during the last ten years has been by far greater than its growth during the first twenty years. This is a significant statement when it is understood that the organization has been dealing with the presidents and the managers and the superintendents of railroads—gentlemen whose hard business sense enables them to see through a proposition about as soon as any class of men on top of the ground; gentlemen whose occupation is such that they have all kinds of propositions made to them, most of them not worth considering. Now, after close contact with the kind of work that the Railroad Young Men's Christian Association has done through these years, the managers are giving their hearty co-operation in extending these organizations among their men, more than ever before, because the organization is better understood. The Railroad Young Men's Christian Association is the railroad man's club, and when I say that it is putting it as briefly as it is possible to put it, and as accurately. They spend their time bowling, playing billiards, in the reading-room, or in the lunch room, for many of the organizations have lunch rooms for the men; or in the dormitory upstairs. Many men who run from one point to another, and are away from home every other night, find this place a club, where the privileges are within their reach.

At the present time, after this thirty-one years of effort, it is rather significant that the organization possesses a membership of 62,000 railroad men. It owns in buildings and real estate property amounting to $1,250,000. Another significant thing connected with those figures is this: That at the outset the leaders of this movement among the railroad men felt that if they were able to get the men to contribute one dollar for every two dollars that the companies contributed, it was a good proportion, and about as much as they could be expected to do. But during these years the proportion that the men have given has increased so that the men now give more than a dollar for every dollar that the companies contribute. If I read that statement aright, it means that the men themselves are more interested in this organization than the companies. It is not a missionary movement to them, but it is a movement among themselves; it is not a going-down of outsiders among the railroad men to do missionary work with them. It is a club composed of railroad men themselves. Eighty-seven of the 114 railroad branches in the country own their own buildings, and buildings are going up faster than one a month, and only in one case in two years has one of these buildings been erected for the Railroad Young Men's Christian Association where it has not been opened entirely free from debt. In erecting the buildings the companies usually contribute three dollars to one dollar contributed by the men, and in that ratio they agree to contribute up to a certain amount, that ratio being larger than the ratio for support, which is about dollar for dollar.

Now, I have spoken somewhat at length in describing this kind of work, because it seems to me that there is a similarity between steam railroad men and street railroad men. I have been interested to hear one or two gentlemen speak inferentially of the fact of their having been connected with steam railroads formerly. The two are so related that the character of the employees is quite similar; their tastes, their mode of life, all mark them as being men of similar caliber, and men who can be reached by the Railroad Young Men's Christian Association on the steam railroads can be reached, I believe, with equal efficiency by the same organization among street railway employees. Before I speak further about this matter I want to call on two gentlemen who are here to-day, members of your organization, who have some knowledge of this work as it is now being done in the State of New York, and I am going to call first upon Mr. Nicholl of the Rochester Railway.

Mr. Nicholl—I was rather under the impression that my friend Pearsall was going to make more of a speech before he called upon me. If I had not, I think when I went out a few minutes ago I would have stayed out longer. Aside from any religious views that I may have, or that I ought to have, I am really very much struck with the Young Men's Christian Association work among street railway men, and I have good reason to feel that way, from the fact that a little over a year ago we, in Rochester, organized the first street railway Young Men's Christian Association, they tell me, in the world. I have my doubts about the correctness of that statement, but they say it was the first in the world. And I promptly became the first member, not because I knew anything about religion, because you know street railway men can't possibly know much about religion; they don't get any opportunity to go to church or to attend religious services of any kind; on the contrary, they are continually up against the real thing in the way of dealing with the public, who are not, as you know, always considerate, and very often liable to try your patience, try the patience of the conductor and motorman, as well as of the man in the office.

A little over a year ago we started with one member, and two or three persons joined very soon afterward. In May last our Association was asked to send delegates to Topeka, Kan., to attend the conference, as they call it, of the Railroad Men's Young Men's Christian Association. We sent, I think, four delegates to that conference, and at that time we had less than 100 members. That was in May. To-day, in Rochester, we have nearly 200 members of the Young Men's Christian Association, men to whom really it has been of assistance, who have watched the development of things and have made up their own minds, without the slightest coercion, that it was the proper thing for them to do to join this Young Men's Christian Association. You understand we have outside of the Young Men's Christian Association a benevolent association that takes care of the men in the way of providing for their families should they be disabled or sick, built very much upon the same lines as the Metropolitan and other associations. But the Young Men's Christian Association comes in and takes charge of our rooms particularly, and of the conduct and morals that are in vogue in those rooms. In Rochester we spent between $5,000 and $6,000 in fixing up the rooms for reading, where we have all the popular magazines of the day, newspapers, billiard rooms, ping-pong tables, etc., besides toilet, bath rooms and a nice room where they can retire for religious meetings. Let me say that we are somewhat religious, for on Sunday morning last I understand that they had thirty-five of our boys who voluntarily attended what they call a prayer meeting in the morning. It certainly has done a great deal of good morally. Before we had the Young Men's Christian Association in

charge of the rooms there was a great deal of blasphemy and all sorts of funny talk about the rooms. Since they have been in charge we haven't heard a word of it. Everything has been nice and courteous. The men have been courteous to each other, and you will never hear a blasphemous work spoken, because as soon as there is something of that kind the secretary goes up and in a very quiet and gentlemanly manner does not insist but requests that it be discontinued, and rather shames the man. I think it has a subduing effect on those men and has made them more patient than they otherwise would be in their connection with the public.

I cannot help but say that I am heartily in favor of it, and I think that the manager makes a mistake that does not allow the Young Men's Christian Association, where they can do so, to exercise its influence in the same way as it has in Rochester, through their secretary, who is the only man that they appoint, the other men being appointed by our own men themselves. Of course, there is an incentive to the men to belong to the Young Men's Christian Association. Men outside of the association are required to pay a little more for their games of billiards and bowling and for the use of towels, etc., than the men that belong to the association, but it is quite trifling. Still it is sufficient to make the men feel that it is a good thing to belong to the association. They, of course, come under the influence of the secretary and others, perhaps, who feel religiously inclined.

I don't know that I have anything farther especially to say about the matter. I have been rather, you might say, forced by the officers of the Young Men's Christian Association into the position of standing up and speaking for them, but I do so most heartily, feeling that it is a good thing. Although not a religious man myself I must say that I appreciate it for others.

Mr. Pearsall—I would like to have the gentlemen here know that Mr. Nicholl was at the big railroad gathering at Topeka, where President Roosevelt and he made the two leading addresses in the convention of railroad men, which was attended by thousands, and his speech was applauded most heartily and circulated in the press.

I would like to say this with reference to the religious element of the organization. In the first place we don't hide it. In the second place we don't apologize for it. And in the third place we don't intrude it. I ask your attention to this one fact, that in the thirty-two years that we have been working among railroad men—and I was a railroad man myself; I went into the secretaryship out of the railroad service—in that time the religious side of the work has been handled so wisely and unobtrusively that it has won its way into the confidence of railroad officials who, if it were sectarian in its character or obtrusive in its methods, would throw it out of the railroad service. The association stands for twentieth century religion. It believes that affording a man chance to have a clean bed and a square meal is a religious act. It stands for the kind of religion that I believe you gentlemen stand for and believe in. A significant thing is that railroad officials who were afraid of this movement fifteen years or twenty years ago are now not only its leading supporters but are the leading officials in the State and national organization.

I am going to ask now if Mr. Clark, of the Binghamton Street Railway, will say a word.

Mr. Clark—I feel myself in a somewhat embarrassing position at this time in attempting to discuss a proposition concerning which I have a comparatively limited knowledge, and particularly in following in the wake of my friends, Secretary Pearsall and Mr. Nicholl, who, to my knowledge, made a long, extensive and very eloquent address upon this subject at the national convention held recently at Topeka, which address I read with a great deal of interest and a great deal of pleasure.

My first contact with Railroad Young Men's Christian Association work occurred about three or four months ago, when it was my pleasure and my privilege to participate in the dedicatory exercises of the new Railroad Young Men's Christian Association Building in Binghamton. I am ashamed to say that notwithstanding there had been a local branch in the city of Binghamton bearing the name of the Railroad Young Men's Christian Association for a number of years, I was not aware of its true character, the class of work it was performing, or the great benefit it was extending to its members. You may imagine my surprise when I accepted an invitation to make a few remarks, upon entering a beautiful brick structure of considerable size and finding gathered there several hundred railroad employees with their families, who were to be addressed by President Truesdale, of the Delaware, Lackawanna & Western Railroad Company, and F. M. Olyphant, secretary of the Delaware & Hudson Company, and two or three prominent Erie officials. Before we commenced the exercises we were shown about the building, and we found a splendidly equipped place. We were taken up-stairs first, where we were shown a succession of nicely furnished bedrooms or dormitories; we were shown into several first-class bath rooms or lavatories, and everything that goes toward completing the sanitary regulations of a well-kept institution of that character; and when I was informed that all those advantages and all those privileges were afforded to the members of the Railroad Young Men's Christian Association at a very nominal cost, I can assure you I was surprised. Upon going down-stairs we were shown through a handsomely equipped reading room, a finely furnished billiard room, card rooms, a first-class assembly hall and the office. We were then taken to the lower floor and were shown splendid bowling alleys and other athletic conveniences. I can assure you, gentlemen, that it was one of the most completely equipped club houses that I ever visited.

At the completion of the exercises I casually said to the secretary of the local association that I thought privileges of that character would be a great thing for street railroad employees. "Well," he said, "why don't you take advantage of them? You are eligible. Your boys are at perfect liberty to attend and participate in these benefits upon paying a nominal fee," I think two dollars a year. "They can enjoy the bedrooms upstairs at a cost of 10 cents a night. While we have not, perhaps, presented the proposition as thoroughly to the street railroad interests of the country as we should have done, yet your men are eligible, and we should be glad to welcome them to membership at any time." As a result, the following day I posted an order on the bulletin board setting forth what I believed to be the advantages and stating that those privileges would be accorded to them gladly; and I am pleased to state that within ten days from the posting of that notice upward of seventy of our 200 motormen and conductors connected themselves with the Railroad Young Men's Christian Association, of Binghamton, and have from that time enjoyed its privileges and advantages with great benefit to themselves and to ourselves. There is no question but that the refining influences of the association are a benefit to the men. I am not speaking from a spiritual standpoint at all; I am going to put it upon a plain, ordinary business basis. I think as a business proposition that this subject is worthy of the most thorough and careful consideration of the street railroad companies of the State of New York, because anything that has a tendency to refine or elevate men necessarily increases their efficiency. And I believe that the seventy men from among our motormen and conductors, notwithstanding the fact that they have been members comparatively a short time, are improved and benefited by the privileges which they have enjoyed. I think as an economic proposition the street railroads of the State can well afford to consider the advisability of taking advantage of the privileges that the Railroad Young Men's Christian Association affords.

In a conversation with National Secretary Moore, following

the occasion which I mentioned a while ago, he stated to me that they were going to take up more actively the question of identifying street railroad employees with their work; and he said, furthermore, that when our membership had increased in the city of Binghamton to one hundred he would be very glad, indeed, to establish a railroad branch, and I shall be very glad (and I am sure Mr. Rogers bears me out in the statement) to have him do exactly that thing. We believe, irrespective of any spiritual or religious benefit that they may derive from their intercourse with the officers of the Association and their associates, that as a business proposition it will be both profitable and pleasant. Therefore, I say, without taking up further time, that I think this is a matter of considerable importance to the street railroad companies of the State of New York, and a question to which they should and, I believe, will give due consideration.

I presume it goes without saying that if the street railroads of the country generally take advantage of the throwing open of the doors of these various associations throughout the United States, possibly the question of their assisting in their maintenance may arise; but I believe that any co-operation along consistent and economical lines tending toward the development of the Railroad Young Men's Christian Association movement among street railroad employees will be money well invested and well spent.

Our boys, irrespective of creed or of belief, take advantage of the manifold privileges which they enjoy; you can see them daily enjoying the privileges of the lavatories; you can find them at the tables in the reading-room; you can find them participating in games. I say to you unhesitatingly that I believe it is infinitely better for an employee of any street railroad company, when his day's work is ended, to seek diversion with the Railroad Young Men's Christian Association rather than in the temptations of the saloon. As I stated before, anything that has a tendency to elevate, or that has a tendency to improve the morals and conduct of the men is a good thing for them, and necessarily the railroad companies must inherit a benefit therefrom also. Therefore, I say in closing that I am most heartily in sympathy and accord with the work, and I sincerely trust that the street railroad companies, not only of the State of New York, but of the United States generally, will give this question careful consideration.

Mr. Pearsall—I wish to make two statements. The first is that I presume that in New York State there are only a few cities where the street railway men are as closely related in various ways to the location, for instance, of the steam Railroad Young Men's Christian Association building as to enable them to take advantage of the facilities to the same degree that they do in Binghamton. In most cases it is very likely that the managers will find it desirable, if not necessary, to establish reading-rooms for their own men, as Binghamton may, in the course of the months, as they find out that the men themselves call for such an organization and promise their support to it.

Now, with the relation to the Young Men's Christian Association form of organization, I have three things to suggest regarding it. I believe it is desirable, because in the first place it brings into its work the experience of more than thirty years and adopts methods which have been tried and proven by time. In the second place, it has been training secretaries, many of whom came from the ranks, and know how to appeal to the men; and after all that is the chief difficulty in any kind of work of this character. It is not the money that is the chief difficulty. It is one of the hardest things in the world to try to do good to others, and I believe you gentlemen know it quite as well, if not better, than I do. The difficulty is in helping a man in such a way as not to pauperize him for one thing; not to knock his support from under him by making him think that you are going to carry him in your arms and help him unduly. It is not the lack of money chiefly that stands in the way. One of the wealthy men of the United States, feeling his responsibility in view of his great wealth, has apparently searched to find how best he could spend his money for the benefit of his fellows, in order that he may not die a rich man. To-day he has only found one method, so far as we are able to see, and the danger seems to be as great that he will die in spite of all a rich man, as that some of us may die poor men. The third thing regarding the Young Men's Christian Association is this. There are two supervisory organizations which look after these individual associations, which isolated would be likely to do a less efficient work, the State committee, whose secretary for the railroad work I am, and the national committee, whose secretary Mr. Clark mentioned a moment ago. We follow up these individual organizations, try to co-ordinate their efforts, and carry along the plan from one place to another, and in any way we can, without cost to those organizations, endeavor to make their work efficient.

I hope, gentlemen, that the support which has been given to this work by the officials of the steam railroads, men who stand and have stood as leaders in all that is best and largest in the steam railroad world, men such as Mr. Ingalls, Mr. Depew and Mr. Vanderbilt, that the support which has been accorded to the Association of railroad men by these gentlemen may be emulated by similar cordial support by the leaders in the street railway work of the Empire State. I want to suggest, if it is considered wise to devote any farther time to the consideration of this topic, I should be glad, so far as I am able, to answer any questions that may be asked.

Mr. Nicholl—I must say that the eloquence of our friends Mr. Pearsall and Mr. Clark, together, has made me more convinced than ever that I did right in starting this movement in the city of Rochester, and I am more convinced than ever that it is a very important thing for this Association to take in hand. Having that in mind, if it is in order, I would be glad to move that this matter be referred to our executive committee, to take it into consideration and under investigation through the proper channels and make recommendations as to what we shall do at another meeting.

The motion, as suggested by Mr. Nicholl, was put by the president, seconded and carried unanimously.

The President—We will now hear from J. B. Storer, of Syracuse, on "Power Transmission for Interurban Lines." This paper is printed on another page.

Mr. Barnes—We have had two very interesting and instructive papers on high voltage transmission. In the discussion of the first one of them the question was asked whether the poles were labeled "Dangerous" or not, and the answer was made that in some cases they were so labeled. Seeking for information, I would like to inquire why a pole carrying a high-voltage current is labeled "Dangerous?"

Mr. Storer—I don't see any reason, if the transmitting line is operating successfully, why the pole should be labeled "Dangerous" with a 20,000-volt circuit any more than with 2200 volts. The general conditions, of course, are such that if a high-voltage circuit drops on a cross-arm or on a pole, you can't help but notice it, because it generally sets fire to the pole or the cross-arm and begins to burn it up. But I don't think the amount of leakage that would come from an ordinary pole would be sufficient to injure any person. It is more with the idea of keeping people away from it and impressing them that it is not safe to throw wires across transmitting lines than it is from any actual danger of the operating line itself.

Mr. Barnes—Have any tests been made of the voltage that can be taken from a pole in wet weather with defective insulation? Do you know of any tests of that kind?

Mr. Storer—No, sir; I don't know whether any tests of that kind have been made.

Mr. Barnes—My questions were based on the idea of securing information as to whether defective insulation on a high-voltage transmission line would affect the pole in a manner which would produce or result in a serious shock to people coming in contact with the pole.

Mr. Storer—No, I don't think it would.

The President—I will ask if the wire came in contact with the pole wouldn't it char it?

Mr. Storer—It usually sets fire to it.

The President—In wet weather wouldn't there be danger?

Mr. Storer—Well, the pole is part of the ground just as much as the person who is standing on it and touching the pole, and for that reason I don't see that there could be any great danger in a person standing on the ground and touching something which is actually connected with the ground.

Mr. Rockwell—Mr. Storer means that 22,000 volts wouldn't kill any quicker than 2000.

Mr. Storer—I have known of people taking everything up to 30,000 volts and lived through it, so I don't think that electricity will necessarily kill.

Mr. Danforth—I would like to ask Mr. Storer concerning his statement or recommendation of six wires on single-pole lines, for instance, in preference to three heavy wires, in giving more reasonable, proper or continued service. In case of the breaking of an insulator on one circuit, or the breaking down of the insulation in any way, or a wire dropping off from the insulation upon a cross line the cross line may be burned off, and very frequently the pole is burned to the ground. Doesn't that endanger the other circuit?

Mr. Storer—Certainly it endangers it, but in general the damage is not carried that far before it is discovered that one circuit is in that condition. Your ground detector should enable you to know that there is a grounding of one wire, and that circuit should be thrown out of service at once and the service put on the idle line before the damage could have reached any such serious stage, while a person operating a system with one line would be forced into on account of the necessity of keeping the cars moving. With merely one transmission line you have got to keep the cars moving and keep the line in service, whereas if you have duplicate lines you could detect it almost instantly and could take advantage of the ground detector and transfer the pressure over to the idle circuit and let the defective circuit remain idle.

Mr. Pardee—I would like to inquire if any one has had any experience with municipal interference with high-voltage lines near highways?

Mr. Allen—We have a transmission line operating at 22,000 volts, and of about 31 miles of that line 1000 ft. is in a street in a village of about 1200 inhabitants. A resident on that street made a complaint to the State Board of Health, claiming that we were operating a line at 22,000 volts pressure over and above his sidewalk, and that he thought it was dangerous. That communication was referred to the Board of Railroad Commissioners, and in turn was referred to Mr. Barnes, and the matter is now being held without determination by the Board of Railroad Commissioners. I think that is a very important question. I know of one situation on this line now, in a city of 25,000 inhabitants, where a transmission line of 16,000 volts is being held up awaiting the determination of the State Board of Railroad Commissioners in this matter.

Mr. Barnes—I am not going to make any official report, but I agree with Mr. Allen in thinking that this is an important subject, and one which should receive the serious consideration of this convention. The increase in the weight of cars operated, and the speed at which they are run on suburban lines located through highways, has materially increased the danger, not only to the operation of the electric road, but to travelers on the highway. There is this new element of danger appearing, if it is such; and if it is not, this convention should take steps to let the public know that it is not dangerous; and this new element is the construction of high voltage transmission lines. When you put poles through the streets and label them "dangerous" the public has a right to believe that they are so; and if they are not dangerous the public should be informed, and not be misled into believing that they are dangerous. It is a very serious question, I think, and one that should be thoroughly discussed.

Mr. Wilcoxen—We found labeling the poles on our high-voltage line a very good thing. I don't know whether it is so in other parts of the State, but every boy out of Rochester for 40 miles has got a gun, and when the line was first put up the insulators made the best kind of targets. We had a great deal of trouble with broken insulators, and finally we labelled the poles. We had some signs printed and they were placed on about every tenth pole. Copies of the signs were given to the different public schools in the villages through which we ran, and the principals of the schools were requested to show the signs to all the school children and explain to them that the line was very dangerous, and that there might be a liability to accidents in shooting the insulators, providing the wire should drop or anything of that kind happen. Since that was done we have had very little trouble with insulation along the line.

Mr. Brady—It seems to me the question of what is high voltage is something that has hardly been settled. In 1886 there was a war between the Edison Company and the Westinghouse Company regarding high voltages. The Westinghouse Company at that time spent a great deal of money in trying to convince people that a 100-volt line was not dangerous. Now you are talking about 2000, and 10,000, and 20,000. I know that both of the large electric companies have reached a point where they are transmitting at 60,000 volts. I think the General Electric Company has several plants out West of that voltage, and I know the Westinghouse Company has installations where it is using as high as 60,000 volts, and that it is being done with success. This question is one that immediately affects the matter of insurance. The board of underwriters presented some resolution on the subject at their last meeting, and it was held up for the time being, with the suggestion that these high-voltage transmission lines be restricted from approaching within a certain distance of buildings. It would not surpise me to see an effort made to have legislation enacted that would be very detrimental to the transmission lines which are using high voltage, and, inasmuch as the railroad business is developing so fast that would be very bad, I think.

You will have to face the question sooner or later. I know now steps are being taken to bring the St. Lawrence power down through Central New York as far as Utica and to Syracuse; and if that is done they must use 50,000 volts or 60,000 volts. The time is coming when I don't believe there will be as much water going over Niagara Falls as would run a 100-hp wheel, but the power of that falls will be distributed east and west of that point for hundreds of miles. I don't believe there is a railroad west of Syracuse that within the next ten years will not be served by power from Niagara Falls.

Mr. Cole—At the last electric light convention in Chicago the question was very instructively discussed between the underwriters and electric light men as to what constitutes a dangerous current for high potential transmission, and a complete report is to be made on that subject at the next meeting of the National Electric Light Association. The claim among the electric light men was that a 22,000-volt current was no more dangerous than 2200 on a well-constructed line, so that no shock could be received from the pole in case of leakage or during rain storms, and that there should be some standardizing of the method of construction of high-potential lines. That was conceded by both sides.

Mr. Storer—Referring to Mr. Brady's remarks concerning what is high voltage, I wish to refer to a conversation that I had some time ago with Professor Ryan, of Cornell University, who had been conducting some experiments in connection with the protection of transformers and high voltages. He ventured the prediction that in our lifetime we should see power transmission circuits operated at not less than 500,000 volts. If that is the case it will be a very simple matter for the Manhattan to use its steam power plant as a reserve for the Niagara power. I would not be at all surprised if we were to see that time come, and the question as to what is high voltage to-day is no more settled than what high voltage was twenty years ago. The question is merely relative. With reference to the question of its effect on human life, that is a question depending entirely on the physical condition of the person getting the shock. We know of people that have been killed with 100 volts, and we know of those that have taken all the way up from 100 to 30,000 without being killed. One person that I know of particularly was connected with a 30,000-volt current so long, and was burned so badly that both feet and one arm were amputated as a result, yet he still lives, and aside from that he is in reasonable health, considering that there is only part of him left. I think that any steps that the Legislature or the underwriters may take with reference to transmission lines and regulations as to their position and construction should be taken with a great deal of care, for if it is done unwisely it will certainly restrict transmission line construction and the distribution of power to such an extent as to be very detrimental to all railroad interests.

Mr. Connette—We have one employee connected with the Syracuse Rapid Transit Railroad Company who will stand with his bare feet on the ground and take hold of a trolley wire with his bare hands without any apparent disturbance.

Mr. Barnes—The matter that I had in mind was not a theory. It is a fact. The companies are to-day using a 22,000-volt current. In some cases those currents are transmitted on the highway. What Mr. Brady suggested I think is so: That the Legislature may be called on to take some steps to prevent a danger which, perhaps, does not exist. And I think this Association can do a great deal in heading off unnecessary legislation in that direction by taking some initiative action in the matter. Without expressing an opinion, there is a great question whether the current transmitted at that voltage in the way it is at present is a danger to the community. One man may take 30,000 volts and live, but we know that an electric current will kill, and the general public know it. They know that people can be killed with a great deal less voltage than 20,000. Some intelligent action on the part of this Association in determining whether the present transmission and construction of lines over which power is transmitted is dangerous or not would do a great deal to satisfy the public mind in the matter. If it is not dangerous they should be convinced that it is not, and if it is dangerous some steps ought to be taken to minimize that danger. My suggestion is that a committee be appointed by this convention that shall undertake an investigation of the conditions as they exist to-day, and report at the next convention.

Mr. Peck—As the American Society of Electrical Engineers have taken this matter up, I think it would be proper for this Association to appoint a committee of three (and I would so move) to act jointly with that society and the National Board of Underwriters, the committee to be appointed by the chair and report later.

The motion was seconded and carried.

The president appointed as members of the nominating committee Messrs. T. E. Mitten, H. A. Nicholl and J. T. Smith.

On motion of Mr. Connette, duly seconded and carried, the convention adjourned until 9:30 a. m. on Wednesday morning.

WEDNESDAY MORNING'S SESSION

The convention met, pursuant to adjournment, and the president introduced Orlando W. Hart, who read his paper on "Despatcher's Duties and Electric Signals," which was printed last week on page 708.

The President—Mr. Hart's paper and the discussion by Mr. Wilcoxen, of Rochester, are so closely related that we will take up the discussion after Mr. Wilcoxen reads his contribution on the topic of "Car Despatching." The next order will be Mr. Barnes' paper.

Mr. Barnes—Unfortunately I was seated near the speakers' table last night and I have got such a cold that I don't think I could make myself heard by the convention, and for that reason I have asked Mr. Clark, of Binghamton, to present the paper for me, and he has kindly consented to do so. Mr. Clark thereupon read the paper of Mr. Barnes on "Steam Railroad Crossings, or Right-Angle Crossings of Electric Lines," which appears in this issue.

On motion of Mr. Connette the thanks of the convention were extended to Mr. Barnes for his paper.

Mr. Barnes was asked whether the number of crossings stated included crossings of switches, and he replied, "Yes. Every crossing of a steam railroad track over which there is any operation, whether freight or passenger, is considered as a crossing of a steam railroad."

A member mentioned that his company reported one crossing, but there were two or three switches which were crossed, and he asked whether those were considered steam railroad crossings.

Mr. Barnes—Yes. We have had accidents occur at crossings of that character, and experience has led us to consider them as steam road crossings.

Mr. Hart—I would like to know if Mr. Barnes prefers a stop-block or a derailing switch on street railroads.

Mr. Barnes—I don't want to express an opinion on that. Any means of derailing a car or preventing its passage onto a steam railroad track in the manner described in the paper is sufficient protection in my judgment, whether a stop-block or otherwise.

The President—The Board of Railroad Commissioners has suggested two topics for discussion here, one of which is "The Advantages and Disadvantages of Oil Tail Lights for Interurban Cars." I would like to have some remarks upon that subject.

Mr. Barnes—A number of accidents have occurred in the State which have been caused by cars breaking down, being derailed, or stopping from other causes, and losing their supply of electric current, thus leaving them in darkness. Cars following have run into the rear end of them, and the Board of Railroad Commissioners has suggested to the managers of the roads the plan followed by steam roads of having an oil light or signal on the rear end of each car, especially on suburban or interurban cars. This is not restricted to roads operating at high speed, because we have had a number of accidents of that character on what might be termed ordinary interurban or suburban roads. I am glad to say that nearly every road, with few exceptions, to-day has its cars of that class equipped with oil tail lights.

The President—The next topic is "Street Car Controllers—Their Proper and Improper Operation."

Mr. Barnes—In some respects it seems hardly possible that there can be any defect in the modern controller as manufactured by the leading electrical companies, but in the case of nearly every collision investigated the motorman has a stereotyped answer in reply to the question why he didn't bring his car to a stop, and that is, "The brake wouldn't work, and I tried the controller and that wouldn't take." In some cases I have come to the conclusion that that is the fact, whether through inexperience in its use or lack of knowledge of its construction, or because of an inherent defect in the controller

itself. The matter is one which will bear discussion at this convention.

Mr. Cole—I think there is no question that all mechanical appliances, especially those with as many moving parts and as many working parts as a controller, afford some chance for a defect; but I believe that has got to be taken care of in the inspection. When a motorman turns his car in at night it should be either reported O. K. or defective, and a system should be developed that will check off the repairs to the car before it goes out in the morning, showing what inspector made the repairs. It is entirely up to the inspection in the car house to keep it in order.

The President—We will now proceed with the discussion of topics suggested by Mr. Vreeland last year. One of these is "Interurban Service," divided into three heads; the first part treating " Standard Equipment." C. Loomis Allen, of Utica, has kindly consented to open this topic.

Mr. Allen—Standard equipment for the successful operation of interurban lines is a very large question. To-day, within the limits of the State of New York you can visit many interurban systems or lines and you will find in operation as many different types of cars, and as many sizes and types of motors as there are roads. Whether it is possible to adopt a standard car for interurban service is a question, in my mind. Each system, or each road, has some peculiar conditions that must be dealth with. I have in mind to-day a road operating through about 40 miles of sparsely settled farming country, in which there are three or four hamlets, and I do not presume that the gross receipts of that property will exceed $100.000 in a year. Still, upon that road are operated large interurban cars that weigh not less than 30 tons to 35 tons, and will seat comfortably sixty-two people. I cite this instance as one where a road has purchased equipment that is far greater than the demands of the traffic require. I have in mind another interurban road whose gross receipts are approximately $650,000 a year, whose service every day between the terminii is never less than thirty minutes, and on Saturdays, Sundays and all holidays is cut to fifteen minutes and possibly seven and a half minutes. The equipment used on that road is not heavy, so far as weight is concerned, the cars seating approimately forty-eight people and weighing not to exceed 50,000 lbs. light. This is the other extreme.

What kind of car and equipment could be used as a standard is a question which I think this Association should take up. Perhaps I might give my personal experience. At the time the Utica & Mohawk Valley Railroad Company was purchasing cars for the operation of the road the question arose whether long, heavy cars should be purchased, or whether cars of less length and not so great weight, but more of them, should be purchased. A study of the conditions as they existed at that time showed that it was not the long rider we would have to deal with; that we would have to deal with the rider who would be on our cars not to exceed forty-five minutes. We adopted a car not of great length, and not of great weight. We believe that the people in that particular territory have responded to the service and to the policy which we have adopted in giving them that service; namely, that it was not a large car hourly that the people wished, but it was a comfortable car and more frequent service. To be a little more explicit: We could have placed upon our system a car weighing approximately 35 tons to 40 tons, and seating from sixty to seventy people, and could have taken care of the traffic with hourly service, but we have adopted a shorter car and have given half-hourly service.

As to the electric equipment on a standard car for interurban service, I hardly think it is possible to attain that point. There are so many local conditions controlling, grades, frequent stops, and the alignment of the road that they should determine the question of the size of equipment to be placed under an interurban car. As to the trucks, I think interurban practice has settled down practically to three types of trucks. First, the master carbuilders' truck, which has come into general use; second, the large, heavy truck, as built by the Brill Company and sold for heavy elevated service and for heavy interurban service, and practically the same type of truck which is built by the Peckham Manufacturing Company.

When we take up the question of trucks the question of wheels naturally follows. Those who have been operating cars at fairly high speeds with chilled wheels wish that they could feel sure the wheels were thoroughly safe. It has been a question in my mind why we do not get the quality of wheels that we did ten years ago. I am sure that in city service the mileage we are making to-day on chilled wheels is not as great as we made in the years from 1893 to 1898. The question whether a chilled wheel or a steel wheel is the proper thing to use on interurban cars from an economical standpoint is one that should be investigated very carefully. On the question of safety, I think general practice has shown that there is but one wheel to adopt; namely, the steel wheel. The question of whether the steel wheel is economical or not depends very largely upon the dimensions of the flange and tread; the greater the depth of the flange and its width the greater the life will be of the wheel. What I have said of the dimensions of the steel wheel is true also of the chilled wheel. Steel wheels that by reason of local conditions have to be designed with shallow treads and with shallow flanges will not, of necessity, give the service that a wheel that has the large tread and the deep flange will give. I think the consideration of safety alone should control the question of wheels. One of the most serious accidents that occurred in the territory surrounding the city of Cleveland last winter was due to the breaking of a wheel while the car was in motion at a speed of approximately 40 miles an hour. The body of the car left the trucks completely, and rolled over on its side, and some of you probably will remember the photograph that was shown in the Street Railway Journal of a car lying on its back. The photograph was published in an advertisement of the quality of cars of a certain car builder.

As I said in the beginning, it seems to me a difficult matter to adopt a standard car. In steam railroad practice this was not so. Steam railroads are built with as little grade and as little curvature as possible. If the trolley road were limited to low grades and light curvature it would not exist. The trolley has made its success through the fact that it has been possible to overcome grades and overcome difficult locations by the use of very sharp curves. Those two things alone would control, in my mind, to a large extent, the question of what the car should be on any interurban line.

Mr. Rockwell—I would like to ask Mr. Allen whether he considers a 1-in. flange sufficient for a 50-mile-an-hour-car?

Mr. Allen—I have operated cars having a 7/8-in. flange and a thickness of 3/4 in. at speeds up to 50 miles an hour. We have adopted on the Utica & Mohawk Valley the standard master car builder's wheel, with the exception of the width of the tread. Our flanges are 1 1/8 ins in depth, and 1 1/8 ins. in thickness, and our tread is 2 3/4 ins. Our special work has been designed and built for that. We have operated chilled and steel wheels over old girder rail sections which had originally only a depth of 1 inch from the head. This was a difficult task, and beyond doubt was expensive as far as the item of power was concerned, because the car was riding practically on the face of the flange. But since that time we have been operating those wheels and not confining them to any one piece of track, but have operated them all over our whole system. There is not a double-truck car in the city of Utica today that has not wheels having a flange of 1 1/8 ins. in depth and 1 1/8 ins. in thickness. We have chilled wheels in city and suburban service that have operated a mileage of 36,000 miles

to 40,000 miles, while wheels having a flange of only 7/8 in. or 3/4 in. depth have not given, on the same roads and the same streets, a mileage exceeding 20,000 miles to 25,000 miles.

Mr. Rockwell—I hadn't reference so much to mileage as I had to safety. The question in my mind is whether a 7/8-in. flange is sufficient for a speed of 50 miles or 60 miles an hour. No doubt we have all had the same experience with many sections of girder rail on which a deeper flange could not be used. In T-rail construction we don't have the same difficulty. Our T-rail work or special road work will carry almost any type of flange, but girder rails will not. The great difficulty I find with the Trilby rails is to keep them clean, and I find that there is great liability to spring an axle. In spite of all the care taken oftentimes the tracks will not be all alike, and if you do any interchanging with steam roads you will find many times cars that will not track at all; you will find the flange resting in such a way on the side that you are very likely to strain an axle. We use a 3-in. tread altogether.

Mr. Allen—I don't consider the flange the only dangerous point in the wheel; in fact, I believe that the tread is just as great a source of danger, if not greater, than the flange. The flange trouble may occur in a steel wheel, although not quite to such an extent as it does in the chilled wheel. But there are certain classes of accidents due to the bursting of the tread of the wheel that seem to me of far greater importance than the breaking of the flange. As an example, before we could equip our cars with steel wheels we had a chilled wheel burst, and approximately one-half of the rim of the wheel came off and protruded through the car floor while the car was running not less than 45 m. p. h.

The President—"Car Despatching" is the next sub-head under "Interurban Service," and Mr. Wilcoxen, of Rochester, has kindly consented to open the discussion.

Mr. Wilcoxen then read the paper entitled "Interurban Train Despatching," which is printed on another page.

Mr. Barnes—The two able papers that have been presented here are on the right line. I don't know of any department in the operation of electric cars that needs more overhauling and revising and improving than the one under consideration. Nine-tenths of the collisions that occur on electric railroads to-day are the direct result of defects in train despatching. It is a branch of the operation which should be improved for the protection of the public and for the financial interests of the companies. I was very much interested in both papers. Mr. Hart's paper included a new feature providing that where a train despatcher makes a mistake means are at hand of rectifying it before a collision occurs. As an additional means of preventing an accident caused by a mistake on the part of a train despatcher, I think a safer and easier method in such cases would be to enable the train despatcher, either through switches in his office or by direct communication with sub-stations or the power house, to shut off the current on the trolley wire; and if the train despatcher has made a mistake no collision will result from it.

A serious question, and one which should receive proper consideration, is whether it is advisable to give trains operating in either direction a superior right on electric roads. In deciding that question the class of employees on electric railroads must be taken into consideration. While that is the plan employed by steam roads, with their experienced engineers and conductors and train crews, it is questionable whether accidents on electric lines would not be lessened by not giving any train superior rights. The suggestion made by Mr. Hart that train despatchers should be brought together and these questions discussed and some plan adopted by them and presented to this convention for its approval, is a good one. The standardizing of equipment is a good thing, but the standardizing of train despatching is more important and will prevent more accidents.

Mr. Pardee—On the question of shutting off the power in case of a mistake by the despatcher, I would call attention to an accident that occurred last summer on the Grand Rapids & Muskegon road in Michigan. A despatcher found that he had made a mistake and the cars would probably come together head on. He immediately telephoned to the sub-station and had the current shut off. One of the cars was on one side of a valley and the other was on the other side; they both saw each other, but they had no power to stop the cars, and they came together in a head-end collision.

Mr. Hart—I will say that on the Boston & Worcester Street Railway, between Boston and Worcester, they have a device whereby they shut the power off the entire line, whether it be east or west of the despatcher's office; nevertheless, they have had accidents there. The only objection that I see to shutting the power off the entire line is that you upset your entire schedule, which you want to adhere to as nearly as possible. By a device which has been in use on the New Bedford road for the last two years a system is used whereby they can set a signal at any terminal by telephone communication, and after that signal has been locked in that position so it cannot be disturbed by any malicious person, the despatcher feels safe to run a train against that signal. The signal used is only a 7-in. disc, which, in my opinion, is not large enough. At least a 30-in. semaphore should be used, and I believe a constant light should be used in connection with it, not dependent upon the operation of the signal for its illumination.

On motion the question of car despatching was referred to the committee on rules, with instructions to present a standard system if possible.

The President—The next topic is "Standard Methods of Fare Collection and Ticket Taking."

Mr. Stephenson's paper on "Interurban Ticketing" was read at the opening of this discussion. The paper was printed last week in the STREET RAILWAY JOURNAL, page 707.

The President—We shall proceed to the topic of "Extra Freight and Baggage Service on Interurban Lines," under three heads, suggested by Mr. Vreeland. The first is "Traffic Arrangements with Steam Roads and Boats." It was found that no company had had extensive arrangements of this kind.

If there is no one here who wishes to discuss this subject, we will pass to the next topic, "Traffic Arrangements with Other Interurban Lines." Mr. T. J. Nicholl, of Rochester, will reply to that.

Mr. Nicholl—We have no special traffic arrangement with other interurban lines. We are running a freight and express business over our own lines, but we are not turning it over to other lines, except in one case where we turn it over to a steamboat company, and that is not sufficiently developed to be of any value to this convention. We anticipate that we shall be compelled to make arrangements with other interurban lines for the transportation of passengers as well as freight.

We have, however, a number of contracts with other interurban lines or lines entering our city, and possibly our form of contract may be interesting, as I don't know of any other company that has precisely the same form of contract that we have with other lines in our city. To begin with, our policy has been to welcome reliable promoters who were really going to build a road, and let them use our tracks under proper restrictions. One of the restrictions is that we retain the right to change the crews at the point of junction. That is, although we generally allow their crews to come into the city, at the same time we retain the right to put our own crews on their cars; and the crews of the entering company have to be under our orders and under our control. I presume the main feature of all these contracts is the same in that respect. We require the incoming road, in consideration of the privilege of doing such traffic as they wish on our streets, to pay us the gross

earnings on that line per car mile. They can pick up passengers or drop them off anywhere, or do a city business on the street on which they come in, but if the car earnings on that line are 20 cents we require them to pay us 20 cents for the use of track and power. They supply their own cars and provide their own men to run the cars and indemnify us from accidents. This is unusual, I think, for the companies are generally charged a fixed rate per car mile, and the expense of running the cars is divided, and the interurban company is required to pay to the city company so much for each passenger it picks up—about half or a little more, or something of the kind. That is the main difference between the contracts. We not only give the incoming road the right to use our tracks and use our power, and to do the same business that we do on those streets, but we give them the right to transfer. They issue a transfer which is specially designed or colored, upon which we carry a passenger to any part of the city on any other of our 5-cent lines, and in turn we agree, in some cases, to sell their tickets, where it can be done, to some resort point or some amusement point. Of course, we cannot carry a full line of tickets for a road extending from Rochester to Syracuse for all the way stations; but our conductors are allowed to carry, as a rule, one set of tickets to some special point outside the city. Those tickets we sell and we take up their coupons. The transfers that they issue, the special colored transfers, which we take and which we honor, and the coupons which we take up of theirs are redeemed at one-half fare. We think that is equitable, because we carry the passenger from some point on our line to the center of the city or to the connecting point with the interurban line, and we charge them 2½ cents for carrying them there. And when they bring a passenger into the city or pick up a passenger in the city, they issue one of their own transfers and they redeem the transfer at 2½ cents. That evens up the matter of fares. It has been suggested by some of our friends that our arrangement is a little hard on some of the interurban companies; but when you come to figure out the privileges that they are getting without the initial cost in obtaining rights of way through the city, and the value of the franchise, and the amount of fixed charges that we have to pay on the installation of the property, and power, etc., I think you will find that it is not very far out of the way. We have found it to work very satisfactorily to the companies that operate in that way.

The President—The next subject, and the last, is the "Development of Freight and Express Service."

Mr. Clark—The executive committee of this Association invited E. F. Seixas, of St. Catharine's, Ontario, to respond to this subject. Mr. Seixas expected to be here, but at the last moment stress of business prevented. He forwarded his paper with the request that the same be read. I move that his paper be received and spread on the minutes, and the thanks of this convention extended to him therefor.

The motion was seconded and carried. The full text of this paper will be found elsewhere in this issue.

The President—I was to appoint a committee of three to act with the National Underwriters and the Electric Light Association. I will appoint J. B. Storer, of Syracuse; W. F. Rockwell and R. E. Danforth as such committee.

Mr. Connette, of the committee on rules, I understand, will report.

Mr. Connette—This Association adopted the report which was submitted at the last meeting of this Association at Lake George. Since that time the standard rules committee of the American Street Railway Association has submitted a report at the meeting in Saratoga last month, and the report, to a large extent, was about the same as was adopted by this Association, so far as the rules governing motormen and conductors are concerned. There were some minor changes made by that committee, but they were not essential. The committee of this New York State Association believes that it is a good idea to recommend to this Association to adopt the report that was adopted by the National Association, because it differed but very little from the one which is already in vogue. The committee makes that recommendation. Now, as to the rules governing interurban service, it was deemed by the National Association, we believe, that action upon them should be deferred. However, the code will be submitted here, but we suggest that action be deferred until the State Board of Railroad Commissioners can have an opportunity to examine it and pass upon it. We would recommend, therefore, that the Association adopt the report so far as the rules governing conductors and motormen are concerned, and that the recommendations governing interurban service be postponed—that is, that action upon that portion of it be postponed until the State Board of Railroad Commissioners can have a chance to examine it and pass upon it, and that the committee be continued, and make its final report on the interurban service rules at the next meeting.

The President—Gentlemen, you have heard the recommendation of the chairman of the rules committee, what is your pleasure?

Mr. Allen—I move that the report of the committee on rules be accepted, and that the committee be continued for another year.

The motion was seconded and carried.

The President—The report of the nominating committee, of which Mr. Mitten is chairman, is now in order.

The Secretary—The committee has submitted in nomination for officers and members of the executive committee of the Association for the coming year the following:

For president, G. Tracy Rogers, of Binghamton, N. Y.

For first vice-president, E. G. Connette, of Syracuse, N. Y.

For second vice-president, Addison B. Colvin, of Glens Falls, N. Y.

For secretary and treasurer, W. W. Cole, of Elmira.

For members of the executive committee, C. Loomis Allen, of Utica; B. B. Nostrand, Jr., of Peekskill; W. H. Pouch, of Newburg, and J. H. Pardee, of Canandaigua.

The President—It is very kind of the nominating committee to send my name in, but I think it is time now for some one else to take the laboring oar. I find upon looking back for the last nine years that a good share of each year has been devoted to the interests of this Association. It has been a heart work with me, but my own interests are now getting larger, and I find I must devote some of the time in the future to my own affairs. The friendships that I have formed in the last nine years I will carry through life with me. My relations with the executive committee (who have worked equally as earnestly for the success of this Association and have not spared either money or time) have always been most cordial. Gentlemen, I thank you, but I must decline the nomination.

Mr. Ely—I quite appreciate the position taken by Mr. Rogers in this matter, and in moving you, Mr. Secretary, that the declination of Mr. Rogers be accepted, I only desire to say that I have often wondered how it was possible for Mr. Rogers to give so much of his time to the affairs of this Association. If he feels (as I know he does from personal conversation with him) that he ought to be relieved from these duties which have proven arduous and time-taking to him, I think that the Association owes it to him to grant his request in the most cheerful way. I know that even though we shall not have him as president of the Association longer, the welfare of the Association will always be very close to his heart and mind, and that those who may succeed him in the office which he has so long and so ably held will receive his cordial support and assistance all the time. I cannot say anything that would aptly or fittingly describe what in my judgment the Association owes to Mr. Rogers. As he described it last evening, when this convention

met here nine years ago, which was the occasion of his first being elevated to the office of president, it was a small, struggling affair; and I think it has been largely due to the time, the energy, and the ability which he has devoted to the affairs of the Association that it has grown to its present prosperous condition. It is at the present time, in my judgment, one of the greatest instrumentalities for the good of our business that there is. I have been much struck at these sessions with the attendance, the matters and things submitted, the discussions and the papers and the general esprit du corps, as I might term it, of this Association. I have the honor to be the president of the American Street Railway Association, and I may say that if during my incumbency of that office I were able to bring it, with the assistance of those who work with me, to such a high plane as this Association occupies, I should deem my holding of the office not to have been in vain. In making the motion that I do, gentlemen, I can only say farther that no words of mine could describe or fittingly characterize the debt that this Association, in my judgment, owes to Mr. Rogers. I hope the motion will unanimously prevail.



EX-PRESIDENT
G. TRACY ROGERS



EX-SECRETARY AND
TREASURER H. A. ROBINSON



PRESIDENT
E. G. CONNETTE



SECRETARY AND TREASURER
W. W. COLE

The motion to accept the declination of Mr. Rogers was seconded, and upon being put by the secretary was unanimously carried.

Mr. Ely—Mr. Secretary, a vacancy now exists. I do not wish to seem to usurp any of the functions of the nominating committee, but as this matter has presented itself to my mind, as the result of careful thought and deliberation, I venture to rise again to place a name before you in nomination for the presidency. The gentleman that I will present is a very able man, a man of ideas and of ability in every way, devoted to the Association, and an able member of our profession or business. In making the nomination I feel that I should fail in my duty to him, to all of you, and to myself, did I not say a few plain, straightforward, candid words. From the report of the committee it seems to me that there must be in the minds of those who have considered the matter the idea that a radical change in the personnel of the officers of the Association should be made, and I think that it comes about in this way. For a long time certain gentlemen have occupied certain positions, and while I believe that it has, in the main, been for the best interests of the Association, still there comes a time in the life of such an Association as this when there ought to be a change in the personnel of the management, because, practically, the officers do manage the concerns of the Association. I know my own feeling. I know Mr. Vreeland's feeling, I know Mr. Robinson's, Mr. Nicholl's and Mr. Rogers'. We have talked this matter over very carefully and very earnestly. In consideration of the matters involved I must pay this tribute to my associates: that I have never seen questions more fairly met, more earnestly discussed, or more honorably dealt with than these particular questions that are associated with the change outlined in the report of the nominating committee. I wish to say that not only the future president but all of the officers of the Association will receive the earnest, the cordial and the hearty support and co-operation, whenever it is desired, and at all times, of those who have been in the immediate past officers of this Association. I know that I can make that statement with the feeling and in the belief that those who shall fill those places will never find that the word which I speak has been broken by any of those in behalf of whom I speak it. I wish to nominate for the office of president of this Association Mr. Connette, of Syracuse, who has entertained us so beautifully during our stay here. (Applause.)

The nomination was duly seconded.

Mr. Clark—Mr. President, I move you that the secretary be empowered to cast one ballot as the choice of this Association for E. G. Connette for president.

The motion was seconded and carried.

A. B. Colvin, of Glens Falls, was then elected first vice-president; John L. Heins, of Brooklyn, second vice-president; W. W. Cole as secretary and treasurer, and C. Loomis Allen, B. B. Nostrand, Jr., W. H. Pouch and J. H. Pardee as members of the executive committee. It was also decided to hold the next meeting at Utica.

Mr. Clark—I think it but just that before the close of the routine business of this meeting a formal expression of our thanks and gratitude should be extended to the local committee of Syracuse, who have so generously arranged for our splendid and hospitable entertainment. That we have been nicely cared for I think no one will gainsay. That the twenty-first annual convention has been an overwhelming success I think is generally conceded. That much of the credit for the success of this important and pleasant meeting is due to the local committee I am sure that you will all agree. Therefore, for the purpose of placing an expression formally before this meeting, I would move that the thanks of the Street Railway Association of the State of New York be, and they are hereby extended to each individual member of the local committee, to each member of the ladies' committee, to the citizens of Syracuse, and to the press of this city, to the city officials, and to all who have combined to make our stay in this, the Central City, pleasant and agreeable. I take pleasure in offering this motion, and I hope that it will be unanimously and heartily endorsed.

The motion was seconded and carried unanimously.

Mr. Ely—At the risk of being tiresome, I wish to say one word more. For years past—I don't just recollect how many—but for a number of years past, this Association has had as secretary and treasurer one of the ablest lawyers in street railroad law that there is in the United States of my acquaintance. I don't know of any association of business men with which I have ever been connected that has had, without cost and

without expense, the services of so able a man as the retiring secretary and treasurer, Mr. Robinson. I wish to make, in behalf of us all, a formal statement of the obligation which rests upon the Association and moves toward Mr. Robinson, and at the proper time I wish to make a motion that a committee be appointed to draught a suitable resolution to be spread upon the minutes with reference to the retiring president and secretary and treasurer.

The motion was put by Mr. Ely and carried unanimously, and Messrs. Ely, Cole and Allen were appointed to act on the committee.

The regular meeting was then adjourned.

PROGRESS ON THE BUFFALO, DUNKIRK & WESTERN RAILROAD

Work on the Buffalo, Dunkirk & Western Railroad, now under construction, from Buffalo (N. Y.) to Westfield, Chautauqua County, a distance of about 70 miles, is progressing rapidly. The line from Fredonia to Westfield, a distance of about 20 miles, is substantially finished, and the company will soon be operating cars on this section. The line from Buffalo west to Angola, a distance of 22 miles, has been graded for double track with all of the concrete, culverts and foundations for bridges in. The bridges have been delivered and will soon be erected. Ties and poles have been delivered along this section, and it is intended to have the line to Angola from Buffalo in operation before Jan. 1. From the rapidity with which construction has been progressing during the past summer the entire line should be in operation by July 1, 1904, which will be six months in advance of the date specified for the completion of the contract. The standard of construction of the track is that of the best steam railroad practice, and the electrical equipment is standard of that of the best constructed interurban electric railway. When in complete operation the system will comprise 90 miles of track. It is stated that the company has concluded an agreement with the International Traction Company, of Buffalo, by which passengers will be brought into that city from the city line by the International Company.

FREE LEGAL ADVICE FOR EMPLOYEES

The recent announcement that the Boston Elevated Railway Company would furnish advice on legal matters free to its employees has brought to light the fact that the Chicago City Railway Company has for years followed this practice for the benefit of its employees. The employees make considerable use of the legal department for this purpose, and the free service is evidently much appreciated.

SCHOOL TEACHERS "BEAT" CLEVELAND COMPANY

In connection with the recent reduction of fare to six tickets for a quarter, the Cleveland Electric Railway announced that all children more than six years of age would be charged full fare, and those younger than that age would be carried free; thus dispensing with the half-fare rate formerly in vogue. It is apparent that the company did not figure on the possibilities of such a rule, as was demonstrated by a recent incident. Four young ladies accompanied by about forty tots from a kindergarten boarded a car. The young ladies paid their own fares, but protested against paying for the children, who were all under six years of age. The conductor maintained that the company had made no agreement to carry a whole kindergarten, and, on arriving at the car house, the matter was laid before the superintendent. The latter decided the children would have to be carried free, but the rules of the company will be altered at once to provide for such cases.

RUMORED ELECTRIC CONVERSION

It is announced that the Cincinnati, Hamilton & Dayton Railroad Company, one of the leading Ohio steam systems, is planning to equip several of its short lines with electricity. The experiment will first be tried on the Findlay-Deshler branch, a line about twenty miles in length, which connects Findlay with the main line. Formerly it was quite an important part of the system, but recently the company acquired the Findlay, Ft. Wayne & Western Railway, so that the Deshler line is now used largely for local traffic.

INTERCHANGEABLE MILEAGE BOOK AT INDIANAPOLIS

Plans are being considered by the managers of the interurban electric railways entering Indianapolis looking to an arrangement for issuing interchangeable mileage books, also for the interchange of freight and express matter. As outlined unofficially, the mileage books are to be made up for 500 and 1000 miles, and are to be good over all lines entering the city and such other lines in the State as it may be deemed advisable to enter into an agreement with. The rate of fare charged by most of the roads is 1½ cents a mile. This fare will probably be cut to 1¼-cent rate. The Indianapolis & Northwestern Traction Company, which has not yet been operating a month, has already announced that it plans to issue mileage books, irrespective of the action of the other companies.

ASSESSMENTS OF IOWA INTERURBAN PROPERTIES

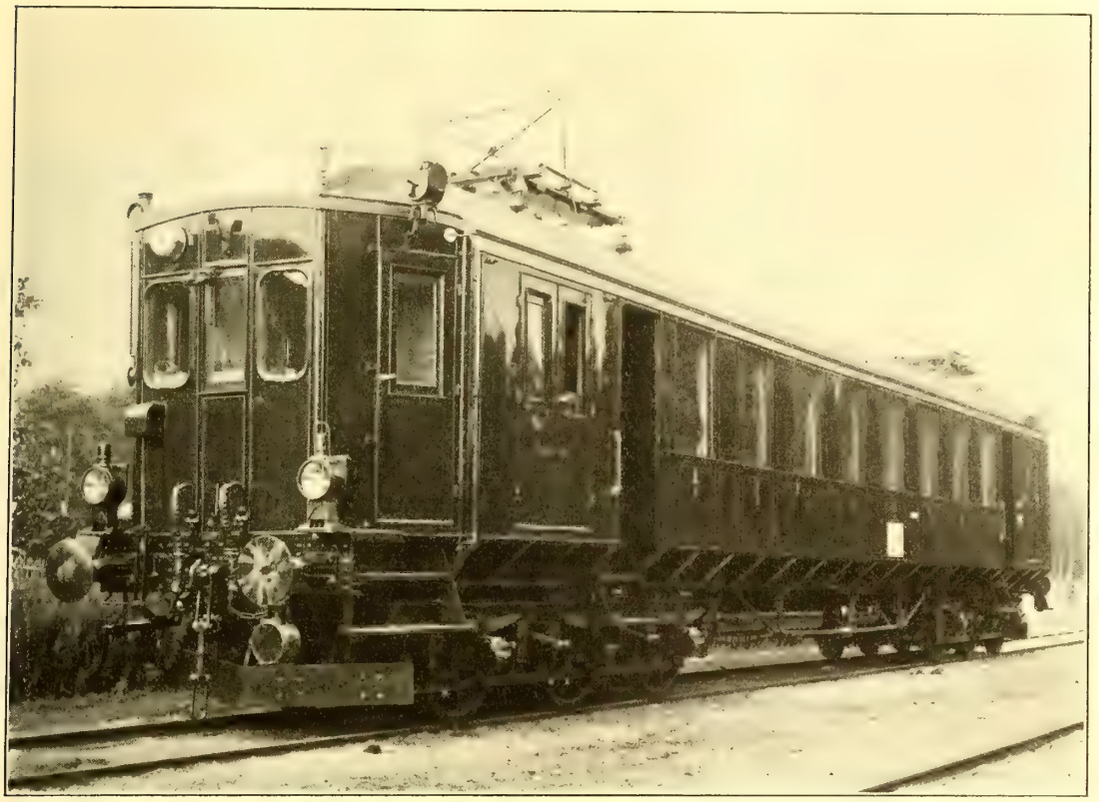
The Executive Council of Iowa has completed the assessment of interurban railway companies within the States. The Des Moines Interurban Railway Company was assessed $2,500 per mile for 23.41 miles of track, or $56,825 in all. The actual value of the property of the company is $234,100. The Boone Suburban Railway Company, with 4.7 miles of track, was assessed $1,000 per mile, or $4,700 in all; actual value $18,800. The Cedar Rapids & Marion City Railway Company, with 12.06 miles of track, was assessed $3,731, or $44,995; actual value $179,983. The Mason City & Clear Lake Traction Company, with 14.62 miles of track, was assessed at $900 per mile, or $13,158; actual value $52,632. The Tama & Toledo Electric Railway Company, with 2.75 miles of track, was assessed $1,818 per mile, or $4,999; actual value $19,998. The Waterloo & Cedar Falls Rapid Transit Railway Company, with 40 miles of track, was assessed $2,500 per mile, or $100,000 in all; actual value $400,000.

SATISFACTORY SHOWING OF A CONVERTED STEAM LINE

At the annual meeting of the Cincinnati, Georgetown & Portsmouth Railway, held a few days ago, the following officers were elected: J. W. Comstock, president; W. R. Todd, vice-president; R. E. Field, secretary-treasurer. The other members of the directorate are: J. S. Conner, W. J. Thompson and Samuel Tappin. This property was formerly a steam road, and the details of the work of changing it to an electric system were described in the Street Railway Journal of Feb. 21, 1903. For the year ending July 31, 1903, the gross receipts of the property were about $130,000, as compared with $105,000 for the year previous. This, too, despite the fact that passenger rates were reduced from 3 cents per mile to 1½ cents per mile. The freight business, which is still handled by steam locomotives, also showed a large increase, and the company has just placed a contract with the Westinghouse Company for two 50-ton electric locomotives of 500 hp each. A spur line to Batavia has recently been completed, and work on an extension from Georgetown to West Union is under way.

NEW GERMAN SINGLE-PHASE RAILWAY SYSTEM

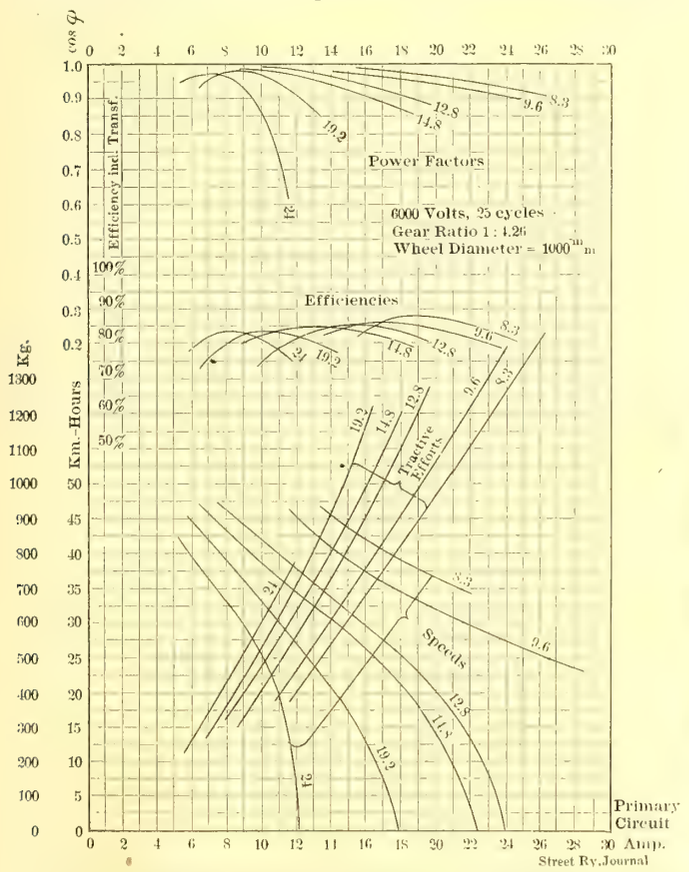
For several months past the Union Elektricitäts-Gesellschaft, of Berlin, Germany, has been conducting a series of important experiments with its new single-phase, high-voltage system on the State Railroad connecting the towns of Niederschöneweide, Johannisthal and Spindlersfeld, suburbs of Berlin. The line is 4.1 km (3 miles) long, and all trial runs are made at schedule speeds between the regular steam trains. Its use for this purpose was secured through the efforts of Regierungs and Baurat Wittfeld, of the Prussian State Railways.



EXPERIMENTAL CAR USED ON THE NIEDERSCHONEWEIDE-SPINDLERSFELD SINGLE-PHASE RAILROAD

The principal feature of this system is the single phase motor designed by Messrs. Eichberg and Winter, and shown in the accompanying illustration. This motor is said to embody all of the electrical qualities of the direct-current series motor, besides having a large air gap. By reference to the accompanying performance curves it will also be seen that this motor possesses the chief characteristics of the direct-current series type, giving a great starting torque and automatically speeding up for light loads.

In addition to these features this single-phase motor possesses two others which are very important, namely: It can be wound for the direct application of any practical voltage; speed regulation takes place without any waste of energy in external resistances and without any wattless currents larger than the ordinary working ones, where the power factor amounts to 98 per cent.



Note.—The numbers placed on the curves refer to the transforming ratio of the regulating transformer under the conditions indicated, thus, 19 means a ratio of 19.1, etc.

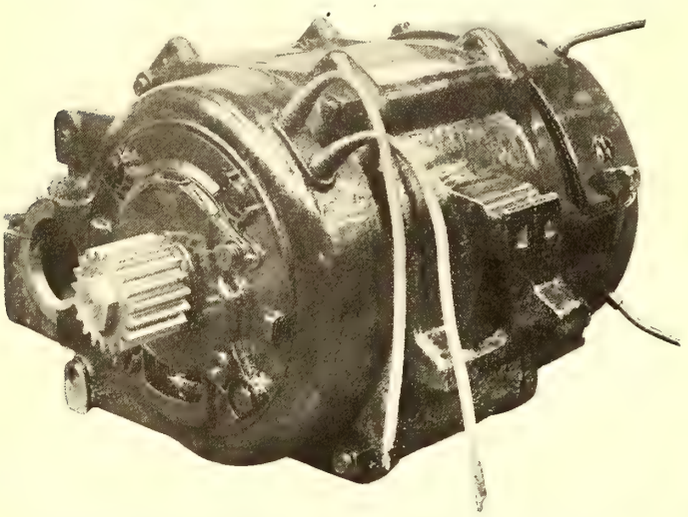
MOTOR CURVES



OVERHEAD CONSTRUCTION ON THE NIEDERSCHONEWEIDE SPINDLERSFELD SINGLE-PHASE RAILROAD

The effect of these latter advantages is that sub-stations containing revolving machinery will not be required, in many instances no sub-stations at all, and in all cases where acceleration periods are frequent the energy saved by using this method of speed regulation should effect considerable economy.

Single-phase current at 6000 volts, 25 cycles, is conducted through an overhead wire suspended over the center of the track from one or two parallel steel wires, connected by cross wires spaced 3 m (10 ft.) apart. This construction, illustrated herewith, was adopted to prevent accidents caused by wire breakage. The steel wires are not insulated from the main wire, and, therefore, act as feeders. They are insulated from the ground, and suspended from cross-bars connected to the side poles. The current-collecting device consists of two sliding bows, from which the current is conducted to the transformers. A door-locking mechanism in connection with this current-collecting method prevents access to the high-tension apparatus when the bows are in contact with the power wire. The door can only be opened by taking off the collector bows, and as long as it remains open the collectors cannot be placed on the wire.



THE EICHBERG-WINTER SINGLE-PHASE RAILWAY MOTOR

It is characteristic of this system that under ordinary operating conditions the high-tension circuit suffers no interruption, as all regulation takes place in the low-tension circuit, which even at the highest speeds does not exceed 190 volts. At a recent test it was noted that when the car was brought to a full stop the current in the primary circuit was from 8 amps. to 10 amps., and 30 amps. at 40 km (30 miles) per hour. As the line voltage was 6000 the product of current and voltage at full load was, therefore, 180 KV-A. The wattmeter on the car simultaneously indicated 180 kw, showing that the motor operates at unity power factor under regular running conditions.

The complete electrical equipment includes two four-pole type WE-I motors, each of 125 hp, the necessary transformers, and controlling apparatus embodying the most advanced developments of multiple-unit control. The total weight of the electrical apparatus is 5600 kg (12,600 lbs.), which is stated to be somewhat less than for a corresponding direct-current outfit, principally on account of the omission of external resistances.

The complete experimental car shown herewith weighs 51,660 kg (116,200 lbs.). It contains twenty-one first and second-class seats and twenty-eight third-class seats. A motorman's cab and baggage room are furnished at each end.

Within a few weeks an additional car will be ready for service, after which complete trains, consisting of one motor car at each end and two or three non-motor cars in between, will be operated.

COMBINATION CAR FOR THE GALESBURG & KEWANEE RAILWAY

The car shown in the accompanying engravings was received by the Galesburg & Kewanee Electric Railway Company ten days after the contract for same was made with the American Car Company of St. Louis. The car was built originally for another company, but when the Galesburg company bought it, motors had to be brought from the East, the car mounted on trucks, the new name painted on it, the electrical equipment installed and other work had to be done. It was necesssary to have the car on a certain day and the delivery was made on time.



INTERIOR OF GALESBURG & KEWANEE CAR

The car measures 33 ft. 6 ins. over end panels and 42 ft. 11 ins. over crown pieces. The width over sills and sill plates is 8 ft. 4 ins. It is vestibuled at both ends and has a steam car roof. The sides are straight and sheathed with tongued and grooved poplar boards. The vestibules are sheathed with metal outside and wood inside. The upper sashes of the windows are stationary and the lower arranged to drop into wall pockets. Between the passenger and baggage compartments is a hardwood partition, with glass in the upper part, and a swinging door.

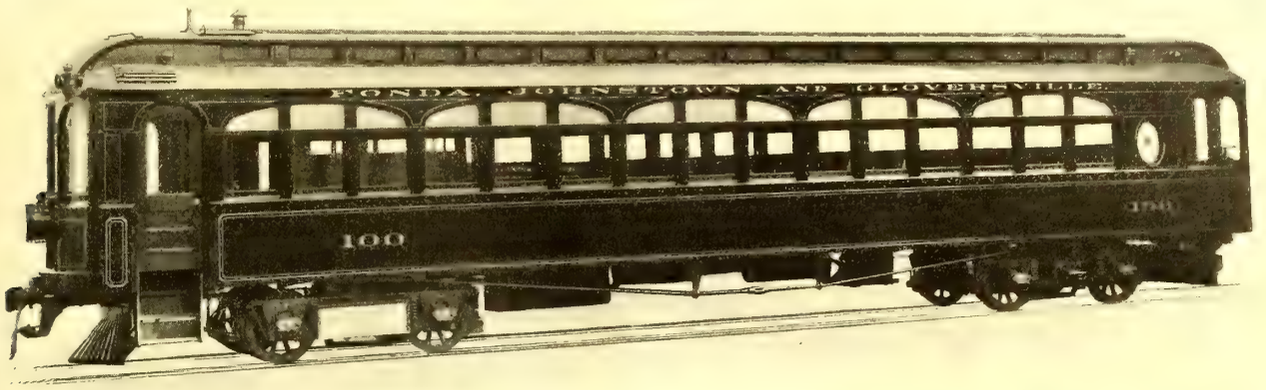


COMBINATION CAR OF GALESBURG & KEWANEE ELECTRIC RAILWAY

Large sliding doors in the baggage compartment are glazed and two windows on each side of this compartment correspond in size to the rest of the windows of the car. Folding slat seats accommodate the passengers. The seats in the passenger compartment are placed transversely, with the exception of those at the corners. The trucks are Brill 27-G, equipped with two motors each.

FRAMEWORK OF CARS FOR THE FONDA, JOHNSTOWN & GLOVERSVILLE RAILWAY

In the Street Railway Journal of May 9, 1903, the somewhat remarkable channel iron bottom framework for the cars of the Fonda, Johnstown & Gloversville Railway was briefly described and illustrated. In the issue of Aug. 29, 1903, a plan of this type was given, together with a photograph taken during construction, showing the framework. The accompanying cut is an illustration of one of the finished cars.



CAR FOR THE FONDA, JOHNSTOWN & GLOVERSVILLE RAILWAY

These cars have excited considerable comment because of the unusually heavy steel bottoms and the extraordinary precautions taken in the car framing for withstanding collisions. All parts of the bottom frame are designed to minimize the effect of a head-on collision. The bumpers at the ends are so braced as to take up, without injury to the framing, a blow from 150,000 lbs. moving at slow speed, transmitting it to the longitudinal and diagonal framing of the bottom frame, after the destruction of the drawbars has allowed the bumpers to meet. The main sills consist of 10-in. channels bolted together, with malleable separators 3 ft. apart, and with transverse beams at the ends. The steel work riveting in the bottom is entirely independent of the woodwork. The outside channels are rounded at the corners and form the end of the sills. The transverse beams are 10-in. I-beams, fastened to the main sills with angles and plates. The frame under the platform consists of 6-in. channel irons. The bolsters are built up from 8-in. 24½-lb. channel bars and are reinforced with 1-in. x 7-in. plates. The steel in the bottom alone weighs 18,500 lbs.

At all important joints, where the body framing is attached to the bottom frame, the timber work is under compression. To relieve the wood framing of any lateral strain the truss rods, both top and bottom, are proportioned to put only compression stresses on the framing. The car lines are of steel in one piece across the entire car. They are shaped to form a double brace at the posts and are bolted from the top side of the cant rail clear through the posts to the under side of the steel bottom frame with heavy, round steel rods. The nuts on each end of the rods have metal bearings top and bottom, thus binding the side and roof framing together in a very rigid manner and preventing loosening up of any joints except by the rods being strained beyond their elastic limit. Another purpose in the use of rods is to prevent the shearing off of the posts in case of collision. The cant rail is further provided with 1½-in. x 3-in. steel plates on the inside, making a continuous steel band around the entire car, to which all carlines are rigidly secured. All steel connections in the car are on steel.

The cars are splendidly finished inside with African mahogany. They contain smoking compartments, which are partitioned off from the main body of the car by glass partitions, so that the view is not obstructed, as it usually is by smoking compartments built into the main body of the car. The ventilation of the smoking compartment is distinct from the body of the car. The upper sashes of each window are stationary and filled with ornamental glass. The lower sash combines in the sash a plate glass window pane and a guard for protecting the window space when the sash is lowered to open the window. When the sash is raised to close the window the guard is obscured by the ceiling. The floors are double, and between the upper and lower floors are four thicknesses of asbestos fibre as a precaution against the spread of fire. The cars are 55 ft. 10 ins. over bumpers, with 45-ft. bodies, and seat fifty-four persons. They are the work of the St. Louis Car Company.

SALT LAKE CITY NOTES

The Consolidated Railway and Power Company of Salt Lake City has begun work on an extension of its Murray line to Sandy, about fifteen miles from Salt Lake City. A branch of the new line, 1½ miles long, will also be built to Bingham Junction. The new work will comprise seven miles of single track, laid with 35-lb. rails, and with bracket overhead construction.

During the last few months the Consolidated Company has relaid two miles of double track on First South Street, in Salt Lake City, replacing the light rail with 60-lb., 60-ft., standard A. S. C. E. T-section rail. A half mile of paving has been done and another half mile is under construction. As the poles are placed in the center of the street in Salt Lake City, the car tracks are set 7 ft. apart, and the railway company is required to pave the center of the street to a total width of 21 ft.

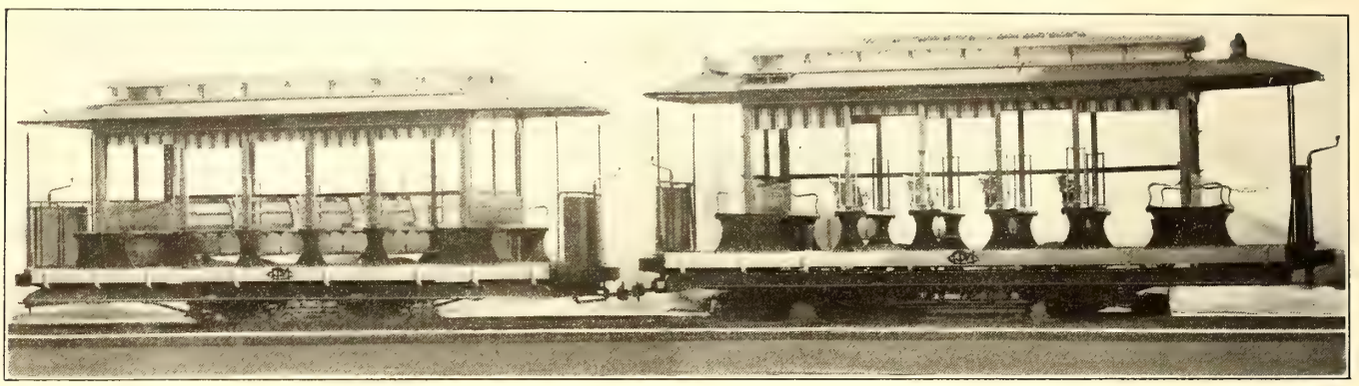
On the North State Street line 1200 feet of double track is being relaid with 60-lb. rail, and considerable other new track work is proposed.

In the way of new equipment the Salt Lake Company is about to place in service eight new double-truck closed Laclede cars. These cars have 27-ft. bodies and are provided with longitudinal seats, with a capacity for seating forty passengers. The trucks are of the Laclede type and are equipped with four 12A Westinghouse motors of a total horse power of 108 per car. On account of the location of the local telephone poles and electric light poles in the center of the street and close to street crossings, the railway company is practically prohibited from using cars having bodies longer than 27 ft.

The company is in favor of all four-motor equipments for all new cars, as the added advantage in rapid acceleration and increased traction on grades and in wet weather are believed to offset the additional expense. The low platform is still adhered to, as only one step is necessary, and after passengers mount that one step to the platform they can take their time in mounting the other step to the inside of the car. From the company's standpoint the officials are in favor of longitudinal seats for closed cars, as the car is more easily emptied, it will carry more people and can be more easily cleaned.

NEW CARS FOR CINTRA, PORTUGAL

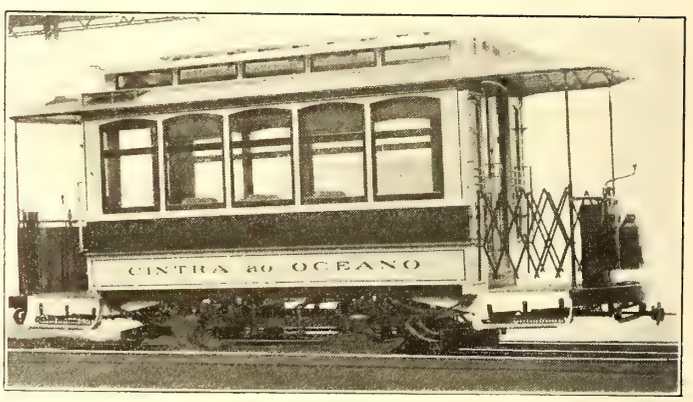
The J. G. Brill Company recently shipped thirteen cars to Cintra, Portugal, a city about fifteen miles northeast of Lisbon. The lot was divided into four styles—four eight-bench open motor cars, four eight-bench open trailers, three closed motor cars and two closed trailers. As the width was restricted to about 6 ft. 6 ins. over all, and transverse seating arrangement was desired for the closed cars, double seats 33 ins. in length were placed on one side and single seats 17 ins. long on the other, leaving a 17-in. aisle. The seats are spring cane, with reversible backs. Double seats are placed longitudinally at the corners. The total seating capacity per car is seventeen. Both window sashes of these cars are arranged to drop into window pockets and hinged covers are provided at the openings of the pockets, forming arm rests on sills at the windows.



OPEN MOTOR AND TRAIL CARS FOR CINTRA, PORTUGAL



INTERIOR OF CINTRA CAR



CLOSED CAR FOR CINTRA, PORTUGAL

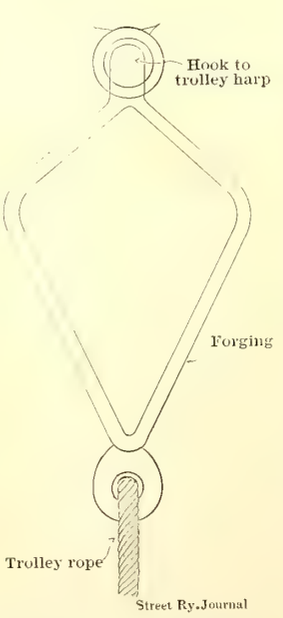
The general dimensions of the closed cars are as follows: Length over end panels, 14 ft. 8 ins.; length over crown pieces, 22 ft. 8 ins.; length over sills, 6 ft. 1½ ins., and over posts at belt, 6 ft. 5 ins.; size of side sills, 3¼ ins. x 5½ ins., and of end sills, 3¼ ins. x 6½ ins.; thickness of crown posts, 3¾ ins., and side posts, 2 ins.

The closed trailer cars are of the same dimensions as the motor cars. The general dimensions of the eight-bench open motor cars are as follows: Length over crown pieces, 24 ft. 10⅜ ins.; from centre of crown posts over crown pieces, 4 ft. 4 ins.; width over sills, 5 ft. 5¾ ins., and over posts at belt, 6 ft. 4½ ins.; sweep of posts, 5 ins.; from center to center of side posts, 2 ft. 10 ins., and between corner posts and side posts, 3 ft. 7 ins.; size of the side sill, 3¾ ins. x 7 ins., plated on the outside with ½ in. x 7 in. steel. Thickness of corner posts, 3⅝ ins., and of side posts is 2¾ ins.

The open trailer cars have the same dimensions as the open motor cars. The closed cars are finished inside in cherry of natural color, with decorated birch ceilings; the open cars' interiors are finished in cherry and ash, with birch ceilings. The cars are fitted with Brill patented specialties, as follows: Angle iron bumpers, radial drawbars, ratchet brake handles, "Dump-it" sand boxes and "Dedenda" alarm gongs. Both the open and closed motor cars are mounted on Brill 21-E trucks, with 6 ft. 6 in. wheel base; 33-in. wheels; track gage, 3 ft. 3⅜ ins. The trailer cars are mounted on Brill gear trucks, with 6 ft. 0 in. wheel base and 30-in. wheels. The cars were built in sections and knocked down for ocean transportation.

SAFETY DEVICE FOR USE WITH TROLLEY RETRIEVERS

The Indianapolis & Martinsville Rapid Transit Company, in common with a number of other interurban roads around Indianapolis, has adopted the Knutson trolley retriever, which automatically draws down the trolley pole whenever it leaves the wire and starts on an upward journey. This retriever, as is well known, has a strong spring which draws down the trolley pole with considerable force, as it must act very promptly. It was feared that should the trolley wheel or harp catch above the trolley wire as the retriever drew it down a bad wreck of the overhead line or a pulling out of the trolley pole would result upon reaching a span wire. To preclude any possibility of this a diamond-shaped forging has been hung directly under the trolley harp, and the trolley rope is attached to this forging rather than to the harp, as made plain by the sketch. This makes it impossible for the harp or wheel to catch above the wire when the retriever is drawing the pole down.



SAFETY ATTACHMENT FOR TROLLEY RETRIEVER

PAPERS PRESENTED AT THE SYRACUSE CONVENTION

PHYSICAL EXAMINATION FROM THE PHYSICIAN'S STANDPOINT

BY DR. J. J. MOOREHEAD, OF NEW YORK

From present indications it requires no prophet to predict that the profits of a street railway company will soon cease to be based on the number of passengers carried and the operating expenses, but instead be computed by the number of accidents occurring and the amount that the legal and claim department requires to pay in adjusting the same. Every lage city seems to be an epidemic center for the development of the Claimant Bacillus, and like most germs of that sort, many are infected by contact therewith and none become better until they take the Gold Cure dispensed by the treasurer's department. These conditions have made necessary the establishing of a medical examining department; and it is of this that I wish to say a few words that may seem to justify its existence.

In determining the value of what we may call the "physical investigation" of the claimant, the surgeon is called upon to answer three main questions, namely:

First, could the accident as described reasonably cause the effects complained of?

Second, are these effects actually present?

Third, if they are present will they be temporary or permanent?

In confirming or refuting what is claimed, he is guided by visible or objective symptoms and by subjective or invisible symptoms. His task is comparatively easy if all the ills are of the former class, but if to a simple scalp wound are added the symptoms of ringing in ears, dizziness, spots before the eyes, or a host of other subjective signs, then is his labor of a different caliber. This suggests the question as to the advisability of an examination, where the effects of an accident are evident, and where a visit from a surgeon would exaggerate the claimant's already great self-importance and induce him to add to his ills. This query would readily be answered if all claimants were honest, and if objective and subjective symptoms were not closely allied, and if the element of exaggeration were not present in nearly 80 per cent. of the cases we are called upon to diagnose. If a man in a brawl or in falling downstairs receives a battered face and a black eye he will probably return to work next day; but if the same injuries be received in a fall from a car, he immediately goes to bed, and when examined a week later, two physicians are in attendance, his head is swathed in bandages, and a trained nurse is keeping the ice-bags replenished to aid the medical men in their diagnosis of "threatened meningitis following concussion of the brain."

In a general way we can divide all claimants into three classes, to wit: Honest, partly honest and shammers. The first class is rare enough to demand a special note in the making of a report. The second is the most numerous and the hardest of properly estimating. And the third often demands a searching scrutiny that resolves itself into an effort on the part of the examiner to get the claimant off his guard and thus fail to maintain a symptom hitherto well mimicked.

It may be of interest to cite a few of the commoner complaints and show how readily some of them are disposed of.

The most familiar of all alleged effects from railroad accidents are those under the general caption of "Nervous prostration," "Railroad Spine," or "Neurasthenia." Such a claimant rarely presents greater objective signs than a small discoloration on his back, but what he lacks in outward manifestations he makes up in subjective signs. There is no ill in medical lore they have failed to acquire; they cannot eat and cannot sleep; they have no memory; and, to use their own terms, they are "mental and physical wrecks." On examination they appear generally in good health, and their memory is so apt that the minutest detail connected with the happening and sequence of the accident is readily recalled and they act out precisely how they fell, and all this despite their assertion that memory and muscular power are bygone things. Of all the cases the surgeon examines, these are the hardest, and his opinion is most guarded concerning them. Frequently they are complicated by asserted paralysis of a limb, and you find your claimant in bed at the time of your call, and you are told that no power exists to rise therefrom. This occurred not long ago in a collision case, and the injured woman was surrounded by the usual sympathizers who cheeringly told her she was crippled for life. There was a suspicious resistance in the paralyzed leg during the manipulation and it readily remained in the position it was placed, even when suspended above the bedding; suffice it to say that this woman got out of bed and stood alone before the examination ended.

Deafness is frequently consequent upon a blow on the head according to many claimants, but the majority of these cases have been hard of hearing for years. In two recent cases the removal of a piece of ear wax brought about a marked change; another showed a hole in the ear drum that followed the child's recent attack of measles, and of course it had nothing to do with the accident.

Internal injuries are frequently asserted, especially in women, and this term is designed to cover anything from dyspepsia to a ruptured spleen.

Floating kidney comes under this class; and a woman from out of town said her right kidney was displaced six inches owing to a fall as she was about to get on a car. Her physician made the diagnosis for her because she had a bruise on the right side of her abdomen, but he forgot to examine the opposite kidney, which was even more movable; and also neglected to lay the blame on a recent long illness which had caused marked loss of flesh.

Within three months three cases of appendicitis have been traced to car accidents by the attending doctors because the abdomen in each case was slightly bruised. Injury is the rarest of all the causes for such a condition, and in two of the cases which were operated upon, an inspection of the appendix showed that it had been inflamed for years.

Tumors and various enlargements are favorite claims, birthmarks even being foisted on the unsuspecting examiner. This was well shown last spring in the Supreme Court where a very reputable physician supported a veracious plaintiff in her claim that an enlargement on the back of her neck was due to "fatty tumor" following a sprain and bruise of the neck. The examination made a few months previously had disclosed a bony enlargement such as we all have in about the location where a man buttons the back of his collar. This was pointed out to the jury, and each talesman felt his own neck and brought in a verdict for the company. Many times the swelling over the "Adam's Apple" (technically known as Goitre) has been said to follow a bruise in this region, but this is readily proved due to other causes.

Ruptures frequently follow our accidents if all the claims regarding them are to be believed. As against this is the experience of many competent physicians that such effects occur only in those having a tendency thereto, and do not result therefore directly from a fall or a blow. One case is recalled following a collision, in which a large rupture was claimed, but this individual had worn a truss so long that his skin was shiny by the friction produced.

Disabled joints, especially the shoulder, constitute a large share of alleged effects. These individuals will many times forget their part when suddenly asked to remove or replace their clothing, and in so doing widely move the part supposed to be immovable. Not long ago a woman on the witness stand claimed inability to move her right thumb, and she kept up the deception before the judge and jury until she had her attention riveted, and she was then asked to remove the glove from the other hand, and in so doing she moved the alleged stiff thumb.

Fractures are exceedingly common and are frequently hard to diagnose, especially if they are not seen until several weeks after they are received, a plaster of paris cast having meanwhile been employed causing a stiff joint. In such cases we have found the recent installation of an X-ray apparatus of extreme value and predict that certain doctors well known to us will have fewer cases of this sort and more sprains and contusions when they learn that their schemes can be literally seen through. It is our practice to allow the claimant to view the examiner's hand first and then his own, with the double object of showing how plainly the bones are outlined and also relieving him of any fear. With the machine employed as stated, accidental burns never occur and an opinion of the gravity of a case can be instantly formed. Its value was recently shown in a case where the attending surgeons had set a fracture and dislocation about the elbow, and in which they expected a speedy recovery. An examination of a fraction of a minute with the X-ray showed that the fracture had been set poorly, and that the dislocation had not been set at all. There

was still greater swelling about the parts and little handling could be attempted, and the diagnosis was made without removing the bandages. A bad outcome was predicted in our report; and the physicians have recently stated that this man was operated upon in West Virginia because the "dislocation had slipped out of place," as they put it, and another operation is to be attempted within a few days in a New York hospital.

These are some of the more frequent consequences alleged that would result in large damages were they incapable of medical disproof. That many cases are defeated on medical testimony alone is also true, and we have recently had two experiences illustrating this very forcibly.

In one instance paralysis of half the body, with convulsions and loss of memory, was alleged as a result of being struck by a car. The claimant presented a sorry appearance, and there was no question of some of his symptoms. Suspicion, however, was aroused in some way, and it was learned that he had been in a certain hospital prior to the alleged accident. On investigation we soon learned that he was a well-known clinical exhibit and had been used by many professors during the last decade to exhibit the very symptoms he now manifested to the court and jury. When some of these professors appeared in court as our witnesses, he suddenly pleaded illness and left the court and has not been heard of since. His injury was not due to the accident on our lines, but occurred fifteen years ago in the New York Central freight yards, where he fell from a car.

In the other case a verdict of $7,700 had been rendered for the death of a man six months after the receipt of a compound fracture of the wrist which had practically healed two months before his demise. His doctors claimed that his sudden death was due to an abscess of the brain from the original injury, and they performed an autopsy to prove their contention. We contended that this brain condition was due to a long-standing ear disease, and showed that 80 per cent of such abscesses follow such ear troubles. On appeal, the presiding justice reversed the verdict on the medical testimony alone, and his opinion analyzes the expert testimony with skill that would excel that of many a physician.

So much then for the physician in his effort to present exact conditions medically to the claim agent leading to the adjustment of the case, and in his testimony at the trial of these actions.

But aside from what value he may possess in his detection of the shammer and the exaggerator, there is what might be termed the moral function exerted alike over the claimant or his physician or attorney. The time is not far distant when some method will be demanded to curb the growing tendency to make minor accidents an excuse for the legal blackmail now so universally levied on street railway companies. Let it become known that the company insists on a rigid physical investigation of every case, then it is not too much to predict that many of these cases will fail of their own accord. A claimant will not hesitate to furnish a long list of witnesses to support his version of the occurrence, but he hesitates at submitting his alleged numerous infirmities to a doubting examining surgeon. The verbose attorney's bill of particulars, rich in such phrasing as "Sick, sore and disabled, and has been and will be subject to much pain and suffering for a long time if not permanently," will dwindle into less roundabout terms if he knows a medical examination will disprove his statements; and the member of my own profession who knowingly calls a simple sprain a severe fracture, will be more cautious of his moral and professional standing when he learns that an X-ray is to dispute him and that a plaster of paris splint cannot cloak even so bold an attempt at deception.

It is perhaps too ideal to hope that one day there will be what may be termed a medical jury to pass on cases of the sort we are all so familiar with. Such a jury within a very few moments could verify or nullify the alleged symptoms, and their decision as to the medical merits of a case would make unnecessary the unseemly contentions of so-called experts who usually succeed in baffling rather than aiding a jury of the laity. Much valuable time would be saved to all concerned and the hopeless congestion of the courts would be much relieved and more equable justice dispensed.

There is also another feature of the surgeon's relations to his company, and one that is not always taken at its full value, namely, his knowledge of his own profession and his acquaintance among them. It is our practice to index the various physicians we meet, and in this way we soon learn their bias or fairness. An honest physician with an honest claimant meets the company more than half way, and an amicable adjustment results minus the interference of the ambulance-chasing legal light. A scheming physician may seek to distort and exaggerate his patient's illness prior to the examination, but at the bedside he knows that every statement needs ocular proof. Strange as it may seem, he will not hesitate to stretch his moral fiber, but he balks in the presence of another doctor when called upon to swear falsely regarding medical axioms.

There is an auxiliary branch of the medical investigation almost as important as the physical examination, namely, the seeking of what we term the hospital record. As soon as possible after an accident one of our staff appears at the hospital and obtains the ambulance or accident ward diagnosis, the disposition of the case, and the attending doctor's name. The latter is then interviewed and from him the exact nature of the injuries learned with their possible outcome. Any statement made by the patient as to how he was injured is also learned, as is also his condition regarding alcoholism. In this manner we are able to obtain information at first hand from trained observers who are generally alert for the maligner. In very many cases, facts obtained from these hospital doctors have won cases that otherwise would have resulted in large verdicts. Incidentally our acquaintance professionally is much enlarged, as in the ten hospitals of our city maintaining ambulances for emergency work there are seventy-eight doctors who are well known to us, twenty-six of whom leave the hospital each year, many of them remaining in the city. A special address book is kept and any of these hospital men can be located, even though some of them are at the present moment in Beirut, Pekin, Paris and Honolulu.

That the medical examination has a legitimate place in the investigation of nearly every case we firmly believe, and it is our conviction that its monetary value is equal to that of any other single line of work in the disposition of claims.

PHYSICAL EXAMINATIONS, THE REPORTS OF WHICH ARE PRETTY DRY READING, BUT MOST ESSENTIAL

BY W. A. DIBBS, OF NEW YORK

By the time you get through perusing a few hundred medical reports a month, as we have, you are pretty well acquainted with the human frame and its functions.

We believe it most advisable to get an examination whenever possible, and it invariably means a strong argument in settlement. The claimant will present his case with a plea that he is injured for the remainder of his life, that he is the most maligned one in existence, that he is suffering the tortures of the damned, but as soon as the suggestion is made for an examination he tells you that there is nothing to see or feel. We insist upon an examination more than ever, as our suspicions are certainly aroused. After the examination, when he is told by the surgeon that he is in a healthy condition (and the type is usually pretty healthy) he frequently comes to our own terms, or we might express it charitably and say that his mind has been relieved. Others, despite the fact that nothing is the matter with them, will not admit that there is nothing physically wrong, and many still believe that they are intense sufferers. This has been instilled into their minds by friends and unscrupulous physicians, something with which we are burdened in New York. Then our troubles begin. If it is a case warranting settlement, all arguments and blandishments are of no avail. It means pay a price which you know is not commensurate with the injuries, or stand a suit, with the physician to back up the claimant, and probably get a verdict against you that will make you swear, even if you are a railroad man. I might here cite a few cases of this kind which have come under my observation recently:

A youth fell from a moving car. His physician took charge of the case, acting in an advisory position as well as physical. He presented the claim, contending that the boy was thrown by a sudden start, and had received a dislocation of the shoulder. Our examination, made shortly after the accident, failed to bring out any evidence of dislocation (generally a pretty hard condition of affairs to disprove). Nevertheless our surgeon was positive that the injuries claimed did not exist. The boy resisted the efforts of the surgeon to flex the arm beyond a certain degree. This was a case just as we explained. The boy believed he was permanently injured, and the doctor fathered the thought. All the time previous to the trial (we had refused the claim) the boy had the arm either in a sling or carried partly helpless at his side. On the day of the trial our astute counsel while cross-examining him, asked him how far he could raise his arm. He could not get it beyond a level with his shoulder, but when he asked how far he could raise it before the accident, he forgot himself and his teachings and put the arm far above his head. It is needless to say that the jury gave us a verdict.

A patrol wagon with a number of police officers was hit by a car. All of the cases were disposed of except one. This par-

ticular officer weighed probably 250 pounds, he was short in stature and could hardly walk on account of his fat. He alleged that he was so nervous that he could not sleep, although it took considerable punching to awaken him whenever we called upon him. He had all kinds of backaches and all kinds of headaches. We had him examined, and all we found was fat. We declined to deal with him as his claim was too exorbitant. After he found out his game had no effect he started off on another tack, and began to develop facial paralysis. Whenever he thought someone from the road was near he began to screw up one side of his face, and kept it that way for some time. We demanded another examination, and to our surprise we got it. In making a test our surgeon got him to stick out his tongue, but he forgot himself and stuck it out on the wrong side, and when he found that out it was quickly moved to the other side, but he was too late.

An interesting case came up a few weeks ago. A woman of respectable appearance claimed she was thrown by a sudden start, and that the shock affected certain muscles, which in course of time became powerless, and she was unable to retain urine, and at the same time had bladder hemorrhages. At the call of our doctor she volunteered to show him the discharges of blood, but was unable to do so. Later on, however, she did show him a discharge that had the appearance of blood, but on closer examination it was found to be snuff which she had carefully dropped into the receptacle.

A woman from the South claimed to have injuries she had sustained by falling against the edge of the car seat. On the examination she was found in bed apparently paralyzed from the waist down, and paralysis of different functions. She complained of a girdle sensation about the waist. She was able to withstand sudden and unexpected pricking with needle, even under the toe nails without flinching. An abrasion of the skin over spine some two inches in length was found. There was something about the case that aroused the suspicions of the surgeon. One of the reasons was the fresh appearance of the abrasion, and that the skin about the abrasion was not black and blue. We were to have a test made with a battery, but the woman requested that it be put off for a short while as she could not stand a thorough examination at that time. Arrangements were made to continue the examination the following morning. When he arrived there it was found that she had left on the midnight train. Upon investigation it was found that her husband had used a knife and scraped her skin over the spine, and that he did it just before our physician had arrived there.

Another woman claimed that she had received a fracture of patella or knee-cap. Upon our doctor's examination it was found that the leg was put up in a very pretty cast of plaster. The woman was attended by a presumed trained nurse. At the removal of the plaster for the examination we were unable to find signs that there had ever been any injury. The woman contended that as a result she had become completely paralyzed, and the doctor in attendance was grossly deceived by her. She was able to gain the sympathy and support of a number of charitable women, and also several pyhsicians. She remained in bed for several months, but got tired of the game and left for the West. Later we received a report that she had been arrested for forgery, and seemed then to be in first-class physical condition.

The cases quoted show the paramount importance of an examination, and, of course, the surest way to detect the fraud. An argument might be raised as to what effect morally the examination has on the majority of cases, and from our experience the effect can be easily seen. The injured lose their aggressiveness, and then say: "What will you give me?" and glad that they get something no matter how small. A discourse on this point can be lengthened out, but the fact nevertheless is apparent that the examination does have a material moral effect. Of course there are exceptions.

Now let us take up cases of more serious moment—I mean cases of severe injuries. We are presented with a claim running into big money, if we may apply that term. Presuming that your claimant has a serious fracture which has been reduced by the attending physician and plaster applied, as is frequently done before we are aware of the extent of the trouble. When a claim is presented for adjustment all signs of the fracture are gone. Though the demand is made upon the severity of the injuries, it is advisable to get the examination as soon as possible. The claim will be based upon the length of disability, a fact easily established by the attending M. D.

Now we come to another type, namely: Internal injuries. Most of these are subjective and hard to disprove, but if examined within a short period after they occur something can invariably be noticed. We have had cases of this character which upon the closest medical examination were found to be well-developed cases of appendicitis (something in a new way of claims), the attorney and the doctor contending that the appendix was injured in an accident, though the disease at the examination was so far developed that it could be plainly seen that it was there before the accident.

Another form that is deceiving is dislocation of shoulder after replacement, though they do sometimes leave a permanent affection. Women with internal trouble brought about by child bearing have endeavored to foist the damages on the road, but a surgeon well versed can without much trouble detect the real cause.

There is still another type that can be touched upon, and that is brain concussion, an injury the consideration of which it is pretty dangerous to delay. It might or might not leave a permanent effect. An early examination is most advisable. Whenever concussion is claimed another examination later on will be advantageous. The surgical examination is almost as imperative for the defense of an action as witnesses, and we have upon a number of occasions won our cases on the medical testimony alone, and we presume others have done the same.

Let us say a few remarks about some of the so-called M.D.'s. How they ever passed an examination in anatomy Heaven only knows. One doctor, when asked if he knew what a fracture was, replied: "Why, certainly, it's a contusion." Some of these fellows, to the detriment of the reputable ones, have a good deal to do with foisting fraudulent claims, declining to allow an examination of patients at first, and advising claimants to hold out for exorbitant sums. After the examination has taken place and they are told that the patient is but slightly hurt, they usually recede from their independent stand and accept the diagnosis of the company's surgeon, who they know is, and has to be, a doctor in all that the term implies. Here, again, the moral effect bears fruit.

We can take up in a few words our experience with the reputable physicians. It is an experience upon which we can look back with a good deal of admiration for the medical profession. M.D.'s of this kind come out straightforward and tell you that the patient is a serious subject or he is not. They never stick to the former or say that there is no chance for a complete recovery, nor do they act as legal advisor, telling their patients that such and such a lawyer might get a lot of golden dollars, but they do advise arbitration and counsel peace. Physicians of this kind are plentiful in New York, and our experience with them has always been of the most pleasant nature.

It probably will not come amiss to explain the system in the claim department of our road showing how the medical records are kept. A form with a duplicate perforator through the center, then file number, date, place of accident and circumstances, attending physician, and whom to communicate with to arrange for examination. They are then separated and entered into a book. One is sent to the company's surgeon, the other filed with the papers.

Upon the return of the surgeon's report the receipt is checked off in the book and the report with the papers. If there is no examination to be had the surgeon endorses his part of the blank and returns to the office with the proper explanation, and that is put away with the papers. A record is also kept stating how many cases this and that M.D. has, and how he is disposed toward the road, and how he appears upon the witness stand.

Claim agents with whom I have had much to do, are very much divided upon the necessity of having immediate attention from the company's surgeon. While such prompt attention may be given to the injured in small towns and villages, or in places in which the accidents are not numerous, it seems to me that as far as the larger cities are concerned it would be impossible, and in many cases undesirable, to have the immediate attendance from the company's physician. In such larger cities there are first, the well appointed ambulances of the various hospitals, and second, the representatives of the school of the First Aid to the Injured, and frequently many passing physicians through whose efforts the suffering of the injured is allayed. In the denser populated portions of the city where the greater number of accidents occur, doctors are to be found in the immediate neighborhood, who, as a rule, reach the scene of the accident within five or ten minutes after its occurrence, making far better time than could the company's physician.

It seems to me that the standing of the company's physician, if sent regularly to the accident, at or about the time of its occurrence, is greatly injured, if not entirely destroyed, if in this way he becomes a portion of the investigating force of the claim department. There is no doubt that their standing in the medical profession would be impaired by the continuance of such a line of conduct.

TRACK CONSTRUCTION AND MAINTENANCE

BY THOMAS WILLIAM WILSON, OF BUFFALO

The close relationship of the terms "Construction" and "Maintenance" does not seem to be fully appreciated. The track upon which all the traffic has to be carried is one of the most essential parts of a railway, and yet the importance of the track and track work in relation to the operation of the railway, and the portion which the maintenance of track bears to the total operating expenses does not seem to be fully recognized by street railway officials. This proportion is usually high and due in great measure to the fact that the majority of street railways were originally built by promoters with regard to immediate cheapness of construction. While this was excusable in many cases because tracks were constructed in advance of the prospective travel, still in too many instances the mistake has been made of adhering to the original types and standards of construction long after they became inadequate to the greatly increased traffic and the heavier equipment. The result of this is seen on the auditor's books, the road having to sustain an undue continual charge for maintenance. If those who originally built street railways had to maintain them they might have been built differently. This rebuilding of old track to take care of increased travel and heavier equipment makes necessary the construction account, of which has been aptly said: "The construction account can never be closed until our railways are built. To attempt it involves a destruction account of fearful magnitude. Under our present system we are perpetually rebuilding our railways, not reaching the life of our works, and thus running capital to waste. A better system will strike at the root of the evil by correcting, not nursing, the defects of our permanent way."

It behooves us, therefore, carefully to review our standards of construction in order to be certain that we are building for the future.

On October 9, 1901, the committee on standards of the American Street Railway Association reported in favor of a T-rail for use in city streets whether paved or unpaved, their recommendation being: "We recommend a T-rail as the most desirable under any conditions."

This is the generally accepted solution of the rail question, the familiar arguments of the T-rail being small resistance to tractive force, ease of installation and the keeping of vehicular traffic away from the tracks. And yet it would seem that we lose sight of the most important point, viz.: the maintenance of the pavement along the gage line side of rail. On Archer avenue, in Chicago, a mile of Trilby girder rail and a mile of T-rail were laid side by side about two years ago in order to convince the municipal authorities that T-rail was the best. The writer inspected this stretch of track lately and found that while the girder rail track was practically as good as new, the paving along the inside of the T-rail had been rutted out badly by the teams, in some places the ruts being 4 ins. deep. That track looks as if it would have to be entirely repaved within a short time, and meanwhile is a constant menace to the wheels of all vehicular traffic, with a consequent liability for accident. Again, the track on North Main street, Buffalo, was relaid four years ago with a semi-groove girder with block stone paving in the tracks. Within a year afterward the paving stone next to the gage had worn down to the lip of the rail but no further. It has remained in the same condition four years and will apparently outlive the rail. If this track had been built of T-rail, repaving would now be in order.

So it would seem that we cannot afford to overlook the fact that the pavement along the T-rail is subjected to much greater wear than along the girder, and may be a source of expensive maintenance on busy st eets. As to the question of keeping the vehicular traffic away from the tracks, this might possibly be the case on wide, smoothly paved streets of cities of less than 200,000 population, and where there is very little trucking. But in the narrow, busy thoroughfares of the larger cities, where there is not room enough in the street for the vehicular and car traffic, this would be impossible, and a rail must be installed which will provide for the trucking as well as for the cars, and afford the best protection to the paving adjacent to it.

These were the reasons which probably led up to the adoption of the "Crimmins" or "Trilby" shaped rail (so called on account of its resemblance to a foot when inverted), which has been laid in New York, Chicago, Washington, and many other cities, and finds its highest development to-day in a section weighing 137 lbs. per yard, now being laid in Philadelphia. The extra weight of this rail has nearly all been placed in the lip, solely for the purpose of furnishing a runway for the tires of vehicles and keeping them off the pavement. Another argument against the T-rail is that nearly all the municipal authorities of our larger Eastern cities, and the public, are against its adoption on account of the rutting, and the city ordinances usually prohibit it. As public carriers, we can scarcely afford to ignore their point of view.

A practical solution of the rail question would seem to be to use the 9-in. Trilby type in the busiest thoroughfares of our larger cities where the trucking is heavy and the traffic congested; the semi-grooved girder in the quieter streets and those districts which by reason of architecture and location have become fixed as resident sections, and the T-rail in the smaller towns and cities and in the suburbs of the large cities.

Besides the shape of the lip of the girder rail, which has already been mentioned, there are two other important points to be carefully considered, viz.: the width of base and the depth of groove. The base of a 9-in. girder should not be less than 6 ins. This makes a firm support when superimposed upon concrete, and lessens the tendency of wide gage, due to tipping. Too little attention is paid to this point by street railway engineers. When the track and all its fillings are new a narrow base does not matter so much, but after eight or ten years of continuous service, with the pavement loosened and the ties rotten, the 6-in. base should do its work well.

The depth of groove should not be less than 1¼-ins. With the use of a concrete roadbed the wear upon the head of the rail is undoubtedly greater than with a flexible roadbed, and every 1-32-in. of increased depth means a longer life for the track, depending of course upon depth of wheel flange and condition of traffic.

Very careful measurements in Buffalo have resulted in determining that the average wear of head for four years on the busiest street has been 1-32-in. per year. The largest tread operating over this track being ¾-in. and the original depth of groove being 1¼-in., a very simple computation gives 16 years as the life of this track. In this connection it will appear strange to the old trackman to speak of the life of the rail being fixed by the wear of the head, rather than the joint, but this is one of the results the welded joint has achieved. To be paradoxical, after the joint is welded it ceases to be a joint.

JOINTS

With the advent of welded joints came a great decrease in maintenance. The cost of welding of joints has been carried on for some eight years, especially in the West, with varying success. The percentage of breakage never seems to have been less than 2½. The electric weld we are all familiar with, and it seems to be the highest type of joint to-day. The per cent of breaks during the last year has been kept down to the astonishing figure of one-tenth of 1 per cent. The only objection to this joint is in its method of application, a train of 4 cars being necessary, occupying the track and interfering with the regular traffic. Another drawback is, that it is not possible to contract for a small number of joints on account of expense attached to shipping the equipment from place to place. This puts it beyond the reach of all roads which have less than 2000 joints to weld.

Among the best of the mechanical joints is the riveted splice-bars of the Philadelphia Rapid Transit Company. It consists of the regular splice-bar, with rivets substituted for bolts, and the space between the rail and the bar is filled solid with molten zinc.

With the introduction of concrete roadbed came the necessity for a steel tie, as with a track whose life is estimated at from 15 to 20 years, it would hardly be economy to install ties with a life of from 10 to 12 years. These steel ties should be secured to the rail by means of brackets which fit up well under the head of the rail, and which accomplish the same purpose as a brace tie-plate or a tie rod. Old rail can be very readily used as a tie when cut up into proper lengths.

Where wood ties are used on interurban work, they should be white, rock or burr oak, or long leaf southern pine. Cedar, while being long-lived, is too soft, especially with heavy interurban passenger and freight service, and will not hold a spike.

While on the question of ties, it may be of interest to note that the steam and electric railways of the United Sates are using over 100,000,000 wood cross ties per annum. The prices are constantly advancing, and it is evident that we will be forced to turn to the steel tie as a substitute for wood. As a starter, the entire roadbed of the Pittsburg, Bessemer & Lake Erie Railroad is being equipped with steel ties.

ROADBED AND PAVING

One of the greatest, if not the greatest, source of expense for track maintenance is on account of no ballast, loose track, and consequent failure of pavement. Miles upon miles of track in which the rail was good, the joint perfect, and the tie sound, has been torn up and relaid because the ties had been laid originally in the mud, concrete placed on top of them and around them, in

fact any place but underneath them, and the whole surmounted by a 3-in. veneering of asphalt laid right against the rail. Could anything be more criminal? Such a track will last from three to six years, depending upon traffic, and then suddenly the pavement will all go to pieces.

"Never lay asphalt against a steel rail" has come to be a street railway axiom.

Brick, sandstone, granite, all make a very acceptable pavement, but in order to preserve the pavement it is necessary to have a foundation of concrete, and this means concrete under the rail and ties.

The concrete roadbed consequently, either of the beam or solid type, has come to be a recognized standard, and although some objection is made to this construction on account of the rigidity of the track and the wearing of the rail, yet a railroad can better afford to have the head of the rail wear for a certain period for no maintenance, than to have it wear a little longer time with constant repairs to pavement.

Owing to different prices of material at various places, estimates of cost must necessarily vary with the locality. The following may be of interest, however:

CONSTRUCTION

1. Replacing old 6-in. track in asphalt pavement with new 9-in. 94-lb. girder rail, Portland cement, concrete base, steel ties at 10 ft., welded joints, No. 1 Medina sandstone block paving with grouted joints, toothing and asphalt in 2 ft. strip, including cleaning up street, and allowing salvage on old 6-in. rail. Per foot of single track, about $4.30.

2. Relaying and welding rail already in street, concrete base, steel ties, pavement, etc., as above, except that there is no salvage. Per foot of single track, $3.30.

MAINTENANCE

The cost of maintenance of track and roadway of 9 railways, per mile of single track, per year, for 1901, is given in table below. It will be seen that the cost varies from $215 to $733 per mile. It is interesting to note that the larger the mileage the higher the cost of maintenance seems to be. Not much can be gleaned, however, from these comparative figures as the conditions are so diverse; for instance, the Brooklyn Heights is mostly on elevated structure, and of course is more costly to maintain. The cost per car mile of maintenance of track and roadway for International Railway Company for 1903 was .008 cent.

COST OF MAINTENANCE PER MILE OF SINGLE TRACK FOR YEAR 1901

Railway Company.	Mileage.	Tracks and Roadway.	Remarks.
Brooklyn Heights R. R. Co..	401	$733	6 mos. end. Dec. 31
Cleveland Elec. R. R. Co....	...	630	All city
Montreal St. Ry.....	103	469	All city
Rochester Ry. Co.....	100	378	City and suburban
Denver City Tramway.....	144	298	All city
International Ry. Co., 1901..	330	290	City and suburban
International Ry. Co., 1903..	357	258	City and suburban
Milwaukee, 1900	225	250	City and suburban
Scranton Ry. Co.....	76	221	City only
Schenectady Ry.	32	215	City and suburban

As potent a factor as any in the economical construction and maintenance of track is the organization not alone of the track department, but of every individual job undertaken. All work should be carefully laid out and planned beforehand, and the plans rigidly followed. As little initiative as possible should be left to the sub-foreman. Cheap tools, cheap material and cheap foreman are not necessarily economical, but are usually the reverse. And above all, a close watch must be kept on details, with a view to turn aside all the undirected and misdirected tendencies which might lead to extravagance, inefficiency, or whatever in the end might operate depressingly upon dividends, which after all constitute the ultimate aim of our friends the directors.

POWER TRANSMISSION FOR INTERURBAN LINES

BY J. B. STORER, OF SYRACUSE

The successful and efficient transmission and utilization of power is something which has been an object of study for many years, and, while it may seem to be in a very advanced stage, yet there is certainly much room for increased efficiency in transmission, conversion and distribution,—particularly the latter two—before it can be said to have attained anything like perfection in connection with interurban railway lines. It is, of course, the ambition of electrical engineers to perfect their type of equipment so as to make it advantageous to the great steam railroads to adopt electricity as a motive power, but unless some very radical improvements are made in the present electrical systems it will be a long time before any such change will be seriously considered.

A computation of the series of losses that occur between the steam engine driving an electrical generator in a centrally located power house, and the driven wheels on a motor car is not so apt to make one enthusiastic over the efficiency of that system as it is to bring to one's mind the thought of the extraordinary losses that must occur in a steam locomotive to make such a wasteful electrical system as widely used as it already is. It is safe to say that on an average not over 50 per cent. of the energy delivered to a generator is utilized in actually moving the cars. The balance is consumed in the generator, transformers, transmission line, rotary converters, distributing lines, motors and gears. However great this loss may be, there are, fortunately for the electrical men, other factors besides the mere consumption of coal—labor being the chief one of these—and this gives the electrical outfit such advantages that steam locomotive manufacturers have been forced to make great advances in their own line. The compound locomotive engine as now used on the principal steam railroads is a very different machine from the old simple engines that have made such records as coal consumers. It now becomes imperative that the electrical manufacturers should bring out a corresponding improvement if they are to retain the prestige they have already gained.

In considering the possible improvements that may be made in the electrical system as now used on interurban lines, the separate sources of loss must be considered independently to see where and how they may be decreased. It is safe to say without going into details, that no further improvements can be made in generators, transformers, rotary converters or motors that will sensibly affect their efficiencies. The only thing remaining is to cut down the losses of transmission and distribution. This can be done in two ways: that is, to increase the voltages or increase the size of the conductors. The transmission loss cannot practically, or commercially, be reduced to less than 5 per cent unless the original cost of power be very high. In general it cannot be reduced to much less than 10 per cent—the customary figure for present lines—for too high a voltage brings an increased risk of operation that may more than offset any advantage gained in small losses, and large conductors bring up the first cost too much. This also applies to the distributing system except with regard to the percentage loss, which can seldom be placed at even as low as 10 per cent. The location of sub-stations closer together than is now customary may materially reduce the loss but only at a very considerable increase in cost of attendance, which in general more than offsets the gain. The transmission and distribution losses therefore seem to be at a minimum the same as in the apparatus, and it becomes evident that the desirable increase in efficiency must come, not in the present system, but in some other one that will possess all the advantages now attained, and will reduce waste energy to a minimum by doing away with all unnecessary steps or transformations in the power generated. It remains to be seen what this next improvement will be.

Among the many questions pertaining to power transmission that have been more or less the subjects of discussion, that of the frequency of the system has perhaps attracted more attention than any other. It has been attacked on all sides, but the great majority seem to favor 25 cycles as being the best from an operating standpoint. This is of course due to the better regulation on the transmission line and also to the greater success met with in the manufacture of rotary converters of this frequency. It is a question, however, if this is not due more to the fact that, owing to the choice of 25 cycles at the Niagara plant, rotary converters of this frequency were developed more rapidly and to a greater extent than others. In a measure it became standardized as a strictly railroad frequency, as well as for general systems making use of direct current for lighting purposes through rotary converters. Later experience has shown that for almost all purposes except the strict transmission of the power a higher frequency might better have been selected. Even the transmission drop due to inductance may be so regulated by means of compound-wound rotary converters that no difficulty is experienced in lines operating at as high frequency as 60 cycles. This is due to the high power factor that can be maintained over widely varying loads and without hand regulation. In this respect as well as in efficiency, the rotary converter will always be preferable to motor generators. This applies to both induction and synchronous motors, for although the latter may be adjusted for a high power factor at some one particular load, the power factor changes with every change in load, and unfortunately it changes in the wrong direction. This cannot be overcome on a railway system by hand

regulation of the field rheostat owing to the too rapid fluctuations of load.

The induction motor, while it may have a lower power factor at full or partial loads than can be attained with the synchronous motor, has a much more even effect on the transmission line, and it is one that may be provided for as a certainty. It is, therefore, preferable to the synchronous motor, but as already mentioned, the rotary converter is preferable to either.

The question of frequency for railway circuits is decided under existing conditions not so much by what may be considered as the best for the purpose as by conditions imposed by something that may be quite at variance with what is considered strict railway practice. Most power equipments for new railways, as well as for old roads that are being reconstructed, are installed with a frequency the same as the nearest large water power or steam plants, purely for commercial reasons. This has been made possible only by the success finally attained in the manufacture of rotary converters of high frequencies, which, although it comes at a considerably later date than the success attained with 25-cycle converters, is nevertheless just as marked. There are to-day in New York State large railway systems operating at 25, 40 and 60 cycles, and the representatives of those companies will verify my statements that all are operating equally successfully and satisfactorily.

The long transmission systems for electric railways involve so many considerations of a commercial nature that the electrical engineers having their design and construction in charge must in reality often entirely subserve their own personal preferences from a technical point of view to other conditions. In fact it is incumbent on electrical engineers to make themselves almost as familiar with financial and commercial matters pertaining to railways as they are with strictly technical subjects. This is owing to the necessity of being able to realize, in a measure, the possibilities of the future with reference to consolidations and the consequent necessity of having everything as interchangeable as possible, and to decide how much considerations of this kind should influence the character of any installation. The laying of a few sections of rails between local railway companies to complete a through road is a small matter compared to connecting a number of power houses together through high voltage trasnmission lines, and operating all as one common system. One is a purely mechanical piece of work, and, once completed, it is done for all time. The other is but started when it seems to be completed.

The necessity which frequently arises in comparatively small railway systems, of putting in a power transmission outfit at a reasonable cost—or, to be more exact, at a small cost—also emphasizes the necessity of having a grasp of strictly commercial conditions, so that a successful outfit may be installed without burdening the company with such a heavy fixed charge that it is unable to operate on a profitable basis. There are many engineers, for example, who profess to believe that a high voltage transmission line built with poles having anything smaller than an 8-in. top, or with wire smaller than No. 3 or No. 4, can never be maintained in successful operation. The difference in cost, however, between a pole line of that type and one with poles having 6-in. tops and with No. 6 wire, is very marked, and would make considerable difference in the interest charge. There is no question but that the latter outfit would be entirely successful if carefully erected, and would be durable, and that it would have no higher percentage of depreciation than the former.

There would certainly be greater reliability of operation on a system with two complete lines of No. 6 wire than with one of No. 3 wire, and the cost would be practically the same. The reliability of the smaller transmission line is illustrated by one in Central New York which has been operating for over five years furnishing light and power. During that time no break has occurred in the twelve miles of line, except when caused by a falling tree, which would have broken any line ever built. On a railway system using both No. 6 and No. 3 wire, I was recently told that less trouble had been experienced with the smaller wire than with the larger. In general too much emphasis is given to making the poles of a certain size top, and too little attention is paid to the size of the pole where it enters the ground and where the greatest strain comes.

It would hardly be fitting to close a paper of this kind and at this time without referring to the new single phase railway system as developed by Mr. Lamme, of the Westinghouse Electric & Manufacturing Company. The main feature of improvement claimed for it is the absence of rotary converters, with a higher distributing voltage and consequent lower loss as well as less cost of installation. The simplicity of the system from a transmission and distribution standpoint will make it attractive. It should enable a single power house to handle with ease a railway 100 miles long, and with the least possible item of labor. The line could readily be sectioned, as in city service, and with high voltage feeders for each section, with transformers connected in as part of the transmission line, we would have a system as simple to operate as an ordinary city railway plant. The transformers could be fused so heavily that nothing less than a continued short circuit would open the incoming and outgoing lines, suitable circuit breaker protection being given in the main power house as in present installations for each feeder circuit. It may be said that this would multiply the number of wires to an objectionable extent, but by using a common return this could largely be obviated, and duplicate pole line construction would render continuity of service almost assured. The main objection to the new system seems to be from commercial considerations rather than from anything electrical. The frequency, about 17 cycles, at which it is proposed to operate is unlike any system in use, and as the motors are also alternating it precludes their use on direct current circuits, except where a double type of control would be adopted for the cars, which would be very cumbersome. Its advantages from an operating point of view, as regards efficiency and items of attendance or labor, must be demonstrated very clearly before its general adoption will render the present commercial objections ineffective.

INTERURBAN TRAIN DESPATCHING

BY E. P. WILCOXEN, OF ROCHESTER

The question of the proper method of despatching trains on interurban lines has no doubt caused the operating department more worry than any other subject, and, although the handling of freight and express has been a little troublesome, it does not touch the vital part of the system as does the despatching of trains. How are we to despatch them in order to protect the public, our employees and ourselves? The solution must naturally be looked for in one of three ways, namely, telegraph, telephone or block signal.

If we adapt the telegraph, we must naturally adopt the steam road system, which requires a larger force of experienced employees, and means increased cost of maintenance. We will have the advantage of almost an uninterrupted service, which it is impossible to get from the telephone on account of atmospheric conditions, also, the benefit of operators and agents paid by ourselves, whom we are able to control and who will give our interests better attention than operators and agents receiving commissions for their services and who devote part of their time to other business.

The electric block signal we can safely say also suffers from atmospheric conditions and mechanical defects, and cannot always be depended upon, so if the telegraph or block system is used, our resources must be such as to stand the increased cost of installation and maintenance, and furthermore other methods must be provided for controlling trains when the electric block is out of order. As in steam railroad practice, an automatic block signal system, in conjunction with an efficient despatching system, would be an ideal situation. The present automatic block signal systems either provide for the operation of the signals and targets through contactors arranged along the trolley wire, which are operated by the travel of the trolley wheel, or through contactors placed along the track and operated by some attachment to the car. The electrical and mechanical difficulties due to the sudden making and breaking of circuits, makes the use of block signals more or less uncertain. Prominent switch and signal builders are endeavoring to produce a system which will use the rails for at least one side of the circuit independent of continuous current running therein, in a manner similar to that by which automatic blocks are now operated on steam railroads. During the last few months experiments have been going on along this line, but the system has not been sufficiently perfected to be put in regular operation. This leaves to the ordinary interurban road the last method of controlling the operation of trains, namely, by the use of the telephone.

In the ordinary practice a telephone system is laid out along the railway, telephones placed in stations, agencies, or sidings, or carried on the cars, and orders from despatcher transmitted verbally by telephone either direct to conductor or motorman, or to agent or operator, and with more or less formality. Train orders thus given vary all the way from an informal conversation between conductor and despatcher, to a verbally transmitted order from despatcher to operator, taken down on proper blanks, repeated, O.K.'d, signed for and completed, strictly according to

steam railroad practice. All railroads endeavor to have the verbally transmitted orders so worded as to remove, as far as possible, chances of misunderstanding, and the length to which each suburban road management goes in obtaining this end depends largely upon personal characteristics and local conditions.

The Rochester & Sodus Bay Division of the Rochester Railway system has been in operation four years, using the telephone system for despatching trains. It is a single-track line, extending from Rochester to Sodus Point, a distance of 40 miles, 13 of which is on private right of way with sidings every mile, a majority of which are used only for freight, and meeting points when trains become late.

Telephones are in agencies at each village, in sub-stations, and on each car, and plugging boxes are placed at every siding. The despatcher is located at Rochester, the western terminus of the division. Train crews receive written orders issued in triplicate form, the motorman, conductor and despatcher retaining a copy. Meeting points of regular trains are denoted by heavy-face type on time-tables, which govern all regular trains when on time. The despatcher keeps a train sheet showing location of trains, which are reported by sub-station attendants at Ontario, 18 miles out, and at Sodus, 31 miles out. Conductors report the arrival and departure of trains at Sodus Point, the eastern terminus of the line.

Standard steam road signals are used with the following exception: No signal is used on the rear end of train during the day, and only one red light at night.

Watches are inspected every three months, and train crews examined twice each year. Train crews report for orders and register at terminal points. They also report at meeting points when the opposing train is late, and when unable to make meeting points on time. Agencies are equipped with red flags and lanterns, which are displayed when train orders are to be given. At sub-stations and agencies the attendant or agent acts as operator, writing the train orders in triplicate form, retaining a copy, and, after repeating to the despatcher, in turn repeats to the motorman with proper O.K.

On sidings the conductor acts as operator, and after repeating to despatcher delivers copy to motorman, who repeats it to despatcher for O.K. Train orders are numbered consecutively each day, commencing at midnight with No. 1. Extra trains clear regular trains at meeting points by three minutes. Trains are run under number displayed on left side of front vestibule, corresponding with same number on official time-table.

Motorman on a train carrying signals, when passing another train, sounds his gong or whistle three times, to call the attention of the motorman on the opposing train to the signal carried. This signal is answered in the same manner by the motorman on the opposing train. Should the motorman carrying the signal fail to get the answer, he immediately stops and calls the attention of the other motorman to the signal carried.

When the telephone service becomes defective and train crews are unable to get the despatcher, the following rules immediately go into effect:

First class regular trains wait at meeting points until opposing train is 5 minutes late, then proceed with caution until opposing train is met. "Proceed with caution" means that conductor will go forward and flag all curves. We do not give trains going in either direction an absolute right of way, as we have found it safer to require both crews to proceed with caution.

When regular trains proceed after waiting the required 5 minutes, they are not allowed to make up time, but must run at least 5 minutes' late until the opposing train is met. Second class trains wait at meeting points for first class trains 10 minutes, and then proceed in the same manner. Westbound extra trains immediately lose their rights as extra trains, and always follow westbound regular trains as second sections.

We have found this method of car despatching to work very satisfactorily.

STEAM AND ELECTRIC RAILWAY CROSSINGS

BY CHARLES R. BARNES, OF ROCHESTER

The danger caused by railroad operation at grade crossings of streets or highways is directly proportionate to the number of trains operated on railroads and the amount of pedestrian and vehicular traffic on the street or highway.

Before the introduction of street railways every city or village street or country highway had a natural and legitimate amount of travel over it. This travel increased in the same proportion as the population or the business of the section through which the street or highway was located. This condition was changed by the introduction of the electric railroads. A line of cars operated through a city street usually effects the pedestrian traffic in a section on either side of it, increasing the number of people who pass over the street through which the electric railroad tracks are constructed, and to a like extent reducing the number on the streets in the territory which is tributary to this particular street car line.

For example, if three city streets extend parallel with each other, with a line of street cars operated through the middle one, all of them crossing a steam railroad at grade, there would, almost invariably, be more people cross the steam railroad track on the street through which the electric cars were operated than on either of the others, even though the population were greater on either one of the other two.

This holds good in the case of parallel country highways, and perhaps to a greater degree for the reason that the suburban electric railroad reduces the number of vehicles in use on the highways tributary to it.

The foregoing statements tend to prove that the introduction of the electric road has caused a greater number of people to pass over the grade crossings of steam railroads on the streets or highways, through which they are constructed, than did before, increasing the liability of accidents at these crossings and decreasing it at others. The danger is still further increased from the fact that a large percentage of the people passing over these crossings are in a car, and if an accident occurs more people are thus liable to injury than if the same number crossed the tracks in the usual manner. In addition to the liability of injury to passengers, in an electric car, must be added the possibility of derailment of the steam train and the resulting possible injury to its passengers.

Another feature of the operation of electric cars over steam railroad tracks which must be taken into account when considering the increased danger incident to such operation, is the fact that the passengers in a car cannot exercise their judgment as to the safety of going over the steam tracks at the time, but must depend entirely upon the judgment of the two men operating the car.

Grade crossing accidents are usually the most serious ones which occur on electric roads and in most cases result in loss of life. It is not necessary to use arguments or cite cases to impress on the minds of electric railroad managers the dangers connected with grade crossing operation. They all realize the danger, and have taken precautions to prevent accidents at such crossings on their roads, but in most cases the precautions taken are not sufficient to prevent accidents, and are of such a nature as to give the manager a sense of security which does not really exist. He reads in his morning paper of the Cohoes or the Newark grade crossing disaster, expresses sorrow for the passengers who were killed or injured, sympathizes with the manager of the road and congratulates himself that no such accident can occur at his grade crossing, for all of his motormen bring their cars to a stop and the conductors go ahead and pilot them across the steam tracks. In addition to this, the crossing is equipped with gates, and the steam road company has a man there to operate them at all hours. That manager is sincere and honest in his conviction that his cars are operated over the grade crossing in a safe manner, and if an accident occurs at that point he satisfies his conscience with the statement that he has made the crossing as safe as possible and the accident was one of those, incident to railroad operation, which could not be prevented and which will happen as long as railroads are operated.

The investigation of accidents for a number of years shows that the conditions which led the manager to believe his crossing safe added an element of danger rather than diminished it. The rule referred to is a good one if the instructions in it were properly complied with. This is not done. If this statement is doubted, let any railroad manager go on some road where he is not known and watch the operation over grade crossings. He will find that in most cases the rule is complied with in a perfunctory manner. He will find that the usual custom is for motormen to slow up within a few feet of the crossing, the conductor will run ahead about even with the front end of the car and usually hold a conversation with the motorman until they reach the first rail of the steam track and he will board the car and it will proceed over the crossing. I do not wish to be understood as claiming that this is done in all cases, but my observation convinces me that this is the method in a large majority of cases. Complying with the rule in this manner adds an element of danger to the operation, for the reason that if the conductor remained on the rear end of the car, the motorman, for self-protection, would exercise more care than he does when the responsibility for the safety of his car is placed on the conductor, who does not know the condition existing on the steam track.

The operation of gates at a grade crossing of steam and electric railroads adds an element of danger to operation at that point, for the reason that gates are placed at grade crossings of steam railroads for the purpose of preventing pedestrians and vehicles from going over the steam tracks when a train is approaching the crossing. I know of no case where gates have been placed at crossings for the purpose of preventing an electric car from going on to the steam tracks when a train is approaching. These gates are usually operated by men in the employ of the steam railroad companies who are in no manner responsible for the safety of electric cars in going over the crossing. Accidents have been investigated where motormen have run through the gates, and several accidents have occurred by gatemen raising the gates on double-track roads after a train had passed the crossing in one direction and another approaching in the other, the gateman not seeing the latter one. Where crossings are equipped with gates, motormen and conductors will invariably become so accustomed to their use that they will depend upon their position as an indication of the conditions on the steam track. The most serious accident at grade crossings of steam and electric railroads in this State occurred at a crossing equipped with gates. There were 33 passengers on the electric car, 15 of whom were killed outright and 16 injured. Within the last three months an accident has occurred in this State at a crossing equipped with gates. The crew of the electric car operated it in the manner described, the motorman slowed up approaching the crossing, and the conductor running ahead to the front end of the car. A train was passing in one direction at the time and the gates were lowered for it. As the rear end of this train was going over the crossing the gateman raised the gates, not seeing another train approaching on the opposite track from the other direction. His view of the latter train was obstructed by the train which had previously passed over the crossing. Both the motorman and conductor, when seeing the gates raised, took this as an indication that the crossing was clear for them and proceeded. From where they stood had they looked they could have seen the approaching train 1500 feet away, but they did not do so, depending entirely upon the condition of the gates with the result that their car was completely demolished.

The Board of Railroad Commissioners, acting under the authority conferred upon it by the laws of the State, has caused an examination to be made of every grade crossing of steam and electric railroads in the State, as to the physical conditions at the crossings and the approaches on both roads; the distance a view of the steam tracks can be had from the electric tracks; the number of trains operated on the steam road and the headway on which electric cars are operated over the crossing. The Commission, realizing the liability of accidents at these points, and that the most perfect rules as rigidly enforced as possible were not sufficient protection at these points, even where gates were maintained, have ordered additional protection at these crossings. In cases where the traffic on the steam and electric roads warranted, they have ordered derail switches operated from a tower; in other cases where the traffic was not so great they have ordered derail switches, to be operated by the conductors of electric cars, the levers for operating these switches placed in such a position that the conductor must go onto the steam tracks before they can operate the derail. They have also ordered, where necessary, special work cut crossings, and at all crossings copper troughs placed on the trolley wires.

There are at present 410 crossings of steam and electric railroads in this State, 164 of which are under or over grade, and 246 at grade.

The ideal protection at the crossing of steam and electric tracks consists of derail switches, in the electric tracks, interlocked with home and distance signals on the steam road, arranged so that after a train has reached the home signal the derail cannot be set for an electric car to proceed until after the train has passed the crossing. In the case of a steam road with more than one track, this condition should hold good when a train approaches a crossing on a track over which trains are usually operated in the opposite direction; the home and distant signals should be set at danger before the derail can be set on the straight track, and these interlocked so that the signals cannot be moved to safety until the derail is set at derail; semaphores should be rigidly connected with the derail switch, and both set at danger normally; a metal trough on the trolley wires should extend over the steam tracks a sufficient distance to carry the rear end of the electric car clear of the steam track in case the trolley wheel leaves the wire; a first-class special work cut crossing should be provided and all of the signals and derails operated from a tower located where the towerman can have an unobstructed view of the steam and electric tracks. In addition to the equipment described, safety of operation requires that the derail and signal on the electric track should not be set for the electric car to proceed, until the conductor has gone ahead to the center of the steam tracks and signalled the towerman to operate them. In addition to insuring the stopping of an electric car, before going over the steam tracks in regular operation, derails are necessary to safe operation on grades descending to steam road crossings, for the purpose of preventing runaway cars from going onto the steam tracks. Several accidents in this State resulting from this cause would have been prevented had crossings been equipped with derails. Metal troughs are ordered by the Railroad Commission to be placed on the trolley wires for the purpose of insuring the supply of power for the operation of cars over steam tracks if the trolley wheel leaves the wire. In this case it is caught by the metal trough, which is in metallic contact with the wire, and the wheel receives current from the trough. This device is necessary for safe operation of electric cars across steam tracks.

I find that managers of electric railroads throughout the State realize the importance of proper protection at grade crossings of steam railroads. There is, however, in some cases, a difference of opinion as to the protection required at these points, but in a majority of cases, the derails properly installed are considered by them the best means of protection, and the orders of the Board of Railroad Commissioners in reference to their installation are being cheerfully complied with.

Considering the large number of grade crossing accidents occurring throughout the country, managers of electric roads in this State are to be congratulated on the comparatively small loss of life and the number of persons injured at grade crossings.

FREIGHT DEVELOPMENT BY INTERURBAN ROADS

BY E. F. SEIXAS, OF ST. CATHERINES, ONT.

The transportation service performed by the railroads includes the movement of freight, the carriage of passengers and the transmission of mail and express matter. Each of these services merits careful consideration. Whether viewed from the standpoint of public benefit or considered with regard to the volume of business done and profits received by the company, the transportation of freight is the most important service performed by the railroad. The income from the passenger business is about one-fifth of the total income and earnings of the railroads in the United States, while the receipts from the freight amount to seven-tenths. Moreover, the social welfare is more dependent upon cheap and unfettered movement of commodities than upon inexpensive and speedy means of travel; however important it may be that the relatively few people who may at any one time desire to take a journey should be able to reach their destination promptly and comfortably, it is of incalculably greater consequence that producers should be able to dispose of the commodities upon the sale of which their livelihood depends, and that consumers should have the power of drawing upon distant, as well as near, sources of supply for the satisfaction of their wants and the gratification of their desires.

The volume of freight transported increases rapidly with the progress of civilization and the diversification of men's wants. The freight business is carried on to enable men to secure what they want, and the more complex their demands, the more goods will be produced and transported. The growing demand for the freight service has furnished a most powerful stimulus to inventors and engineers to lessen the obstacles to the movement of commodities by improving of tracks, cars and locomotives, and making other changes in the railroad mechanism whereby the costs of transportation have been reduced to their present small amount. Whether the endeavor of railroad companies to increase the speed of their passenger trains or their efforts to lessen the cost of freight movement have been the more potent incentive to mechanical improvements, it would be impossible to say, but the results accruing to society from these improvements have come more largely from the greater facilities for the shipment of goods.

So writes Professor E. R. Johnson, in his very excellent review of American Railway Transportation, and with this summary we may for the present dismiss our friends the steam roads. The conditions that have caused such signal success in the passenger business of interurban lines that depend on electric energy for their motive power are to a great extent responsible for the hearty greeting with which the average shipper, be he merchant or farmer, hails the advent of the trolley, and for the great complaisance with which he views the humming, whizzing cars that frighten his team of colts and send clouds of dust into his wife's otherwise immaculate parlor.

The first condition that tells in favor of the interurban line is the frequent service and the frequent stopping places. The second is that the interurban line is more or less of a local affair, and for that reason is more intimately cognizant of local necessities. In the battle between the piston rod and the trolley pole, passenger rates have suffered to a more or less extent, while

freight rates have pretty generally remained where they were. The interurban lines have not found it nesessary to inaugurate a rate war to get freight business from the steam roads, for they receive and are justly entitled to their proportion of the business on account of the increased facilities.

The present Niagara, St. Catharines & Toronto Railway was originally a steam road, constructed in 1886, and changed to electricity in 1899 and 1900, the first electric car running July 19, 1900, from Niagara Falls, Ontario, to St. Catharines. Prior to the change in 1900 the road had, through poor management and consequent poor patronage, fallen into the hands of a receiver, and was sold by the courts under the hammer to the present stockholders, who converted it into an electric line and afterward extended it to Port Dalhousie, and establishing communication with Toronto by steamers, which are also owned and operated by the company. A track connection had by the original company been arranged with the Michigan Central Railroad Company at Niagara Falls, Ontario, which has been since maintained, and which affords free interchange of cars to and from all points in Canada and the United States, thus forming a line in competition with the Grand Trunk Railway system in the territory covered by the electric line and its steamers, for which purpose the road was intended. The gross annual freight earnings of the line prior to 1900, or during the operation by steam, was less than $20,000, and the freight handled was confined to low classes of carloads, such as coal, this being in fact the principal traffic handled. Very little attention was paid to the higher class traffic, such as package merchandise, and it was not until 1901 that any marked increase was shown. This upward tendency was caused by an energetic and persistent endeavor on the part of the management to increase the development of the facilities which were practically dormant, in taking care of higher class traffic and leaving the low class to itself. The methods of handling had to be improved, a system organized, and particular attention paid to the despatch of business taken hold of. There was no attempt made to reduce rates, the traffic being carried on exactly the same conditions as steam lines under all circumstances. It was found that accommodation to patrons had a great deal more effect than any benefits derived from useless rate-cutting could afford. Cars are placed at convenient points for shippers to load, they are picked up at convenient hours, and shipping receipts are given at the counters of the business firms by a responsible man who has the freight train in charge, thus saving the customer the trouble and time of going to the railway station to make shipments. All this tended to increase popularity, and consequently, by increased shipments, revenue, until for the year ending August 31, 1093, we are able to show an earning of 120 per cent greater than in 1900, and an operating expense of 52 per cent as against a previous loss. The package freight must stay with the electric roads, as their methods will, if properly organized, hold it against steam roads, unless congestion is allowed, when the great advantage of quick handling will be lost. The handling of low class freight involves the expense of terminal facilities which in large cities is practically prohibitory, and unless there is assured enough freight to keep a regular competitive service against steam fully alive, it is better that electric roads confine their business to the higher classes of package merchandise. With us it is found also that switching service is a source of revenue, which if facilities are available is remunerative. We have arrangements to switch loaded cars to and from the Grand Trunk Railway, our competitor, and for industries located on our tracks. This service is easily performed and at a very little expense, the distance usually being short and the cargo quickly handled, and it pays because ordinary power is employed at times when we can afford it without detriment to our other interests. There is, in our opinion, ample revenue in the development of freight service for interurban lines provided, as has been done in our experience, that low class traffic is not sought after too closely and only taken care of when it involves the higher classes. No freight can be handled at a profit that pays less than 1 cent per ton per mile, and even at that figure there is not enough revenue to warrant short-haul lines seeking it. To sum up, all that is necessary to make electric lines a factor in freight traffic is to seek high class freight, handle it quickly, and attend promptly to customers' requests.

We have found that working arrangements cannot well be based upon a mileage rate unless a constructive mileage is allowed the smaller line, and it is not practicable to do this in our case (although conditions with other lines may be different and groupings may be obtained from connecting lines), because ours is a lake and rail line, peculiarly situated and breaking bulk, and our connections do not, therefore, favor percentage arrangements. We have worked out almost our entire traffic on an arbitrary basis, receiving as our proportion on classes one to six under the official freight classification the following figures, viz.:

Class	1	2	3	4	5	6
Cents	8	7	6	5	4	2½

per 100 pounds for our haul, whether long or short, and not participating in any reductions made by connections due to competition from various causes. We therefore submit that interurban lines are in a better position on an arbitrary basis than on a percentage arrangement, although the disadvantage of having no voice in rate making without consent is apparent by reason of nonparticipation in the reduction of rate asked, but this is only a matter of correspondence, we find, and is generally acceded to readily by connections upon representation of facts. The classes shown do not cover the low class or commodity traffic which I have alluded to in the first part of this paper, which are carried only by special arrangement between lines interested and generally calls upon the short lines to reduce their earnings to merely what it costs to handle, hence the assertion that it is better to leave it alone except where it may carry other higher traffic with it, when it cannot profitably be turned down because the manufactured product might be lost, and as this is high class it is profitable. We unfortunately had to take hold of an existing line, with its rates and obligations fixed, and were unable to alter the existing divisions of rates, although we have from time to time endeavored to do so. Initial errors are costly, and upon interchange being arranged care should be taken to have all traffic arrangements thoroughly arranged by competent men, fully conversant with such subjects. The earnings per ton per mile should be fixed as high as possible, and never allowed to be less than what steam lines earn. Short mileage allows fair revenue such as our earnings, being not less than 25 per cent minimum of through rates, and upon extension of line minimums could be increased correspondingly. Conditions of traffic in Canada differ, however, from the United States in many respects. For instance, we have in large centers cartage to perform which is forced upon us by an old existing arrangement made by the Grand Trunk Railway when it was practically the only line in Canada. It was inaugurated by that line to take care of friends. This is a burden, because the expense is not covered by extra charge made above freight rates, part being absorbed in the rate. Another factor of expense in handling is the freight car equipment, which costs interurban lines a per diem rate of 20 cents for every calendar day if foreign lines permit the use of cars. No line should be dependent upon equipment belonging to others, nor should they undertake to do more than deliver on cars at convenient points, unless the circumstances are very exceptional, as every transfer or movement necessarily costs money and increases the operating expenses materially. Rates should be maintained, and although steam roads are liable to cut with a view of forcing the business from electric roads, the public soon finds that the real object is to force the electric road out of the business and enable the steam line again to put up its rates with all the old disadvantages of slow time and poor service. Another commanding advantage to interurban lines is that their business is done on main roads in a number of cases where there are no terminal expenses, unless they endeavor to enter into active competition with steam lines, when terminals must be provided.

The handling of fruit is an important item in our season's business, Toronto being the central market. To handle our heavy freight traffic with the quickest despatch at a minimum cost has brought us to a point of efficiency whereby we find it necessary to allow our boats only 30 minutes at terminal points to load and unload from five to seven carloads of freight. To meet the requirements of our traffic we built a number of 4-wheeler platform trucks, the platform of which is similar to express trucks seen on steam lines, and capable of carrying 2 tons. On these we load all merchandise and package freight, ready to run aboard the boat on her arrival. The incoming freight is received from the forward gangway, and the outgoing freight is run on board over the after gangway. To handle our fruit traffic with despatch we have erected at points along the line fruit platforms, on which we keep a supply of these trucks. The farmer drives to this platform, loads his fruit on the trucks, and this is picked up by our fruit-train, which consists of flat cars the same height as the platforms, and run to make connections with each boat. This train carries three men, who run the loaded trucks from the platform on the cars. At Port Dalhousie they are run directly from the cars on the boat. This prevents handling, which is very damaging to the fruit, and also permits the fruit grower to use a cheaper grade of baskets, thereby effecting a great saving for him.

On the whole, therefore, freight business of interurban lines will pay if confined to the higher class of traffic, and if particular attention is paid to despatch and accommodation to the public.

ANNUAL REPORT OF THE INTERURBAN STREET RAILWAY COMPANY OF NEW YORK

The Interurban Street Railway Company, of New York, published on Oct. 7 its annual report for the year ending June 30, 1903. It occupies twenty-nine large pages, and is probably the most complete report of any street railway company which has ever been issued. It is accompanied by a map of the owned and leased lines of the company, showing by different colors those operated by electrical and those operated by animal power. It is understood that the company will issue similar reports each year.

The accounts of the company, as shown in the report, have been audited by Haskins & Sells, certified public accountants, whose certificate is appended thereto.

The gross earnings from operation of the entire system for the year are shown to have been $21,549,545.95, an increase of $618,377.43 over 1902. This increase was considerably less than the normal increase, because of a number of adverse conditions, the most important of which was the subway construction upon Fourth Avenue, Forty-Second Street, Lenox Avenue and upper Broadway, which necessitated the partial suspension of operation upon certain lines and seriously interfered with traffic upon many others. The operation of several other important lines was practically suspended for a considerable part of the year by the work of installing the underground electric system upon those lines. The operating expenses of the year were adversely affected by the same conditions, as well as by a substantial increase in wages, the abnormally high prices for fuel, due to the coal strike, and the high prices for materials and supplies, including feed for upward of 4700 horses which the company was compelled to use.

The fixed charges were increased by $431,444.44 for interest upon the $11,000,000 of Metropolitan Street Railway Company 4 per cent refunding bonds, which were issued pursuant to the Interurban-Metropolitan lease as part consideration for the sum of $23,000,000 in cash, payable by the Interurban Company thereunder. While the increase in earnings for the year was not sufficient to overcome this additional fixed charges, it is expected that it will be largely exceeded by the increase in the net earnings, which will follow the completion of the extensions and improvements now in progress, which the issue of the $11,000,000 of refunding bonds made possible.

Among the current improvements mentioned in the report reference is made to the new Kingsbridge power plant. This station is intended to generate high-tension current for transmission to the sub-stations in the upper part of Manhattan Island and in the borough of the Bronx and Westchester County. It is expected before the close of the present fiscal year that all the current required for the operation of all the lines in the boroughs of Manhattan and the Bronx, and in Westchester County, will be supplied from this power station and the Metropolitan power station at Ninety-Sixth Street and First Avenue, with the result of very materially reducing the aggregate cost of producing current. These two power stations will have together a maximum generating capacity of 116,000 hp, which is sufficient to provide for the growth of the business for several years to come.

The income account of the Metropolitan lines, including the Metropolitan, Thirty-Fourth Street Crosstown, Fulton Street, Twenty-Eighth and Twenty-Ninth Streets Crosstown, Central Crosstown and Mount Vernon lines, was as follows:

Gross earnings from operation		$16,178,563.57
Less operating expenses—		
Maintenance	$1,282,735.97	
Transportation	4,968,118.25	
General (including damages and legal expenses).	1,555,464.27—	7,806,318.49
Net earnings from operation		$8,372,245.08
Income from other sources		248,599.06
Gros income from all sources		$8,620,844.14
Deductions from income—		
Rentals of leased lines, including interest upon funded debt of companies leased or controlled.*	$3,715,964.34	
Interest on $11,000,000 Metropolitan Street Railway Company 4 per cent refunding bonds, issued under Metropolitan-Interurban lease	431,444.44	
Proportion of net income of Central Crosstown Railroad Company applicable to 1006 shares of stock (out of 6000) not owned by Interurban Company	11,305.06	
†Taxes	952,791.00—	5,111,504.84
Surplus		$3,509,339.30

* Excluding interest and dividends upon stocks and bonds of constituent companies owned or controlled by Interurban Company. † Franchise taxes on appeal to United States Supreme Court not included.

Surplus available for guaranteed dividend of 7 per cent upon capital stock, Metropolitan Street Railway Company	$3,509,339.30	
Balance of guaranteed dividend paid by Interurban Street Railway Company	130,452.45—	$3,639,791.75

The income account of the Third Avenue lines, including Third Avenue, Forty-Second Street-Manhattanville, and St. Nicholas Avenue, Dry Dock-East Broadway and Battery, Kingsbridge, Union, Westchester Electric, Southern Boulevard, Yonkers, Tarrytown-White Plains and Mamaroneck lines, is as follows:

Gross earnings from operation		$5,370,982.38
Less operating expenses:		
Maintenance	$626,459.32	
Transportation	2,229,144.34	
General (including damages and legal expenses).	727,187.63	
		3,582,791.29
Net earnings from operation		$1,788,191.09
Income from other sources		324,809.23
Gross income from all sources		$2,113,000.32
Deductions from income:		
Interest on funded debt	$2,027,000.00	
*Taxes	227,684.58	
		2,254,684.58
Deficit for the year ended June 30, 1903		$141,684.26

* Franchise taxes on appeal to United States Supreme Court not included.

These two accounts combined cover the operations of the entire Metropolitan Street Railway system.

The consolidated balance sheet of the Interurban Street Railway Company follows:

ASSETS

	Total	Metropolitan Lines	Third Avenue Lines
Construction, equipment, leases and franchises	$141,239,200.51	$67,759,212.93	$73,479,987.58
Additions and betterments—leased lines	21,376,239.38	21,376,239.38	.....
Investments	4,125,368.58	20,380,268.58	1,500.00
Materials and supplies	1,034,144.03	787,200.96	246,943.07
Current assets—			
Cash	$2,238,579.87	$1,861,567.28	$377,012.59
Cash—on deposit to pay coupons	995,390.01	145,890.00	849,500.01
Bills receivable	199,586.61	110,861.06	88,725.55
Accounts receivable	440,197.95	260,859.53	179,338.42
Metropolitan Securities Company subscription to Interurban Street Railway Company's securities	10,202,000.00	10,202,000.00	.....
Total	$14,075,754.44	$12,581,177.87	$1,494,576.57
Due from companies in the system—Third Avenue lines	.....	1,292,567.59	.....
Dividends accrued on stocks owned	13,893.75	13,893.75	.....
Prepaid accounts—			
Insurance, track rentals, etc.	286,153.27	219,895.52	66,257.75
Total assets	$182,150,753.96	$124,410,456.58	$75,289,264.97

LIABILITIES

	Total	Metropolitan Lines	Third Avenue Lines
Capital stock	$67,582,100.00	$59,403,100.00	$23,754,400.00
Funded debt	88,007,000.00	39,978,000.00	48,800,000.00
Interurban Street Railway Company ten-year notes	3,465,000.00	3,465,000.00	.....
Real estate mortgages	950,000.00	950,000.00	.....
Metropolitan Securities Company—			
Securities due it under subscription	12,132,500.00	12,132,500.00	.....
Current liabilities—			
Coupons due and unpaid	$995,382.50	$145,890.00	$849,492.50
Bonds due and unpaid	6,000.00	6,000.00	.....
Accounts payable	2,492,309.29	1,769,200.72	723,108.57
Employees' deposits	25,137.51	12,692.59	12,444.92
Unclaimed wages	660.42	.....	660.42
Total	$3,519,489.72	$1,933,783.31	$1,585,706.41
Due to companies in the system—			
Metropolitan lines	.....	.....	1,292,567.59
Accrued liabilities—			
Interest and rentals	$851,199.95	$741,158.29	$110,041.66
Taxes	1,073,676.97	805,115.05	268,561.92
Wages, etc.	56,284.31	43,718.85	12,565.46
Totals	$1,981,161.23	$1,589,992.19	$391,169.04
Reserve for controlled companies.	.....	534,578.07	.....
Profit and loss—surplus	4,423,503.01	4,423,503.01	534,578.07
Total liabilities	$182,150,753.96	$124,410,456.58	$75,289,264.97

The discrepancies in some of the items between the sum of the "Metropolitan" and the "Third Avenue" figures and the "total" column are due to certain eliminations made for the purpose of presenting the net assets and liabilities of the Metropolitan and the Third Avenue lines combined.

In adition, the report shows a detailed schedule of the funded debt of all the lines, miles of track owned, passengers carried, schedule of real estate owned, comprising some sixty different pieces; general balance sheets and income and profit and loss statements for all the sub-companies.

MUNICIPAL OWNERSHIP DEFEATED IN SAN FRANCISCO

The proposition to issue bonds for $710,000 to secure funds wherewith to take over the Geary Street, Park & Ocean Railroad, of San Francisco, has been defeated by the people of the city, who voted against the plan Thursday, Oct. 8. The company's franchise elapses in a short time, and the suggestion that the city buy and operate the line, seemed to meet with great favor. The vote on the question, however, was not as heavy as had been anticipated. The vote in favor was 14,481, and against 10,745. As a two-thirds majority was essential, the measure was defeated by over 6000 votes. The line is a 2-mile cable road, with double tracks, and its own power-house. Besides being a short line, it is greatly handicapped by having no franchise for the few blocks from its terminus at Newspaper Corner to the ferry and on the other end lacks ½ mile of reaching the beach. It is thus a "middle" line and transfers to the ferry. The plan of the city to take over the line included the installation of electricity as motive power. The details of the proportionment of the $710,000, as worked out by the city, follows:

Conversion of present cable road to underground electric road, conduit system, Market Street to Fifth Avenue (3.333 miles)	$60,620
New road on Point Lobos Avenue from Fifth Avenue to Fulton Street, including bituminous pavement (0.818 miles)	115,150
Removal of pipes, conduits and other obstructions	25,000
Power-house, three-story brick building office and car house, cooling tanks and oil reservoirs	94,000
Thirty double-truck cars 32 ft. long, each supplied with two 35-hp motors	133,500
Conductor cable, lead-covered ducts, etc.	90,000
Real estate	35,000
Total	$646,700
Engineering and contingencies add about 10 per cent.	63,230
Total estimated cost	710,000

The bonds were to be forty-year serials, carrying 3½ per cent interest.

The estimate of the surplus available for the betterment of the service rendered was placed at $17,825 a year.

BROOKLYN COMPANY ADOPTS MERIT SYSTEM

Another large company has been added to those which have adopted the merit system of discipline. This is the Brooklyn Rapid Transit Company, and the announcement was made Oct. 1 in a formal notice from the company to its officers and employees. The new system became effective Oct. 15, when all suspensions from duty with loss of pay were abandoned.

To place all on an equal basis each employee began the new system with a clean record. The official circular, which fully explains the system as it has been worked out, follows:

THE BROOKLYN HEIGHTS RAILROAD COMPANY,
OFFICE OF GENERAL SUPERINTENDENT

To Officers and Employees.—Commencing Oct. 15, 1903, all punishment of conductors, guards, switchmen, flagmen, engineers, motormen and firemen in train service by suspension from duty with loss of pay will be abandoned, and thereafter discipline for neglect of duty, violation of rules and bad conduct shall be by reprimand, demerit marks or dismissal from the service.

On that date, every employee above-named starts with a clear record, except that when subsequent records show that past offenses are being repeated, the persons concerned will be dismissed from the service or double the demerit marks entered against them.

It will be understood that disloyalty, intemperance, insubordination, immorality, willful or gross carelessness, incompetence, dishonesty, false statements or concealing facts concerning any matter under investigation will be dischargeable offenses.

A complete record of each employee will be kept and all discipline imposed will be shown thereon. Credit will be given for excellent conduct, deeds of heroism, or extraordinary service rendered, and these credits will receive due consideration in connection with any charges which may be made against such employee.

For every three (3) consecutive months of service free from demerit marks or reprimand, five (5) marks will be deducted from any that may have been previously entered against an employee's record. When sixty (60) marks shall have been entered against the record of an employee his services will be dispensed with.

On Jan. 1, of each year, the names of employees who have at that time completed a year with a clear record will be posted.

In the promotion of employees, their previous record will always be considered.

Record bulletins of an educational nature will be posted periodically, giving a brief account of cases where employees have been disciplined, stating what action was taken in each case, but will not ordinarily give the name of the employee nor any information that would identify him.

Each employee will be notified in writing of any action concerning him, and will have an opportunity to appeal from any decision as to the number of demerit marks, but such appeal must be made to the division superintendent within ten days after receipt of notice.

The objects of this system are:

First—To continue employees in the service without interruption, loss of wages and consequent suffering to those dependent upon their earnings for support.

Second—To obtain greater efficiency in the safe and careful operation of the company's service by encouragement to faithful and intelligent performance of duty.

This system is introduced in the belief that it will be beneficial to employees, and that it will meet with their hearty co-operation.

D. S. Smith,
General Superintendent.

Approved:
J. F. Calderwood,
Vice-President and General Manager.
October 1, 1903.

NEW YORK ELEVATED MEN VOTING ON QUESTION OF A STRIKE

A committee of the Brotherhood of Locomotive Engineers, representing the motormen of the Interborough Rapid Transit Company, which operates all the local elevated lines, called on Superintendent Hedley, of the company, last week to protest against the increase in the frequency of the tests carried on by the company for the purpose of discovering physical defects in its employees. Mr. Hedley said the examinations were for the safety of the public, and that they must go on. On Monday, Oct. 12, the committee appealed to General Manager Bryan, who consented to meet the men in conference. On Tuesday another meeting was had with Mr. Bryan, and on Wednesday the representatives of the committee again met Mr. Bryan. At this last meeting a flat refusal was made by the company to stop the physical examinations of the men, and the committee was told that this was final. A report of this action was immediately made to the joint executive committee of the employees, and it was decided to call for a general vote on the question of the advisability of declaring a strike. As this paper goes to press the vote is being taken.

OFFICIAL REPORT ON THE NEW BRIDGE TRAFFIC SCHEME IN NEW YORK

Engineer Archibald McLean, in charge of the Brooklyn Bridge, has made his report to Commissioner Lindenthal on the operations of the Poulson plan at the test which took place last week at the Manhattan terminal of the Brooklyn Bridge, and which was noted in detail in the Street Railway Journal of Oct. 10. Mr. McLean does not appear to be very enthusiastic over the Poulson plan, and, in fact, concludes his report to Bridge Commissioner Lindenthal with the statement that in his judgment there is nothing to be learned from further tests of the Poulson plan. No expression of views on the plan has been made by Commissioner Lindenthal, but an official of the department says that if Mr. Poulson insists on further tests, the Bridge Commissioner will very likely accommodate him, unless there is objection from the public. This official said the Bridge Commissioner was anxious to show Mr. Poulson and the latter's friends in Brooklyn, particularly the Manufacturers' Association, that he is not prejudiced against the Poulson plan, and that every opportunity would be given the inventor to demonstrate the practicability of the scheme.

FINANCIAL INTELLIGENCE

Wall Street, Oct. 14, 1903.

The Money Market

The money market continues to occupy what may be described as a fairly comfortable position. Nobody can say that funds are easy and abundant so long as it is known that the railroads and other corporations which need banking capital to help them in their business are still being held rigidly at arms length. But for all the necessary requirements of the season—and these include commercial borrowings and currency withdrawn to move the crops—bank reserves seem likely to be quite sufficient. The crop-moving demands, to be sure, have not yet reached the volume they will attain later on. The Treasury's position as a creditor in the market is, moreover, artificial and temporary. Bank surpluses cannot long keep from beginning the descending movement which always takes place in the autumn season. Still, with all this, the present surplus of the New York banks is $16,500,000, against $1,527,000 in 1902, and is, in fact, exceptionally high for this time of year. This circumstance is assurance enough that if the banks reserve their lendable balances only for the most necessary borrowings, the money market will get along without any trouble. The disposition to shade rates on commercial paper—which has been one of the most notable incidents of the past week—doubtless reflects the slowing down of general trade, and the consequent belief that the demand for mercantile discounts will fall off, as compared with preceding years. Something of the same explanation probably accounts also for the easier tendency now visible in time money rates. Meanwhile the extraordinary delay in the currency withdrawals by the interior, and the disbursements of the Treasury on bond redemption, and for other unusual purposes, are holding local bank reserves stationary. In the absence of any speculative demand, call money rules at nominal figures on the stock exchange. The prevailing rate is 2¼ per cent to 2½ per cent. Sterling exchange, though lower on the week, is still well removed from the gold import point, and a movement of gold from Europe this season still appears unlikely. Sixty-day money is quoted at 4½ per cent, and money for the three to six months at 4¾ per cent to 5 per cent.

The Stock Market

Renewed weakness has appeared in the stock market this week, but it is of a different sort, and evidently results from different causes from the weakness of the summer's market. On previous occasions forced unloading of securities by wealthy speculators and promoters has been the leading feature. It has been so urgent and so indiscriminate that all classes of securities suffered with almost equal severity. During the past week, while some of the selling is attributable to embarrassed capitalists the principal liquidation has undoubtedly come from a multitude of small investors alarmed over the recent disturbing developments in some of the industrial companies. This liquidation has converged almost wholly upon the industrial shares; the railroads, while under pressure at times, have shown, on the whole, a decided resistance to the decline, and their whole behavior has suggested that real selling in these stocks has pretty well run its course. Two circumstances of the last fortnight are particularly responsible for the prevailing distrust felt toward the industrial quarter of the market. The first of these was the reduction of the Steel common dividend, the second the unsavory record of the Shipbuilding Trust revealed at the hearing of the companies' affairs a week ago. Undoubtedly the scandalous revelations made in this testimony marked the case as an extreme one, and Wall Street has been altogether too ready to assume that the same disreputable methods of financing have been employed in other industrial consolidations of the same sort. It is also pointed out with perfect truth that the recent disclosures in the Shipbuilding company revealed little that was not known before. Yet, with all this the episode, combined with the action of the Steel directors, has greatly intensified the feeling of suspicion against all industrial combinations which came into existence during the inflation period of the last few years. The decrease in the Steel Corporation's earnings has, moreover, called attention to the slackening of general business. Reaction has gone farther, probably, in the steel industry than anywhere else, but the fear is certainly not unreasonable that a downward movement once it becomes well defined in the steel trade, will not be long in spreading to other industries. All the securities of the steel manufacturing and steel-using companies have followed this week the example of the United States Steel Corporation stocks, and many of them have established new low records. At the present writing this liquidation is still in progress, and while a more hopeful sentiment prevails as to the immediate future of the railroad stocks, nobody expects any decided improvement until the market for the industrial issues is proved to have finally reached its bottom.

The local traction stocks have been less prominent in this week's dealings than in those of the previous week's. They have sympathized with the firmness of the railroad shares rather than with the weakness of the industrials. Manhattan Elevated has, as usual, displayed the best resistance of the group, but Brooklyn Rapid Transit has also disclosed a considerably better support than has been extended to the stock for some time past. The annual report of the Interurban Company, submitted during the week, has come in for a great deal of criticism, both good and bad. On the face of things the figures apparently show that the 7 per cent Metropolitan guarantee has been very nearly earned. The stock has responded very little to the report, either one way or the other.

Philadelphia

Weakness has continued in several quarters of the Philadelphia market, but it has been by no means as general as on the two previous weeks. Shares of the Philadelphia Company have had another sharp drop, the common selling down from 37½ to 35, and the preferred from 43¾ to 42, both of which represent the lowest prices on record. This decline is associated with the speculative troubles in Pittsburg, where the Philadelphia Company stocks are largely held. They have apparently been sold merely in consequence of the general depression, and not because there was anything wrong with the company's affairs. For like reasons United Traction of Pittsburg preferred fell two points to 48½, although the sales of this stock were comparatively light. The home traction shares have held generally steady. Philadelphia Traction lost a half a point to 93½, and Philadelphia Rapid Transit dropped from 12½ to 11⅞. Union Traction sold down from 42¾ to 42¼, but rallied to 42½. Good investment buying was observed in this issue. The only other sale of the week was a single one in Consolidated Traction of New Jersey at 60.

Chicago

The street railway people and the Chicago city officials are getting together on franchise matters, but so far there have been no important developments for or against either party. It is said that a tentative franchise has been drawn up and is satisfactory to the City Railway, with the exception of the compensation clause. In well-informed quarters it is believed that this franchise, if accepted by the City Railway, will also be adopted by the Union Traction. At the best, however, the franchise controversy seems likely to be long-drawn out, and will not be settled without some concessions on the part of all concerned. As far as can be learned the city has shown no disposition to recede from its requirement for a limited twenty-year extension with heavy compensation in the bargain. Judge Grosscup has issued an injunction restraining the minority stockholders of the North and West Side lines from interfering in any way with the Union Traction reorganization. This injunction remains in force until terminated by a higher court. A dividend of 2 per cent has been ordered on North Chicago stock, payable Oct. 15. This is at the reduced rate authorized a few weeks ago. Trading in the Chicago securities has been very light, and of small consequence during the week. Metropolitan common sold down from 18 to 17, and back to 17¾. The preferred rose from 54 to 55, then dropped to 54 again. The only other sales comprised Northwestern common at 17, Lake Street at 4½, South Side at 94, City Railway at 175, and Union Traction common at 4½.

Other Traction Securities

The Boston traction specialties have all steadied down considerably after the extreme depression of ten days ago. Liquidation in this group seems to be over for the present at least. Massachusetts Electric common fell rather sharply from 20½ to 18¾, rallied to 19½, and sagged off to 19 again, but selling of the stock was very light. Massachusetts preferred, on the other hand, held steady dur-

ing the week at 77½. Boston Elevated rose sharply from 137 to 138, but dropped just as abruptly again to 136½. West End common was exceptionally strong at an advance to 91, while the preferred sold at 109 and 108. In Baltimore the United Railways issues have again been under some pressure, but more particularly in the stock and in the income bonds than in the first mortgage 4s. The stock declined from 9½ to 9 and the income bonds from 59⅜ to 58¼, the latter being a new low record price. On the other hand, the general 4s held steady around 90. Other Baltimore sales for the week include Lexington Railway shares at 40½, the 5 per cent bonds at 100, Atlanta Street Railway 5s at 103, City and Suburban, of Washington, 5s at 93, Charleston Street Railway 5s at 104½, and Anacostia & Potomac 5s from 91¾ to 91. On the New York curb Interborough Rapid Transit showed continued weakness, dropping from 82⅛ to 81. New Orleans Railway common stock sold at 9¼, the lowest of the season. Other sales comprised Brooklyn Rapid Transit 4s at 77½, Washington Traction 4s at 71, and St. Louis Transit at 15.

Cincinnati Street Railway featured in the trading at Cincinnati last week. Sales numbered 1250 shares, and prices ranged from 128¾ to 130. Detroit United opened the week at 66 and gradually declined to 61½ at the close of the week; sales numbered 202 shares. One small lot of Toledo Railway & Light sold at 20, and Cincinnati, Dayton & Toledo Traction sold at 28, while several lots of the bonds of this road sold at 81½. Columbus, Delaware & Marion, Mansfield & Zanesville bonds all sold at the old price, 101.

At Cleveland there was considerable bidding for Cleveland Electric Railway stock. It opened the week at a very low figure, 63, and advanced to 65¼. Sales numbered 285 shares. Northern Ohio Traction & Light became active towards the close of the week, and 180 shares were sold at 15⅛ to 15⅜. It has been inactive at 15 bid, and 16 asked for some time. On Monday two lots of Lake Shore Electric common sold at 5, a drop of five points from the lowest previous sale. Northern Ohio Traction became quite active again, and 400 shares sold at 15, a drop of three-eighths from last sales.

Security Quotations

The following table shows the present bid quotations for the leading traction stocks, and the active bonds, as compared with last week:

	Closing Bid	
	Oct. 6	Oct. 13
American Railways	42	41
Aurora, Elgin & Chicago	a17	—
Boston Elevated	135	136½
Brooklyn Rapid Transit	33⅛	31⅞
Chicago City	170	170
Chicago Union Traction (common)	4	4
Chicago Union Traction (preferred)	30	30
Cleveland Electric	60	65½
Consolidated Traction of New Jersey	59	59
Consolidated Traction of New Jersey 5s	104¼	103
Detroit United	64	55
Elgin, Aurora & Southern	a42	a56
Lake Shore Electric	a7	a5
Lake Street Elevated	4¼	4
Manhattan Railway	130½	130
Massachusetts Electric Cos. (common)	20	18
Massachusetts Electric Cos. (preferred)	77½	77½
Metropolitan Elevated, Chicago (common)	18	17
Metropolitan Elevated, Chicago (preferred)	53	53
Metropolitan Street	105	103
New Orleans (common)	9¾	7
New Orleans Railways (preferred)	30	a30½
North American	71	72
Northern Ohio Traction & Light	15⅛	13
Philadelphia Rapid Transit	12	11¾
Philadelphia Traction	94	93½
St. Louis Transit (common)	15¼	13¼
South Side Elevated (Chicago)	90	91
Syracuse Rapid Transit	—	a30
Syracuse Rapid Transit (preferred)	—	73¾
Third Avenue	105	100
Toledo Railway & Light	17¼	a20
Twin City, Minneapolis (common)	86	80½
Union Traction (Philadelphia)	42½	42¼
United Railways, St. Louis (preferred)	62	61

a Asked. b Last sale. * Ex-dividend. † $10 paid.

Iron and Steel

Next to the cutting of the Steel dividend, interest in the iron situation has centered in the concerted action undertaken to curtail the production of pig iron. A leading trade authority estimates that the product for the last quarter of the year will be reduced by 825,000 tons. Both buyers and sellers are waiting to see how this vigorous treatment of the situation will affect the market. Little business is being done at present, but it is expected that if the makers succeed by lowering output, in working off accumulated stocks, buyers will be found at current prices in considerable quantity. Nothing new has happened in the steel situation. Less is heard now, however, about shading of steel billet prices below the official quotations. This is rather a favorable sign. Quotations are as follows: Bessemer pig iron $16.35 a ton, Bessemer steel $27, steel rails $28.

Metals

Quotations for the leading metals are as follows: Copper 13¼ cents, tin 25 15-16 cents, lead 4½ cents, and spelter 6 cents.

CHICAGO TRACTION MATTERS

The sub-committee on franchises of the local transportation committee of the Chicago City Council has been holding numerous sessions with the officers of the Chicago City Railway Company the last two weeks. The Chicago City Railway Company has submitted figures on the amount it proposes to spend in changing its cable lines to electric traction and improving the entire property so as to bring it up to date in every particular. The committee also has prepared figures on the amount it believes will be necessary to expend on their work. The company contemplates an immediate investment of about $17,000,000 in improvements, but the sub-committee and the representatives of the company have been unable to agree on the compensation to be paid the city. Some time ago, when franchise matters were first considered, it was commonly the talk in Chicago that 20 per cent of the gross receipts should be turned over to the city. Others favored 4-cent fares in place of 20 per cent compensation to the city. The company, however, now maintains that with the investment which it is necessary to make and the limitation of the franchise to twenty years, 20 per cent, or even 10 per cent, would be excessive, and would not admit of a proper return on the investment and provide for depreciation.

The fact that the agreement will probably provide that the city can take over the property at the end of twenty years at an appraised valuation will make it necessary to provide more than is ordinarily done for depreciation. Under the present law all franchises must expire at the end of twenty years. At the end of that time all physical property of the company can be purchased by the city at an appraised valuation. The stockholders who invest their money to-day in new securities, as well as stockholders having money already invested, should therefore be paid back the full face value of their capital stock at the expiration of the franchise. To pay back these stockholders and to retire any bonds which may be issued the company will have at the end of twenty years only the amount which it can obtain by an appraised valuation of the physical property plus whatever sinking fund may have been established. The property, taken as a whole, must earn enough to return all the original investment at the expiration of the franchise. This means that not only ordinary depreciation must be taken care of, and that the physical condition of the property must be kept up, but that depreciation due to improvements in the art must be considered as well. While the appraised valuation may in theory give a return to the stockholders of nearly all they put into the property originally, in practice it never does, and the only safe course for the company would be to figure on getting only scrap value for its physical property at the end of the grant.

The question of compensation may ultimately be left to the entire body of the Council to decide. It is at least certain that the sub-committee on franchises will not decide it, but will leave it for the entire committee on local transportation to pass upon before reporting an ordinance to the Council.

Among the provisions of the ordinance proposed are these: that all rails hereafter laid in streets paved with asphalt, granite, brick or wooden blocks, shall be grooved rails, and that wherever a street occupied by rails of a different type shall be newly paved with any of the aforesaid materials, the company shall replace its girder-rails with grooved rails. All cars must have center aisles and be without running footboards along the sides.

Chicago Union Traction matters have made little progress. Another formal application for permits to substitute the trolley for the cable on certain lines has been filed. Judge Grosscup has heard the testimony of John Spry, who acted as middleman in the attempt of the minority stockholders last summer to secure $100,000 to stop blocking a reorganization plan approved by the majority. Mr. Spry's testimony only served to bring out details as to the way the offer came to be made.

Attorney Levy Mayer, who represents the minority stockholders, has announced that he will file in the State Courts a supplemental bill attacking the right of the North and West Chicago Street Railroad Companies to enter into the reorganization leases. He did this in spite of the fact that Judge Grosscup, who has charge of the Chicago Union Traction Company, announced that he would consider it as an interference with his court.

Mayor Harrison has refused absolutely to grant any permits to put trolley wires over the present cable lines. The city authorities profess to believe that there is an attempt on the part of the Union Traction Company in asking these permits to secure rights which could be construed as permanent grants under the ninety-nine-year act, and then, having secured these grants, the company would make a fight on the ninety-nine-year act. Judge Grosscup, in reply to Mayor Harrison's charges that there is a trap in connection with these permits, has announced that there is nothing of the kind, and the permits were applied for by the receivers under the direction of the court.

Among other things, the Judge says: "This talk about a possible trap is nonsensical, because when two parties are trying to make an agreement, one cannot waive rights which he did not intend to waive. The city officials may make any reservation they desire in these permits, and thus pave the way for giveng the public better transportation facilities."

REORGANIZATION OF THE WORCESTER SUBURBAN COMPANIES

A plan of reorganization of the Worcester & Southbridge Street Railway Company and the Worcester, Rochdale & Charlton Depot Street Railway Company, of Worcester, Mass., now in the hands of receivers, has been prepared by a committee of the stockholders at the request of the receivers. The plan contemplates the purchase of the property at the amusement park at Pinehurst, if it can be bought for $24,000. It is not considered advisable to do anything with the Overlook Hotel property in Charlton. Both these latter properties were concerned in the failure of the street railways, and were placed in the hands of a receiver. The Southbridge & Sturbridge Street Railway, of which the report speaks, has been under the same control as the roads now under a receivership.

It is proposed by the stockholders to unite under a single management the Worcester & Southbridge, the Worcester & Rochdale Railways, the Pinehurst property, and the Southbridge & Sturbridge Street Railway Company, which now has a capital stock of $60,000, bonds $60,000 and floating debts of $26,000, these three railways forming a continuous line of about 30 miles, and extending substantially from the City Hall in Worcester to Fiskdale mills in Southbridge, while the Pinehurst property, being conveniently located along this railway, will always be to its benefit in the matter of passenger traffic. To do this will require about $131,000 in cash.

The stockholders propose to form a securities company with a capital stock of say $850,000, of which, say, $250,000 shall be 4 per cent non-cumulative, no voting power preferred stock, which shall be preferred as to dividends and division of assets up to par. The balance, $600,000, shall be common stock. Of this, $40,000 stock will be given to stockholders of the Rochdale road at par in exchange for the stock of that road; $400,000 stock will be given to the stockholders of the Worcester & Southbridge road in exchange for $500,000 stock, thereby reducing that company's stock by 1000 shares; $60,000 stock will be given to stockholders of the Southbridge & Sturbridge road at par in exchange for the stock of that company; 1000 shares, which have already been underwritten, will be issued for cash. The company will thereby be provided with $100,000 in cash to pay on account of the $131,000 specified above. The remainder will be provided from sale of rails, accounts payable and cash on hand, which will leave a balance sufficient to provide also for the expenses of receivership, etc.

The securities company will hold a majority of the stock of the three companies, subject to underlying bonds of $500,000 of the Worcester & Southbridge Street Railway, $60,000 of the Southbridge & Sturbridge Street Railway and $40,000 of the Worcester, Rochdale & Charlton Depot Street Railway, a total of $600,000, with interest of $27,300. A joint note of the three railway companies to an amount equal to the outstanding indebtedness of the Worcester & Southbridge Street Railway Company will be given to the securities company. The indebtedness is given as approximately $930,000.

The securities company will issue twenty-year first mortgage collateral bonds, subject to call, to an amount equal to 75 per cent of the outstanding debts represented by said notes; said bonds to bear interest at the rate of 3 per cent for the first two years, 4 per cent for the next two years, and 5 per cent thereafter.

Said bonds will be secured by a mortgage to a trustee of the notes of the three railway companies as above specified, together with a controlling interest in the stock of the three railway companies and the Pinehurst property.

It is proposed to exchange the outstanding indebtedness of the Worcester & Southbridge Company for collateral bonds of the securities company to an amount equal to 75 per cent of the face value of such debts, and 25 per cent par value in the preferred stock of the securities company.

The estimated earning capacity of the properties it is proposed to unite is $36,380, of which $22,500 would be required for the payment of interest. The $13,880 surplus is sufficient to pay 4 per cent on the preferred stock. The stockholders suggest that the prospective freight and express business to be carried on will add to the estimated earnings.

The report is signed by George W. Wells, Fred. Thayer, Calvin D. Paige, Samuel H. Colton and Edward S. Parker, all prominently identified with the affairs of the roads.

The receivers, John A. Hall and Charles M. Thayer, are proceeding with an examination of the affairs of the road. There has been talk of forged signatures of bonds. No definite action has been taken resulting from this.

EXCURSION AND MEETING OF THE ENGINEERS' CLUB OF PHILADELPHIA

Upon invitation, a large party, made up of members of the Engineers' Club, of Philadelphia, visited the works of the J. G. Brill Company, in that city, on the afternoon of Oct. 3. The representatives of the club were "personally conducted" through the plant by W. H. Heulings, Jr., who was subjected to a heavy fire of questions in every department. On completion of the inspection refreshments were served in the office of the company, and the visitors departed with a great deal of information as to the methods of manufacture and details of construction of all classes of trolley cars, including trucks.

At the regular meeting of the club, held the same evening, Mr. Heulings read a paper on the "Development of the Brill System of Trucks for Electric Motor Cars." During the Centennial Exposition several types of steam motor cars were put in use on the streets of Philadelphia. John A. Brill saw at that time that if cars were to be self-propelled, the motors would require a frame-work separate from that of the car body. The frame-work of the cars is required to be as light as possible, and would therefore be unable to withstand the vibrations and strainings of the motors. Before 1887 some cars had been built with the motors set upon the front platform or hung from the body, but the racking and straining very quickly shook the cars to pieces. The truck was the starting point of the mechanical success of electric motor-driven street cars. Mr. Heulings traced the successive development of the Brill system of truck, and stated that the right method of motor support was adopted for the first type of truck, and that this method of support is now in universal use. In the earlier forms of trucks the use of coil springs resulted in a bounding motion or oscillation of the car body. It was discovered that this oscillation was caused by a rhythmic motion in the springs produced by the rail-joints, and the difficulty was obviated by introducing, in connection with the coils, slower acting elliptical springs. Later on the full elliptical springs were superseded by semi-elliptics which were slower acting. The correct principle in all truck building is to have the frame support the car body as nearly as possible over the points where they are themselves supported. The use of longer car bodies necessitated pivotal trucks, and the maximum-traction truck, consisting of a pair of ordinary-size driving wheels and a pair of pony wheels, was devised. In this truck the weight is eccentrically distributed so that the large wheels carry nearly all of the load, the pony wheels bearing just enough to enable them to guide on the track. A large part of the paper was devoted to the manufacture of the solid forged side frames, and the lantern slides generally referred to this part of the subject.

In the discussion which followed the paper it was stated that the large cars used in this city weigh about 32,000 lbs., while the heaviest car manufactured at this time is used on interurban railways, such as those of Detroit, and weighs about 86,000 lbs. An interurban car with 36-in. diameter wheels and solid forged truck recently made 10 miles in eight minutes' running. In answer to an inquiry, Mr. Heulings stated that they had found the best brake-shoe to be one of soft, gray iron with pieces of wrought iron let into the face.

After passing a vote of thanks to Mr. Heulings for his paper, and to the Brill Company for the courtesy shown the club in the tour of inspection, the meeting adjourned.

LABOR MATTERS ON THE CHICAGO CITY RAILWAY

The agreement between the union employees of the Chicago City Railway Company and that company expired on Oct. 1. Immediately following its expiration a committee of the union waited upon Robert McCulloch, general manager, presenting another agreement which they wish the company to sign. At the meeting between Mr. McCulloch and the committee the demands made in the agreement were firmly refused, mainly because the agreement proposed by the union provided only for the employment of union men, and practically took the management of the road out of the company's hands. The company has been very fair in its treatment of its men, and positions on the Chicago City Railway are recognized as very desirable. When an increase in wages was asked about eighteen months ago, the company granted as much increase as seemed possible under the circumstances; but the union refused to accept the company's offer, and stood out for the increase they originally asked. The whole matter was submitted to arbitration, and the proposition of the company was practically adopted in full by the arbitrators. The company has lived up to this agreement in good faith, but it is to be regretted that during the time the agreement has been in force, an unwarranted proportion of the general manager's time has been taken up in listening to complaints from committees of the union. In order that all the employees might understand the demands of the union and the position taken by the company (since only 100 men out of 2000 attended the meeting at which the demand was voted on), the company had printed and placed in the hands of every employee a pamphlet giving the demands of the organization, the company's answer, and the company's proposition.

The following is the contract proposed by the Amalgamated Association:

First.—The Company agrees to pay the following wage scale:

Electric men, sixty (60) days or more in the train service, to receive twenty-eight cents (28c.) per hour.

Electric men, less than sixty (60) days in the train service, to receive twenty-three cents (23c.) per hour.

All electric night car crews to receive the sum of two dollars and sixty-five cents ($2.65) per night.

Gripmen and motormen operating mail cars to receive the same rate of wages as regular gripmen and motormen.

No train runs on the cable lines shall be paid less than two dollars and eighty cents ($2.80) per day.

No trailer runs on the cable lines shall be paid less than two dollars and forty-nine cents ($2.49) per day.

Supply and cinder car motormen to receive twenty-eight cents (28c.) per hour.

Supply and cinder car conductors to receive twenty cents (20c.) per hour.

Where men are required to work on snowplows or sweepers, or make extra trips after completion of day's work, they shall be paid at the rate of time and one-half. Time to be computed from reporting time until relieved from duty.

On cable and electric lines, it is agreed that there shall be no reduction in pay on account of blockades or loss of trips caused by any tie-up, and employees shall be allowed full pay that their runs call for under normal conditions.

This clause also to apply in cases where a trip is prevented being made by absence of one of the crew, or the company's inability to supply cars, or for other cause which prevents regular trips being made.

The work day of all motor repairers, car repairers, grip repairers, inspectors and dopers shall be nine (9) hours, excepting Sundays and holidays, which shall be eight (8) hours, for which they shall receive the present ten (10) hour pay.

New men employed as car repairers, motor repairers, grip repairers, inspectors and dopers shall be paid one dollar and ninety-two cents ($1.92) per day for the first year; after one (1) year they shall receive the regular wage scale.

All car pushers, car cleaners, car couplers, lampmen, flagmen, gas clerks and towboys shall receive ten per cent (10%) over and above the present wage scale.

All members in the barn and mechanical service shall be paid at the rate of time and one-half for overtime.

Second.—In the matter of time-table schedules, the Company agrees as follows:

Excepting Sundays and holidays the work day of train service men shall be not less than ten (10) nor more than eleven (11) hours.

All Sunday runs to be straight.

All day runs to be ten (10) hours straight.

All day trippers to be completed inside of twelve (12) consecutive hours.

All common trippers to be completed inside of fifteen (15) consecutive hours.

All runs scheduled for less than ten (10) hours, excepting Sundays and holidays, to be paid for ten (10) hours.

No less than one-fourth of the runs on each line to be day cars.

No less than one-fourth of the runs on each line to be day trippers.

All night car runs to commence at midnight and finish not later than 6:30 a. m.

All runs classed as day trippers shall finish work not later than 8:00 p. m.

Trailer conductors on Cottage Grove avenue shall not be compelled to report Sundays as extra men.

Trainmen shall be allowed at least twenty-five minutes for meals.

Third.—Any grievances that may arise in the future that cannot be amicably adjusted between the properly accredited officers of the Company and the properly accredited officers of the Association shall be submitted to a temporary board of arbitration, to be selected in the following manner:

One arbitrator shall be chosen by the Company, and one by the representatives of the Association. The two arbitrators so chosen shall meet daily to select the third, and said three arbitrators so chosen shall then likewise meet daily for the purpose of adjusting said grievances, and the decision of a majority of said board submitted in writing to the railroad company and the Association shall be binding upon both parties.

In the event of the failure of either party to appoint their arbitrator within six (6) days after arbitration is decided upon, the party so failing shall forfeit its case.

Fourth.—All employees in the train and car house service to be members of the Association in good standing, and where new employees are hired in the future they shall be on probation for a period of 45 days. At the expiration of that time, if satisfactory to the parties hereto, they shall become members of the Association.

Fifth.—The properly accredited officers of the Company agree to meet and treat with the properly accredited officers and committees of this organization on all questions and grievances that may arise in the future.

Sixth.—The Company agrees that any member of this organization who has been unjustly suspended or discharged shall, upon reinstatement, be reimbursed for all time lost.

Seventh.—The Company agrees that officers and members of this organization shall be granted leave of absence on organization business when so requested.

Eighth.—The Company agrees that any member of this organization who now holds office, or who shall be elected to any office of said Association which requires his absence from the Company shall, upon his retirement from said office, be placed in his former position.

Ninth.—The Company agrees to maintain an adequate extra list in the train service at all times.

Tenth.—Members of this Association who are employed in the general shops shall be protected under this agreement.

Eleventh.—The Company shall place in the office at each car house of the respective lines an open book, in which the man can register the particular day or days on which they want to get off, and the men who register first for any particular day or days shall have first privilege; provided, however, that the executive board members and others having business to do for the Association shall be entitled to get off in preference to others. Said book shall be dated seven days ahead.

Twelfth.—All car repairers, motor repairers, grip repairers, inspectors, dopers, car pushers and car cleaners shall have the right to be absent from duty every other Sunday.

Thirteenth.—The Company agrees that any member of this organization who receives injury while in the performance of his duties shall receive free medical attendance and be paid for all time lost.

Fourteenth.—A suitable seat or rest shall be provided for motormen.

Fifteenth.—This agreement to be binding and in force beginning this———day of————, 1903, up to and including the 31st day of May, 1905.

The company's reply to the foregoing propositions was as follows:

Gentlemen: The Chicago City Railway Company, in accordance with agreement, hereby makes answer to your proposition which was submitted on Thursday, September 24, 1903.

First.—The first clause in your proposition, consisting of 15 paragraphs, relates exclusively to an increase in wages.

This question was adjudicated a year ago by a board of arbitration which awarded substantial advances.

Manufacturing and steam transportation companies, and business concerns generally, have provided for increases in wages by advancing their rates and the prices of their commodities; the rate at which this Company must sell its product is fixed and it can make no such provision, but must provide for increase in expense solely through increase in business. All its increase in business has been more than absorbed by the increase in wages awarded a year ago, and there is nothing in the financial affairs or condition of the Company to justify or warrant or allow a further increase in wages.

Second.—The second clause of 12 paragraphs provides for an arrangement of time-tables considering only the convenience of the men operating the cars.

Whilst the Company desires to make its work as agreeable as possible to its employees, it has assumed and owes a higher duty to the public—that of operating its cars as will best provide transportation at such time and in such manner as their going and coming shall require—and it cannot enter into any agreement that would hamper or restrict it in the performance of this duty, or which would at any time hinder it in holding the convenience and accommodation of the traveling public as a sole guidance in time-table arrangement.

During the past year time-tables were made for several lines in compliance with findings of arbitrators whose conclusions were the result of your suggestions. When these tables were posted for use the men in interest invariably petitioned for the retention of the old tables, showing conclusively that the present plan on which the tables are arranged is as satisfactory as any that can be devised.

Third.—The third clause of 3 paragraphs provides for arbitration, to which the Company assents, except that it will not assume responsibility for the required daily meetings of either the two first arbitrators, or the three.

When the arbitrators are selected, they claim and exercise the right to regulate their own meetings.

Past experiences have demonstrated that the Company and its one representative on the board have always been ready for daily meetings, the delays and continuances having invariably been in deference to your representative. It is suggested that the word "daily," which is used twice, be stricken out, and the clause is acceptable to the Company.

Fourth.—The fourth clause gives your Association complete and absolute control of the selection, employment, retention in service, and discipline of all employees.

Under prevailing laws and customs, the Company is responsible and liable to the public for the acts of its employees whilst on duty, and, precedent to any discussion of this clause, your Association must give the Company ample and acceptable security that it can and will assume and take care of said responsibility and liability of the Company to the public, since it proposes to assume the absolute control of the selection, employment, retention in service and discipline of all employees.

Fifth.—To the fifth clause the Company makes no objection.

Sixth.—As to the sixth clause, the Company will not unjustly suspend or discharge any man.

Seventh.—The seventh clause provides for leave of absence without restriction or limitation, for all of your members.

Men are employed for the performance of specific duties, and the performance of these duties must have precedence over all personal or Association engagements.

There will be no objection to granting such leaves of absence as do not cripple the Company in its service to the public.

Eighth.—The Company assents to the eighth clause, provided the member in his absence from the Company's service is not guilty of acts which disqualify him for said service.

Ninth.—The Company endeavors at all times to maintain an adequate extra list.

Tenth.—The tenth clause is vague and indefinite and cannot be intelligently answered.

Eleventh.—Your request that men who apply first shall have first privilege of lay-off, is fair and satisfactory to the Company, but the Company cannot otherwise discriminate, and members of your executive board must arrange with their fellow-workmen for a waiver of claim for precedence, when they do not hold such precedence by reason of priority of application.

Twelfth.—The requirement of this clause is already a custom, and there is no objection to its continuance under the same conditions now prevailing.

Thirteenth.—The Company will not undertake so extensive an insurance scheme as the thirteenth clause provides for.

Fourteenth.—The Company will take pleasure in surrounding the performance of duty with all the comforts possible, but to seat the motorman would be to place him in a position where his opportunity to observe danger and his promptness of action to avert it, would both be greatly impaired, and doing so would be almost criminal, unless we approach much nearer to immunity from accident and collision than is indicated by past or present happenings.

The contract proposed by the company was as follows:

First.—That the Chicago City Railway Company makes no opposition to its employees being members of the Amalgamated Association of Street and Electric Railway Employees of America, and that there shall be no discrimination or distinction on either side for or against men who belong to the union, or men who do not choose to belong to it, but all employees are at liberty to exercise their pleasure in the matter.

Second.—The general plan of operation of cars, hours of work and rates of wages now prevailing shall be continued through the term of this agreement.

Third.—The Company will meet and treat with the committees of the organization on all questions or grievances not herein provided for that may arise during the term of this agreement.

Fourth.—It is mutually agreed that all questions at issue between the Company and the Association, which cannot be settled through action under the preceding section, shall be referred to a board of arbitration composed of three persons to be selected as follows: The Company shall select one, the Association one, and the two thus chosen shall select a third, and the findings of said board on all questions submitted to them by either or both parties, when reported in writing, shall be binding on both parties, and, pending the appointment of the board of arbitration, and their decision on any matter submitted to them, there shall be no cessation of work, no disturbance of existing conditions, and no strike. Each board of arbitration, appointed as above, having made final reports, shall cease to exist.

Fifth.—This agreement shall be binding on both parties and continue in force to the 1st day of January, 1905.

At a meeting held October 10, members of the union voted to again present their demands to the management of the company. In case the demands are refused, the matter of a strike will be submitted to a vote of all the employees who are members of the union.

On October 12 a committee of the union, headed by Organizer Pratt, again presented the demands to the management, and of course were firmly refused, as the company took a firm stand on the main points at issue, viz.: the right to hire either union or non-union men and the right to manage its men rather than turn their management and discipline over to the union.

NEW ROAD IN INDIANA

The Indiana & Northern Traction Company has recently been organized, with $500,000 of 5 per cent gold bonds and $500,000 of common stock, to construct a line about 20 miles in length between Marion and Wabash, Ind. The officers of the company are: President, Jilson J. Coleman, of New York; vice-president, R. E. Breed, of Marion; secretary and treasurer, Edward Hunt, of Trenton, N. J.; chief engineer and general manager, Henry F. Coleman, of Philadelphia. The directors are the president, vice-president, general manager, John C. Calhoun, of New York, and Hon. Frederick S. Ketchenbach, of Trenton. The Trenton Trust & Safe Deposit Company is the trustee of the mortgage. The financial arrangements of the road have been entirely completed and the contract has been let to J. G. White & Company, of New York. The grading contracts have been sublet, work has been commenced, and it is expected that the grading will be completed by December 20. Track laying will be begun as soon as the spring opens and it is expected that the road will be in operation by June 20, 1904. The line will be built for high speed and constructed entirely over its own private right of way, on steam railroad methods. A speed of 50 miles an hour is expected.

The Blue Island, Riverdale & Hammond Street Railway Company, with offices in Chicago, Ill., and Oklahoma City, Okla., has been chartered in Guthrie, Okla. The purpose of the corporation is to construct a line of street railway from West Pullman, Cook County, Ill., south through Harvey, Phœnix, South Holland, Calumet, Thornton, Chicago Heights, Steger, Crete, thence in a westerly direction to Joliet, Ill. A cross line from Blue Island easterly through Calumet, Riverdale, Dalton, thence in a northeasterly direction through Thornton, West Hammond, and a line from Tinley Park in an easterly direction through Hammond to Thornton and Lansing. The estimated length of the road is 60 miles and estimated cost $1,500,000. The capital stock is $15,000,000. The incorporators are W. R. Owen, A. W. Miller, J. F. Noel, T. J. Owen, W. S. McCaul, Frank E. White, of Chicago, W. F. Harn, W. F. McMecham and John Treadgil, of Oklohoma City.

INTERURBAN STATION AT CLEVELAND

After several months of discussion, it is announced that arrangements have been completed between the City Council and the electric railways for the erection on the Public Square of a waiting room for interurban passengers. The plan was proposed by the Cleveland Electric Railway, and provides that that company shall pay two-sevenths and the five interurban companies one-seventh each, toward the cost of construction. The city furnishes the land and is to maintain the building. It will be located on the southwest corner of the square, and will be of ornate design with a wide roof, which will extend over the cars so as to shelter the passengers. The waiting room will be a large apartment with toilet rooms accessory.

SAN FRANCISCO ARBITRATION COMMISSION HOLDS SESSION IN NEW YORK

The commission sitting in the arbitration proceedings between the United Railways of San Francisco and its employees embraced in Division 205 of the Amalgamated Association of Street Railway Employees, held a brief session in New York on Monday, October 12, and after fixing the time for the filing of written argument adjourned until Tuesday, October 20. The commission is composed of Patrick Calhoun, of New York, nominated by the company; W. D. Mahon, of Detroit, international president of the Amalgamated Association of Street Railway Employees of America, named by the employees, and Oscar Straus, of New York, formerly United States Minister to Turkey, selected by both. The question to be arbitrated is that of wages, the employees asking a wage scale of 33 1-3 cents per hour for a 9-hour day. Testimony covering an exhaustive inquiry into the cost of living in San Francisco and elsewhere, wages of street railway employees in other cities and wages of other trades in San Francisco has been taken before a commissioner in San Francisco. Congressman E. J. Livernash, of California, appeared for the employees and A. A. Moore for the company.

ORDER FOR REGISTERS IN ST. LOUIS

The Security Register Company, of St. Louis, Mo., has just closed an order for 1000 registers with the St. Louis Transit Company, to be used on the new cars which the St. Louis company is having built for the World's Fair traffic. The order was the result of a competitive test conducted by the St. Louis Transit Company of several different types of registers, and it is probably the largest single order which has ever been given for registers. It was closed by Jilson J. Coleman, of New York, for the Security Register Company.

TOM JOHNSON'S POLITICAL METHODS

An Ohio newspaper writer, who is evidently untouched by the serio-comic campaign now being waged in that State, makes some very interesting comments on the situation, which will be appreciated by street railway men:

"Away off to the southeast somewhere a machine is going chug-chug and a man is going puff-puff. The combination is that of Tom Loftin Johnson and his "Red Devil" automobile. Machine and man are making a hard time of it in spectacular campaign. Being a spectacular man, Johnson draws the attention particularly of the world outside of Ohio. Within the State he is a twice-told tale. The curiosity to see him is not as great as it was last year.

"The crowds that turn out to hear him are large—very large. W. S. Cappeller, who managed Senator Foraker's two successful gubernatorial campaigns, while talking about the large crowds Johnson is calling forth, remarked:

" 'Johnson is not a man of facts, but of fads. He preaches home rule and meddles everywhere. He advocates a single tax, but has to be sued in the Cleveland County courts for the taxes he tried to dodge. He advocates a 3-cent fare for street cars, but when he controlled two-thirds of the mileage in Cleveland eleven tickets for half a dollar were considered by him as cheap fare. On his Johnstown, Pa., line the fare was 5 cents straight.' "

Do you ever stop to think what a string of people would be walking into the office to report you if you were a street car conductor?—Atchison Globe.

NEW LAKE SHORE SCHEDULE

The Lake Shore Electric Railway has announced a new winter schedule. For some weeks past cars have been operated out of Cleveland on half-hourly headway, one car running through to Toledo, and the next going to Sandusky. For the winter there will be half-hourly headway to Lorain, and the cars on the even hour will run through to Sandusky. These cars will be met at Ceylon Junction by cars for Toledo, making it necessary for Toledo passengers to change. The plan will keep down the mileage of the cars, and will obviate the long run of 119 miles. To provide a better service for through traffic the company has announced three limited cars, which will run through from Cleveland to Toledo, making stops only in the larger towns. These cars will leave Cleveland at 7:30 a. m., 1:30 p. m., and 6:30 p. m. They will make the run in four hours and forty-five minutes, whereas the regular cars take six hours. The company has abandoned the freight business on the Toledo end of the system, and the service of the Electric Package Company has been extended through to Toledo. The new express cars have a schedule of seven hours, and stop in all towns to load and unload goods.

IMPORTANT PROJECT FOR CINCINNATI

Application for a charter has been made for a company to be known as the Cincinnati Rapid Transit Railroad Company. The project embraces an elevated railroad and subway from the neighborhood of Fountain Square, in the heart of Cincinnati, to Walnut Hills, and connecting with Avondale, Norwood and other suburbs. The application for a charter is made under the steam railrod laws, and it is desired to haul freight trains as well as passenger, and to use electricity as motive power. The company will build on a private right of way, some of which it expects to have to condemn. Three routes to Norwood are under consideration, and it is quite probable that entrance to the heart of the city will be made by subway. One of the chief aims of the company will be to bring into the city a number of the interurban roads which now enter over the surface lines, incurring great loss of time. The promoters of the project are men of prominence in Cincinnati, among them being: M. E. Ingalls, president of the Big Four Railroad and the Merchants' National Bank; J. G. Schmidlapp, president the Union Savings Bank and Trust Company; August Herrmann, president of the Board of Waterworks Commissioners; Henry Burkhold, of the Franklin National Bank; William H. Alms, of Alms & Doepke Company; Casper H. Rowe, vice-president of the Market National Bank; A. V. Voorheis, vice-president the Union Savings Bank and Trust Company, and the German National Bank. W. E. Baker, of New York, is preparing plans for a report on the proposition.

CHATTANOOGA RAILWAY PARK

The Chattanooga Electric Railway Company, which controls Olympia Park, Chattanooga, Tenn., is now preparing plans for extensive improvements of that pleasure ground. When the alterations are completed Chattanooga will have, through the liberality of the railway company, one of the finest parks in the South.

The park is only two years old, but has already attained great popularity. The theater opened last year was used to present popular plays and high-class variety at reasonable figures, and was so liberally patronized that the coming season will find the seating capacity doubled and the stage enlarged.

The ground, though purchased at a high figure, required considerable attention, and has been beautified by the cultivation of blue grass and flowers. One of the most popular features is a fine race track, the use of which the company has always permitted for nothing. The park gates are always open to the public, and numerous regular policemen are on hand to protect women and children in case of need.

One of the changes contemplates the construction inside the race track of a large lake for boating and swimming. A skating rink is to be built around the present dancing pavilion, and a roller-coaster will also be installed.

Negotiations are pending for the establishment of a new base-ball park inside of the main park. The Chattanooga Electric Railway Company states that if Chattanooga is represented next year by a team in the Southern Baseball League a park will be built free of charge.

Owing to the great initial expenses incurred in creating this park, the profits have been quite small. There is little doubt, however, that they will not only increase in future, but that the good will of the Chattanooga public will prove of even greater benefit to the company.

CHANGES IN THE CINCINNATI, DAYTON & TOLEDO TRACTION COMPANY

At a meeting of the stockholders of the Cincinnati, Dayton & Toledo Traction Company, held last month, it transpired that control of the property had passed from the Mandelbaum syndicate to interests identified with the Cincinnati Traction Company, and displacements were made both in the officers and directors, so that the new interests might be well represented. Conferences were held between the two interests before the meeting, and the following ticket of directors was finally named and elected: George B. Cox, W. Kesley Schoepf, J. Benson Foraker, Jr., C. C. Richardson, Claude Ashbrook and Louis A. Ireton, of Cincinnati; M. J. Mandelbaum and H. C. Lang, of Cleveland; W. C. Sheppard, of Hamilton. Immediately after the stockholders' meeting the directors met and organized by electing the following officers: George B. Cox, president; W. Kesley Schoepf, first vice-president; C. C. Richardson, second vice-president; J. Benson Foraker, Jr., secretary and treasurer; F. C. Williams, assistant secretary and assistant treasurer. F. J. J. Sloat, the present general manager of the road, was re-elected to the same position. His salary was raised, and the new board complimented him on the showing he had made in the operation of the property. W. J. Boyer was re-elected auditor. The operating office of the company will be continued at Hamilton, but the general headquarters of the company will be changed from Cleveland to Cincinnati. The directors organized an executive committee consisting of W. Kesley Schoepf and C. C. Richardson. Mr. Schoepf was made chairman of this committee.

EXTENSIONS TO SOUTH AMERICAN AND EUROPEAN ROADS

Considerable extensions are to be made to South American and European electric traction systems whose initial power-house and rolling-stock equipment is largely of United States manufacture. One of the roads referred to is operated by La Capital Tramways Company, Ltd., a British capitalized concern in Buenos Aires, Argentine Republic. The head offices of the company are in London. The purchasing agent, Hugh R. Parrish, is located in New York, in the Havemeyer Building.

The Lisbon Electric Tramway Company, Ltd., which operates the only electric traction system in Portugal, is also about to construct additional lines. The company is controlled by the London financial house of Werner, Beit & Company. W. J. Clark, one of the Werner-Beit electrical experts, is now general manager of the road, W. B. Rommel having resigned. The American purchasing agent is the Elmer P. Morris Company, of New York.

INDIANAPOLIS AS AN INTERURBAN CENTER

The Indianapolis "News" calls attention to the growth of Indianapolis as an interurban center in a way that is very convincing:

"At this time 117 interurban passenger trains, operating on regular schedules, are coming into Indianapolis daily, and 117 are going out of the city. Within ten days at the most 18 trains in and another 18 trains out, daily, will be added by opening the Lebanon-Frankfort line, and opening service on the part of the new Noblesville-Tipton-Logansport-Peru line in October or November will add another 18 trains or 20 trains each way. It is safe to predict that before the year is completed there will be 155 cars coming into and 155 going out of Indianapolis on regular daily schedules. When this number is attained it will remain practically stationary, at least until next spring, when Charles L. Henry will open the Indianapolis-Cincinnati line as far as Rushville, and another 18 trains or 20 trains will be added. The Union Traction Company may also increase the number by adding a number of limited trains. Besides these regular trains the Greenfield line and several others operate half-hour cars on Saturdays and Sundays. Freight cars are not included in the count. The number of cars operated in and out of Indianapolis daily by the different roads is: The Union Traction, 26 in 26 out; Indianapolis & Eastern (Greenfield line), 18 in 18 out; Indianapolis, Greenwood & Franklin, 18 in 18 out; Indianapolis & Martinsville Rapid Transit, 19 in 19 out; Indianapolis & Plainfield, 18 in 18 out; Indianapolis, Shelbyville & Southeastern, 18 in 18 out. These six companies operate 281 miles of road running out of Indianapolis, while their connections—such as the Indianapolis & Eastern's connection at Dublin into Richmond, Dayton and Columbus (Ohio), and the Union Traction's connections—would increase the mileage several hundred miles.

HOLD-UP MEN SHOT AT AURORA

Three masked men held up a Riverview Park car southwest of Aurora, Ill., on the lines of the Elgin, Aurora & Southern Traction Company, the evening of Oct. 8. No one was on the car but the motorman and conductor, and only $7 was obtained. The bandits were later discovered by police officers on an Aurora, Elgin & Chicago car, which was just leaving Aurora for Chicago. A battle ensued between the officers and the three bandits, which resulted in one of the latter being killed and the others wounded. It is thought that the bandits intended to hold up the Yorkville interurban car, which is usually crowded, instead of the local car, which had only the conductor and motorman.

REPORT OF THE CAMP BAY COMPANY

The report of the directors for the period ended December 31 last states that the final section of the Camps Bay Tramway Company, Limited (namely, the Kloof line), extending from the terminus of the Cape Town Tramway Company's system in Burnside road down to Camps Bay, was opened on November 10, 1902, thus completing the tramway system as originally designed. The total length of track now in operation is about 9½ miles, and while the directors look forward to a permanent increase in the traffic and receipts as the development in both the Oranjezicht Estates and the Cape Marine Suburbs proceeds, they have thought it advisable, during such period of development, to grant to the Cape Electric Tramways, Ltd., a lease of this company's tramways for three years from January 1, 1903, on mutually advantageous terms. The profit and loss account shows a credit balance of £873.

THE ELECTRIC RAILWAY IN GERMANY

According to United States Consul Harris, at Mannheim, Germany, recently published figures place the total number of miles of electric car lines in Germany at 2117. "Considering the area and population of the Empire," the Consul says, "these figures show a comparatively slow development of this branch of railway building—this, too, in spite of the fact that in electric lighting and in other applications of electricity Germany has taken advanced rank. The cause of this backwardness, says Mr. Harris, "is to be sought mainly in the fact of State ownership of the larger part of the existing steam railways and the unwillingness on the part of city and other authorities to grant charters to private companies. Local and suburban travel is heavy, but is as yet carried mainly by steam railway lines, often of cheap construction."

The Grand Duchy of Baden, a small part of the Empire, has an area slightly larger than that of the State of Connecticut, with a population somewhat more than twice as great. In 1900 it had five cities of upward of 40,000 population, namely, Mannheim, Carlsruhe, Freiburg, Pforzheim, and Heidelberg. There were in 1900 fourteen cities of upward of 10,000 population. The State includes a thickly settled portion of the Rhine Valley about 160 miles long, with an average width of 10 miles, which would seem to be a specially good field for electric railway lines. And yet at present electric lines are in operation only in or near the following cities:

	Length of line. Miles.
Mannheim (including Ludwigshafen extension)	25
Carlsruhe (including line to Durlach)	9
Heidelberg (including Heidelberg-Wiesloch line)	11½
Freiburg	8

In each case the same track is used in part by the cars of several lines. Thus the total track length of the Mannheim city and suburban lines is 14 miles.

The city of Kehl, Baden, is connected with Strassburg by a branch of the Strassburg city lines, but does not operate an independent line. Of the above lines, each belongs to the respective city except in the case of the Heidelbrg city lines, which are operated by a private corporation, the city being the owner of three-quarters of the capital stock.

The fare charged varies with the distance, long rides and transfers on a single fare not being permitted to the extent they are in the United States. The fare for ordinary distances is 10 pfennigs (2½ cents), tickets good for twenty-five rides being sold for 2 marks (48 cents).

Of the lines now in operation in Baden only two can be said to be interurban lines—a line of about 9 miles from Heidelberg to Wiesloch and a somewhat shorter line from Carlsruhe to Durlach.

NEW PUBLICATIONS

Engineering Preliminaries for an Interurban Electric Railway. By Ernest Gonzenbach; 71 pages, illustrated. Price, $1. Published by the McGraw Publishing Company, New York.

This is not a general treatise on electric railroad engineering, but is based upon a specific case, and relates the measures taken and the reasons which influenced the adoption of the plans described. The work should command the attention of engineers and investors who may be interested in similar projects, for while the conditions confronting them will doubtless vary in some particulars, the general line of investigation pursued by the author as a preliminary to his report on the enterprise he describes will serve as a guide or suggestion for the general line of inquires to be followed.

A number of practical features of construction and equipment are discussed, including the relative merits of the overhead trolley and third rail, and the reasons why the latter is growing in favor are clearly pointed out. The necessity for securing a private right of way is emphasized, especially where it is proposed to operate at high speed, and in competition with steam lines. In road-bed and track, Mr. Gonzenbach is conservative, and he looks with disfavor upon the tendency to follow steam roads in determining the weight of rail to be laid, as he points out that the conditions of service differ materially. In the selection of rolling stock and electrical equipment for cars many valuable suggestions are offered that have a general application. The advantages of establishing car shops early in the work are enumerated by the author, and these views are now being accepted generally by those who are engaged in this class of construction. "Power Stations," "Transmission Line" and "Distribution System" are headings under which the author advances some ideas based upon his experience, that are a departure from the practice generally followed, but on the whole they commend themselves as sound in theory, and many of them have proved successful when given a fair trial in commercial service. This is particularly noticeable in the matter of sub-stations. Mr. Gonzenbach recommends small stations, located at comparatively short distances, and equipped as simply as possible, so that the expense of attendance may be kept down. The sub-station building could also be used for a passenger and freight depot, and dwelling for the attendant, and the local agent could care for the station equipment when designed along the lines suggested. A competent man could have general supervision of the electrical system, and he should inspect the apparatus daily in all sub-stations, thus making it unnecessary to keep experts at the several points of distribution. The estimates regarding the cost of construction and equipment will be found to be conservative, yet they undoubtedly make ample provision for a road of the character considered, and it is for the guidance and instruction of men who may become interested in similar properties that these papers were originally written. The practice here outlined is not advocated for large interurban properties, where it is proposed to furnish service on a par with the more important steam trunk lines, but more particularly for the rapidly growing class which has done so much toward the development of sections in the West, which have not enjoyed the advantages of older communities.

Friction and Lubrication, a handbook, by William M. Davis; 225 pages, illustrated. Price, $2.00. Published by the Lubrication Publishing Company, Pittsburg, Pa.

The author was for over ten years in the employ of a large oil refining company as mechanical expert, looking after tests and complaints, making experiments, etc., and is now in the employ of a large steel manufacturing company as oil inspector, and in charge of the lubrication of the engines and machinery at its numerous plants. He is, therefore, well qualified to discuss this subject, and his book will be found of interest to engineers, mechanics, superintendents and managers. Mr. Davis first discusses the general subject of friction, friction losses and the theory of lubrication. He then gives a chapter to the testing of oils for viscosity, the flash and fire test, specific gravity, etc., and follows this with a discussion of lubricating appliances and their care, and special chapters on common faults in lubrication and the lubrication of different classes of machinery. He points out that the object of lubrication being to reduce friction and heat, test will tell immediately whether this result is being realized, and believes that some large engine builders will equip the main bearings of their engines with thermometers, so that the temperature can be noted. He also points out that the best lubricant for a bearing, under normal conditions, may not do so well when heat commences, as a viscous oil, such as cylinder oil, which becomes thin and limpid at high temperatures without burning. His chapters on the care of lubricators and common troubles in lubrication are extremely interesting and valuable. One chapter is devoted to the lubrication of street railway cars. He explains that grease has been used quite largely on electric car journals, but with the advent of the heavier car, running long distances at high speed, there is a tendency now to the use of oil, although grease is still used largely on motor bearings for the reason that owing to the close proximity of the armature the oil would get on the coil and injure the insulation.

Trust Companies of the United States. Compiled by the Audit Company, of New York. 228 pages; price, $2.00. Published by the United States Mortgage & Trust Company, New York.

This volume contains statements from upwards of 1100 trust companies throughout the country, and consequently comprises a collection of facts which will be of interest to the entire financial public. These statements are compactly arranged and in the main show, in concise form, the condition of the companies on June 30, 1903. This, of course, eliminates the new companies formed during the last year, but aside from these the work is practically a complete summary of the conditions of these institutions, and the data presented comprises a very complete review of the financial condition and personnel of the trust companies of the country at the present time. The publishers claim, and apparently with reason, that nothing so comprehensive has ever been published in behalf of American trust companies. It is expected that the book will be widely consulted now, but its particular usefulness, it is pointed out, will be as a means of comparison with future statements of conditions, changes in personnel and other facts not hitherto obtainable for lack of complete facts and figures regarding trust companies.

The Financial Red Book of America for 1903. 388 pages; price, $10.00. Published by the Financial Directory Association, New York.

The publishers announce their purpose of presenting a comprehensive, complete and reliable directory of the men and women in the United States who are estimated to be worth $300,000 or more, including the leading financiers, industrial magnates, retired men of fortune, women of independent means, managers and executors of large unsettled estates, and others who fill stations of marked financial responsibility. The list is classified according to States in their alphabetical order and again subdivided in cities. Naturally the greatest number of persons coming within this classification are found in the larger Eastern cities, but it is worthy of mention that every State in the Union has its representatives in this volume. The minor cities and towns included are numerous, and it is evident that a considerable number of people of wealth maintain their homes far distant from the great centers of population. The publishers have gone to great trouble to make the work accurate in every particular, and in this they have received the co-operation of many prominent banking houses throughout the country.

Railroad Curves and Earthworks. By C. Frank Allen. Third edition, 200 pages. Illustrated; price, $2.00. Published by Spon & Chamberlain, New York.

This book was originally written for students in engineering colleges, and consequently much of the material is similar to that found in other field books, as it covers the same ground in the conventional manner of such treatises. But since its first appearance in 1899 much additional matter has been inserted, and in the third edition an entire new chapter on the spiral easement curve has been substituted for the former data. The treatment of this subject is new in detail. Additional matter has been added to chapters on other special features, particularly that on "Special Problems in Earthwork." Although prepared originally for students, the work has been found of great value by engineers in practice and has been received with general favor.

Field and Office Tables, Especially Applicable to Railroads. By C. Frank Allen. 293 pages; price, $2.00. Published by Spon & Chamberlain, New York.

This work comprises convenient tables for easement curves and for earthwork computation, including the "Cubic Spiral" easement curve, also the "Offsets from tangents for a 10-deg. curve," and "Angles proportionate to squares of distances." The two latter are especially applicable to easement curves, and they allow the rapid and simple working of spirals of any length or for any setoff from the tangent. The tables for earthwork computation, especially those for regular three-level sections and for prismoidal correction, are based upon tables used for computing the earthwork in actual practice on a prominent Western railroad, and that for triangular prisms is similar in principal to that for prismoidal correction. There are a number of new features in this work, including tables seldom found in books suitable for field use. An explanation of tables is also printed, and it forms a very valuable feature.

MEXICAN CAR BUILDING PLANT

Construction work is about to begin on an extensive car building plant to be erected in Mexico City by the Mexican Car & Foundry Company, in which Isaac M. Hutchinson, of Mexico City, who represents the St. Louis Car Company and other prominent American manufacturing concerns, is the leading spirit. The initial capacity of the plant will be twenty cars per day. Later on electric cars will be built at the rate of a score monthly. The plant will be electrically operated. An independent power equipment will be installed. Contracts will be awarded within the next three weeks for a 500-hp plant. The equipment, including machine tools, etc., will involve an expenditure of about $100,000.

STREET RAILWAY PATENTS

UNITED STATES PATENTS ISSUED OCT. 6, 1903

[This department is conducted by W. A. Rosenbaum, patent attorney, Room No. 1203-7 Nassau-Beekman Building, New York.]

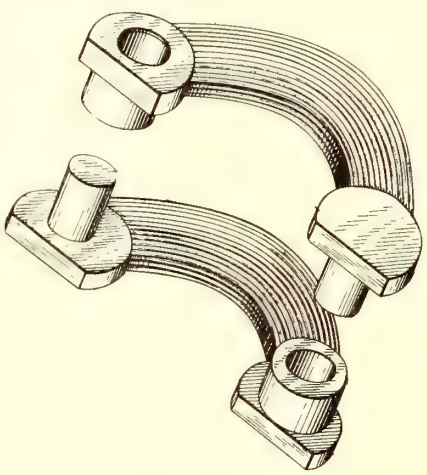
740,558. Adjustable Truck Wheel; William E. Hamilton, Zanesville, Ohio. App. filed Jan. 17, 1903. The axle of one pair of wheels is adapted to slide toward and away from the other pair in ways in the truck-frame by means of racks and pinions, to thereby shorten or lengthen the wheel-base.

740,572. Snow-Plow; Fred Kiefer, Priceburg, and Charles Freeman, Scranton, Pa. App. filed Jan. 31, 1903. Blades are hinged to the wings of the plow and held in place by springs, which permit of their yielding when abnormal pressure is reached, thereby obviating disabling of the device. The blades, after riding over the unyielding obstruction, spring back to normal position.

740,577. Trolley Pole; Joseph F. Mackin, Columbus, Ohio. App. filed April 25, 1903. The trolley pole consists of a frame in the shape of a parallel ruler, which permits the trolley-wheel to remain at all times in a vertical plane.

740,707. Trolley; Bruno Stenvall, New York, N. Y. App. filed March 21, 1903. The trolley pole is made up of two rods, carrying two horizontally arranged wheels, and is pivoted to the base and to the wheel-frame in such a manner as always to maintain the axis of the wheel in the same horizontal plane.

740,792. Attachment for Street Car Hand-Straps; Charles Andress, Chicago, Ill App. filed March 2, 1903. An auxiliary handle suspended from a cord wound upon a spring-winding roller, which is mounted upon the usual hand strap.



PATENT NO. 740,912

740,851. Track Sweeper; Bennard Hemann, Belleville, Ill. App. filed March 11, 1903. Brushes mounted adjacent to the rails on a shaft in a yielding frame and caused to rotate by means of an endless chain connection, with a shaft having friction pulleys engaging the car wheels.

740,860. Brake Mechanism for Cars; William S. Howland, Old Saybrook, Conn. App. filed May 26, 1903. The brake-shoes are applied by springs and held out of operative position by tension devices controlled by the motorman.

740,912. Rail-Bond; Louis Pfingst, Dorchester, Mass. App. filed July 16, 1902. A double bond having their respective ends connected together through two openings in the web of the rail.

740,929. Closure for Street Cars; Charles S. Sapp, Wilmington, Del. App. filed May 9, 1903. A double curtain for open cars, one part passing upward and the other downward when opened, the upper curtain having a sash with a pane of glass.

740,985. Street Car Fender; Emil Melzer, Zella, St. Blash, Germany. App. filed Jan. 12, 1903. Details.

PERSONAL MENTION

MR. RICHARD C. SWING, superintendent of the Cincinnati & Columbus Traction Company, of Cincinnati, Ohio, was married last week to Miss Susanna Isham, of Mt. Auburn, Ohio.

MR. H. H. VREELAND, president of the Interurban Street Railway Company, of New York, has started the fund for the erection of a laboratory for the department of railway engineering of Sibley College, Cornell University, with a gift of $1,000.

MR. ROBERT SCOTT, who has for two years been superintendent of the Muncie Belt Railway Company, Muncie, Ind., has tendered his resignation and gone to Chicago to accept the position of superintendent of the Indiana Harbor Railroad Company.

MR. ELLIS BARTHOLOMEW, president of the Toledo, Columbus, Springfield & Cincinnati Traction Company, was married Sept. 13, at Toledo, to Miss M. A. Armbruster, of that city. News of his marriage was not known to Mr. Bartholomew's closest personal friends until a few days ago.

MR. FRANK J. GOULD, of New York, first vice-president of the Virginia Passenger & Power Company, of Richmond, Va., and his sister Miss Helen Gould have given the local branch of the Street Railway Young Men's Christian Association at Richmond $5,000, which it is proposed to apply to the improvement and equipment of a clubhouse for the employees of the company.

MR. J. M. MERRILL, for the past two years superintendent of the Ohio Central Traction Company, has been made auditor of the Western Ohio Railway, succeeding Mr. Charles Thrasher, who is general manager of the New York & Long Island Traction Company, of Mineola, N. Y. All of the properties mentioned are controlled by the Pomeroy-Mandelbaum interests, of Cleveland.

MR. JOHN TEEGARDEN, superintendent of the Lima Electric Railway & Light Company, of Lima, O., was married a few evenings ago to Miss Lucy Cardiff, of Atchison, Kan. The employees of the company turned out in two decorated special cars, and headed by a band, tendered the couple a rousing surprise. They presented the bride and groom with a number of articles that will be especially serviceable in their home.

MR. THOMAS P. SWIN, the secretary-treasurer of the Brooklyn City Railroad Company, died Thursday, Oct. 8, at his home in Brooklyn, in the 46th year of his age. Mr. Swin entered the employ of the Brooklyn company as a messenger boy and went through various grades to the secretaryship, which he has held for the past nine years, succeeding Secretary Thompson, to whom he was first an assistant. He is survived by a wife and two children.

SOME CHANGES are announced in the personnel of the Boston Elevated Railway. Mr. Geo. S. Lawler has been appointed superintendent of power distribution. On the elevated division Mr. Harry M. Seward has been appointed to succeed Mr. Frank C. Stowell, resigned; Mr. Frederick P. Wyman has been appointed chief train despatcher, to succeed Mr. Fred. H. Orr, resigned; and Mr. James G. Mabee has been appointed second train despatcher.

MR. J. S. BADGER, general manager of the Brisbane Tramways, of Brisbane, Queensland, passed through New York last week on his return to Australia. Mr. Badger attended the convention of the American Street Railway Association in Saratoga last September, since which time he has visited London, at which city the head office of the Brisbane Tramway Company is located. Mr. Badger expects to sail for Australia about the middle of November, and will reach home about the middle of the following month.

MR. J. W. SMITH has left the employ of the Jersey Central Traction Company to become superintendent of the Schuylkill Traction Company, of Girardsville, Pa. Mr. Smith was born in Illinois in 1871, spent his boyhood at Newburgh, N. Y., and graduated from Cornell University in 1893. After working for some time in Philadelphia he accepted a position with the General Electric Company at Schenectady. He was engineer and superintendent of the Fairmount Park Transportation Company, of Philadelphia, for about six years, and resigned that position to act as constructing engineer for the Jersey Central Traction Company.

MR. WALTER H. MANSFIELD has been appointed general manager of the Keeseville, Ausable Chasm & Lake Champlain Railroad Company, of Keeseville, N. Y. Mr. Mansfield was for five years assistant roadmaster of the West End Street Railway, of Boston, and for ten years was connected with H. Gore & Company, general contractors, of Boston. At present Mr. Mansfield is connected with the Powers & Mansfield Company, of Troy, N. Y., which owns the controlling interest in the Keeseville, Ausable Chasm & Lake Champlain Railroad Company. Mr. J. A. Powers is president and treasurer of the Powers & Mansfield Company. Mr. Powers built the Hudson Valley Railway, and was formerly president of the Niagara, St. Catherines & Toronto Railway Company.

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EDITORIAL NOTICE

Street railway news, and all information regarding changes of officers, new equipments, extensions, financial changes and new enterprises will be greatly appreciated for use in these columns.

All matter intended for publication must be received at our office not later than Tuesday morning of each week, in order to secure insertion in the current issue.

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Chicago Franchise Matters

We have announced so many times to our readers that negotiations for the renewal of the franchises of the Chicago city railway companies were again in progress, that we fear some may have taken it as a standing joke. Tedious these negotiations have been in the extreme, but it is not to be expected that such important matters could be settled in a few days. Whatever may be said regarding the obstructive policy of some of the city officials of Chicago, notably Mayor Harrison, there is no doubt that the local transportation committee of the Chicago City Council, which has had immediate charge of the franchise negotiations, has been painstaking and honest in its work. The Arnold report, which was arranged for by that committee, is but one example of the thoroughness with which it has attempted to do its work. It is but natural that this committee should attempt, in driving a bargain with the companies, to get as favorable terms and as high compensation for franchises as possible. However, it is to be hoped that in their zeal to drive a good bargain for the city these gentlemen will not place such burdens upon the companies in the way of compensation that the local transportation business will be crippled in Chicago for the next twenty years. Such an event would be nothing short of a great public calamity. That there is some danger of this just now there can be no doubt. The committee is now at work on a franchise for the Chicago City Railway Company, and it is understood that most of the details have been arranged, with the exception of the clause which provides for the proportion of the gross receipts which are to go to the city. What proportion will finally be agreed on no one knows at present, but it is practically certain that it will be higher than has yet been required in any city in the United States.

For those who have not followed the progress of the franchise negotiations in Chicago, we may say that the situation at present is, briefly, as follows: The franchise of the two principal companies, the Chicago City Railway Company and the Chicago Union Traction Company, on the principal streets of Chicago, are claimed by the city to have expired July last. There is considerable doubt as to whether these franchises really did expire on that date, as an act, commonly called the "Ninety-nine-year act," passed by the State Legislature many years ago might be construed in such a manner as to give the companies ninety-nine-year franchises. The validity of the franchises under this act has never been passed upon by the courts, and the result, consequently, is entirely problematical. The general proposition which is being embraced in the new franchise extension ordinances is that the companies waive all rights that they might have under the ninety-nine-year act, and accept in exchange for these rights a franchise giving them a clear title to all the streets upon which they are at present operating, together with some needed extensions, for twenty years. In addition to this it is proposed that the companies pay a proportion of their gross receipts to the city. At the end of twenty years the physical property must be purchased of the companies by the city or a renewed franchise must be given.

Relations of Employers and Workmen

An interesting and instructive document is reproduced on another page of this issue in the form of a letter written by George F. Chapman, general manager of the United Railways of San Francisco, and intended for the guidance of newly-employed platform men on that system. It is a straightforward statement of the relations between the employees and the company, defining the duties of the men and the attitude of their employer. Honesty, courteous treatment of patrons, conservative operation and strict observance of the general rules are the main requisites, and in return the men are assured regular employment, promotion according to relative merit and fitness, and the support of the management. There is nothing more conducive to good service than a sense of security among employees, and nothing so harmful as lack of it. It is impossible to maintain discipline where influential friends are of more importance in holding a position than efficient service, but the motorman or conductor who has the general manager's word that if he is honest, patient and polite, careful and obedient, that he will not be unjustly deprived of his position that promotion is for him, and that any specially meritorious acts he may perform will be fully recognized, will soon realize that his position is a valuable one, and that the best way to retain it is by strict attendance to duty. In general the terms set forth in Mr. Chapman's letter are the same as those which are generally understood to form the basis of employment, but they have not always been lived up to in some parts of the country, and for that reason an explicit understanding is desirable.

Stokers—Human and Other

The "Question Box" of the Pennsylvania Street Railway Association, which we give in part in this issue, contains much information suggestive of comment, but nothing more pertinent than the discussion of mechanical stokers, their merits and demerits. The question is one that is emphatically a familiar and well-worn one, to which, perhaps, no final answer need be expected, but the experience brought out in this instance was more instructive than usual. Stoker men in general may be divided into two classes—those who like mechanical firing and those who do not, and as a rule opinions on the subject may be impolite and irrelevant, but they do not lack variety or definiteness.

Four questions on stoking were asked, the first relating to the minimum size of plant for which an automatic stoker was to be considered. As touching this point, the opinions expressed were practically to the effect that after a plant was too large to be handled by a single fireman the automatic stoker was worth looking into, the corresponding horse-power being, say, 1000 to 1600.

The basis of this conclusion seemed to be that since a man was necessary anyhow to look after the mechanical stokers, he might as well be shovelling coal as doing work of supervision. There are two criticisms to be made on opposite sides of this judgment. It is held by some that the mechanical stoker will do enough better work than a fireman to justify its use in almost any case. On the other hand, interest and repairs on the machine must not be forgotten, and if these, for the sake of argument, equal a fireman's wages, then there will be no saving until a considerably larger size is reached. The answer really hinges on that pertaining to the next question in the box, which dealt with the relative economy, including operation and maintenance, as between hand-firing and automatic stokers.

Here there cropped out very radical differences of opinion, ranging from a claim of 30 per cent saving in coal down to the story of the automatic stoker squarely defeated by hand-firing. Some figures given in course of the discussion as to cost and the maintenance of automatic stokers are decidedly instructive. Figures from several Edison stations, while giving a material saving in cost of handling by the use of mechanical stokers, reported the extra repairs to be from 25 cents to $1 per horse power per annum.. Taking the installation cost of the stokers at $3.50 per horse power, the maintenance account would seem to lie between about 7 and 25 per cent, with an average of 17 per cent or so. This looks high, and if true requires a very good showing in economy of coal to justify the expense. In one answer an efficiency of 11.25 lbs. of water from and at 212 degrees was claimed for run-of-mine coal costing $2.35 per ton in the bin. This is stated to have been a result about 30 per cent better than was given by hand-firing, which evidently must have been rather poor. On the next two questions, as to whether the same automatic stoker could handle both soft and hard coal, and whether one could force the output of the boiler as well as with hand-firing, the answer dealt in flat contradictions as to fact, and, as usual, when statements are contradictory, they failed to be illuminating. In fact, the sum total of all the answers does not greatly add to the chances of elucidating the subject. It is, however, an interesting and pertinent one, which is well worth study.

The fact is, that taking all available sources of information together, there seems to be a very wide difference of opinion as to the relative value of the two rival modes of firing. Some excellent engineers uniformly recommend automatic stokers, while others as consistently prefer hand-firing. And undoubtedly these differences of practice and opinion spring from real differences in experience. Each man derives his ideas from the conditions under which he has personally worked; thus one whose natural fuel has been a low grade of Western soft coal will reach very different conclusions from one who regularly uses the best anthracite. On general principles, the better the fuel, or the less fuel that has to be handled, in any given case, the easier it is for a skillful fireman to compete with an automatic stoker. In plants where the fuel handled is only 2 or 2¼ lbs. per horse-power hour, one fireman can take care of 1000 horse power with ease. In several of the auxiliary stations of the Boston Elevated Railway Company, two men per shift, a fireman and a coal passer, take care of 2000 kilowatts without difficulty, and the total fuel bill for the year is so moderate that the charge for maintenance of mechanical stokers would have to be very much lower than the figures here quoted to give the slightest chance for economy. On the other hand, it is easy to see that in cases where the fuel to be handled rises to 4 or 5 lbs. per horse-power hour, a single fireman can take care of only a very moderate capacity, and will have to work hard to do that. Then he is likely to get careless, and the evaporative efficiency of his efforts falls off.

This much is certain, however, that while good fuel gains little or nothing from mechanical stoking, year by year, the world must learn to make the best of low-grade fuel. Almost the best opportunity for economy in steam generation lies in the study of the utilization of coals of low evaporative power. Good fuel will yearly get dearer, and furnaces and boilers must be planned to make the best of what is available. Here there is a great future before the mechanical stoker. Its task is to handle large quantities of fuel so uniformly and cheaply that although intrinsically poor, the economic result will be good. If one knows how to make the best of automatic stoking with low-grade fuel he has found the secret of cheap power.

The Confusion of Fusion

The gentlemen in charge of the literary bureau of the Citizens' Union are getting mixed in their dates and lame as to facts. Here is an abstract from a recent pronunciamento:

"The Metropolitan Street Railroad has made haste under the Fusion administration to effect great improvements in its equipment, substituting electrical for horse-power on all its cross-town lines."

While the street railway management has been eager all along to effect the improvements indicated it has not been able to secure the necessary legal consent, and we do not recall any assistance that has been offered by the Fusion administration, or any other for that matter, toward increasing the transportation facilities. The company has been obliged to solve the problems itself, and if it were permitted to do so unhampered it would be satisfied, but when certain measures were before the Legislature at Albany last winter, intended to enable the street railway companies of the State to effect improvements and extensions, Mayor Low opposed their enactment, and, according to his own statement, secured their defeat. It would seem, therefore, that whatever improvements in the street railway service of Manhattan have been made were accomplished in spite of the Fusion administration and not through its good offices. But the most remarkable exhibition of borrowed plumage that has been displayed before the admiring gaze of this constituency in many a day is this:

"The Manhattan Elevated Railway system has availed itself of the progressive attitude of this administration to make ex-

tensive improvements upon its lines, the most conspicuous being the change of motive power from steam to electricity."

Mayor Low's term of office began Jan. 1, 1902, and the Manhattan company had at that time not only completed its arrangements for changing over the elevated system from steam to electricity, but it had actually begun to operate trains by the new motive power. We do not recall any remarkable display of activity, intelligence or comprehension of the situation by the present city administration during the agitation last winter over the subject of transportation. Whatever may have been the merits of Mayor Low's administration, and in many respects it has been admirable, the least said about his "transportation record," under the circumstances, will serve the best purpose for Fusion.

A New Competitor

Many of our readers will probably agree with us that while the description of the new German single-phase electric railway system, given by our foreign correspondent in the last issue of this paper, was not so complete in all its details as might be wished, nevertheless, the account furnishes a great deal of food for thought. Our correspondent is not yet able to state definitely the character of the motor from which the results were obtained, though, of course, it looks like a series-wound proposition, but the results themselves are somewhat startling, particularly the efficiency of the regulation. To be sure, the work so far has been purely experimental, and we do not in the least know what snags the workers may have struck, but they certainly have developed a single-phase motor which, in some respects, is very remarkable. We have steadily been disposed to discount somewhat reports concerning single-phase traction motors on the ground that no single-phase motors have yet been put into ordinary commercial work which have anything like as good properties as those attributed to the experimental traction motors. And the common stationary motor is a very much easier proposition than the traction motor, both in its smaller demand for weight efficiency and in its freedom from the requirements of a large air gap. Yet we are bound to say that the Union Elektricitäts-Gesellschaft, like the Westinghouse Company in this country, cannot fairly be suspected of an unlimited bluff, and we shall be vastly interested in the inevitable show-down. The results, so far publishable from the Union Elektricitäts-Gesellschaft road, are certainly enough to whet curiosity as well as to provoke a certain feeling of lurking uneasiness. The foreign experiments on polyphase traction, which we have often described and commented upon, have promised a special, rather than a general, solution of the alternating-current traction problem, and have, therefore, been of indirect rather than of direct importance. But a successful single-phase motor is a cat of quite another color, for it is easily applicable to general traction purposes.

In this case the contact arrangements are simple enough, and there is no good reason why the motor should not be applicable to urban and suburban lines as well as to the long-distance roads for which some sort of alternating motor is especially desirable. For ordinary street railways an alternating motor has in itself no particular advantage. The usual direct-current railway motors are wonderfully reliable and efficient machines. The commutator troubles have been so far reduced that they are of relatively little moment, and are quite certainly much less than would be encountered in an alternating motor of the commutating persuasion. But on long suburban and interurban lines the advantages of a motor drawing its current from alternating-current working conductors are very great, indeed, in the matter of cheap and efficient distribution. So long, however, as the alternating system cannot conveniently be used in the urban part of the general system, alternating current is inconvenient in the outlying portions. The double-conductor system demanded by polyphase motors works against their general use, for the experience with double trolley systems of any kind is very far from encouraging. A single-phase motor requiring but a single-working conductor can obviously be used as conveniently as any other motor if its other properties are good. We have been awaiting with great interest the equipment of the promised American single-phase roads, but the Union Elektricitäts-Gesellschaft work shows plainly that our German friends have been far from idle, and are prepared to give us a run for our money in this as in other directions. We cannot afford to be outdone on this side of the water, and if we are to retain supremacy in the supply of electrical apparatus it is high time to be up and doing. A really good single-phase traction motor will stir up the art most surprisingly when it really comes, and will cause a sudden revision of the present methods of distribution. With the present tendency toward the construction of long and widespread networks of electric roads the possession of such a motor is a very valuable and important thing, and however skeptical one may be disposed to be as to the facts it will pay to remain open to conviction. We hope ere long to give to our readers a further description of the Union Elektricitäts-Gesellschaft methods.

Freight Delivery in Chicago

An important movement in connection with local transportation is to be inaugurated in Chicago when the Illinois Telephone & Telegraph Company begins its freight delivery service through its system of underground tunnels. This company, instead of building the ordinary conduits to take the wires for its new independent automatic telephone exchange, has gone 26 ft. below the surface of streets and has constructed a set of deep tunnels under the principal streets. These tunnels are of sufficient size not only to accommodate the telephone cables but to permit of the operation of small freight cars for delivering goods from railroad depots and warehouses to various buildings in the down-town center. The tunnels are of concrete, arch construction, 12½ ft. wide by 14 ft. high. The top is 26 ft. below the street level. Lateral branches enter the basements of the principal buildings. This freight delivery service ought to relieve the streets of considerable team traffic and result in a cheapening of the cost of delivery, as well as an improvement in surface transportation service. A single-track narrow-gage railway is to be operated in the tunnels. The cars will be small, to permit of the turning of the short curves and so that they can be easily handled, after the manner of mine cars. That electricity will be the motive power goes without saying, and in this connection come some interesting problems for the electric railway engineer. That some method of relieving the congestion of drays and coal wagons on the streets of our largest cities is needed is painfully evident, but the company which built the Chicago tunnels has been the first to have the financial courage to prepare an underground system at enormous cost to take care of the freight business, though, of course, in this case the chance of using the tunnel space for dozens of other purposes reduced the financial risk to practically nothing.

INTERURBAN FREIGHT AND EXPRESS

The Electric Package Company of Cleveland, which operates the express and baggage departments of the Lake Shore Electric Railway, the Cleveland & Southwestern Traction Company, The Northern Ohio Traction & Light Company and the Cleveland, Painesville & Eastern Railway, is now occupying its newly completed Cleveland station. The property is owned by the Electric Depot Company, an organization formed by the several interurban roads for the purpose of building the station. Each of the interurban roads mentioned has one share in the company, while the Cleveland Electric Railway, over whose lines the interurbans operate into the city, holds two shares.



OFFICES AND WAREHOUSE



WAGON SIDE OF STATION

The Electric Package Company, which, as a matter of fact, is not an incorporated body, but simply a representative working arrangement under which the express business of the several companies is handled, leases the station. Barney Mahler, formerly president of the Lake Shore Electric Railway, is president of the Electric Depot Company, and is also general manager of the business of the Electric Package Company. C. A. Kenworthy is general superintendent of the affairs of the Electric Package Company, while D. L. Ingham is local agent in charge of the Cleveland station.

The business of the Electric Package Company is not an experiment, but has been in successful operation for several years. During the last two or three years the development of the business has been seriously handicapped owing to the poor terminal facilities in Cleveland. Up to the time of the completion of the new station the company had as its headquarters a store room on one of the business streets, and the goods had to be loaded and unloaded from the street, there being neither sidings nor platforms.

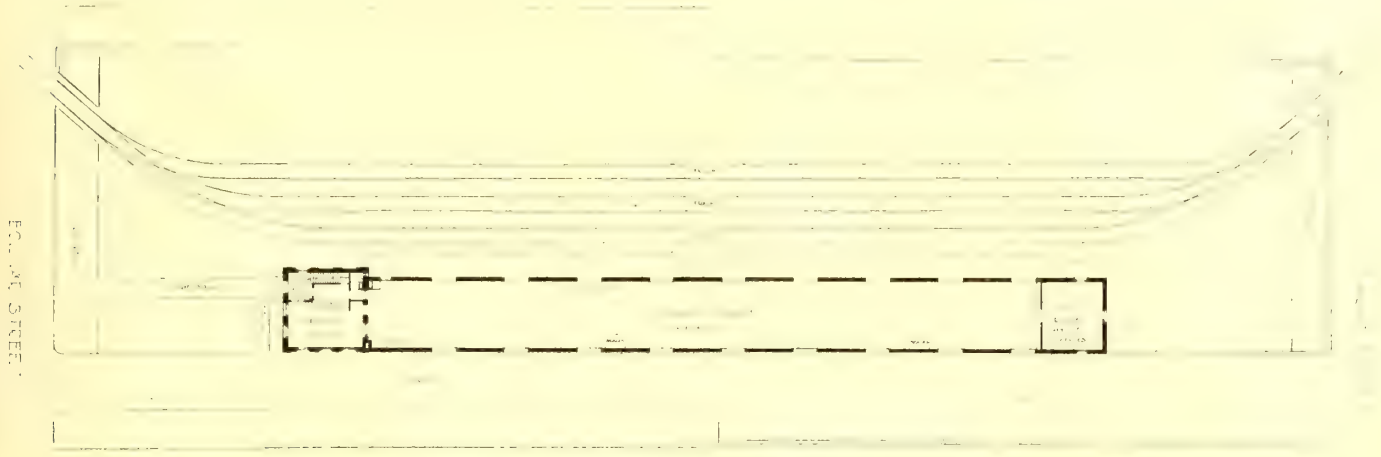
More than three years ago the companies realized that the business could not be developed under these conditions, and accordingly the Electric Depot Company was formed for the purpose of building a large station which should be designed for both passenger and express traffic. The committee in charge went so far as to purchase a tract of land extending from Eagle Street to Bolivar Street, adjoining Erie Street, and plans were prepared for the station and tracks were laid through the property. Then came the Everett-Moore embarrassment, which put a quietus upon all plans for improvements for the Cleveland properties. Lately it became imperative for the express company to secure better facilities, and arrangements were completed for financing the depot project on somewhat modified plans.



TRAIN SIDE AND LOADING PLATFORM

The present station occupies only about one-half of the company's property, and it is quite probable that before many years a passenger station and additional express facilities will be provided. The location of the station, while perhaps not an ideal one from the standpoint of the public, which has been accustomed to seeing both freight and passenger business centered at the public square in the heart of the business district,

possesses many advantages which would not be possible were the site nearer the centre of the city. The new station adjoins Erie Street, the first north and south thoroughfare east from the square, and it is in the district known as the "New Center," which within the last five or six years has made tremendous strides as an office building and shopping center. At the present time only one city line traverses the portion of Erie Street nearest the station, so that the interurban cars are not held up by the congested traffic that they would have to encounter down town. The lines running east and south from the city may reach the station without passing through the congested district, and by slightly changing the routes of the other lines it will be possible for them to enjoy the same advantages. This feature makes the location especially desirable for passenger service, and the property is laid out with three through tracks, so that it will be convenient for cars to lay up while loading and unloading passengers without interfering with city traffic. The Cleveland managers believe it is of great advantage to have a starting point for cars—a place where they lay over any desired length of time. Formerly the interurban cars were permitted to lay over on a siding at the public square, but a change of city routes has deprived them of this privilege. For some months the Lake Shore Electric Railway has utilized the tracks on the depot site as a laying-over point, and nearly every car has laid over one trip. This gives time for cleaning and inspection, besides making it possible for every outgoing car to leave promptly on time. It is probable that other roads will follow this practice, although, as before stated, it is improbable that a passenger station will be erected for some time to come.



FREIGHT HOUSE, LOADING PLATFORMS AND YARDS



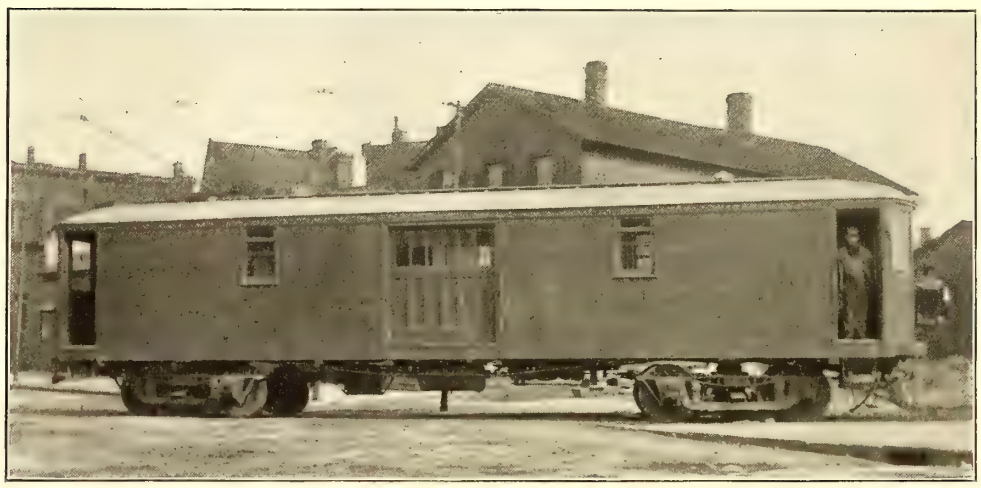
BAGGAGE DEPARTMENT

The new station building occupies only about one-third of the depot property, and is located to the west of the three tracks running through the property. It has an outside measurement of 255 ft. x 32 ft., including the platform on the track side, which



GENERAL INTERIOR VIEW

is about 9 ft. wide. To the west of the building is a paved driveway 20 ft. wide for teams. The freight shed proper is one-story high and is built of hard brick, while the office building in front is two stories high, and is built of pressed brick with sandstone trimmings. It has an ornamental front and is built in the most substantial manner. As shown in the plan, the greater portion of the ground floor of the office building is utilized as the agents' receiving room. A corner is allotted to the agent in charge of the station, which is fitted up as headquarters, and there is a desk for the cashier. The second floor is divided into three rooms, two of which are for the bookkeepers, stenographers and auditor, and the third is a large private office for the superintendent of the package company. The interior finish is Georgia pine, and the general appointments, while not elaborate, are neat and substantial. The office building has a basement in which is built a furnace for heating.

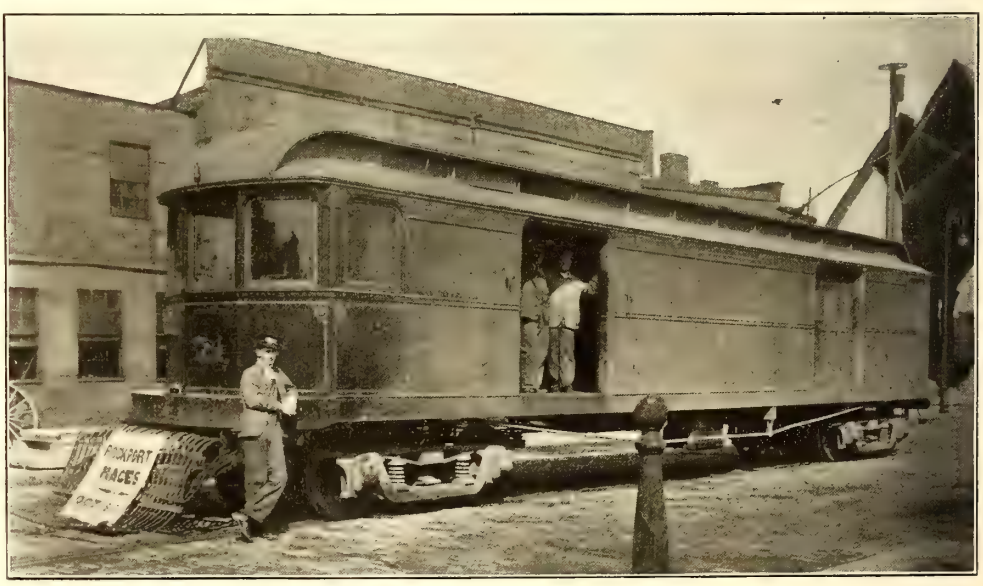


EXPRESS CAR ON LAKE SHORE ELECTRIC ROUTE

The express shed proper is 249.6 ft. long by 22.6 ft. wide. The end adjoining the office building is fenced off, forming a baggage room 25 ft. long. This is provided with a counter and shelves for packages; also racks for bicycles, which are handled as baggage under a State law. This room may be reached without entering the main express room, and there is a separate door from the driveway for delivering baggage into the baggage room. The south end of the building is partitioned off as a supply room and "old hoss" room, the appellation given unclaimed express and baggage, which, by the way, accumulates rapidly. Adjoining this room are a number of lockers for drivers and other employees. The express room proper is nearly 200 ft. long. On each side are nine doors, 8 ft. wide, provided with metal rolling shutters. At either end of the room are 2-ton platform scales, and at one side of the room on the platform side is a "coop" for the caller and bill clerk. This will be heated in winter by a stove, since, of course, it will be impractical and undesirable to heat the entire room. The doors on the team side are designated by a driver's number, while those on the track side are designed by the names of the several interurban routes. All goods intended for delivery by any driver or for shipment by a certain route are gathered at the proper place, so that there is no delay or confusion in handling. A small overhead crane will be installed for handling heavy articles. The flooring of the express shed and platform is double, being 2 in. x 4 in. planking on end, with matched flooring above. The roofing is corrugated sheet iron, with tarred paper and gravel roofing above, and there are peaked skylights at frequent intervals, making the room very light, which is heightened by white finish throughout. There are numerous clusters of incandescent lights and the platform is well illuminated in the same manner. The platform has a covering, and it is the intention to erect a similar covering on the drive side of the building. The station was designed by and erected under the supervision of Searles & Hirsh, architects, Cleveland.

The force at present employed in handling the business at the station includes two porters, one head porter and caller, one baggageman, one bill clerk, two night men, one cashier and one counter clerk and telephone man, in addition to the agent. At the present time there are nine single and double teams operating from Cleveland. The drivers are paid by the day, and, of course, they assist in loading and unloading their express. Each car has a messenger and a motorman.

The improved terminal facilities will, of course, aid greatly in the development of the business, and many plans are already being placed in operation which will speedily show returns. It is the intention to go after the market produce business, and it is believed that by offering improved facilities to the produce farmers in this district more of them may be induced to ship their goods to Cleveland.



CLEVELAND & SOUTHWESTERN CAR

A short time ago the company perfected traffic arrangements with the Canton & Akron Railway and the Canton & New Philadelphia Railway, so that goods are now shipped from Dennison, New Philadelphia and Canal Dover direct into Cleveland, connection being made with the Northern Ohio Traction & Light Company at Akron. Another arrangement which is of great advantage to shippers is one made with the Cleveland & Detroit and Cleveland & Toledo boat lines. Goods are transferred by the company's wagons in Cleveland and it is possible to ship direct from points as far south as New Phil-

adelphia to Detroit, and even to distant points in Michigan, through connection with the freight cars of the Detroit United Railway. In fact, a shipment is possible by this company between points that will necessitate transportation over 300 miles. Within the last two weeks the service has been extended to Sandusky and Toledo on the Lake Shore Electric system. As has already been outlined in these columns, the Toledo end of the Lake Shore business has always been conducted on a freight basis. This gives a continuous express run of 119 miles, said to be the longest electric express run in the country. The Cleveland-Toledo run has a schedule of seven hours, and stops are made for loading and unloading in all towns. The new arrangement makes it possible to ship goods from New Philadelphia and Canton and have them delivered in Toledo the same day, the distance from New Philadelphia being over 200 miles.

At the present time the company maintains agents and teams in twenty-five towns. All of these employes are on a salary basis. In some of the smallest towns the company makes arrangements with teamsters on a monthly basis, but in the large



FREIGHT STATION OF EASTERN OHIO ADJOINING ELECTRIC PACKAGE DEPOT

majority of cases the teams are owned by the company itself. There are nine teams in Cleveland; Toledo has four, Akron three and Sandusky two.

The rates charged by the Electric Package Company are practically the same as those charged by the old line express companies and the methods of handling are almost identically the same. A special rate, generally 10 cents, less than the regular rate, is made for fruit, poultry, eggs and produce. Milk delivered to hotels is also handled at a special rate, but the Electric Package Company has nothing to do with the milk handled in bulk by the several roads, this being hauled in separate milk cars and delivered to milk wagons at the city limits.

All of the Cleveland roads now use express cars exclusively, and the use of combination cars has practically been abandoned except on the spur lines.

The time of departure for the cars of the several roads and the towns where agents are maintained, together with the distances and special and regular rates are shown in the accompanying table.

It will be remembered by those who have read the articles published in the STREET RAILWAY JOURNAL relative to the freight business of the Eastern Ohio Traction Company, that it has no connection with the business of the Electric Package Company. The Eastern Ohio Company serves a farming district practically untraversed by steam roads. The company has found it advantageous to handle a heavier class of goods than is taken care of by the Electric Package Company, and the business is conducted strictly on a freight basis.

Believing it would be of advantage to centralize the interurban business, the company some months ago secured a site adjoining that of the Electric Depot Company. A residence was fitted up for general offices, and in the rear of this was erected a small freight station, which is reached by the same tracks

Route	Name	Distance from Cleveland, Miles	Special Rate Per Cwt.	Regular Rate Per Cwt.	Time of Departure From Cleveland	
					a m.	p.m.
Lake Shore Elec ...	Lorain	27	30	40	7.00 10.30	2.00 7 30
	Sandusky	57	40	50	10.30	7.30
	Norwalk	57	40	50	7.00	2.00
	Monroeville	63	40	50	7.00	2.00
	Bellevue	70	50	60	7.00	2.00
	Clyde	77	50	60	7.00	2.00
	Fremont	84	50	60	7.00	2.00
	Toledo	119	60	75	7.00	2.00
Cleveland & South-Western	Elyria	27	30	40	5 30 9.00	12.30 3.00
	N. Amherst	32	30	40	5.30 9.00	12.30 3.00
	Lorain	37	30	40	5.30 9.00	12.30 3.00
	Grafton	34	30	40	5.30 9.00	12.30 3.00
	Oberlin	38	30	40	5.30 9.00	12.30 3.00
	Wellington	47	30	40	5.30 9.00	12.30 3.00
	Norwalk	57	40	50	5.30 9.00	12.30 3.00
	Berea	14	30	40	8.45	2.15 7.15
	Medina	33	30	40	8.45	2.15
	Seville	45	40	50	8.45	2.15
	Creston	48	50	60	8.45	2.15
	Wooster	60	50	60	8.45	2.15
Cleveland, Painesville & Eastern...	Willoughby	20	30	40	6.30 9.00	1.30 4.30
	Painesville	30	30	40	6.30	1.30
North'rn Ohio Traction & Light Co ..	Bedford	12	30	40	9.00	2.00 9.00
	Cuyahoga Falls	30	30	40	9.00	2.00 9.00
	Kent	35	30	40	9.00	2.00 9.00
	Ravenna	43	40	50	9.00	2.00 9.00
	Akron	37	30	40	9.00	2.00 9.00
	Barberton	42	40	50	9.00	2.00 9.00
North'rn Ohio Traction & Light Co., via Canton & Akron Ry.....	Canton	63	40	50	9 00	2.00
	Massillon	73	40	50	9.00	2 00
	Canal Dover	91	50	60	9.00	2.00
	New Philadelphia	95	50	60	9.00	2.00

that serve the depot site. A spur runs into the Eastern Ohio station. The arrangement makes it convenient for transferring goods from one station to the other and enables the two systems to co-operate.

OPEN COMPARTMENTS IN WINTER

In these columns recently attention was called to the present attempts to provide rolling stock which will accommodate those who wish to ride outside during the greater portion of the year, as exemplified by long platforms and the half-open compartments to be found in some cities. In that article a certain street railway man was quoted as being of the opinion that people were seeking open-air seats more than formerly. Of course, public habits in one city do not necessarily correspond with those in another having a different climate. General Manager Robert McCulloch, of the Chicago City Railway Company, says that while in the early days of cable traction in Chicago seats on the open grip car were taken in cold weather, the present tendency is to "hug the top of the stove" as soon as the weather turns cool. He considers a compartment car worthless for use the year around in that climate.

"Prominent among the good things that have come to Honolulu with the asurance of stable government is the passenger service of the Honolulu Rapid Transit & Land Company, which operates more than eighteen miles of car track. * * * The company is extending its lines constantly and expects to attain the Pali, the top of Tantalus and Moanalua within the next two years, as well as to gridiron the city with its rails. * * * It has been only two years since Honolulans were given the privilege of riding in electric cars. The old horse and mule system held a monopoly of the streets that could not legally be set aside for a long time. Honolulu was probably the last American community of any size to adopt electricity as a means of rapid street transit, and when it did modernize itself in this particular there were hardly enough cars to carry people."—Paradise of the Pacific.

ROADBED CONSTRUCTION FOR WORLD'S FAIR INTRAMURAL RAILWAY

Work on the construction of the intramural railway at the World's Fair grounds in St. Louis has progressed sufficiently to give some idea of the character and extent of the enterprise. It will comprise a scenic route, 6 miles long, double tracked throughout, and so arranged that visitors next year may take a car at any of the entrances, or at any one of the seventeen stations distributed at intervals along the route, and make an entire circuit of the grounds. A general view of all the big exhibit palaces can be obtained on such a trip, and one may thus reach a point within easy walking distance of any important building.



RAILWAY BRIDGE CROSSING RAVINE

In the construction of the intramural 5 miles of the 12 miles of track to be laid are completed, and work on the remainder is being pushed rapidly. The maximum grade is 3 per cent, and the maximum curvature 20 degs., except the loop curves at the terminals, which have a radius of 75 ft. Three hundred men are now engaged in constructing the trestles, grading and laying the tracks. The road is perfectly graded throughout except for a short distance in the western part of the grounds, where work is still in progress. Work is being pushed on the trestle which will carry the road down Government Hill, close to the eastern fence. This trestle will be 2100 ft. long, and will be built on piling of heavy double-deck structures, 30 ft. high. A truss bridge, which will carry the road over the World's Fair terminal surface tracks, is now being erected. This bridge has a length of 112 ft., consisting of two 56-ft. spans.

The intramural tracks will be used for transporting building material and exhibits during the pre-exposition period, and they are now used to a limited extent for this purpose, as shown in the cuts. The tracks throughout are standard gage, 4 ft. 8½ ins., which is the gage of both the intramural and steam railway equipment. The construction of the entire line will be heavy enough to run the largest switch engine over it without danger, and steam cars may be handled on the tracks of the intramural road at all times.

Installation of the poles for carrying the feeder wires is progressing as rapidly as the tracks are laid. The poles are 30 ft. long and of white pine. They set 6 ft. in the ground, so that the trolley wire will be 18 ft. above the top of the rails. Center-pole construction has been adopted, and the wires will be supported on brackets attached to the poles.

The cars for the intramural are now being built at the St. Louis Car shops. There will be seventeen trains, each consisting of two motor cars and a trailer. A few open cars will be used, but most of the cars will be



TRESTLE WORK AND HIGH EMBANKMENT ACROSS GULCH AT HEAVIEST GRADE ON LINE.

closed. Each car will have four 40-hp motors, and the "multiple-unit control system" will be employed. A 500-volt current will be used, and the system will be sectionalized so that one section may be cut out at any time without impairing the operation on the rest of the road.

An interesting feature of the roadbed construction is the time and labor-saving method employed in ballasting the roadbed with cinders. A large cinder dump-car, used by the street railways of the city, was run onto a flat car on which rails had been laid. It was impossible to run the electric car over the intramural tracks on account of the difference in the gage, but it was utilized by running the flat car close to an embankment the exact height of the car. On the embankment a spur of the street railway tracks was laid with a trolley wire extending a car's length beyond it. The spur and the rails on the flat car made perfect connection, enabling the electric car to be transferred with ease and safety. To the flat car is then coupled a locomotive, and as the car is drawn slowly over the system the cinders are distributed along the tracks, where they are afterwards leveled. It is estimated that $10 is saved on each carload of cinders dumped, or about $2,500 in all. It takes about fifteen minutes to distribute a carload by this method, where by the old way it took four hours.



LAYING CONNECTION ON INTRAMURAL IN SOUTHERN PART OF GROUNDS



ELECTRIC DUMP-CAR MOUNTED ON FLAT-CAR AND DRAWN BY LOCOMOTIVE FOR DISTRIBUTING CINDERS IN ROADBED CONSTRUCTION

THE RESULTS OF NEWSPAPER ADVERTISING OF THE TRENTON, N. J., LINES

The experiments in newspaper advertising, both paid and free, which have been tried by several street railway companies entering Trenton, N. J., prove conclusively that this kind of advertising, as a means of increasing traffic, does pay. Actual comparative figures as to the results are not available, because the companies have not yet operated two seasons, but evidence of the increased returns is strikingly apparent.

The Trenton, Lawrenceville & Princeton Railroad was the first company entering the city to pay cash for advertising time-tables. A few months ago, when the Yardley, Morrisville & Trenton Street Railway was completed to Newtown, Pa., the New Jersey & Pennsylvania Traction Company, which controls both lines, began running special advertising in the local newspapers. Before the Newtown road was open a week it was overloaded with business, and at times could not begin to handle the crowds that gathered at the Trenton terminals. Two fares, or 10 cents, are collected for the 12 miles between Trenton and Newtown, and two semi-convertible 40-ft. cars are run every 40 minutes, each making a single trip in 35 minutes. A small tripper runs between Trenton and Morrisville, just across the Delaware River, and these three cars, on a single day, recorded more than 10,000 fares. For several days before, the company had been running small reading notices in the two morning papers, telling of the line and the connections it made, and without some sort of newspaper publicity the public could scarcely have known that the road was in operation. The cars started, at that time, from



HANDLING FREIGHT IN STEAM CARS OVER INTRAMURAL ROADBED

an obscure point on Calhoun Street, Trenton, one block west of the State Capitol, and it was here that people blocked the street from early morning until late at night, on the Sunday in question. All through the summer the traffic was heavy each day, and on Sunday every car was filled to the doors. The advertising was varied slightly from week to week, but had for its object the booming of the Newtown line and connections. This line carried on a certain day just five times as many passengers (counting fares) as another line, with far better facilities and just as interesting a trip, which did not advertise. No other reason can apparently be given for the wide difference in travel.

The Trenton & New Brunswick Railroad, running from the Inter-State Fair Grounds, Trenton, to Milltown Junction, 25 miles, and New Brunswick, 28 miles, was placed in operation less than a year ago, with a traffic which was very light. During the winter only a single car was operated, on a 3-hour headway, as this was all the traffic warranted. There are no intermediate towns or villages adjacent to the line, and it must depend almost entirely upon the through travel. Traffic increased slightly during the spring months, and cars were operated every hour. For months the newspapers had been a trifle reticent in "booming" the line, because of the uncertainty as to its purpose. About this time, however, the company began advertising in the newspapers, and a little later took a party of local newspaper writers and editors over the line in a special car, and banquetted them at New Brunswick. This aroused the newspapers to an active interest in the line, and advertising the special features caused the traffic to jump to two or three times what it had been. On a single Sunday the road carried more than 2000 passengers, of whom about 85 per cent went all the way through from terminus to terminus. This is remarkable when it is considered that the single fare from the center of Trenton (by ticket only) to New Brunswick is 45 cents, or 80 cents return. Of course, most of the people who went one way returned again, but this is included in the figures. In other words, more than 2000 passengers were on the cars during the day. This traffic has held up remarkably well, and from 500 to 700 are carried every weekday, with three cars in operation, and so arranged that practically only three crews are needed.

As previously stated, no comparisons with a previous year are possible, because neither line has been in operation a year. The great increase in traffic is undeniable, however, and upon neither line is there any sign of an abatement. Some of the pleasure traffic has fallen off, of course, but the regular traffic very nearly makes up for it. Most of this regular traffic has been newly built up by the companies, too.

Because the Trenton Street Railway Company is largely a local company, it has never gone into newspaper advertising to any extent. The newspapers are all on friendly terms with it, however, and anything new which it has to offer is exploited at length in the local press. The company has, at various times, advertised Spring Lake Park, which it owns.

Free advertising, which offers great possibilities, was worked by the Trenton companies to a considerable extent. During the last three years, at a rough estimate, the electric railways have been advertised through favorable articles to the extent of thousands of dollars worth of space. An open policy with the newspapers has been largely responsible for this. There is not an electric railway line running into Trenton to-day that does not treat the newspaper men with courtesy, and all of them are very liberal in answering questions, either by telephone or in person.

The first outside line to enter Trenton was the Camden & Trenton Railway, and this company placed every facility in the way of the newspapers for obtaining the news. Every movement of the company was chronicled in the press, and the placing of a switch or siding was considered sufficient excuse for printing a column of news concerning the line. The road has enjoyed a large patronage, and has won public sympathy largely through the fact that the newspapers give every possible item of information concerning it.

The Yardley, Morrisville & Trenton Street Railway was the next line to enter the city, and its doings were followed with a care which would have almost appeared ludicrous to an outsider had he been acquainted with the details. One stormy night, after midnight, a local newspaper man walked 2 miles to measure some rails and ties. If they measured a certain number of inches they would be for the use of the company in question; or if not, they would be used for another purpose. The officials of the company were expecting them, but even they did not know that they had arrived during the evening. They measured right, and the next morning at least one of the newspapers of the city printed nearly a column descriptive of what would be done, using the arrival of the supplies as a basis. This effort would never have been put forth had not the company kept in close touch with the newspapers and engendered a friendly feeling. It was free advertising of the best kind, and kept public interest alive.

The Trenton, Lawrenceville & Princeton Railroad received as great or greater attention than the Yardley, Morrisville & Trenton, if possible. Both were and are under the same management. The Trenton, Lawrenceville & Princeton Railroad was longer building and being put in operation, and it afforded better opportunities for news. Every incident connected with its early operation was faithfully portrayed.

An instance of the good that results from this cordiality of feeling between the companies and the newspapers is shown by the statement of an editor in regard to a certain company, whose manager made it his business to give the facts to the papers. This editor said that he always tried to use the utmost care in handling accident reports of this particular line, because the officials always supplied him with the details promptly, and he never had to watch them for fear they would disappoint him. That road received thousands of dollars worth of free advertising, and no fault could be found with the publicity from the manager's standpoint.

DETAILS OF THE UNDERGROUND RAILWAY ACCIDENT IN PARIS

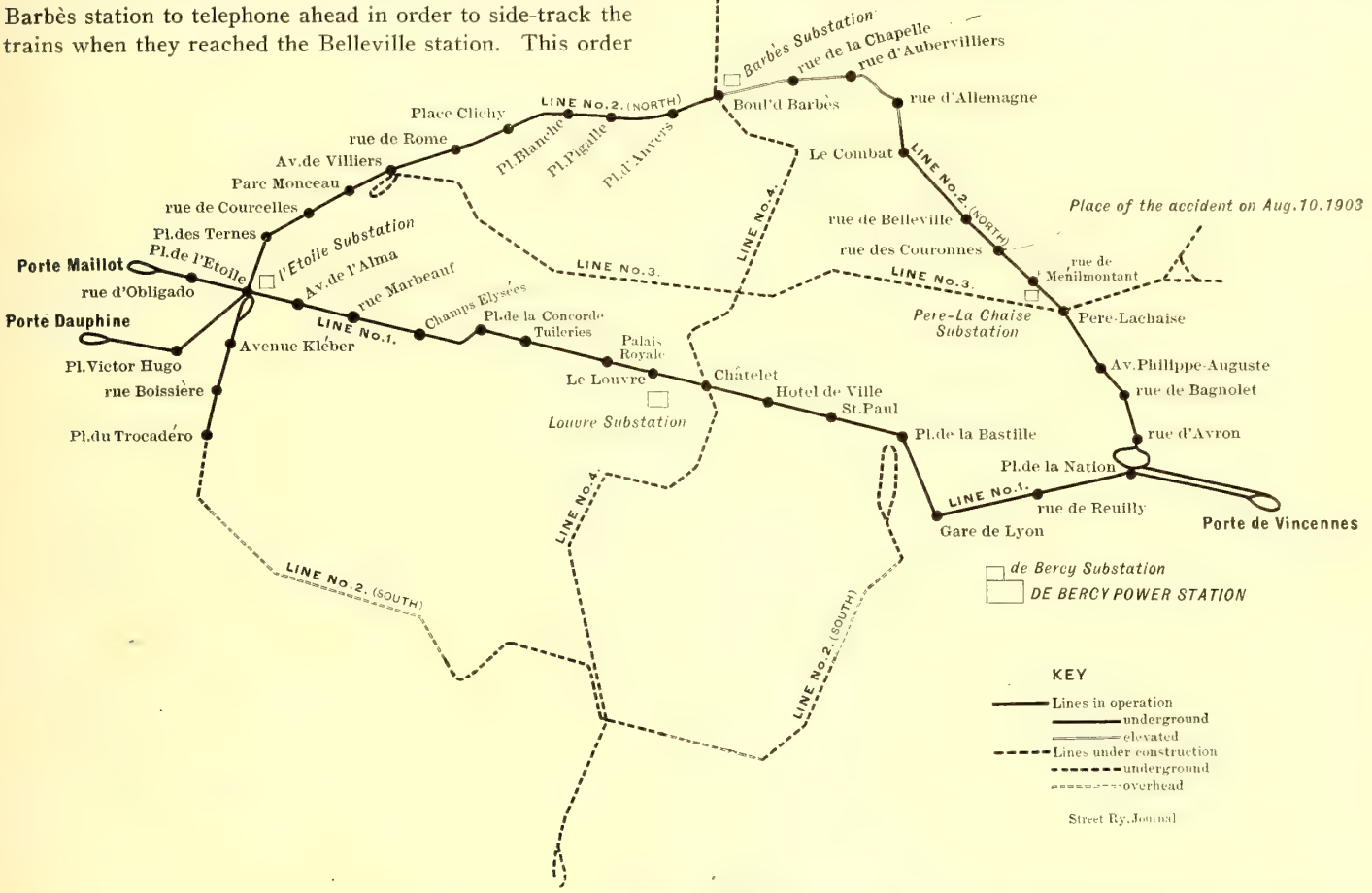
Some details of the accident on the Metropolitan Underground Railway, of Paris, which occurred Aug. 10, and which resulted in a large loss of life, have been brought out during the last month by the official investigation. In view of the number of underground electric railways now in operation in different cities, and those which are proposed, some particulars adduced at the inquest may be of considerable interest.

The accident occurred on Line No. 2, north, as shown by the accompanying map, in a part of the tunnel very near Menilmontant station. Soon after a crowded train of eight cars left the Dauphine station, running toward the Nation station, and at the foot of the grade which connects the underground portion of the line with the elevated, the motorman noticed trouble in the electrical equipment of the front motor car in which he was stationed. It was probably a short circuit in one of the motors, and was possibly caused by excessive friction of the brake-shoes on the wheels, as the motorman noticed, on leaving the Dauphine station, that the brakes were working badly. Nevertheless, the facts on this point are not very clear. Whatever may have been the cause the trouble appeared insignificant to the motorman, who started off with his train and mounted the 4 per cent grade up to the neighboring Barbès station on the elevated line. At this moment the motor in question began to behave worse. The motorman, believing that his train was disabled, discharged his passengers at Barbès station, according

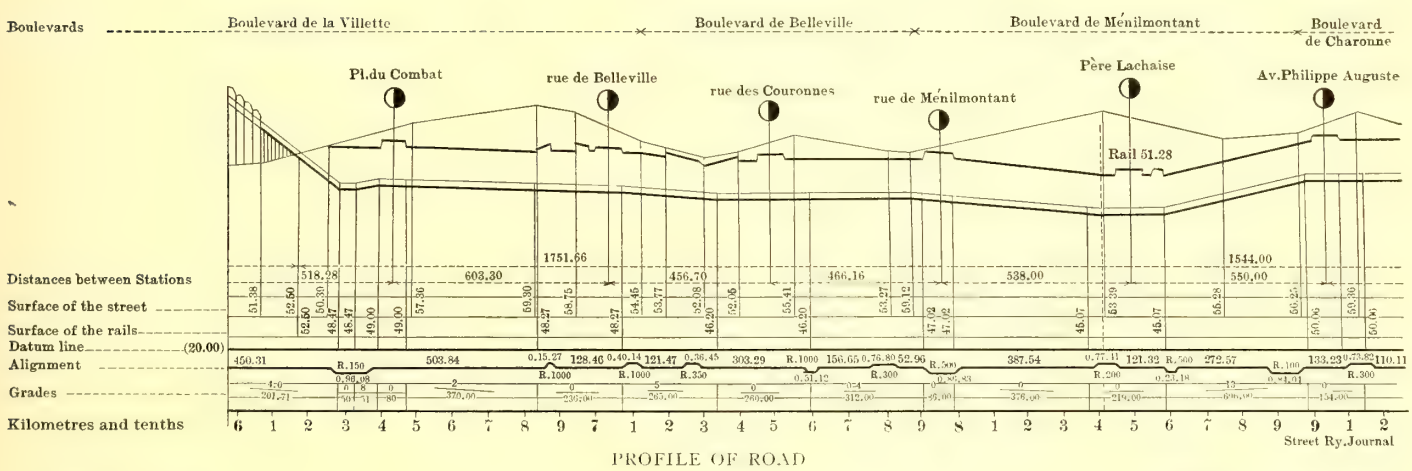
to the rules, and asked to be pushed by the following train. This second train, which had four cars, discharged its passengers in its turn and commenced to push train No. 1.

According to the evidence, it seems that the motorman neglected the precaution of raising the third-rail shoes connected to the disabled motor car and of opening the motor cut-out switches in the controller.

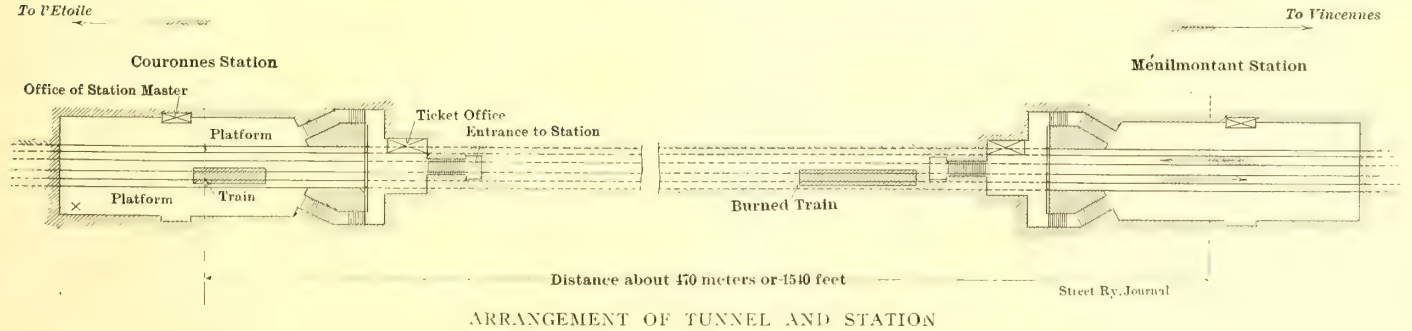
The double train, consisting now of twelve empty cars, left the station at high speed to prevent a block, after one of the conductors of train No. 2 had asked the station master at Barbès station to telephone ahead in order to side-track the trains when they reached the Belleville station. This order seems to have been transmitted. The double train ran the entire distance of the elevated structure without stopping, and it was only at the Combat station, the first station on the underground road, that the employees noticed that the head motor car was smoking. By the use of water and patent extinguishers they succeeded, as they thought, in putting out the fire, which seems to have started at Barbès and to have been brought to a blaze by the current of air on the elevated structure. Even at this time the employees on the train evidently considered the train to be in no danger, but it



MAP OF SYSTEM



PROFILE OF ROAD



ARRANGEMENT OF TUNNEL AND STATION

seems that the liquid acids in the patent extinguishers and the water used to put out the fire affected the insulation of the cables, particularly those which connect the shoes with the controller. It should be remembered that these shoes had not been raised, and that the defective motor had not been cut out. The double train finally arrived at the Belleville siding.

The versions are conflicting from this point. The station master at Belleville affirms that he was ready at the switch to have run the train onto a siding. This, however, would have been useless, as it should have been taken directly to the Nation station without blocking the line. The double train went through the Belleville station at full speed. When the Couronnes station was reached the station master saw flames in the head car, and made the signal to stop, which was probably not understood by the crew, who were not aware of any trouble, and the train continued toward Menilmontant. When within about 150 ft. of this station a violent explosion brought the train to a standstill, and it was seen that the head motor car and the first trail car were on fire. The bodies of these cars were made of green pitch pine, and do not seem to have been fireproofed. A second attempt was made to extinguish the fire, but the smoke became suffocating and the employees were obliged to retreat.

At the time the short circuit occurred the breakers in the nearest sub-station, and which is near the Père Lachaise station, opened. But as the third rail of Line No. 2 is not sectionalized in the sub-stations by separate switches, it is extremely probable that the sub-stations at the Place de l' Etoile and at Barbès, which are run in parallel with the Père Lachaise substation, were not disconnected by the short circuit. The resistance of the third rails and of the track combined was sufficient to keep the current less than that for which the circuit breakers were adjusted. As the third-rail shoes of the motor car had not been raised, an arc was maintained under the car, and naturally prevented the employees from being able to extinguish the fire, and, finally, the entire train soon became a prey to the flames. The fire itself created a draft in the tunnel in the direction of Couronnes station, and the employees were obliged to retire with difficulty.

The only loss would have been the destruction of several cars by fire if, at this time, a very unfortunate combination of circumstances had not occurred. The heat caused by the fire soon destroyed the light and telephone cables, and the tunnel was plunged in darkness.

In order to understand what now occurred it is necessary to go back and follow the movements of the train which was coming in the rear of the burning train. This train took on at the Barbès station the passengers who had been traveling in the first two trains, descended the grade and continued its trip, finding the track free. On arriving at the Couronnes station the signal showed red and the train stopped, the employees believing that it was simply a case of blocked traffic. The wait being prolonged, the station master attempted to telephone to the Menilmontant station in order to find out the cause of the trouble, but was not able to obtain any reply. The wait lasted about twenty minutes. A certain number of passengers becoming impatient left the train and blocked the ticket office, demanding a return of the money for the tickets. The others in the train waited patiently for the train to start, when all at once quantities of black and acrid smoke appeared in the tunnel, coming from the direction of Menilmontant. The passengers complained but the employees advised them not to be afraid, not imagining that there was any danger. The smoke came rapidly, thick and suffocating. The passengers climbed out of the cars and ran to the exit pell-mell, when all of a sudden the lights went out and the tunnel was plunged in complete darkness. Those who found themselves at the side of the staircase appeared to have escaped with great trouble in view of the confusion. The means of access to the station soon became cut off, or, at least, invisible, on account of the heat, smoke and darkness, and it was not until the following day that the firemen were able to penetrate into the tunnel. It was then seen that eighty-four passengers, being deceived in the direction which they should have taken by the obscurity, had been helplessly suffocated against a wall of the station which did not have any exit.

While it is not difficult to derive from the detailed report of this disaster some very conspicuous lessons, it should be said that during the last three years of operation of the Metropolitan over 200,000,000 passengers were carried without accident. The present instance proves, however, the absolute importance of a reliable despatching system and proper protection against fire, the necessity of having the lighting and telephone circuits unaffected by accidents to trains, and the dangers of blind exits in railroad stations.

NEW PRESIDENT OF THE NEW HAVEN

The selection of C. S. Mellen as president of the New York, New Haven & Hudson River Railroad Company is particularly interesting to the electrical industry, not only because of the network of electric roads which now form an important part of the New Haven system, but because of the plans which had been made for extensions and improvements in this branch of the service, and the well-known antipathy of Mr. Mellen to electric traction when he was formerly connected with the company. The question naturally arises, will Mr. Mellen, as president, modify the opinions he entertained when vice-president or will the plans and policy of the New Haven in this matter be altered so as to coincide with those of its new president?

Mr. Mellen is an "operating" man, and he is essentially a steam railroad man, so that under ordinary circumstances little favor might be expected from him for the electric service, but the extent and importance of this branch of the New Haven system has reached a point where it cannot be disregarded. This condition is recognized by steam railway men, and the situation is attracting much attention, because, as stated by the "Railroad Gazette," of the "exceptional nature of the questions which now arise in its administration and development."

It is pointed out, for instance, that the New Haven system includes at least 180 miles of electric railroad, single track, in nine widely separated localities and under quite divergent conditions. The electric lines comprise old trolleys bought up to ward off electric rivalry and still operated as trolleys; former steam lines electrified both by trolley and third rail; and, in one case, an extensive trolley system—the Worcester & Connecticut Eastern—created both by new construction and by purchase to thwart threatened competition by the novel expedient of self-parallelism of the company's steam road. The annual receipts of all these electric lines amounted last year to $772,666.

It is not to be wondered, therefore, that much interest is felt in steam railroad circles regarding the policy to be followed by the new administration. The "Gazette" says:

> When formerly connected as vice-president with the New Haven Company, Mr. Mellen was stoutly opposed to electric experiment and expansion. But he now inherits an electric policy with its concrete outlays, and the question of his own policy becomes one of acute interest both to his stockholders and the public. Will he expand or will he contract the plans of his predecessors? Will he meet electric rivalry or ignore it? Will he drop such unprofitable electric lines as the Nantasket branch or try to develop them further? Will he modify operation of apparently profitable branches like the Hartford-Bristol third rail line? Will he favor third rail, or trolley, or neither? Will he approve or veto, for example, an old plan of Presidents Hall and Clark of third-railing the New Haven-Derby branch, now that electric rivalry is imminent? Will he develop the Boston suburban electric system with its projected terminal and loop under the South Station, or will he let it remain quiescent. And, in broader aspects, what will be his legislative policy toward competitive electric projects, especially in Connecticut and Massachusetts?

TESTS OF STEEL FOR ELECTRIC CONDUCTIVITY, WITH SPECIAL REFERENCE TO CONDUCTOR-RAILS*

BY J. A. CAPP

For certain classes of electric railways a steel conductor is preferable to the older and more commonly used overhead trolley wire. The third rail presents a rather better appearance, because of the absence of an overhead structure; it is easily installed, cheaply maintained, presents a large area for conducting and collecting the current, and is particularly well adapted for high speed and heavy service. With costs calculated on the basis of equal conductivity in rail and trolley wire, the third rail construction is cheaper than the overhead trolley. But the average interurban road will use a trolley wire of considerably less conductivity than would be obtained with the smallest size steel rail (about 60 lbs. per yard) that would ordinarily be used, and here the first cost of trolley construction would generally be less than that of the third rail. While no third-rail installation has yet been in operation long enough to give figures or value, it would appear that the cost of maintenance of the third-rail construction should be less than that of the overhead trolley. This consideration, together with that of sightliness and adaptability (particularly in the case of terminals, yards and very heavy or high-speed service), will frequently offset the higher cost of the third-rail construction and make it the preferable means of conducting the current from the generator to the car motor.

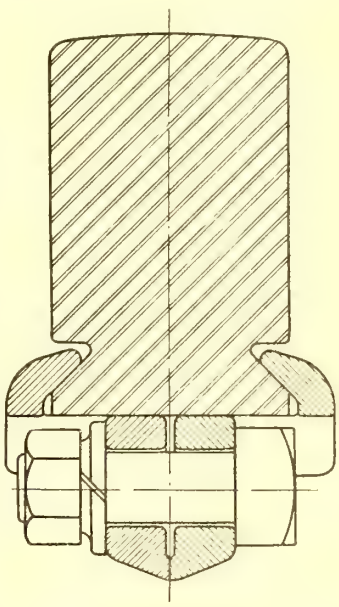
For the first third-rail installations, old track rails were used when obtainable, and these old rails were supplemented with new rails of standard T-section and composition. With the coming of the very heavy, high-speed service during the last few years, the resistance of these old and new standard T-rails was found to be so high that they would not carry the high currents necessary without too great a drop in the line potential. The rails would, therefore, have to be supplemented with additional copper feeders, but as this would be an expensive way to overcome the trouble, rails of higher specific electric conductivity were sought.

Because of the lack of specific data on the relation between conductivity and composition of mild steels, specifications for conductor rails have usually been based on the fact that the conductivity of a metal is generally more or less directly in proportion to its purity. In most cases the purity of the iron specified for such rails has been so high that not only was it difficult to obtain, but the iron was also correspondingly of high price. One of the factors governing the choice between a third rail and a trolley wire is the relative price of steel and copper, allowance being made for the difference in conductivity. Hence, a balance must be struck between high conductivity (which is equivalent to saying a high degree of purity or freedom from the usual metalloids associated with iron) and the cost of producing the steel of the composition necessary for the conductivity required.

With the object of drafting a rational specification for such third-rail steels, a series of tests was started last spring, in the testing laboratory of the General Electric Company, on steels of as wide a range of composition as could be obtained from the steel makers, the results of these tests forming the basis of this paper.

When entering the market with an order for rails of special composition, difficulty was encountered in interesting rail makers, and the reason became apparent. The mills which make the standard T-rails, or standard rails of other sections (such as the girder and grooved rails), have generally been designed with the object of making such rails only, and practice throughout has been standardized to the greatest possible extent, both in the manipulation of the steel and in its manufacture in the furnace or converter. Hence, an order, even of considerable extent, for rails of special composition, has so upset the routine work that it was considered a nuisance to be endured, rather than a desirable business to be sought for. Obviously, then, recourse must be had to mills where such special compositions can be handled economically.

The T-section of rail was the outcome of designs intended to present the greatest life and strength of the section, with the least weight of the metal, conditions necessarily to be met in a running rail. But the conditions for the third or conductor rail are different; here, there must be provided sufficient surface for the collection of the current, and cross section ample to carry the current without an undue drop in the line potential. The strength of the section is of little moment, and any section which is easily installed in an insulator is satisfactory. This permits the use of sections rectangular, or nearly so, which may be rolled easily in any mill equipped for the rolling of merchant-bar shapes of reasonably heavy weight, without any change in equipment or practice beyond the provision of grooved rails of the necessary shape. Mills rolling merchant-bar or structural steel, to-day, are generally equipped to make steel in the open-hearth furnace, which readily lends itself to the making of steel of the special composition demanded by the electrical engineers for the third or conductor rail.



CROSS-SECTION OF NEW CONDUCTOR RAIL, 2.5-INS. WIDE, 4-INS. HIGH AND 98 LBS. PER YARD

Having these facts in mind, a section of a conductor rail has been designed by W. B. Potter, chief engineer of the railway department of the General Electric Company, which, when 2.5 ins. wide by 4 ins. high, will weigh about 98 lbs. to the yard. This shape may be easily rolled in any merchant-bar mill heavy enough to attempt sections of this weight. A dove-tail at the bottom provides an easy means of securing the rails by fish-plates of special forms, and any of the common forms of bond may easily be applied. Ordered in lots of 1000 tons or more, such a rail should cost no more than a plain rectangle of equal weight.

To provide steels of sufficient range to give some indication of the relation between conductivity and composition, we obtained from as many of the steel makers as we could interest samples representing all of their common products. Some of the makers kindly provided us also with samples of special steels made in crucible charges. The samples were mainly forged or rolled bars of from 1 in. to 2.5 in. in diameter, and from them were turned bars of 0.75 in. in diameter, or 1 in. in diameter by 24 ins. in length, on which resistivity was determined. The chips from the finishing cuts were collected and these furnished the samples for analysis. Also, we cut similar bars from the heads of T-rails which were to be found in the yard tracks.

Table I states the electrical resistance and the chemical composition of forty-five samples of steel, and Table II similar data on seven samples of wrought, or refined, iron, together with results on three samples of iron reported by Barrett, Brown and Hadfield in a paper referred to later in this article. The samples were numbered serially in the order of their resistance, No. 1 being of the highest resistance. Samples

* Read at the New York meeting of the American Institute of Mining Engineers, Oct. 15, 1903.

Nos. 1, 2, 4, 7, 11 and 12 are standard T-rails from several well-known makers, while Nos. 24 and 25 are cut from the 100-lb. T-rail used for the conductor on the Aurora, Elgin & Chicago Railroad. No. 45 is a T-rail used by the Underground Electric Railways Company, of London, and ordered from a steel maker in Westphalia. Samples Nos. 46, 47 and 48 are ordinary refined bar-iron, while Nos. 49 and 50 are special

TABLE I.—RESISTANCE AND COMPOSITION OF STEEL

Serial Number	Specific Resistance: Microhms Cm Per Cm²	Specific Resistance: Temp. °C.	Conductivity: Matthiessen Standard	Resistance: Cu.=1	Percentage Composition: C.	Mn.	P.	S.	Si.	Total. Not Fe.	P. + S. + Si.
1	22.72	19	7.58	13.20	0.33	1.27	0,09	0.05	0,05	1.79	0.19
2	20 90	20	8,27	12.12	0.17	1.09	0,09	0.05	0.004	1.404	0,144
3	21.29	25	8 27	12.09	1.40	0.222	0,01	0.020	0 082	1,734	0.112
4	19 87	19	8,65	11.55	0.20	0.95	0,10	0 08	0.05	1 38	0.23
5	19,80	19	8.68	11.51	0.43	0.77	0.10	0,04	0.066	1.406	0.205
6	19,80	19	8,69	11.51	0.36	0.80	0.10	0.04	0.047	1.347	0.187
7	19.81	20	8 69	11.51	0.22	1.08	0.10	0.05	0.06	1.510	0.210
8	19.69	19	8.73	11.44	0.74	0.58	0 043	0.036	0.20	1.599	0.279
9	18.95	25	9 29	10.76	1,61	0.147	0.015	0.018	0.092	1.882	0.125
10	18.17	19	9.46	10.56	0.41	0.72	0.039	0.041	0,11	1.32	0 190
11	17,27	19	9,96	10.04	0.36	0.87	0 08	0.09	0.04	1.44	0.21
12	17.10	19	10.06	9.94	0,37	0.73	0.09	0.04	0.06	1.29	0.19
13	17.10	19.5	10.06	9.94	0.23	0.80	0.046	0.033	0.016	1.095	0.065
14	16.96	19	10.14	9.86	0.30	0.95	0.063	0.01	0.01	1.333	0.083
15	16.95	19.5	10.14	9 86	0.29	0.99	0.084	0.01	0.01	1.384	0.104
16	16.32	19	10.55	9.48	0,23	0.89	0.058	0.01	0.005	1.193	0.073
17	16.25	19.5	10.59	9.44	0 26	0.83	0.053	0.01	0.004	1.157	0.067
18	16.21	20	10.62	9.42	0.28	0.65	0.083	0 06	0.05	1.123	0.193
19	16.09	19	10.60	9.36	0.22	0.68	0.077	0,07	0.05	1.097	0.197
20	16.09	19	10,69	9.36	0.16	0.66	0.074	0.030	0,014	0.938	0.118
21	15 32	19	11.24	8.90	0 33	0.49	0 068	0.05	0.02	0.958	0.138
22	14.57	19.5	11.82	8.46	0.31	0.45	0.10	0.04	0.026	0.926	0.166
23	14.49	20	11.88	8.42	0.25	0.41	0.10	0.04	0.03	0.83	0.17
24	14.73	23.5	11.88	8.42	0.144	0.46	0.09	0.08	tr.	0.774	0.17
25	14.62	23.5	11.96	8.36	0.188	0.48	0 09	0.08	tr.	0.83	0.17
26	14.15	19	12.17	8.22	0 22	0.56	0.024	0.34	tr.	0.888	0.058
27	14.03	19	12.26	8 16	0.192	0.57	0 024	0.34	tr.	0.82	0·058
28	13.86	19	12.41	8.06	0.16	0.48	0.091	0.04	0.01	0.781	0.144
29	13.83	19.5	12.44	8.04	0.10	0.55	0 08	0 05	0.024	0.804	0.154
30	13 80	19	12.57	8.02	0.14	0.41	0,11	0 05	0.009	0.719	0.169
31	13.67	19	12.58	7.95	0.23	0.48	0 024	0.01	0 025	0.767	0.057
32	13.64	19	12.61	7.93	0.24	0.57	0 029	0 01	0.003	0.850	0.042
33	13 90	24	12.63	7.92	0.10	0.25	0 04	0.02	0.05	0.46	0.11
34	13.31	19	12.92	7.74	0.25	0.37	0,04	0.02	0.018	0.708	0.088
35	13.30	19.5	12.94	7.73	0 23	0 49	0 024	tr.	0.004	0.748	0.048
36	13 27	19	12.97	7.71	0,19	0.37	0.09	0 05	0.01	0.71	0 15
37	13.25	19	12.99	7.70	0.27	0.41	0.024	0.01	0 001	0.715	0.035
38	13.18	19	13 05	7.66	0.28	0.28	0.027	0.034	0.04	0.661	0.111
39	13.18	19	13.05	7.66	0.07	0.40	0.08	0.07	0.013	0.633	0.163
40	13.07	19	13.16	7.60	0.28	0.42	0.022	0.04	0 008	0.770	0.070
41	12,87	20	13.27	7.48	0.16	0.38	0.08	0.04	0.009	0.669	0.129
42	12,73	20	13.52	7.40	0 15	0 45	0.011	0.033	tr.	0.644	0.044
43	12,69	19	13.55	7.38	0.19	0.21	0.025	0.04	0.034	0 499	0.099
44	12.53	19	13.74	7.28	0.215	0.22	0.051	0.113	----	0.599	0.164
45	11.01	19	15.63	6.40	0.05	0.19	0.054	0.059	0.03	0.383	0 143

TABLE II.—RESISTANCE AND COMPOSITION OF IRON

Serial Number	Specific Resistance: Microhms Cm Per Cm²	Specific Resistance: Temp., °C.	Conductivity: Matthiessen Standard	Resistance: Cu.=1	Percentage Composition: C.	Mn.	P.	S.	Si.	Total. Not Fe.	P. + S. + Si.
46	13.80	25.5	12,78	7.82	0 15	0.068	0.13	0.02	0.15	0.518	0 30
47	13.82	26	13.37	7.48	0.15	0.064	0.036	0.02	0.13	0.400	0.186
48	13.10	26	13.50	7.41	0.16	0.074	0.12	0.027	0.10	0.481	0.247
49	12.54	25.5	14.07	7.11	0.08	nil	0.13	0.008	0.024	0.242	0.162
50	11.92	25.5	14.80	6.76	0.17	0 027	0 074	0.022	0.077	0.370	0.173
51	10.82	24	16.21	6 17	0.058	0.10	0 014	tr.	0 012	0.184	0.026
52	10.80	25.5	16.34	6.12	0.16	0.018	0.049	0 011	0.015	0.252	0.075
LSS	11.40	17	15.00	6.68	0,050	0.180	0.013	0.011	0.02	0.274	0,044
B	11.00	17	15.57	6.44	0.030	0 036	0.065	0 016	0.14	0 287	0.221
SCI	10.35	17	16.55	6.06	0.028	tr.	0.004	0.005	0.07	0.107	0.079

TABLE III.—RESISTANCE OF STEEL. VARIATION WITH MANGANESE
(Carbon from 0.17 to 0.23 Per Cent)

Sample Number	Manganese	Resistance	Carbon	P. + S. + Si.
	Per Cent		Per Cent	Per Cent
2	1.09	12.12	0.17	0.144
4	0 95	11.55	0.2c	0.23
7	1.08	11.51	0.22	0.210
13	0.80	9.94	0.23	0.065
16	0.89	9.48	0.23	0.073
19	0.68	9.36	0.22	0.197
25	0.48	8.36	0.188	0.17
26	0.56	8.22	0.22	0.058
27	0.57	8.16	0.192	0.058
31	0.48	7.95	0.23	0.057
35	0.49	7.73	0.23	0.028
36	0.37	7.71	0.19	0.15
43	0.21	7.38	0.19	0.099
44	0.22	7.28	0.215	0.164

TABLE IV.—RESISTANCE OF STEEL. VARIATION WITH MANGANESE
(Carbon from 0.27 to 0.33 Per Cent)

Sample Number	Manganese	Resistance	Carbon	P. + S. + Si.
	Per Cent		Per Cent	Per Cent
1	1.27	13.20	0.33	0.19
14	0.95	9.86	0.30	0.083
15	0.99	9.86	0.29	0.104
18	0.65	9.42	0.28	0.193
21	0.49	8.90	0.33	0.138
22	0.45	8.46	0.31	0.166
37	0.41	7.70	0.27	0.035
38	0.28	7.66	0.28	0.111
40	0.42	7.60	0.28	0.070

TABLE V. RESISTANCE OF STEEL. VARIATION WITH CARBON
(Manganese from 0.15 to 0.30 Per Cent)

Sample Number	Carbon	Resistance	Manganese	P. + S. + Si.
	Per Cent		Per Cent	
3	1.40	12.09	0.222	0.112
9	1.61	10.76	0.147	0.125
33	0.10	7.92	0.25	0,11
38	0.28	7.66	0.28	0.111
43	0.19	7.38	0.21	0.099
44	0.215	7.28	0.22	0.164
45	0.05	6.40	0.19	0·143

TABLE VI.—RESISTANCE OF STEEL. VARIATION WITH CARBON
(Manganese from 0.4 to 0.5 Per Cent)

Sample Number	Carbon	Resistance	Manganese	P. + S. + Si.
	Per Cent		Per Cent	Per Cent
21	0.33	8.90	0.49	0.138
22	0.31	8.46	0.45	0.166
23	0.25	8.42	0.41	0.17
24	0.144	8.42	0.46	0.17
25	0.188	8.36	0.48	0.17
28	0.16	8.06	0.48	0.144
30	0.14	8.02	0.41	0.169
31	0.23	7.95	0.48	0.057
35	0.23	7.73	0.49	0.028
37	0.27	7.70	0.41	0.035
39	0.07	7.66	0.40	0.163
40	0.28	7.60	0.42	0.070
42	0.15	7.40	0.45	0.044

TABLE VII.—RESISTANCE OF STEEL. INFLUENCE OF CARBON
(Results of M. Le Chatelier)

Resistance: Microhms	Resistance: Cu. = 1	Composition: C.	Mn.	Si.
		Per Cent	Per Cent	Per Cent
10	5.78	0.06	0.13	0.05
12.5	7.22	0.20	0.15	0.08
14	8.10	0.49	0.24	0.05
16	9.25	0.84	0.24	0.13
18	10.40	1.21	0.21	0.11
18.4	10.64	1.40	0.14	0.09
19	11.00	1.61	0.13	0.08

TABLE VIII.—RESISTANCE OF STEEL. VARIATION WITH CARBON
(Results of Barrett, Brown and Hadfield. Temperature 17° C.)

Sample Mark	Resistrnce: Microhms	Resistrnce: Cu. = 1	Composition: Carbon	Manganese	Silicon
			Per Cent	Per Cent	Per Cent
1392G	19.1	11.19	1.23	0.14	0.12
1392L	17.6	10.31	1.09	0.32	0.17
1392A	17.9	10.49	0.85	0.32	0.17
1392B	17.2	10.07	0.84	0.18	0.20
1392I	16.7	9.78	0.83	0.25	0.06
1392H	16.4	9.43	0.78	0.10	0.10
1166A	13.4	7.85	0.14	....	0.08

brands of refined bar-iron sold for use in staybolts and similar work. Nos. 51 and 52 are Swedish and Norway irons, respectively.

The resistance is expressed in the three ways in which such results are frequently stated. The first column gives the specific resistance or resistivity of a section 1 sq. cm in cross-section and 1 cm long, expressed in microhms (ohms x 10^{-6}) and at the temperature given in the second column. In the third column is given the conductivity (on the basis of Matthiessen's determination of the resistivity of pure copper), i. e., the ratio of the resistivity of copper to that of the sample, expressed as a percentage. The fourth column gives the resistance of the samples compared with Matthiessen's copper as unity (the figures in the fourth column are the reciprocals of those in the third column multiplied by 100). The second half of the table gives the percentages of the usual elements to be found in steel or iron, the total percentage of these elements and the sum of the percentages of phosphorus, sulphur and silicon.

The coefficient of change of resistance with change of temperatures is practically the same for copper and for ordinary steel and iron, hence, even though resistivities are determined at different temperatures, the conductivities or comparative resistances derived therefrom are directly comparable within limits close enough for the purpose of this discussion, without actual determinations of the temperature coefficient in each case, and the reduction of results to a basis of common temperatures. Therefore, in all succeeding reference to results the resistance will be expressed as in the fourth column, i. e., the ratio of resistivity of sample to that of Matthiessen's copper.

By the selection of samples of a composition varying in one element only, an attempt was made to define separately the influence of the several elements upon the resistance of steels. In Table III are listed those samples having carbon between 0.17 per cent and 0.23 per cent, manganese being the principal variable; and in Table IV are listed samples with manganese variable and carbon constant at from 0.27 per cent to 0.33 per cent. These results show that the effect of manganese in increasing resistance gradually increases with the percentage of manganese present, within the limits represented by these samples.

Messrs. Barrett, Brown and Hadfield,* in the study of the influence of manganese on resistance, used steels containing from 0.5 per cent to 18.5 per cent manganese, and found the resistance to increase at first very rapidly, with constantly increasing percentage of manganese, then more and more slowly, until 7 per cent manganese, after which a further increase in the percentage of manganese produces little or no increase in resistance. Le Chatelier* also gives figures showing the influence of manganese on resistance, but he has reported five samples only, and these are of such high carbon content as to be of no service to us in the study of steels available for conductor rails.

To determine the influence of carbon we have selected, in Table V, those steels with manganese constant at from 0.15 per cent to 0.30 per cent, with carbon as the principal variable. In Table VII we have stated results given by Le Chatelier in the paper previously mentioned, and in Table VIII the results of Barrett, Brown and Hadfield taken from the paper previously quoted. With uniformly increasing carbon, the resistance at first rises very rapidly, but the rate of increase gradually drops until it reaches a straight line at about 0.2 per cent C, which continues up to limits of the carbon listed. In all cases the steel is supposed to be unhardened, as it has been shown by Barus and by Le Chatelier that hardened steels may have double or even treble the resistance found in the annealed state. Table VI selects samples, with manganese constant at from 0.4 per cent to 0.5 per cent and carbon variable.

The elements phosphorus, sulphur and silicon were not present in sufficient quantity in any of the samples tested to permit us to draw any curves showing their influence upon the resistance. In both the papers previously quoted the influence of silicon, when present in large quantity, is studied, but the number of samples tested is too small to warrant any conclusions that are really definite. In commercial steels the percentages of all three of these elements is so small that their effect on resistance may generally be neglected.

A study of the several tables given in the paper shows that manganese preponderates in influencing the resistance of steels, and that for lowest resistivity, this element must be present in very small quantity, much smaller than is usual in merchant or structural steels. While all the other elements must be present only in very small percentages, so great is the preponderance of the influence of manganese, that they may be tolerated in quantities which the steel makers would consider reasonable, without unduly increasing the resistance.

For a satisfactory third rail the lowest possible resistance (from 6 times to 6.5 times that of copper?) is not necessary; and the great cost of making such extremely pure steel is not warranted. In fact, such extremely pure steels would probably be so soft that the frictional wear of the collecting shoe would be excessive and the life of the rail in service unduly short. Assuming, then, that a rail made from steel having a resistance not greater than eight times that of copper (13.8 microhms at 20 degs. C.) would be desirable for conductor rails, the figures tabulated would seem to indicate that the following extreme composition would be permissible:

	Per Cent
Carbon up to	0.2
Manganese up to	0.4
Phosphorus up to	0.06
Sulphur up to	0.06
Silicon up to	0.05

This composition, however, would be extreme, and any overstepping of bounds might result in too great resistance; therefore, for resistance up to eight times that of copper, the specified analysis should be:

	Per Cent
Carbon not to exceed	0.15
Manganese not to exceed	0.30
Phorphorus not to exceed	0.06
Sulphur not to exceed	0.06
Silicon not to exceed	0.05

This latter composition is one which could be made easily in any open-hearth furnace and it should present no difficulty in rolling to a shape suitable for conductor rails. In fact, steel of this composition has been successfully rolled into sheets as thin as 0.014 in., a size which was for a long time a standard product of a large sheet mill.

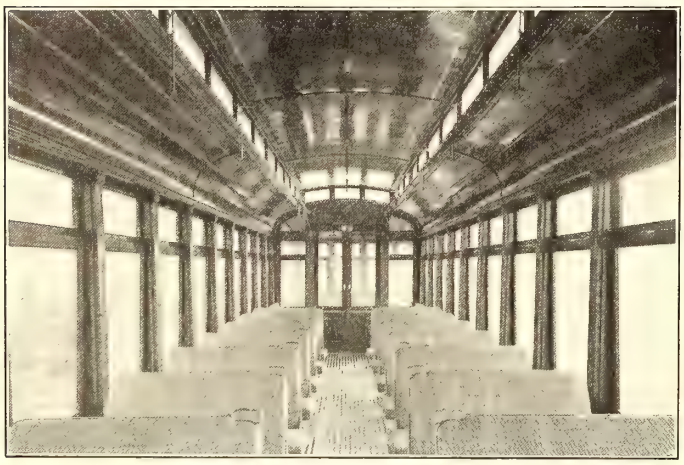
To street railway companies whose employees are "afflicted" with kleptomania, either mild or violent, the following item from the Lahore (Hindustan) "Tribune" may be of interest: "Many wandering gypsies employ a very simple method to check dishonesty on the part of the member of their band of musicians who has to make the collection. They give him a plate to hold in his right hand and a live fly, which he has to keep imprisoned in his left, as he goes round collecting the money."

* "On the Electrical Conductivity and Magnetic Permeability of Various Alloys of Iron," by W. F. Barrett, W. Brown and R. A. Hadfield, in "Transactions of the Royal Dublin Society," vol. vii., series 2, Part IV.

* "Sur le Resistance Electriques des Alliages," par M. H. Le Chatelier, in "Contribution a L'Etude des Alliages," published by the committee on alloys of the Société d'Encouragement pour L'Industrie Nationale.

LARGE CARS FOR COLUMBUS, OHIO

The American Car Company, of St. Louis, has lately completed and shipped two large straight-side cars to the Columbus Street Railway Company, of Columbus, Ohio. The absence of grades and the uniformly wide streets of Columbus permit the running of such cars into the heart of the city. One of the especially interesting features of the cars consists of a



INTERIOR OF COLUMBUS CAR

vestibule at the forward end, which has no door between the vestibule post and the car corner post.

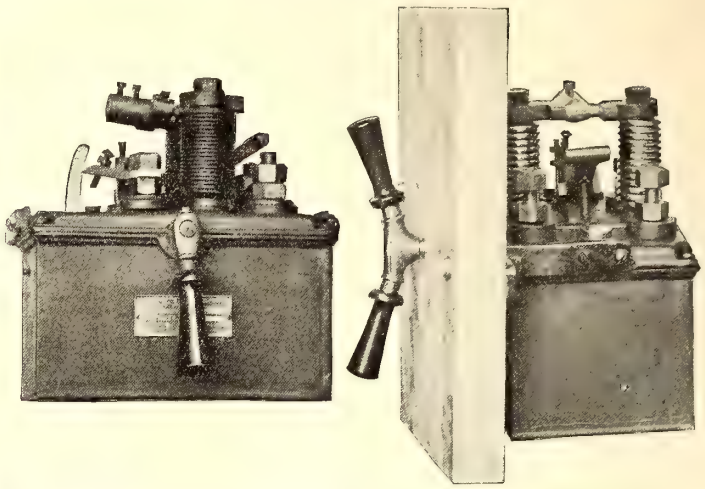
The accompanying illustration gives an idea of the general arrangement. A partition is extended from the vestibule corner post, at an angle with the platform, and is met by a door hung to the inside post of the car door, which door is situated at the right side of the car end, and is of the single sliding type. The rear platform is of Detroit type, and provided with portable vestibule. The car doors at this end are of the twin type. The seating capacity of each car is forty-six. The seats are placed transversely, and are of spring cane with stationary backs. At the rear end seats for six persons on each side are placed longitudinally. The transverse seats are 34 ins. long, leaving the aisles 20 ins. wide. The interiors are finished in mahogany, handsomely carved and decorated, with ceilings of the same.

The general dimensions of the car are as follows: Length over end panels, 34 ft.; length over crown pieces, 45 ft.; from panel over crown piece at front end, 5 ft., and at rear end, 6 ft.; width over sills, including sheathing, 8 ft.; center of posts, 2 ft. 8 ins.; thickness of corner posts, 3¾ ins., and of side posts, 3¼ ins. The side sills are double, each 2¾ ins. x 7¾ ins., with space between to allow room for the large sashes. Sill plates on the outside are ⅝ in. x 8 ins. The center sills are composed of 7-in. I-beams, end sills are 4¾ ins. x 7¾ ins. Both upper and lower trusses are used. Height of platform step, 18 ins.; from step to platform, 14½ ins. The platform knees are reinforced with angle-iron, and angle-iron bumpers of Brill patented type protect and strengthen the platforms. The cars are mounted on the Brill 27-F E-1 trucks, with 33-in. wheels, and equipped with four 38-hp motors per car.

Emperor William has telegraphed his congratulations to the company engaged in the electrical experiments on the Marienfelde-Zossen Railroad, on attaining a speed of 125 4-5 m. p. h.

RAILWAY CIRCUIT BREAKERS

It has been the standard practice until recently to protect railway motor equipments by fuses. This method has been satisfactory only to a limited degree, as the fuse frequently fails to blow at the proper time, causing severe damage to the motor equipment. The delay caused by stopping a car to replace a



FIGS. 1 AND 2.—CAR AND SWITCHBOARD TYPES OF OIL CIRCUIT BREAKER

blown-out fuse is another serious objection to this method.

The automatic oil-car circuit breaker, manufactured by the Hartman Circuit Breaker Company, of Mansfield, Ohio, is designed to take the place of the fuse block and hood-switch on the car. It operates automatically upon an overload, and, at the same time, can be thrown by hand as readily as the ordinary hood-switch. It is said to be practically noiseless in operation—only a faint "click" being heard when the breaker opens even on the severest overload. The manufacturer believes that this feature will be appreciated where car circuit breakers with magnetic blow-out have been used.

The switch contacts are of the laminated type, to ensure



EXTERIOR OF COLUMBUS CAR

perfect electrical connection, and also to prevent "freezing" of the switch at critical periods. The arc is ruptured in oil upon auxiliary contacts. Of these there are four, connected in series, giving a quadruple break.

The circuit breaker shown in Fig. 1 has a capacity for continuous duty of 400 amps., and any desired overload adjustment can be secured from 100 amps. to 900 amps.

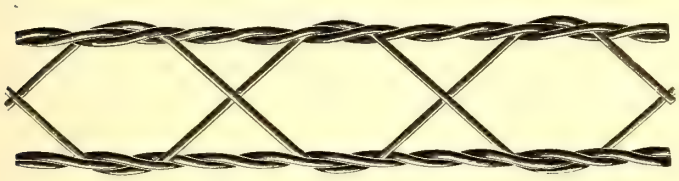
Fig. 2 represents the Hartman circuit breaker mounted for switchboard use. This circuit breaker is especially adapted for the protection of railway feeder circuits where the conditions are peculiarly exacting. The breaker cannot be thrown in while an overload exists, and thus dispenses with the necessity for using an additional switch on the circuit. As a hand switch it is stated to be as reliable as the ordinary knife switch but much safer to operate.

NEW TYPE OF RAILWAY FENCE

The Truss & Cable Fence Company, of Cleveland, Ohio, is manufacturing a wire fence that it believes will appeal to interurban railway builders as possessing a number of advantages. As shown in the accompanying illustration, it is a strand fence erected one strand at a time like a board fence, using as many strands as desired. This feature makes it frequently possible to effect a great saving in the amount of fencing used on a right of way, for in passing pasturage, timber land or grain fields it is not necessary to use as many strands as would be required where small animals are being confined.

Each strand is composed of six galvanized wires, the strength of each strand being equal to the combined tensile strength of all the wires. The six wires form two cables and a double truss, and it is claimed that there is no other way in which wires can be combined to give as great strength. In manufacturing the strands there are no short or abrupt twists, so that the galvanizing of the wire is not broken in any place, thus reducing the chances of rust. Each strand is independent of the others, so that if one strand is broken the remainder of the fence is not injured. It is constructed so that it can be fastened to a post in a way to prevent its stretching, and if a strand is cut or broken between two posts the fencing on either side of the posts will remain as rigid as before. It is claimed that it is impossible for a strand to unweave, and that the fence will not sag.

This type of fencing is especially adapted for rough and uneven country, because it follows the ground line, and there is no chance of its bagging or sagging when the fence changes its direction up and down. The fence is put up in small compact coils weighing about 100 lbs. each, making it convenient for handling and storing. In erecting, it is claimed that fewer posts are required than with ordinary woven wire

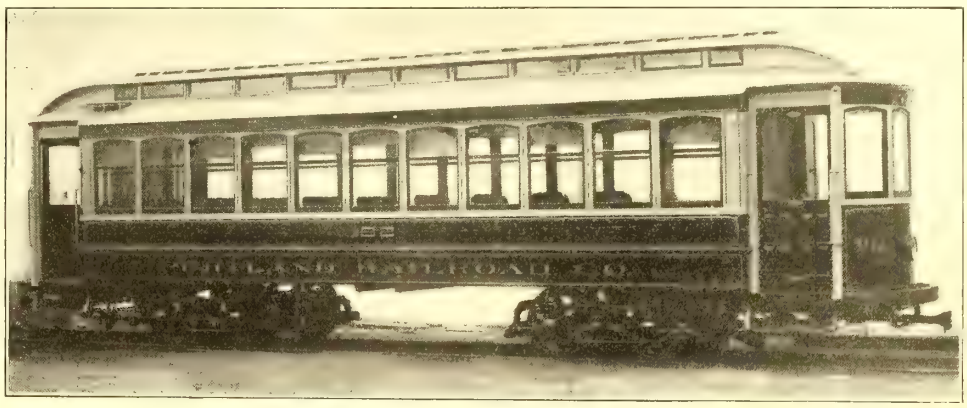


TRUSS AND CABLE FENCE

fences, and that any ordinary laborer can string this fence, as only a simple stretcher is used, which is fastened with ordinary staples. The cost of maintenance of a fence of this type is, of course, very low, as short sections of single strands may be inserted at any time, without the necessity of replacing entire sections. Two different widths are furnished, and for certain service the company advocates combining the two. Truss and cable fences are used by several leading steam railroads, among them the Pennsylvania, Erie and Atlantic Coast Line, and it has recently been adopted by several electric railways.

SEMI-CONVERTIBLE CARS FOR PORTLAND, MAINE

The Portland Railroad Company, of Portland, Maine, has lately received from the J. G. Brill Company three semi-convertible cars like that shown in the illustration. This type has been in considerable use on the lines in Portland for several years. The manner in which the city is laid out, the distance of the principal steam railroad station from the business portion of the city and the numerous suburban towns with which the electric lines connect renders it particularly well suited. In the summer Portland has a large transient population, composed of travelers going to summer resorts and requiring to make changes at that point. The city itself is a popular place in summer, being beautifully located at the head of a bay filled with islands, and within easy access to many popular resorts. The railway owns and operates several amusement parks, and



EXTERIOR OF PORTLAND CAR

the system extends over 90 miles of track, a large part of which is outside of the city proper.

It will be noticed that the cars have steam car roofs and substantial vestibules with folding doors. The windows, when not in use, are raised into roof pockets by the well-known method of this type. Plush upholstered, reversible-back seats are placed transversely with the car, and seat forty-four passengers. Length of the cars over end panels is 30 ft. 8 ins.; over vestibules, 40 ft. 1 in.; from panel over vestibules, 4 ft. 8½ ins.; width over sills, 7 ft. 8½ ins.; over post belt, 8 ft.; size of side sills, 4 ins. x 7¾ ins., ⅜-in. x 12-in. plates on the inside. The end sills are 5¼ ins. x 6⅞ ins.; thickness of corner posts, 3¾ ins., and the side posts, 3¼ ins.

Included with this shipment were two closed cars for winter service, 28 ft. over end panels and 37 ft. 5 ins. over vestibules; width over sills, 7 ft. 4 ins.; over post at belt, 7 ft. 7½ ins.; sweep of posts, 1¾ ins. The side sills are 4¾ ins. x 6¾ ins., with ½-in. x 6-in. plates. Among the patented specialties with which each car is equipped are the following: Track scrapers, "Dedenda" alarm gongs, "Dumpit" sand boxes and radial drawbars. All the cars are mounted on Brill 27-G trucks with 4-ft. wheel base, 33-in. wheels and 4¼-in. axles. Each car is equipped with four 38-hp motors.

PROSPERITY OF BRAZILIAN TRAMWAY COMPANY

The Sao Paulo Tramway Company, of Sao Paulo, Brazil, which was organized by F. S. Pearson, has made a satisfactory record of earnings since its organization two years ago. At that time $6,000,000 of 5 per cent bonds were sold largely to Toronto interests at 90, with a 100 per cent bonus in stock, and such investment now shows 90 per cent profit, the bonds selling at 95 and the stock at 85. At the top of the Toronto boom the stock sold as high as 118. Earnings have just been published for the first six months of this year. They show net receipts of $436,949, compared with $326,787 for the same period of 1902, a gain of $110,162, or 34 per cent. During the six months operating expenses were reduced $20,000, or 9 per cent. Earnings of the Sao Paulo Company now equal 8½ per cent on the $7,000,000 of capital stock ($1,000,000 of new stock having been issued last year at par $100).

THE PRIVATE CAR PALATINE

A very handsome private electric railway car was recently finished by the St. Louis Car Company, and is now in use at St. Louis. It is seldom that such a magnificent stock of African mahogany is available as the St. Louis Car Company had to draw from in the construction of this car. Unfortunately, the beauty of this mahogany finish cannot be reproduced, but the general appearance and furnishings of the car may be appreciated from an examination of the accompanying engraving of the interior. The car has two compartments, a smoker and parlor. At each end of the car is a double observation room. To make these observation rooms possible the entrance is at the center. The buffet is in the smoking compartment of the car. The settee which adorns the center of the parlor, as well as the other furniture, is upholstered in the finest quality of fabrics. The African mahogany finish is inlaid with artistic designs of marquetry. The car can carry a large supply of water, which is stored in a tank under the car, and forced into the toilets by compressed air. As can be seen the lighting is by St. Louis Car Company interior arc lamps. Incandescent lamps are also provided. The lower window sashes have polished beveled-edge plate-glass. The upper sashes are filled with cut plate-glass with an opalescent art glass in the center. This car has been placed on St. Louis Car Company No. 23-A trucks, and is equipped with that company's arc headlights. Charles H. Ledlie, consulting engineer of St. Louis, general manager of the Union Electric Light & Power Company, is the owner of this car.



EXTERIOR OF PRIVATE CAR "PALATINE"

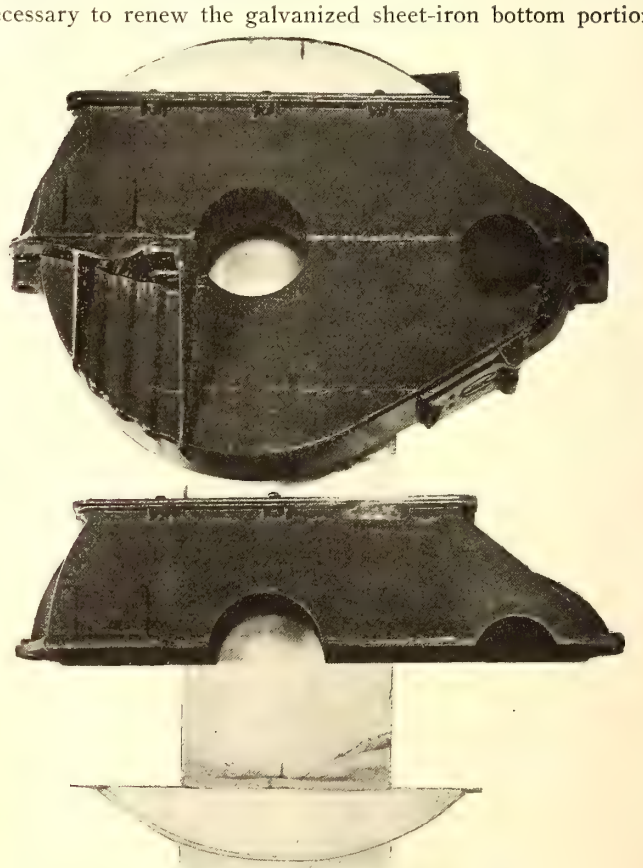


INTERIOR OF PRIVATE CAR "PALATINE"

GEAR CASES AT MILWAUKEE

In a discussion at the Saratoga Convention of the American Railway Mechanical and Electrical Association, Edwin W. Olds, superintendent of rolling stock of the Milwaukee Electric Railway & Light Company, described a gear case of rather novel construction which his company has used for about two years. An illustration of one of these cases is shown herewith. As will be seen, the bottom of the gear case is of galvanized iron, so that when obstructions on the street hit the case it does not wreck the whole casting, but simply makes a dent in the galvanized iron portion. The upper part of the gear case is of malleable cast-iron. The bottom part is No. 20 sheet-iron.

As stated by Mr. Olds in the discussion, none of these gear cases has been broken in service, although it is frequently necessary to renew the galvanized sheet-iron bottom portion.



SPECIAL GEAR CASE FOR MILWAUKEE

This goes to show that the company properly diagnosed the matter when it concluded that if blows from street obstructions could be cushioned the breakage of gear cases would be avoided.

The rapid extension of trolley lines connecting small towns in Indiana has greatly stimulated amusement enterprises. Medium-sized theatrical troupes now appear in such towns, and small theaters and opera houses are springing up rapidly.

QUESTION BOX OF PENNSYLVANIA STREET RAILWAY ASSOCIATION—I.

An innovation was introduced at the twelfth annual convention of the Pennsylvania Street Railway Association, held at Williamsport this year, in the form of a "Question Box," which consisted of a series of practical questions on all branches of railway operation and management. Copies of the list were mailed to members of the organization some time in advance of the meeting, and the questions, together with the answers received, were then printed in pamphlet form as a part of the official proceedings of the convention, thus making a very valuable contribution, indeed. The matter was divided under the following headings:

Power House Department.
Operation and Maintenance of Equipment.
Track and Roadway Department.
Bonding Department.
Overhead Line Department.
Management.

An abstract is presented herewith, covering the questions pertaining to power house machinery and practice, and will be followed in subsequent issues by abstracts from other parts of the document. The plan was received with universal favor by the members of the association.

POWER HOUSE DEPARTMENT

1. In boiler pumps for handling hot water, 200 deg. F. and hotter, what results have been obtained by using ball valves instead of usual flat valves, composition or otherwise?

It is my experience that any pump, handling hot water 200 deg. F. or higher, can be profitably changed over to use ball valves throughout on the water end. The space available for valves may make such change impossible, but in the Dean pump, which is used in our Edison plant, complete equipment of ball valves, with necessary cages, replaced the regular spring controlled disc valves. With the old disc valves, there was always more or less hammering, and valves were refaced or renewed regularly every few months. Since ball valves are used, the action of the pump is smooth and there is no evidence of wear on either ball or seat. The balls and seats, ground to fit, were purchased from a local firm. These with a brass casting for cage and a cast-iron bushing for old valve seat, represented our entire bill of material. The fitting and lathe work was done by the power house employees. The cost for material was approximately $1.25 per valve for 2-in. ball system.—Paul A. Hess.

Have always used flat valves, which have given satisfaction.—H.

In making this change, it is essential that the balls be absolutely true and balanced, and of ample weight to keep their shape under heavy service. Above 2 ins., hollow brass balls are recommended. Use bronze flat valves and find them satisfactory.—A.

With a properly proportioned and balanced ball, it is only necessary to provide a seat ground to fit the ball, and some sort of cage over the ball, rounded up inside at top to the same shape as the seat below, so that ball in rising will meet with a surface similar to its own shape, and of height sufficient to give proper life to ball.—Editor.

2. What type of boiler feed pumps has given satisfactory service with water 200 deg. F. to 210 deg. F.? What is the minimum head of hot water supply above pump suction for reliable pumping service?

Our experience has been that the Knowles double pump works very satisfactorily with water up to 200 deg. F. to 210 deg. F. Three feet head meets all requirements for hot water—F. B. Musser.

Knowles and Blake pumps.—H.

Brass lined outside packed, plunger type of pumps. A head of 4 ft. or 5 ft. is desirable.—M.

The Worthington Admiralty type. Three feet of head with a short and direct connection of ample size; but with a long pipe or several bends in run, the head should be greater.—A.

3. What is the most economical and reliable method for handling drips and condensation from various classes of steam piping?

The steam loop and Holly gravity return system will accomplish this work with the minimum operating and maintenance costs. This system, modified to suit special plant conditions has been installed in practically all modern, high-grade plants.—E. H. Sniffen.

Holly gravity return system. In a recent complete efficiency test of a 1000-kw modern plant, in which almost exactly 200,000 lbs. were evaporated in twenty-four hours, the Holly system required 2300 lbs. of steam in twenty-four hours—slightly over 1 per cent of steam generated.—Editor.

4. Is there any type of steam trap which can be depended on for high-pressure steam lines?

I understand the Flinn mercurial trap works very satisfactorily on high-pressure lines.—E. H. Foster.

The T. K. Kiely trap gives reliable service.—F. B. Musser.

Not only has my experience with steam traps been bad, but I can find practically no engineers who have obtained satisfactory results with reasonable care.—J. O'Toole.

We have found none entirely reliable or satisfactory.—H.

The Pennsylvania Railroad report reliable service from a special open pan float trap, built and guaranteed by one of their steam piping contractors. This trap does not return condensation to boilers, but is generally discharged into an open heater.—Editor.

5. What are relative merits of extra heavy iron and brass for hot feed water piping?

Iron and steel pipe on hot water feed piping is very unreliable, as the hot water corrodes and eats through the pipe from the inside, and also clogs up the feed pipe entering boiler. Brass, on the other hand, is not affected by hot water.—F. B. Musser.

Brass is, in our experience, best for permanent construction. —H.

Brass is preferable where condensed water is used (as iron will pit in a few years); and where there is considerable expansion in short connections.—A.

6. What advantage or economy is obtained by the use of automatic boiler feeding devices?

The use of automatic boiler feeding devices secures a uniform level of water in the boiler, thereby preventing uneven expansion and contraction. Such device also makes boiler steam more uniformly.—F. B. Musser.

We find it best to use regular water tenders to better provide for emergencies.—H.

Inquiry among plants which have used such devices for some years brought out the following statements: "No trouble, better quality of steam, and saving in fuel over our previous results of 5 per cent to 10 per cent," and "A good investment absolutely reliable and practically no repairs necessary. Stops the fireman from filling up the boiler every time steam pressure raises up or blows off. Makes the fireman coal more carefully, and watch the draft in order to maintain even steam line."—J. O'Toole.

No economy in labor except in a very large boiler room, but better regulation. They are also advantageous, provided with a high and low water alarm to give notice of danger.—A.

7. Is there a damper regulator which will control steam pressure within 2 per cent or 3 per cent of normal under railway load conditions?

After thorough trial of several well-known damper regulators, we found none that would control steam pressure closer than 5 lbs. on either side of normal. The damper regulator which gave the closest regulation was one which either entirely closed or opened damper when steam pressure was above or below normal.—J. O'Toole.

Any of the well-known standard makes will accomplish this result, provided fluctuations are reasonable in extent.—H.

Locke damper regulator controls within 2 per cent or 3 per cent under ordinary conditions.—F. B. Musser.

8. What is the best arrangement of valves on individual boiler feed lines in order to regulate water supply, and to permit independent separation of any boiler feed from main supply lines?

Taking valves in order from main feed water line, and assuming 2-in. line to each boiler: (a) Globe or Gate valve, (b) Globe valve, metal seat, for regulating supply, (c) Ball check, and (d) Globe or Gate valve. With this combination the only valve subjected to cutting or serious wear can be repaired or replaced without affecting other boilers.—Paul A. Hess.

Loop feeder water mains, with valves in same to cut out individual boilers.—H.

Duplicate mains provided so that sections of mains and pipes to individual boilers can be cut out.—A.

9. What is the smallest size of boiler plant, or minimum coal consumption, which warrants the use of automatic stokers?

From the labor-saving side of the question, a boiler plant will warrant the use of stokers as soon as it reaches a size requiring the attention of more than one fireman. The fuel saving by the use of a good stoker will be a certain percentage over hand-firing; consequently the size of the boiler plant has little bearing on the question of fuel economy. The labor required for operating the boiler plant is, therefore, the most important question in determining how small a plant will warrant the use of mechanical stokers, and I would say as soon as the plant reaches a size requiring more than one man for hand-firing, stokers would then be a profitable investment.—E. H. Sniffin.

When the plant requires 1600 hp in boilers for regular service, corresponding to an annual coal consumption approximating 16,000 tons.—H.

A plant using about 40 tons of coal on a single 10-hour shift is the dividing line.—A.

The statement of a number of the large lighting stations, using both automatic stoking and hand-firing is that automatic stokers offer no especial advantage where plants are burning less than 1½ tons of coal per hour and able to obtain fair steam coal at a reasonable price. The handling of 1½ tons of coal per hour seems to be regarded as the limit for one fireman with hand-firing furnaces, and it would require one fireman to look after a stoker.—Editor.

10. What is the comparative economy, including operation and maintenance, of automatic stokers and hand firing?

The comparative economy of automatic stokers and hand-firing will be so much affected by local conditions, such as size of plant, kind of fuel, hours per day under full service, etc., that it is difficult to make a definite statement. It is, however, a fair estimate that under average street railway conditions, with the average size of boiler plant, a properly designed and operated stoker should show an economy, including operation and maintenance of 10 per cent and upwards over average hand-firing.—E. H. Sniffin.

Last week we made tests in our boiler house which will interest you. As you know we have put on one of our boilers ——— stoker, and these people guaranteed us a saving in coal of 10 per cent against the best hand-firing. At first we made a test of eight hours, the stoker people getting a saving in coal of a little more than 5 per cent. When we stated then to the representative that he had several advantages against our hand-feeding at this test, he requested to have another test of twenty-four hours. We allowed this after he had signed an agreement in which we gave our conditions. And one of them was that this test should be considered final.

After this test was finished, we saw that we not only worked with the same success with our hand-firing, but had saved 1 per cent more than the stoker man. The man left my office with the words, "I am a sad buried man." As a reason for his defeat, he claims that besides the good fireman we placed against him, our chimney draft was too good. He stated then that with their stoker they got good results only by using Western coal, and where the chimney draft was not so good.—M. E.

The cost of firing boilers by hand or by automatic stokers will at the end of the year be practically equal when the cost of maintenance plus labor is equated, for the stokers against the cost of labor plus maintenance of hand-fired grates.—H. S. N. Y.

Practically no difference in total costs, when all repairs, etc., are included.—H.

In one instance, the boiler room cost for hand-firing, including unloading coal, handling ashes, firing and tending water, was 35 cents per ton; and with stokers, 17 cents per ton. The additional cost for repairs to stokers over hand-fired furnaces was 3 cents per ton.—A.

The figures furnished by a number of the Edison stations, in the matter of hand-firing versus automatic stoking, are as follows: Hand-fired furnaces 25 cents to 32 cents a ton to charge the coal under the boilers. Automatic stokers, in connection with overhead coal bins, 6 cents to 7 cents a ton to charge the furnaces. Repairs are reported from 25 cents to $1 per horse-power per annum more with automatic stokers than with hand-fired furnaces.

In addition the following data was submitted by G. B. Leland: Plant consisting of four 250 hp Babcock & Wilcox boilers, equipped with American stokers, with induced draft, we found the saving over hand-firing to be approximately 30 per cent, using run of mine coal, which cost $2.35 in the bin, from which we were enabled to obtain the equivalent of 11.25 lbs. from and at 212 deg. The cost of renewals and repairs to the stoker was equal to 25.8 lbs. of castings per horse-power per year. The stokers consumed approximately 2 per cent of the steam generated to operate them. On an overload test they would run up to 100 per cent over their rated loads without unsatisfactory results. The stokers cost approximately $3.50 per B. H. P. installed.—Editor.

11. Are there any automatic stokers which are equally adapted for burning bituminous and small sizes of anthracite coal?

The Roney mechanical stoker has been in operation for the past five years at the power station of the Metropolitan Street Railway Company, in New York City, and in other street railway power houses burning both bituminous and anthracite coal.—E. H. Sniffin.

No.—H.

12. Can a boiler be forced as hard with automatic stokers as with hand firing?

With suitable draft and fuel, it is possible with a mechanical stoker to maintain a higher percentage of overload capacity than with the average hand-firing. Boilers have been fired with the Roney mechanical stoker 200 per cent, or three times their rated capacity, and it is a common occurrence for boilers fitted with this stoker to run as high as 70 per cent above rating continuously for twenty-four hours with good bituminous coal.—E. H. Sniffin.

No.—H.

No. The fireman is unable to work his fires with an automatic stoker.—F. B. Musser.

Yes, if forced draft is used.—A.

13. Is there any rapid, simple and easily manipulated apparatus for testing flue gases?

Either the Econometer or the Orsatt apparatus.—A.

The only apparatus which has been tested in power house service and reasonable in cost, is a modified balance type, the Arndt Econometer. This instrument has been tested in power house service by the Chicago Edison Company, and their reports indicate a sufficient commercial accuracy for station purposes. As arranged by them, samples of flue gases can be taken from any boiler during operation by pipe connecting each uptake with test room and the efficiency of the firing is continuously shown by the position of the balance pointer on the attached scale of percentages, the per cent of carbonic acid gas present. This same instrument was carefully examined into on behalf of the Steam Users' Association by R. S. Hale, and his tests and report on this instrument show it to be reliable and a valuable adjunct to the testing equipment of any power house.—Editor.

14. Is there any hot water meter which can be run continuously and maintain reasonable accuracy?

Our experience with hot water meters in the high pressure feed line has been unsatisfactory. The meter seemed to be subject to variable errors, and it was impossible to depend on same for continuous records. The meters we tested were run at low loads, but there were frequent breakages of parts and the meters were thrown out of service.—J. O'Toole.

Some impulse meters have given good results.—A.

Meter manufacturers generally decline to make any guarantees as to continued accuracy of their hot water meters when operated continuously on high pressure boiler-feed lines. Their advice is to arrange by-pass and only cut-in meter for periodical test runs. If so used, the accuracy claimed is within 5 per cent. This applies to meters of both the displacement and impulse types and is in harmony with the observations of R. S. Hale on European hot water meters.—Editor.

15. Has the Venturi meter been applied to measuring feed supply to boiler? If so, what results have been obtained?

The Venturi meter has been used on boilers and the results are expected to be satisfactory.—A.

16. Is it easier for the firemen to handle coal from the floor with a long-handled shovel or from a charging car with a short-handled shovel?

From the floor with a long-handled shovel.—H.

The fireman can handle coal from the floor with a long-handled shovel easier, because he can put his weight on the shovel more advantageously.—F. B. Musser.

The practice in the matter seems to be largely one of local customs. The firemen in a plant where method of handling coal was changed from floor dump to charging car states that at first it was much harder to work the short-handled shovel in connection with charging car; but after a little practice this opinion changed. The knack of swinging shovel secured, the convenience of having all coal grouped in cars in front of furnaces at a distance requiring practically no additional work beyond filling the shovel and throwing into the fire, made this arrangement preferable to the men.—J. O'Toole.

17. What is the boiler room labor cost per ton fired, to cover coal and ash handling?

57.2 cents per ton of coal used.—F. B. Musser.

About 40.9 cents per net ton.—H.

Total labor cost, including dumping from cars, firing into furnaces, and wheeling out ashes, 21 cents per short ton. Coal—run-of-mine bituminous and high in ash.—J. O'Toole.

Our coal, anthracite No. 3 buckwheat, is delivered by carts close to the fire room. Average cost per long ton for firing and wheeling ashes about 150 ft. is 37 cents.—Paul A. Hess.

18. Which is the better or more economical method of increasing boiler capacity during heavy peak loads—forced or induced draft?

This question must be determined largely by the question of the coal used. With the smallest size of anthracite coal, the best results can be obtained by maintaining a reasonable pressure in the ash pit; while with bituminous coal, induced draft is the more economical method of increasing boiler capacity under heavy peak loads. The combination of induced and forced draft with small anthracite coal has been found very effective. There are some large street railway power plants provided with chimneys of sufficient heights to carry the average load and fitted with induced draft fans, arranged by means of dampers, to take care of

the peak of the load, and in effect increase the height of the chimney in accordance with the demands for steam. These fans act as boosters for the draft, and are very effective when thus used.—E. H. Sniffin.

Forced draft, because induced draft increases leakage through settings.—A.

19. Under what conditions is it more advisable to use mechanical instead of natural draft in the regular operation of a plant?

Experience thus far has shown that small or moderate-sized boiler plants are benefited by the use of mechanical draft, for the reason that their economy is more affected by a fluctuating load than are large plants where the variations in the load are distributed over a large number of boilers. It is also advisable to use mechanical induced draft in the place of natural draft when economizers are used, to overcome the loss in draft both by the cooling of the gases and by the mechanical interference with their flow. If natural draft is used, a very tall chimney is required, whereas induced draft will overcome the effect of the economizers and at the same time take care of the peak of the load by increasing the speed of the fans at the time of the greatest demand for steam. There are many railroad plants equipped with economizers and induced draft, where the engines operating the fans are fitted with automatic valve on the steam line, which regulates the speed of the fans according to the boiler pressure and the demand for steam. This is accomplished without any increase of attention by the fireman.—E. H. Sniffin.

Natural draft is preferable.—H.

A large Westerr street railway company recently substituted natural for induced draft, as it was found that the coal required to drive the fan engines for the latter system would pay for the chimney in a short time.

The plant should have sufficient natural draft for ordinary conditions and be supplemented by forced draft for emergencies.—A.

20. Is there any financial economy in lining steel stacks with brick? If so, to what height should lining be carried and what kind of brick used?

The Bethlehem Steel Company is reported as having a steel stack, completely lined with fire brick and yet corroded badly.—M. E.

21. What is relative cost of regular brick, special custodis, and self-supporting brick-lined steel stacks from 160 ft. to 200 ft. high?

In competition we find custodis chimneys are about 10 per cent cheaper than well designed common brick chimneys, besides being lighter and requiring less costly foundations. As compared with lined steel stacks, custodis type is generally cheaper, but there is no way of giving average comparison.—William L. Greeley.

22. Is there any way to protect the interior of brick stacks against cracking and disintegration when boilers are forced and stack temperature is approximately 650 deg. F.?

We presume this refers to the cracking noticeable in the inner core of common brick chimneys as ordinarily designed, and where the core usually has a thin wall of considerable height with consequent pressure. The material used in the custodis chimneys is specially prepared for the purpose, and will not crack at temperatures up to 650 deg. F. Where the temperatures are likely to be much higher and where explosions occur, a sectional lining is used. By so dividing the lining, the expansion is similarly reduced, preventing the lining from cracking. In case lower sections of lining are burned out, these can be replaced without disturbing the upper.—William L. Greeley.

We have experienced no trouble with cracking at 650 deg. F.—H.

23. Is there any reliable method of testing soils in order to ensure brick chimney against cracks and other defects, due to irregular settling of foundation?

The most reliable method of testing soil to ascertain its carrying capacity is to impose loads on it, either with dead weight or by a system of levers and observing the actual settlement. In case foundation is liable to settlement, it should be built of concrete with a grill work of iron rails or expanded metal.—William L. Greeley.

The best plan is to consult and contract with experienced chimney constructing firms, who will examine soil and erect chimney under suitable guarantees covering settling, etc.—H.

24. What difficulties have been experienced with superheaters?

With highly superheated steam, the difficulties are liability of superheated tubes to burn out, and engine lubrication, unless special valve system, like poppet type, is used. Inquiry concerning superheater at a large mill in Philadelphia developed the fact that superheater had been burned out after comparatively short service.—M. E.

Experience with superheaters, heating steam up to 800 deg. F., and in service for considerable period of time, indicates that no troubles are experienced other than those due to gross carelessness in management, and the ordinary wear and tear of settings and furnaces. In one case a superheater was damaged by building a fierce fire under it and subjecting it to this severe heat for several hours with no steam passing through. This same superheater has repeatedly had the flow of steam stopped for half an hour at a time, with no damage whatever. With ordinary care, the superheater is easier to handle than a boiler, and fully as durable. I have seen temperatures of 940 deg. and over realized in a separate superheater, for short periods, without damage to engine or superheater.—Richard H. Rice.

With reasonable care, there is no difficulty with gridiron valves, using steam superheated 100 deg. F. to 105 deg. F., and steam pressure 160 lbs.—H.

25. With moderate superheating, not over 150 deg. F., in plant of 1000 B. H. P., is it more economical or advantegous to install one separately fired superheater or an individual superheater for each boiler?

It is probably more advantageous to install individual superheaters for each boiler within the setting because of the greater economy of burning fuel in large quantities and also in the diminished radiation.—E. H. Foster.

Separately fired.—H.

With moderate superheating, up to 150 deg. F., it is desirable to install a separately fired superheater, because with the individual superheater connected with each boiler the temperature of the steam is highest when the boilers are being forced and load is heaviest, and least when the load is lightest—exactly the reverse of the conditions called for by the engine when operating under the safest and most economical conditions. When an engine is operating with early cut-off and light load the tendency to cylinder condensation is greatest and consequently a high degree of superheating is advisable to overcome this tendency. On the other hand, at late cut-off, a high degree of superheat would be liable to cause damage to the engine, since on account of the diminished tendency to cylinder condensation at the late cut-off, less superheat is used up in overcoming such tendency, and the mean temperature in the cylinder during admission and expansion is therefore higher. For best economy, the temperature of the steam should vary inversely as the load; while the boiler superheater varies it directly as the load. This latter condition forces the use of the lower average temperature than is possible with the independent superheater, and therefore makes it impossible to secure the maximum benefit from superheating. The independent superheater also permits the temperature to be exactly regulated at will, involves less complication of piping and valves and can be more readily repaired and kept in order.—Richard H. Rice.

26. To what extent can superheating be carried safely in plants operating engines with Corliss, gridiron, or usual types of valves?

To a temperature of 500 deg. F., corresponding to a superheat of about 150 deg. above the normal temperature of steam at usual pressures.—E. H. Foster.

The Boston Edison Company use Babcock & Wilcox superheater, and with 100 deg. superheat experience no difficulty in the operation of gridiron valves. Practically all first-class engine builders will guarantee the operation of their valve system and engines to be entirely satisfactory using steam up to 500 deg. F. With steam temperatures in excess of 500 deg. F., poppet valves are recommended.—P.

With 160 lbs. steam pressure, superheating 100 deg. F. is safe.—H.

Not over 50 deg. F. with Corliss or other unbalanced valves.—A.

The extent to which superheating can be safely carried with usual types of valves, depends somewhat upon the nature of the service as to variability of load, and upon the type of superheater. With cut-off at about one-fourth stroke and a steady load, 480 deg. to 500 deg. temperature of steam at the cylinder is permissible; but if the cut-off goes to one-half stroke, a reduction of temperature is necessary. With the varying loads of street railway service and boiler superheaters, 450 deg. to 460 deg. is the highest safe average temperature of steam. If, however, compound engines, fitted with ordinary types of valves, are supplied with a Schmidt reheater receiver, 550 deg. to 600 deg. steam can be safely utilized. The function of this device is to reduce the temperature of the steam passing into the high pressure cylinder when the load on the engine increases, and to increase the temperature when the load falls off. This is performed by using more or less of the steam in the main steam pipe to superheat to a greater or less degree the steam entering the low pressure cylinder. The heat abstracted from the steam entering the high pressure cylinder is therefore not lost, but used to increase the efficiency of the low pressure cylinder; and the action of the apparatus is to preserve the best conditions in each cylinder for all conditions of load, and to maintain the cylinder temperature within safe limits. This per-

mits of the use of a maximum temperature of superheat at all times.—Richard H. Rice.

27. What is net gain in coal economy by the use of either moderately or highly superheated steam?

Net gain in coal economy has been frequently reported at from 8 per cent to 40 per cent. The more wasteful steam engines show the greater percentage of saving. With an ordinary cross-compound Corliss engine, it is safe to count on a coal saving from 8 per cent to 15 per cent, steam superheated 150 deg. F.—E. H. Foster.

A conservative estimate of the saving due to moderate superheating is 10 per cent.—H.

Compared with engines using saturated steam, the use of 150 deg. superheat will save roughly 12 per cent to 14 per cent of steam, and 8 per cent to 9 per cent of fuel; while 300 deg. superheat means a saving of 25 per cent to 30 per cent of steam and 16 per cent to 20 per cent of fuel. These figures are based on actual results. The use of superheat renders beneficial also the use of a high vacuum, the increase of temperature range in the cylinder with superheated steam not involving any increase in cylinder condensation. Curves of steam and heat consumption obtained from various types of engines tested under varying degrees of superheating show that the gain due to the superheat increases more rapidly than the temperature; and it is therefore advisable to carry superheating as high as possible without appearance of superheat in the exhaust. With 140 lbs. to 150 lbs. boiler pressure, engines on the Schmidt system can use steam at a temperature of 750 deg. to 800 deg. with safety and without superheating the exhaust; and under these conditions and a vacuum of 27 ins. to 28 ins. these engines develop a horse-power from 8.9 lbs. to 9 lbs. steam, at rated load; while the variation of economy is less than with saturated steam, under varying load.—Richard H. Rice.

The following data were obtained concerning the economy of the steam plant of Milbourne Mills, Philadelphia, Pa., equipped with separately fired Schmidt superheater and Rice & Sargent engines:

Temperature of steam, approximately, 700 deg. F.

Coal consumption per day, using steam at above temperature, 23,000 lbs.

Coal consumption per day, using saturated steam, superheater cut out, 32,000 lbs.

Approximate net saving due to the use of highly superheated steam, 9000 lbs. coal, or 28 per cent.—Editor.

28. What precautions are necessary to avoid trouble with cylinder and valve lubrication with superheated steam?

Use ordinarily good oil and lubricate positively, or, in obstinate cases, lubricate the cylinder direct.—E. H. Foster.

No trouble if good grade cylinder oil is used and positive feed be used.—H.

The best quality cylinder oil must be used, and fed positively as by oil pump.—A.

The only precautions necessary to avoid trouble with cylinder and valve lubrication with superheated steam, are, first, to use oil having a very small percentage of animal or vegetable constituents; that is, to have the oil as nearly as possible a pure mineral oil, and to have the flash point of the oil regulated in proportion to the amount of superheat which is being used. The higher superheats requiring a flash point of 600 deg. to 650 deg. in air, corresponding to about 700 deg. to 750 deg. under pressure of 140 lbs. per square inch. It is also necessary to avoid the use of springs in the piston packing and to arrange the stuffing boxes with cast-iron rings instead of bronze or soft metal. With highly superheated steam it is necessary to keep the stuffing boxes well away from the high temperatures existing in the cylinders, and in some cases to water-jacket the packings to protect them from the superheat. With this steam it is also necessary to use poppet or piston valves, and to design the cylinder so that the barrel is free from ribs or passages. Lubrication should be by positive oil pumps, rather than displacement cups; and brass, bronze, composition, copper or other similar materials should be kept away from the action of the steam, under which they rapidly deteriorate. All pipes and cylinders should be covered with not less than 3 ins. thickness of non-conducting material of the best quality; and it may not be out of place to mention that recent experimens indicate that this same thickness is economical for saturated steam and pays a handsome return on the investment.—Richard H. Rice.

29. Does the use of superheated steam require a different ratio of high and low pressure cylinders than for saturated steam?

With superheated steam, a higher ratio between the two cylinders may be used because of the elimination of cylinder condensation.—E. H. Foster.

No. Same engines have been used with saturated and superheated system.—H.

30. What type of gasket is best to use in superheated steam mains?

Corrugated brass gaskets have been found to give excellent results. Also woven wire and asbestos gaskets.—E. H. Foster.

Corrugated copper gaskets.—H.

Either ground joints or copper gaskets. No rubber or fiber.—A.

The best gasket for use in superheated steam mains is an asbestos gasket made as thin as possible, and with just sufficient rubber or other binding material to hold the asbestos together and prevent access of moisture to the fibers during the time when saturated steam is passing through the mains.—Richard H. Rice.

We are using corrugated copper gaskets in one of our plants, equipped for moderately superheated steam. This choice was largely due to the experience of the Boston Edison Company with similar gaskets on their superheated steam lines.—Editor.

DISCUSSION ON QUESTIONS 24 TO 30, INCLUSIVE, ON SUPERHEATED STEAM

Mr. Wendle—What changes, if any, are necessary in the present piping systems in the smaller stations?

Mr. Rice—It would likely be necessary to change gaskets and put on a greater thickness of covering. The flanges should be covered after it is certain that the joints are tight. Precautions would have to be taken in regard to increased expansion in the steam lines. I think it would be necessary to remove all the brass or bronze rods. We find a rapid deterioration of such rods takes place.

President Davis—Within your own experience, what has been the effect of 100 deg. superheat in old plants?

Mr. Rice—Where plants have been adapted to the new conditions, no trouble has been experienced.

President Davis—Does the saving amount to 10 per cent under ordinary commercial conditions?

Mr. Rice—I do not think there is any question about it—the actual percentage depends on the degree of superheat.

Mr. Wendle—In connection with an engine proposition, where the guarantees covered saturated and highly superheated steam, there was a difference of 3 lbs. of steam per ihp per hour. The question then was, how much coal per ihp was required to operate the superheater, not only under full load, but under average load conditions obtaining in railway service? Can Mr. Rice state how much this amounts to—banking and all other items included?

Mr. Rice—We have made some tests, but owing to the illness of Professor Jacobus, we have not received the final results. In general, about .15 lb. of coal is required to superheat 1 lb. of steam 250 deg. This would cover full load conditions, and our experience is that superheater efficiency if fairly maintained through a wide range.

Mr. Wendle—If the superheater furnace is operated similarly to boiler fires, then, as the load varied or fell off, the superheater fire required would not fall off in proportion. Suppose the average load on a railway engine is 30 per cent of the full load, and that the superheating requires .15 lb. of coal per ihp at full load, amounting to, say, 14 per cent of coal consumption of engine, what variation would there be in the .15 lb. and in the percentage of coal required by superheater, as compared to total engine consumption, under average load conditions?

Mr. Rice—It would be a smaller percentage of the actual coal used with light load than with full load, because your engine economy is decreasing with decreased load and the superheater economy remains more nearly constant.

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31. In 500-kw units, what are the relative merits of steam turbines and modern compound condensing engines in total first cost and operating economy?

The steam turbine is less in original cost than the corresponding size of steam engine when the latter is put upon the same basis of economy and capacity. Aside from being lower in first cost, it requires a comparatively inexpensive foundation, and there is also frequently much saved in the way of space that would be valuable for other purposes.—E. H. Sniffin.

Actual results with modern compound condensing engines, 160 lbs. steam pressure and 26 seconds vacuum:

One-half load, 14.25 lbs. steam per ihp.

Three-fourths load, 13.4 lbs. steam per ihp.

Full load, 12.5 lbs. to 12.75 lbs. steam per ihp.—H.

Comparison between the 500-kw turbo-generator set, running at 1800 r.p.m., and a modern compound-condensing 500-kw engine unit, running at 125 r.p.m., shows a saving in first cost of about 25 per cent to 30 per cent. This comparison covers the steam prime mover, the electric generator, and all auxiliary machinery, with the exception of the condensing apparatus. In addition, there will be a large saving in first cost for—(A) real estate, (B) buildings, (C) foundations, and (D) smaller items due to decrease in floor space needed, weight, and to the steady revolving motion

of turbine. The operating economy will also be better for the turbine, on account of—(A) higher thermal efficiency of the turbine, (B) reduction in cost of maintenance, due to simplicity of turbine construction, (C) reduction in cost for attendance (all oiling being automatic), (D) saving in oil, and (E) saving in boiler feed-water by use of surface condensers. The lubrication is done by a circulating oil pump, and one-half barrel of oil is about sufficient for a 500-kw set. This oil can be used over and over again until deteriorated. As oil cannot come in contact with steam, no precautions are required in using condensing water for boiler supply.—R. E. Moore.

The operating economy of the turbine unit, erected ready for piping, is given unofficially to the editor as practically 10 per cent less than a high-grade compound condensing Corliss engine.

The operating economy of the turbine unit, considered by itself, is better than the compound condensing Corliss unit; but where direct current is the entire output and direct distribution is possible, there is considerable doubt whether the generating cost, including fixed charges, is not more with the turbine unit and necessary rotaries, etc., than with compound condensing Corliss engines.

32. What overload can be carried by a steam turbine under the control of the governor and without opening bypass or turning on additional nozzles by hand?

The steam turbine should be rated at its greatest capacity, for at that point it gives its best efficiency, and then by means of a bypass it is able to carry 50 per cent overload; or it would give the full rating non-condensing.—E. H. Sniffin.

The DeLaval practically limits the economical range under governor control to 10 per cent above rating.

The Parsons to about 25 per cent, as per tests.

The Curtis does not furnish this information.

On any of the above turbines, extreme overloads up to 50 per cent are taken care of by opening additional nozzles or a bypass. —W.

We build our steam turbines to stand, as a whole, a somewhat larger overload than first-class reciprocating engines. Generally the overload capacity will be determined by the generator capacity, which will usually allow 50 per cent overload for two hours. Our turbine has no by-passes.—R. E. Moore.

33. Does a steam turbine require a special or more expensive condensing equipment than reciprocating engines?

The steam turbine does not require a more expensive condensing equipment than reciprocating engines. To obtain high vacuum, like 27 seconds or 28 seconds, of course requires more expensive condensing apparatus than the lower vacuums, but it requires simply to capitalize the difference in efficiency to prove or disprove the desirability of the extra expense. Usually, high vacuum will be found to pay.—E. H. Sniffin.

From statements of turbine and condenser manufacturers, the general demand is for 28 ins. vacuum, using surface condensers, with two stage air pumps, and every refinement to increase this performance. The condenser manufacturers seem unwilling to furnish any actual figures, but advise that the cost of high vacuum equipment is considerably in excess of that usually supplied for reciprocating engines and giving 26 ins. to 27 ins. vacuum.—J. O'Toole.

It does not require a more expensive equipment; but a high vacuum gives a better efficiency in a turbine than in a reciprocating engine.—A.

An examination of curves, deduced by Mr. Emmett, shows clearly the rapid increase in efficiency of the turbine with high vacuum, and therefore the advisability, in most cases, of the best possible condensing equipment.—R. E. Moore.

34. What is best type of condensing equipment for steam turbines?

There is no particular type of condenser equipment specially adapted to the steam turbine. The type of condenser depends upon the conditions, and in steam turbine practice there are no characteristic limitations.—E. H. Sniffin.

It is our standard practice to use surface condensing equipments, the reasons being higher vacuum and possibility of again reusing boiler feed-water.—R. E. Moore.

An examination of a number of the latest steam turbine installations indicates a special preference for—(a) surface condensers placed as close to the turbine as permissible; (b) centrifugal circulating pumps, operating in connection with a syphon system of water piping, and (c) air pumps of either the Edwards or two stage dry air type.

An equipment of this type, with the amount of piping required, was estimated, by a large steam piping and plant contractor, to cost not less than four times as much as a modern central condensing system suitable for a first-class reciprocating engine plant. —Editor.

35. What vacuum is regularly obtained at the engine cylinder in plants equipped with central condensing system?

Twenty-five inches is good.—A.

Twenty-five and one-half inches with central condensing system, and 26½ ins. with surface condenser near engines.—H.

36. What is the relative cost of fan and natural draft cooling towers for condensing systems? What vacuum can be obtained with their use?

Cooling towers cost about $6 per hp, basing hp rating on Corliss engine performance; vacuum obtainable, 24-ins. to 26-ins., depending on atmospheric conditions.—H. C. Reagan.

37. What is best form of automatic atmospheric exhaust valve for use in condensing plants?

Schutte automatic exhause valve is entirely reliable.—F. B. Musser.

W. H. Gullison Company, of Boston, Mass., makes a satisfactory one.—H.

38. What is relative value of run-of-mine bituminous and the small sizes of anthracite coal in regular plant service, including banking, etc.?

With the grades of bituminous and anthracite coal furnished in our market, we can afford to pay 15 per cent more for a short ton of run-of-mine bituminous coal than for a long ton of anthracite coal No. 3 buckwheat.—Paul A. Hess.

If both coals are clean, there is little difference in the heating power. Any difference in results is due to the method of firing.—A.

39. What is the cost per ton, exclusive of fixed charges on equipment, for handling coal from car to boiler room bins with modern coal and ash conveying machinery, assuming an annual coal consumption of 6000 tons to 10,000 tons?

With such a small annual consumption, it is questionable whether the maintenance and fixed charges on any conveying system would not amount to more than cartage. A modern coal and ash conveying equipment, suitable for handling coal for storage, conveying to boiler room bins and for taking out ashes, would probably cost $15,000 to $20,000, and the relatively low interest and depreciation charge of 10 per cent would make the costs of any such system prohibitive, even if the actual operating cost nothing.—W.

Shoveling coal off car, 5 cents a ton; conveying, 1 cent a ton; and handling ashes, 2 cents per ton of coal.—A.

40. What is the cheapest method for handling ashes in plants of 1000 B. H. P. to 1500 B. H. P.?

Dump directly into conveyer.—A.

Ash cars or barrows would probably be the only method at a reasonable cost.—W.

41. Are economizers a profitable investment in a 1000-hp condensing plant?

We consider they are decidedly. In a plant of 1000 hp we would very conservatively say an economizer will save 10 per cent in fuel. Records show over this. The cost of such an economizer installed and bricked in ready for work would be about $5,200. Taking 3.70 lbs. of coal burned per B. H. P. on boilers for 365 days in the year, and coal at $3 on the grates, an electric plant would consume about $18,000 of coal per annum. Ten per cent of this would make a saving of $1,800.

Allowing 5 per cent for borrowed money on $5,200	$260
Allowing 6 per cent for depreciation on $5,200	312
Allowing 1 per cent for maintenance and repairs	78
Allowing 1½ per cent taxes and insurance	78
Total charges against economizer	$728
Ten per cent saving	1,806
Net gain (20 per cent)	$1,078

This, you will see after borrowing money, will pay 20 per cent on the investment, making all fair allowances and being very conservative. In actual practice it would probably be larger. One of the great advantages of economizers on electrical plants is certainly the large reserve power when sudden demands are made for steam, which item it is very difficult to get any figures on, and only those that have experience realize. The fireman will have no difficulty in keeping up steam during heavy peaks of the load when using the economizer, having about an hour's supply of hot feed water. They do not use this up before the peak of the load is off, and even what water is coming in to replace that which is used has the benefit of the gases when the boilers are being worked to their full capacity. Managers of electric power plants know how the steam begins to drop when very heavy loads suddenly come on the boilers and during the period having to rush a lot of cool water into the boilers makes the work harder for the fireman. An economizer overcomes that. Then again, the de-

positing of sediment in the economizer and the saving in repairs to boilers, it is difficult to estimate or get figures on, but both are important advantages in addition to the saving in fuel. With an economizer of the capacity of your boiler plant, you do not have to keep so many boilers partly banked ready for sudden emergencies, as the economizer increases the steam capacity of your plant 10 per cent. The fact also has to be realized that your men have 10 per cent less coal to handle and proportional amount of ash.—Green Fuel Economizer Company.

No.—H.

None, unless you have an excessively high temperature of flue gases.—A.

In answer to inquiries among plants about this size, using economizers, the consensus of opinion was as follows: In an existing boiler plant, the advisibility of adding an economizer was entirely a question of finance and plant conditions, available draft, etc. The fuel saving against fixed charges and maintenance. If a new plant was proposed, then the almost unanimous opinion was the economizer should be considered in connection with boilers in distributing the heating surface to be provided. The general experience being that of the total heating surface required, 70 per cent should be boiler and 30 per cent economizer.—Editor.

42. What is the maintenance cost and a fair depreciation rate on economizers?

The maintenance cost of economizers in the last fifteen years to twenty years has been proven to be under 1 per cent of the original cost of the machine, and a fair depreciation we consider is 6 per cent, as a machine will last with ordinary attention over twenty years. We can show any number of records of machines that we sold over twenty years ago that are working to-day very satisfactorily.—Green Fuel Economizer Company.

43. Have any power houses been heated by hot water supplied from a special section of the economizer run at low pressure? If so, what difficulties have been experienced?

We do not know of any electric power houses that have been heated by hot water from our economizer, but we are heating a number of mills quite satisfactorily by this system.

We have also recently sold economizers, part of which will be used for heating the power house, to the Canadian Pacific Railway Company shops in Canada. There is no reason that we can see, if we can heat mills satisfactorily, which have to be kept at high temperature, why the hot water cannot be used for heating power houses. The way we do this is, we take the cool end of the economizer furthest away from the entering of the hot gases, and use a portion of that for heating the building, by making a constant circulation of the water through it.—Green Fuel Economizer Company.

44. What is the saving in coal when storage batteries are kept floating on the line?

The coal saving depends upon the class of service for which the battery is installed, and is brought about principally by shutting down engines and generators at the power house and improving the load factor. If a battery is installed on the line at a distance from the power house, for saving copper and improving voltage, it will generally affect only a very small portion of the total load, and may have but little effect on the power house operation and economy. If, however, the battery is installed at the power house and is adjusted to take the fluctuations of load off the machine so that the latter can be operated continuously under a steady load equal to their full rated capacity, instead of under a widely fluctuating load whose average is perhaps under 50 per cent of the rated capacity, about half of the machinery required before the battery was installed, can be shut down, thus saving all the constant losses from friction and radiation involved in operating these machines, and the other half will be run at a point of maximum economy. The saving in fuel thus accomplished would probably range from 15 per cent to 25 per cent. The saving will be greater where the units are few in number and the fluctuations excessive, and will be less where the fluctuations of load are small and the number and size of units such that they can be readily adapted to the load.—E. L. Reynolds.

About 15 per cent.—W. S. B.

45. Does the storage battery require any extra or special labor?

In the great majority of cases, the very reasonable amount of attention required to keep a battery in the best condition is secured without the necessity of employing additional or special labor. With a battery of ordinary size, the time that should be spent on it should not exceed four hours or five hours each week. It has very generally been found practicable to detail an employee who is in the service of the company for this battery work without materially interfering with his other duties.—E. L. Reynolds.

A man carefully selected and properly instructed should be placed in charge of battery, and the battery made his first and most important duty.—L.

Requires only a small amount of labor, but the work done should be done thoroughly, care being taken not to neglect even the smallest details. The most important point in the care of battery is that the man who is in charge of the battery must be able to discover and remedy the slightest trouble in the cells before it grows so large that it affects the good working condition of the battery.—G. G.

Yes, it requires an attendant to take gravity and temperature readings and to fill the cells to a uniform level as the water evaporates. This man is, however, able to perform other duties, as the battery only requires his attention about one-third of the day.—F. B. Musser.

46. What records are essential in order to obtain a low maintenance cost on batteries?

In order to keep a battery in the best condition and obtain a minimum maintenance cost, it should be looked after in the following manner:

In the daily workings of a battery, hydrometer readings of a single cell, usually termed the "pilot cell," should be taken hourly, or as frequently as possible, if the battery is so situated that it is impracticable to take the hourly readings (from one minute to two minutes only is required for taking these readings). When a battery is situated at or near a power house or rotary sub-station where an attendant is present, there should be no difficulty in arranging for the hourly readings to be taken. In the case of line batteries where there is no regular attendant, it can usually be found practicable to have at least four of these readings taken in each twenty-four hours. In any case, one reading a day must be taken. In addition to the pilot cell hydrometer readings, the recording voltmeter records must be carefully observed, and the working of the battery as indicated by these charts and pilot cell readings, kept in proper adjustment.

Once a week, when what is termed the "weekly overcharge" is given a specific gravity reading of each cell in the battery should be taken just before the charge is started. If the charging current can be kept constant, a complete set of voltage readings should also be taken; these at the completion of the charge and just before the current is cut off. If the current cannot be kept constant during this part of the charge, then these voltage readings are not of sufficient value to warrant their being taken, and in their stead, another set of gravity readings should be taken as a check on those taken before the charge is started. In all cases, pilot cell gravity readings should be taken at the end of this charge, as well as at the beginning, and as frequently during the charge as possible.—E. L. Reynolds.

There should be a recording voltmeter to record the hourly gravity readings.—F. B. Musser.

Accurate records covering—(A) Specific gravity of acid, (B) recording voltmeter charts, and (C) Input and output of battery. The first two are essential and should cover both charge and discharge.—L.

47. What is a fair maintenance and depreciation charge on batteries, under railway conditions and floating continually on the line?

The maintenance and depreciation charge of such batteries normally operated and properly looked after should not exceed 5 per cent or 6 per cent annually of the original cost of the battery.

The amount of work that a battery does is a factor that should always be taken into consideration when the question of maintenance charge comes up.—E. L. Reynolds.

Based on the experience with large lighting batteries, which are completely charged and discharged regularly, and with which 7 per cent to 7½ per cent of original cost of battery must be set aside for maintenance and renewals, the annual charge against railway batteries, constantly floating on line, should not exceed 5 per cent of original cost, provided proper care is given battery and sufficient capacity is provided.—E.

For floating batteries, 4 per cent to 5 per cent of the original cost should be set aside annually to cover renewal of plates and an additional amount to cover renewal of lead tanks in ten years.—G. G.

48. Is the differential booster system the best mode of controlling charge and discharge in railway service?

This depends also on the character of service in question. In a small plant where the fluctuations of load are rapid and the battery is installed at the power house, the differential booster is the best method of automatic control that has yet been put into practical service. Where the total output of the plant is large and the battery is used principally for peak work, a compound booster is often more satisfactory and less expensive. Where a battery is installed on a line at a distance from the power house, a plain shunt booster at the power house is preferable.—E. L. Reynolds.

Yes, the differential booster is considered the best mode of con-

trol for the charge and discharge or railway service.—F. B. Musser.

49. What precautions are necessary in cutting out batteries and dynamos in case of line troubles or excessive overloads; and also in cutting in batteries and dynamos after disconnection?

In the case of excessive overloads the circuit breakers on the battery and dynamos should open simultaneously if properly adjusted. It is preferable, of course, to have the feeder circuit open rather than throw the entire plant out, but this is not always possible. Where a booster is in operation with a battery, an interlocking device is installed between the circuit breakers of the battery and the booster motor, so that in case the latter opens first, it will trip the former.

In cutting in batteries and dynamos after disconnection, no special precautions are necessary other than to see that the circuit breakers are operating properly and that the voltage is properly adjusted before throwing switches.—E. L. Reynolds.

When cutting out a battery try and get the battery at or as near zero as possible. When cutting in a battery get voltage equalized same as when cutting in a generator.—F. B. Musser.

50. How often must the acid be removed and renewed?

Unless some extraordinary impurity gets into the battery cells, it is not necessary to consider removing or renewing the battery acid or electrolyte. In the use of the battery, there is some slight loss of the acid in the electroyte, but this is so slight that the cost of replacing is almost negligible.—E. L. Reynolds.

Not more than once a year and likely once in two years. Keep the specific gravity of the acid right.—L.

51. What is the best method of removing and replacing the acid in batteries?

As it is not necessary to remove the acid, means for doing this need not be considered. In replacing the slight loss of acid referred to in the answer to question 50, this can be done without special cost by adding new acid to the cells at the usual time for replacing the evaporation by water.—E. L. Reynolds.

For batteries of fair size, either the syphoning or pumping method is generally the most satisfactory. If battery room has been properly designed, the syphoning method is most economical.—W. E.

Syphon with a rubber hose or pump out.—L.

52. Is there any method, within the resources of the ordinary central station, by which the condition of a battery can be determined accurately?

The condition of a battery can always be gaged by an observation of the cell readings and the physical condition of the plates.—E. L. Reynolds.

By keeping careful records of charges and discharges, in connection with the color of the plates and detailed tests.—L.

53. Is there any difficulty with overcharging a floating battery?

Overcharging is extremely bad in any kind of service, in that depreciation of the plates is increased much beyond what it would be if the battery were properly operated. Continually overcharging a battery, frequently overdischarging it or allowing it to stand for long periods completely discharged are very objectionable.—E. L. Reynolds.

DISCUSSION ON QUESTIONS 44 TO 53, INCLUSIVE, ON STORAGE BATTERIES

Mr. Musser—We have an old-time station, very much overloaded, which we expected to supersede with an entirely modern plant. Somewhat over a year ago, additional capacity had to be provided, and it was a question whether a new steam unit or a storage battery be selected to help us out. After going over the matter very carefully, we concluded to put in the battery, because we could install it more quickly and at less expense. We have been running the battery about fifteen months successfully, and thus far with absolutely no expense except a part of the time of one man. The battery has worked regularly, and unless a good deal of deterioration takes place shortly, we do not expect to spend any money on it for some time to come. We have never made any calculation as to just what the battery has saved us, as we are working at a disadvantage. So far, it has met with all our expectations, taking care of the peak of the load during the rush hours, with practically no care or expense.

Mr. Wendle—When we took up the question of labor costs with some of the large battery users, we were strongly advised that it was the best policy to have one man to look after the battery properly. This statement is the result of considerable experience in paying the maintenance expenses under different modes of caring for the battery, and indicates that saving in labor and inspection means increased maintenance costs, not necessarily at once, but ultimately. From the answer made by Mr. Reynolds and the statement of Mr. Musser, the labor item is regarded as an incidental. Is this condition peculiar to a floating battery or railway conditions?

As to depreciation, the large users of lightning batteries have settled on 7 per cent of the total cost of the battery as the proper rate. Their experts reduce this to 5 per cent for a floating battery. Both of these figures are based on giving the best care possible to the battery. With improper attention or unskilled care, the actual maintenance costs have been much higher. In view of these facts, it would be advantageous to hear from any gentleman who has had a battery in service more than six or seven years, and given it the incidental attention implied by the answers received.

Mr. Reynolds—Most of the Edison Companies have very large batteries. In New York there are 30 batteries distributed over the city. The aggregate amount of labor on these batteries is hardly to the point. Take the average street railway; they have one battery or two, one at each station along the line. You cannot keep a man busy watching these batteries. Half an hour during the day will easily cover the work; but it must be good, honest, intelligent attention. Where the battery is in the power station, the engineer generally looks after it. I will be pleased to refer to a large number of stations, operating their batteries in this way, which have had batteries in service five or six years.

Mr. Wendle—The Storage Battery Company has, by reason of supplying most of the repairs, etc., special facilities for learning the exact maintenance costs. Would it be a fair question to ask what, in the experience of your company, is a reasonable depreciation on floating batteries?

Mr. Reynolds—We consider that 5 per cent ought to be ample. It depends altogether upon the man who is running the plant; given the right sort of attention, there is no reason why the percentage should not be lower.

Mr. Wendle—All the percentages have been based on the total cost of battery. In order to put the matter clearly, what would be the percentage based on the cost of plates only?

Mr. Reynolds—I have never figured it out that way.

President Davis—Mr. Reynolds, will you explain how the acid is taken from the tanks in practice?

Mr. Reynolds—The acid is never removed from the battery unless you have a tank that leaks, or are taking a battery out of commission. The simplest method of removing acid is by a rubber hose syphon. It is not necessary to remove the acid in making repairs to plates. This is done while the battery is working. As a matter of fact, we could renew an entire battery, put in an entirely new set of plates, and keep the battery working all the time. If the number of tanks to be repaired is small, say 5 or 6, these batteries could be cut out and repairs made without effecting the battery as a whole.

Mr. Wendle—In answering question 53, Mr. Reynolds states that overcharging is bad. The question is, is there any danger of overcharging, and how is that to be prevented? The overcharging is generally admitted to be bad; but does trouble of this kind occur?

Mr. Reynolds—There is liable to be trouble on this account through careless supervision; it should be easily determined and stopped. We recommend that every plant be equipped with a recording voltmeter, and it is a simple matter for anyone, with proper instruction or experience, to determine the conditions of charge and discharge of the battery from the records. Further, we are desirous that operating companies send us these voltmeter records once or twice a week. This enables us to notice any overcharging and promptly advise the operating company.

The practical adjustment to prevent overcharging is simple. If your battery is on the line, say, 7 miles or 8 miles from the power house, you adjust the shunt booster to give the proper increase of voltage on the feeder supplying battery; in case no booster is used, the main generator voltage is adjusted until overcharging stops. Where battery is at the power house, adjustment of the differential booster will stop trouble, or a few cells may be added to bring up battery voltage.

President Davis—What provisions are necessary for ventilating and what kind of flooring do you recommend for battery rooms?

Mr. Reynolds—The best flooring is vitrified brick. It is slightly more expensive than cement, but is best for permanent construction.

For ventilation, we do not require any expensive or special methods; but simply want a good circulation. In some cases, ventilators are put in the roof; but if a room is well ventilated for ordinary purposes, it will generally meet all requirements. It is essential to guard against having the room temperature too high.

President Davis—What is the effect of too low a temperature?

Mr. Reynolds—A low temperature is better. With ordinary low temperatures, the only effect is to lower the available capacity of the battery; but with a high temperature, the deterioration of the plates increases.

President Davis—How about the side walls and roof construction in a battery room?

Mr. Reynolds—Iron should be kept out of it as much as pos-

sible; ordinary wood construction is satisfactory. If you must use iron on the sides or in the roof, be sure to have it well painted with acid-proof paint.

57. What is the best practice in regard to circuit breakers on high potential generators?

Use oil switches.—H.

The General Electric Company has long advocated the use of oil break circuit breakers for opening or disrupting high potential power circuits. This type of circuit breaker is not only more positive and reliable in action than the air break switch, but the nature of the break is such as to produce much less resonance effect, with attendant decrease in strain upon the insulation. The oil switch is also more compact in form and may be located at points most convenient and suitable for simplicity in wiring and control. In very large installations, the oil switch is the only safe and reliable means of disrupting the circuit.—R. E. Moore.

58. Are time limit circuit breakers satisfactory?

Yes.—H.

59. In railway sub-stations, is it advisable to connect both the A. C. and D. C. sides of rotaries in multiple?

Not in my judgment.—H.

When rotary converters are connected together at both the alternating current and direct current sides, local interchange of current will take place between the machines unless the brushes of all the machines are set in exactly the same position. On high frequency rotary converters a variation of 1-16-in. in the setting of the brushes may set up local currents between the machines exceeding their rated capacity. The only effect of such local currents is to cause excessive heating. We have seen cases where the temperature had been more than doubled due to this cause, and of such degree as to seriously threaten the life of the insulation. It is a very simple matter to avoid metallic connections between collector rings, either by having a separate bank of transformers for each rotary converter, or else providing a separate secondary winding for each rotary in case a number of machines are run from a single group of transformers.—R. E. Moore.

60. In a complete transmission system, what is the best method for automatically disconnecting main generators, rotaries, etc., in case of line or apparatus trouble?

Oil switches in connection with circuit breakers.—H.

The General Electric Company's practice is to install automatic oil switches with instantaneous overload relay in alternating current rotary converter circuits and in-coming lines at the sub-stations. Time limit relays are placed on the automatic oil switches controlling the outgoing lines from the main station, and oil switches for generators are made non-automatic. With this arrangement a momentary short circuit will only disconnect the rotary converters in the sub-station affected. If the short circuit hangs for a length of time exceeding that for which the time limit relay is set, the line switches at the power station will open. If the trouble continues and is likely to injure the generators, the main generator switches may be opened by the attendant.—R. E. Moore.

61. For combined railway and lighting plants, using 60 cycles main generators, is it better to use rotaries or motor generators for the lighting service?

Use motor-generator sets, consisting of synchronous A. C. motor direct coupled to D. C. or A. C. generator. By this means voltage fluctuations in main generators, due to railway load, are not carried into the lighting system as with rotaries. With synchronous motor and D. C. generator, the fluctuations will be due to change of frequency, which can be kept within limits of good practice. There is also a great advantage in the independent regulation of lighting generators by simple field regulation.—W.

Our practice is to use 25 cycles for combined lighting and railway plans. This frequency is better suited to the design and operation of rotary converters. While 60-cycle rotaries may be built to give satisfactory shop tests and to even operate satisfactorily under service conditions favorable to their use, their necessarily high commutator speeds make them inherently more sensitive than 25-cycle rotaries. In practice, a 25-cycle rotary will respond successfully to demands considerably in excess of its guaranteed capacity without injury and with minimum attention, while a 60-cycle machine must be given skilled and careful attention if subject to heavy fluctuations, as railway loads are usually very fluctuating, it is advisable to use motor-generator sets for the lighting service in order to secure satisfactory regulation on the lights.—R. E. Moore.

62. Are 60-cycle double-current generators commercially satisfactory for combined railway and lighting service?

It is doubtful whether the service is entirely satisfactory.—H.

Regarding the successful operation of 60-cycle generators in combined railway and lighting service, it may be said that with the steam turbine this is easily accomplished and is being done successfully.—E. H. Sniffin.

We do not consider the 60-cycle double current generator satisfactory for this service, due to the impossibility of securing satisfactory regulation where the load is at all variable.—R. E. Moore.

63. In a 500-kw to 1000-kw plant, using compound-condensing Corliss engines and direct-connected generators, what is a good monthly average steam consumption or coal cost per kilowatt-hour?

Large modern plants are operating on 24 lbs. of steam per kilowatt-hour, with total generating cost .556 cent per kilowatt-hour. In a comparatively small station, 500 kw to 1000 kw, 30 lbs. to 32 lbs. of steam per kilowatt-hour, and a total cost of 8-10 c per kilowatt-hour would be good.—H.

RAILWAY EMPLOYEES' DUTIES AND REWARDS

Following is the text of a letter prepared by George F. Chapman, general manager United Railroads of San Francisco, for the instruction of applicants for positions and newly-employed platform men on that company's system. Copies of this letter have just been circulated among recent employees, as a basis for them to work upon:

To Applicants and Employees—The chief requisites necessary to obtain employment and to retain your position with the United Railroads of San Francisco are these:

First. You must be honest. The dishonest man cannot continue long in any service.

Second. You must be patient and polite to the public. The company realizes that frequently passengers may be unreasonable in their demands or exasperating in their manner, and that at times it will require an effort on the part of the employee to refrain from resenting what appears to be an insult or a lesser imposition. But the ability to control your own temper is one of the very necessary qualifications of the service.

Third. You must never lose sight of the fact that your recklessness, your carelessness, or your negligence may render you responsible for the loss of a human life. Never take a chance.

Fourth. Observe strictly the general rules of the company. They have been carefully drawn to protect life and property, and to give the public the best possible service.

The United Railroads of San Francisco pays to its motormen, gripmen, drivers and conductors the highest scale of wages paid to men in similar employment on any system of similar size in the United States. The employee who observes the four cardinal rules above set out may feel assured:

First. That he may have continuous employment with this company. That he is as much a part of the company as are any of its officers.

Second. That no political or outside influence can unjustly deprive him of his position.

Third. That in making promotions the company will give preference to its most faithful and competent men where it is possible to do so. The highest position in the gift of the company is open to the qualified employee.

Fourth. Special meritorious acts by men with a good record will always be recognized.

The new employee on entering the service may find men who do not come up to the standard set out above, and he may believe that such delinquents are successfully deluding the company. The man who indulges this thought deceives no one but himself. The great majority of our employees are honest, capable, industrious men. There are some, as a matter of course, who are indifferent, but the new employee will discover that such men seldom last long.

The company is more than willing to deal fairly with its employees, and it demands in return that employees deal fairly by it. When the company takes you into its employ it is reposing special trust and confidence in you and those who have endorsed and stood sponsor for you, a trust which I hope the future will more than justify, and that you may ever stand on our records as honest, faithful, careful employees.

G. F. Chapman, General Manager.

The Northern Ohio Traction & Light Company has ordered ten new interurban cars and will install a limited service between Cleveland and Akron. Other Cleveland roads are figuring on adopting this plan, which has been developed with great success by the Cleveland, Painesville & Eastern Railway.

FINANCIAL INTELLIGENCE

Wall Street, Oct. 21, 1903

The Money Market

The general features of the money market remain substantially the same as a week ago. The usual autumn demands from the interior continue to be withheld in a truly astonishing manner. In explaining this singular situation, some account must now be taken of the slackening trade activity throughout the country, which means, of course, a diminished pressure upon banking capital. Without much doubt this is a partial explanation for the small movement of currency out of this city. But the main reason must still be found in the exceptional backwardness of the crop-moving, which has the effect of postponing the customary drawing down of New York deposit balances by the interior banks. Last week net shipments of currency out of town were estimated at less than $1,000,000—considerably less than in either of the two weeks before. Meanwhile payments by banks to the Treasury are reflecting the falling off in customs revenue, due to the shrinkage in the volume of our merchandise imports, which, according to the latest statement, were $5,800,000 less in September than in the same month of 1902. Contrary to all precedent at this season the Treasury's disbursements, in this city at least, are steadily falling behind its collections, and the result is that the banks have been able for the last few weeks to add materially to their cash holdings from their operations with the government. With holdings of specie and legal tenders increasing rather than decreasing, and with loans contracting under the influence of Stock Exchange liquidation, the movement of surplus reserve continues to be highly favorable. Last Saturday found a further gain in this item of $850,000, and the account now stands at the highest level of the season in recent years. The strong position of the banks has naturally made itself felt in lower rates for money. Call money has for some time past been purely nominal; it is quoted in Wall Street at 2 per cent and 2¼ per cent. The more important fact is the lowering of time money rates, which for sixty-day loans have fallen since the middle of September from 5½ per cent to 4½ per cent. It is perfectly easy now to obtain accommodation on good collateral at 5 per cent and under over the first of the year. So long as speculative demands continue as light as they are at present, so long as mercantile requirements are curtailed, and so long as the banks continue to discourage the placing of new loans by the railways and other corporations, the money problem, as it was understood and feared six months ago, may be said to have disappeared. Nor is the foreign exchange position a matter of such solicitude as it was a short while ago, for there is no need of gold imports from Europe when the supply of money at home is so plainly sufficient for all ordinary purposes.

The Stock Market

A sharp and general recovery has occurred in the course of the week's trading on the Stock Exchange. The only interruption to the movement came on Monday, when the failure of two important Baltimore trust companies was announced. But yesterday, after it had been ascertained that these suspensions were due entirely to local causes, and that there was small probability of the difficulties spreading, prices resumed their upward tendency with some enthusiasm. The explanation for the week's improvement lies chiefly in the oversold condition of the market, especially in the railroad share list—a fact which has been patent to close observers for some time past. It is evident, in the first place, that the absorption of stocks by strong interests has gone on with its usual secrecy, and that, as always happens, the majority of onlookers have entirely underestimated its actual extent. It is equally plain that the forced liquidation which played so large a part in the demoralized condition of July and August, and which appeared again a fortnight ago confining itself to the industrial shares, has run its course. And in the third place, a short interest of considerable dimensions developed, which has found it difficult after the reduction in the available supply of stocks from the other two causes mentioned, to beat an orderly retreat. These simple technical conditions afford a sufficient explanation for the sharp recovery which has been witnessed during the past week. So far as they relate to the outside situation, they point very clearly to the belief in higher financial circles that the decline in the standard stocks had gone as far as was called for by the extraordinary depressing influences of the past twelve months, and that in view of the successful crop season, the assured prosperity of the agricultural regions and the favorable outlook for railroad earnings, particularly in the West and South, there was abundant warrant for a higher level of prices. No conservative person expects a much further advance for the present. The uncertain position of trade, the possibility of fresh irruptions of the labor party, and the sensitive state of the money market are all firmly opposed to any new speculation for the rise. But financial sentiment naturally finds sufficient reason for cheerfulness in the recent proofs that the market as a whole has turned the corner after its long decline.

There is not much to be said concerning the movement of the local traction stocks beyond what has already been said concerning the course of the general market. All these stocks have simply drifted with the tide. They rose as fast as any during the general recovery at the end of last week, and fell off as rapidly as any when the general market turned weak on Monday. The bear party has devoted a good deal of attention to Brooklyn Rapid Transit, on the theory that the speculative interests particularly identified with the stock are in no position to give it very energetic support. Gossip is still very free with the names of certain street railway capitalists who are supposed to have dropped an enormous sum during the recent break. The notion that these persons have been forced to part with some of their investment holdings and that they are unable to afford much protection against speculative attacks on their properties, accounts for the persistent pressure which is being kept upon Metropolitan shares. Manhattan Elevated, as usual, has acted the best of the traction group. Specialists bear continual witness to the steady investment absorption of the stock, which, they say, is fast reducing the floating supply in the market to insignificant dimensions.

Philadelphia

The only reflection which the financial disturbances at other cities had in the market for Philadelphia street railway stocks, was a further sharp decline in Philadelphia Company shares. This issue is held more or less extensively in both Baltimore and Pittsburg. It was liquidation rather from Baltimore which caused the drop in the common stock Monday from 37¼ to 35⅛. This latter figure repeated the low record made several weeks ago. Philadelphia preferred suffered less, losing ¾ to 43. In yesterday's general recovery the common went back to 36½. Among the other traction specialties, the week's movement took uniformly the direction of the general market; prices rose on Friday and Saturday, dropped back on Monday, and rose again yesterday. Union Traction went from 42½ to 43, then down to 42½, then up to 42⅞; Philadelphia Rapid Transit sold as low as 11⅛ and as high as 11⅞; Philadelphia Traction ranged between 93½ and 94, and American Railways between 41¾ and 42. Scattering sales were also reported in Consolidated of New Jersey at 60, and Hestonville Passenger preferred at 72⅛.

Chicago

The interesting but complicated game between the city and the street railroad companies, in which a liberal franchise extension is the stake, goes on apace. Moves and countermoves, proposals and counter-proposals have been made during the week, but so far as the public knows anything to the contrary, the negotiations are no nearer their termination than they were a week ago. If the market for the traction stocks was a sign of anything in this connection the absolute cessation of all trading which has recently been witnessed, might be interpreted as an indication that the investing public have become apathetic toward the franchise muddle, and have left this part of the investment field in disgust. Not a sale is recorded in any of the surface line securities since a week ago Wednesday. A few trades have been reported in Metropolitan Elevated at 18, and two single transactions, one in South Side Elevated at 91, the other in Lake Street at 4⅛. With these exceptions the week has been a total blank.

Other Traction Securities

Baltimore has been the center of interest among the outside markets this week, on account of the troubles which led to the suspension, on Monday, of two of the leading trust companies of that city. All the securities having their home market on the Baltimore Exchange suffered severely. United Railways stock

and bonds were the only traction issues which come within that category, and they were the only ones accordingly to feel the force of the financial storm. The common stock sold down to 8, and the income bonds to 57¾, both of which were new low records for the year. The general 4s were not as weak, declining only from 90½ to 89¾. All three securities rallied rather sharply in yesterday's trading. Other Baltimore sales for the week included Atlanta Consolidated 5s at 103, City & Suburban (Baltimore) 5s at 110¼, Charleston Street Railway 5s at 104, and Anacostia & Potomac 5s at 90. Nothing of particular consequence has happened in the week's dealings in Boston. Massachusetts Electric, on a small volume of business, sold as low as 18 and as high as 20, ending yesterday at 19¼. The preferred sold between 77¼ and 78. West End common dropped from 91 to 90, the preferred sold at 109, and Boston Elevated between 136½ and 138. On the New York curb Interborough Rapid Transit, after touching a new low record at 80½, rallied sharply to 83, then fell again to 81, on the news received yesterday that the motormen on the elevated lines will probably go on strike. Washington Traction common lost a point to 8, and Brooklyn Rapid Transit 4s sold at 77½. This was all there was to the week's traction dealings, so far as the local curb market was concerned.

Compared with the business of recent weeks there was what might be called quite a run on Detroit United on the Cincinnati Exchange. Following the quotations from New York the stock opened the week at around 60, and declined steadily to 54¾. Around this point it came into pronounced demand, and some 1500 shares changed hands, the buyers being bargain hunters who were anxious to pick up a stable 4 per cent security at such prices. As the result of this demand the quotation rose steadily, and closed the week at 60½. Toledo Railway & Light sold to the extent of several hundred shares at 19 and 20, the lowest figure in many months. Cincinnati Street Railway was firm at around 128½, sales being small scattering lots. A small lot of Miami & Erie Canal changed hands at 6¼, which is a slight advance over previous figures. The future of this company remains clouded in doubt. Several lots of Cincinnati, Dayton & Toledo 5s sold at 82.

At Cleveland, Northern Ohio Traction & Light was the leading issue, about 500 shares selling at 15 to 15½, which is considered a very low figure. Cleveland Electric ranged from 64½ to 67, sales being 380 shares. During the previous week the stock made a low record of 63. It is believed that large local holders are tendering their support on this stock in order to protect stocks put up against loans in local banks. Northern Texas Traction sold at 30, a decline of two points. A sale of Lake Shore Electric common at 5 attracted some attention, and there were plenty of bidders around 6, but no further offerings within range. This property is making on an average of a 35 per cent gain in earnings during the last few months.

Security Quotations.

The following table shows the present bid quotations for the leading traction stocks, and the active bonds, as compared with last week:

	Closing Bid	
	Oct. 13	Oct. 20
American Railways	41	41¾
Aurora, Elgin & Chicago	—	—
Boston Elevated	136½	137
Brooklyn Rapid Transit	31⅞	32½
Chicago City	170	170
Chicago Union Traction (common)	4	3½
Chicago Union Traction (preferred)	30	25
Cleveland Electric	65½	65
Consolidated Traction of New Jersey	59	60
Consolidated Traction of New Jersey 5s	103	103¾
Detroit United	55	55
Elgin, Aurora & Southern	a56	a45
Lake Shore Electric	a5	5¾
Lake Street Elevated	4	4
Manhattan Railway	130	135¼
Massachusetts Electric Cos. (common)	18	18¾
Massachusetts Electric Cos. (preferred)	77½	77
Metropolitan Elevated, Chicago (common)	17	18
Metropolitan Elevated, Chicago (preferred)	53	55
Metropolitan Street	103	105½
New Orleans (common)	7	7½
New Orleans Railways (preferred)	a30½	28
North American	72	73¾
Northern Ohio Traction & Light	13	15⅛
Philadelphia Rapid Transit	11¾	11¾
Philadelphia Traction	93½	93⅝
St. Louis Transit (common)	13¼	14½
South Side Elevated (Chicago)	91	90¼
Syracuse Rapid Transit	a30	—
Syracuse Rapid Transit (preferred)	73¾	73¾
Third Avenue	100	103
Toledo Railway & Light	a20	17½
Twin City, Minneapolis (common)	80½	83
Union Traction (Philadelphia)	42¼	42⅞
United Railways, St. Louis (preferred)	61	31

a Asked.

Iron and Steel

"The Iron Age" blast furnace statistics for September showed production to have been less than in August, but by a trifling amount only. The September total was 1,556,717 tons, against a total of 1,571,126 tons for August. It is, however, to be recollected that the concerted efforts to restrict the output of pig-iron were not begun until after the first of October; consequently, the present production is undoubtedly considerably less than it was, according to the latest investigations of the "Iron Age." With this reflection the fact that stocks of iron on hand again increased by 85,000 tons during the month of September, is not as serious as it would otherwise have been. In the finished iron and steel branch there is a fairly encouraging demand for steel rails for next year's delivery, and also for merchant pipe and wire products. But in sheet steel and tin plate, as well as in structural material, business is decidedly slack. Quotations are as follows: Bessemer pig-iron, $15.85 a ton; Bessemer steel, $27, and steel rails, $28.

Metals

Quotations for the leading metals are as follows: Copper, lake, 13⅛ cents; tin, 25½ cents; lead, 4½ cents, and spelter, 6 cents.

REFERENDUM FOR CHICAGO

At the meeting of the Chicago City Council, Monday, Oct. 19, an ordinance was passed to submit the Mueller municipal ownership law to a vote of the people at the election next spring. The Mueller law is the law passed by the last Illinois Legislature empowering cities to own and operate street railways. It becomes a law as regards any city only after it has been voted upon and carried by the people of that city at an election. The submission to the voters at the election next spring will probably result in its adoption as a law for Chicago, if the result of the ballot held two years ago is any indication. The adoption of the law by Chicago does not have any immediate bearing on the settlement of franchise matters in Chicago, as there is no likelihood that the city will take advantage of its power to own and operate street railways for some years to come. The present companies will probably be given renewed franchises for twenty years, and it will be left for the city at the end of that period to decide whether to take over the street railway properties or to grant franchises again.

NEW RAPID TRANSIT SCHEME FOR NEW YORK BRIDGES

Plans for connecting the transportation systems of Manhattan and Brooklyn by extending elevated and surface lines over the four East River bridges have been submitted to Mayor Low by Bridge Commissioner Lindenthal. Three extensions of Long Island lines to Manhattan are proposed, the first to run over Manhattan Bridge from Canal Street, thus crossing all north and south lines. From the Williamsburg Bridge the Brooklyn Rapid Transit system is to be extended along Delancey Street to the Bowery or to Elm Street, in Manhattan. A third branch of the Long Island lines is proposed over the Blackwell's Island Bridge to a plaza 100 ft. wide, extending from Sixtieth Street to Fifty-seventh Street and parallel with Second Avenue, Manhattan. Mr. Lindenthal advises two extensions of the Brooklyn Rapid Transit elevated over the Manhattan Bridge. It is recommended that all these extensions should be constructed by the city and leased to the Brooklyn Rapid Transit Company. The Mayor will present the plan to the Rapid Transit Commission for its consideration.

The Springfield Street Railway Employees Relief Association, of Springfield, Mass., has a membership of 340. It received during the year $2,839.75 and paid benefits amounting to $2,830. The association has $509.75 in its treasury.

ANNUAL REPORT OF THE METROPOLITAN ELEVATED OF CHICAGO

The annual report of the Metropolitan West Side Elevated Railroad, of Chicago, for the year ending June 30, 1903, was filed at Springfield last week. As compared with the preceding year it shows an increase of $266,056, or 14½ per cent, in gross earnings. But operating expenses increased $256,971, absorbing practically all the gain in gross. Comparing expenses in detail, maintenance charges show an increase of $85,127, while cost of conducting transportation increased $157,962, or 28 per cent. The cost of conducting transportation per passenger carried was 1.75 cents this year, against 1.57 cents last year, due to higher wages, increased cost of material, etc. Charges were some $64,000 greater than the year before, due mainly to increase in bond interest paid, thus the net amount available for dividends was equal to only about 2 per cent on the outstanding preferred stock. It should be noticed that the items in this report which cut down the surplus—that is, high operating cost and increased interest charges—were met in the last annual report, covering the fiscal year ending Feb. 28. Hence the next annual report may be expected to make a much better comparison with its predecessor than this June 30 report makes with the one before it. The detailed statement of the earnings follows:

Year ending June 30—

	1903	1902
Whole number passengers	40,551,301	35,372,909
Daily average	111,099	96,912
Earnings—		
From passengers	$2,025,837	$1,768,525
Miscellaneous	68,171	59,428
	$2,094,008	$1,827,953
Operating expenses—		
Maintaining way	60,964	49,787
Maintaining equipment	162,467	88,517
Conducting transportation	716,055	558,093
General	97,695	84,813
Total operations	$1,037,181	$781,210
Net earnings	1,056,828	1,046,743
Other income	10,462	5,678
Total income	$1,067,290	$1,052,421
Charges—		
Interest	467,153	406,569
Rental	235,351	209,461
Taxes	140,870	175,334
Miscellaneous	58,269	46,653
Totals	$901,643	$837,817
Balance of stock	165,646	214,604
	(3%)	(3%)
Preferred dividend	261,243	261,243
Surplus for year	*$95,597	*$46,639
Per cent op. to gross	49.5	42.8

* Deficit

BALANCE SHEET, JUNE 30.

ASSETS

	1903	1902
Cost of road and equipment	$29,078,580	$28,087,071
Securities of company owned	483,900	483,900
Cash	197,817	258,227
Current assets	163,570	75,783
Miscellaneous accounts	16,235	34,452
	$29,940,102	$28,939,434

LIABILITIES

Capital stock	$16,500,000	$16,500,000
Bonds outstanding	13,000,000	11,500,000
Interest accrued	223,467	163,467
Rent accrued	8,350	8,350
Taxes accrued	32,508	31,901
Unpaid coupons	8,634	38,870
Loans	.....	400,000
Accounts payable	118,915	155,455
Reserve accounts	5,147	2,714
Profit and loss	43,079	138,677
	$29,940,102	$28,939,434

ADDITIONAL TIME FOR EVERETT-MOORE SYNDICATE

A meeting of the creditors of the Everett-Moore syndicate and the bankers in charge of the syndicate's affairs was held last week, and an agreement was reached by which the creditors have granted a further extension of time to April 1, 1905, in order to give the syndicate that much additional time to clear up all outstanding indebtedness. The tightening of the money market and the general depression in all stocks made it impossible for the syndicate to float its securities in time to meet all the obligations devolving upon it by the time specified—July 1, 1903. This condition has been known for some time by the bankers' committee, and it was thought best that the opinion of all the creditors should be obtained as to what should be done. This action was hastened by the fact that one or two of the creditors of the Federal Telephone Company had been pressing matters, and one of them recently obtained a judgment against the company.

It developed at the meeting that since the bankers' committee took charge of the syndicate's affairs, Jan. 1, 1902, more than $12,000,000 of obligations have been paid off, and in addition, about $2,000,000 of new money has been put into the various concerns. The traction properties have been entirely cleared up, and the telephone properties are in a fair way to right themselves. There still remain about $3,500,000 of obligations outstanding, nearly all against the telephone properties. Several plans had been proposed for refinancing the Federal Telephone Company, but owing to the stringency of the money market these plans had been interfered with, hence the necessity for the extension.

To facilitate administrative action a committee, composed of H. R. Newcomb, representing the bankers; Frederick Dickson, representing the Federal Telephone Company, and H. A. Everett, representing the Everett-Moore syndicate, was appointed to act for the bankers' committee and the syndicate in all matters pertaining to the different properties. The bankers' committee remains in existence for consultation purposes, and it will continue to act in such cases of emergency as are beyond the scope or power of the special committee. The status of the various traction properties controlled by the Everett-Moore syndicate was fully outlined in the STREET RAILWAY JOURNAL of May 2, 1903, and there have been no material changes since that time.

REPORT OF THE ACCOUNTANTS' ASSOCIATION

The verbatim report of the Saratoga Convention of the Street Railway Accountants' Association of America has just been received, and will be welcomed by all those who follow the important work accomplished by this Association at its annual meetings. The papers and discussions are printed in full. In addition the volume contains a list of the attendants at the Convention, constitution and by-laws, list of members, standard classification of accounts and form of report, a very valuable summary of the reports of previous meetings, and a handsome half-tone portrait of the president, Henry J. Davies, of Cleveland.

NEW TURBINE AND ALTERNATING CURRENT RAILWAY MOTOR PATENTS

Among the patents granted last week is one issued to E. H. Porter and B. Currier, of Philadelphia, on a combination of a steam turbine and a multiple phase generator, in which several interesting points are noticeable.

In previous practice it has been customary to have the steam turbine and generators two separate machines. The inventors of the present machine propose the electrical generation direct from the turbine blades at a comparatively low voltage. The patent issued describes a multiple set of rotors of an asynchronous induction generator carried on the turbine blades, all acting inductively on a stationary armature, no insulation being required except the fire and moisture proof insulation around the armature bars.

All the losses coincident with electric generation are in this machine returned to the steam itself. In fact, the machine is so designed as to materially increase in it the ordinary electrical losses, thus maintaining the turbine blades at a slightly increased temperature, thus avoiding losses due to the condensation of moisture at the turbine blades and thereby increasing the efficiency of the turbine. It is proposed to start the machine either as an induction motor, running in conjunction with other generators, then by applying full steam pressure to make it take its full share of the load, or it can be brought to approximate synchronism by the turbine and simply thrown in without accurate adjustment.

The same inventors have also been awarded a patent recently on a variable speed polyphase type railroad motor, in which the speed variation is secured by changing the number of poles instead of the insertion of resistances, as heretofore the practice.

The motor is designed for a low voltage current, and is either of the synchronous or ind ction type.

The winding of the stator consists of heavy copper bars, all connected and fed in multiple from the low-tension mains. By its multiple arrangement each bar or set of bars can be readily connected or disconnected from either phase of the low tension supply circuit, and according to the relative position of these bars with regard to the different phases, the number of bars per phase per pole, and therefore the number of poles can be varied.

It is proposed to operate these switches by compressed air, by means of a suitable controlling valve built in conjunction with the motor itself, and connected with the train line pipe.

If all the switches were thrown at one instant there would undoubtedly be serious burning at the contacts, but it is claimed by the designers that the transferring of any bar from one phase to another is accomplished without spark, owing to the large number of bars in multiple with it, at the time the bar is temporarily removed from the circuit, especially with the low frequency current for which the motor is designed. On account of the heavy stator bars and low voltage requiring comparatively light insulation, it is thought temporary variation of the number of bars from a uniform number to each pole and phase during the progressive change of speed, will have no injurious effect.

TROLLEY BEATS LOCOMOTIVE

That little stretch of the Mohawk Valley, N. Y., between Little Falls and Utica promises to enter the field now held almost exclusively by the Western steam and electric railway companies for the prize as the battle-ground for tests of speed between the two motive powers. Over the stretch of country just mentioned the Utica & Mohawk Valley Railway operates an electric line, and its tracks are paralleled by those of the New York Central Railroad. Although the rivalry between the engineers and the motormen is most keen, and the "try outs" between the powers have been more or less frequent, it was not until a few days ago that the opportunity was presented for a test that was perfectly fair. Simultaneously engine 945 of the Central, which used to draw the Empire State Express, and car No. 18 of the Utica & Mohawk line, capable of 60 miles an hour, pulled out of Little Falls. No formal declaration of hostilities was needed. The struggle was on at once. The locomotive soon was setting a hot pace, but the little trolley—little only by comparison with the train of seven cars—was not to be shaken. Indeed, when it seemed to those on board that it had reached the maximum of speed another link was suddenly let out, and the steam monster was slowly but surely passed. Then the little victor with its merry passengers—for they had enjoyed the run immensely—was compelled to slow up, for Small's Gulf suddenly loomed up and a stop had to be made there.

CHICAGO CITY RAILWAY LABOR MATTERS

In last week's issue the extravagant demands made by the union employees of the Chicago City Railway Company were published and General Manager McCulloch's answer thereto and refusal was given also. Since then the men held a meeting and voted to appeal the matter to President D. G. Hamilton and the directors, and in the event of failure to secure concessions, to take a vote of all the union employees as to whether to strike or not. As might be expected, President Hamilton refused in advance to entertain any such propositions, and in an interview in the Chicago "Record-Herald," immediately following the meeting of the employees, stated the company's position very clearly. He said:

"We cannot give higher wages and have the company continue as a paying concern, and we certainly will not run ourselves into bankruptcy. A year ago we increased the men's wages 4 cents an hour, from 20 cents to 24 cents. Now they want 28 cents. The raise given last year has meant an added output of $400,000, while our coal bill increased $300,000. The receipts from additional passengers carried, in other words, the increase in our business, was not enough to pay for the additional wages alone.

"In addition to the increased wages the union demands a great many other things. One clause gives the union members complete control of the selection, employment, retention and discipline of all employees, while another provides for an arrangement of time-tables considering only the convenience of the operatives.

"To the principle of arbitration in a third clause the company has assented in the main. But to grant all the numerous minor demands made would be equivalent to turning over our whole organization, rolling stock and everything else, to division 260 of the Amalgamated Association of Street and Electric Railway Employees of America."

RECEIVER FOR CHICAGO MOTOR VEHICLE COMPANY

The Chicago Motor Vehicle Company, of Chicago, with a factory at Harvey, Ill., was placed in receiver's hands by Judge Kohlsaat on Oct. 13. Edwin C. Potter was appointed receiver. This company has manufactured gasoline automobiles for some time, and recently has started to make gasoline passenger coaches for railroad use, as previously mentioned in these columns.

STREET RAILWAY PATENTS

[This department is conducted by W. A. Rosenbaum, patent attorney, Room No. 1203-7 Nassau-Beekman Building, New York.]

UNITED STATES PATENTS ISSUED OCT. 13, 1903

741,020. Pneumatic Safety Appliance for Street Cars, etc.; John Enright, Cleveland, Ohio. App. filed Dec. 19, 1902. Relates to means for removing obstructions from the car track by compressed air.

741,032. Car Seat; Henry S. Hale, Philadelphia, Pa. App. filed April 2, 1902. Details of construction of a reversible car seat.

741,033. Car Seat; Henry S. Hale, Philadelphia, Pa. App. filed Jan. 14, 1903. Details of a reversible car seat.

741,048. Track-Sanding Device for Tram Cars; Charles W. Angridge, Pueblo, Col. App. filed Dec. 10, 1902. Sand hoppers located beneath and at each side of the car platform provided with nozzles and valve openings, a transversely disposed rod, normally spring-elevated, and bent to limit its vertical movement, valves carried by the rod controlling the openings, and a branch extending above the platform and provided with a foot-rest.

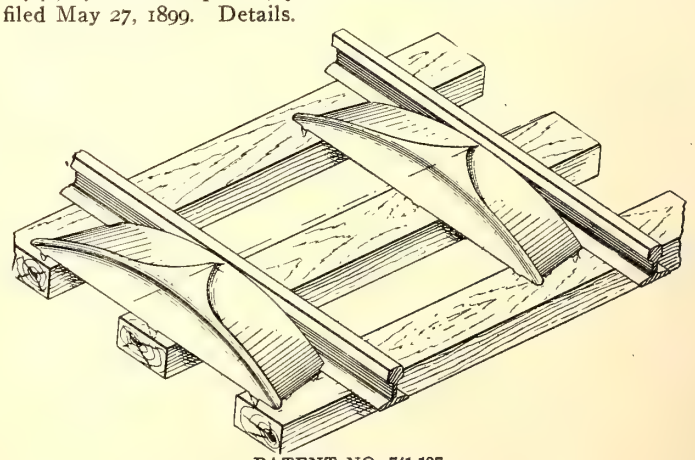
741,097. Street Railway Switch; Walter J. Bell, Los Angeles, Cal. App. filed Aug. 5, 1902. The switch is actuated by a pneumatic piston, an electro-magnetic valve controlling the air.

741,116. Track-Sanding Device; Murry A. De France, Newark, Ohio. App. filed April 22, 1903. A sand-box, a distributing pipe for connection with the sand-box, means for effecting the delivery of sand, and a perforated pipe passing through the sand-box and adapted to supply jets of air thereto for loosening the sand.

741,118. Means for Operating Railway Switches; Joseph O. Dimmick, Denver, Col. App. filed Jan. 21, 1903. An oscillatory shaft is made the core of an electro-magnet, the poles thereof being projected toward the switch point and then rotated, thereby causing the point to follow the poles by magnetic attraction.

741,123. Electrical Track Instrument; Taylor T. Fogel, Allentown, Pa. App. filed Aug. 8, 1902. The wheel of a passing car acts as an armature in the magnetic field of an iron core which is magnetized by an electro-magnet and causes the electro-magnet to oscillate in the direction of the car's course, whereby a signal is operated to indicate the direction of movement of the car.

741,127. Car Replacer; John D. Green, Toledo, Ohio. App. filed May 27, 1899. Details.



PATENT NO. 741,127

741,160. Brake-Operating Device; Michael O'Brien, Chicago, Ill. App. filed March 25, 1901. The brake handle has engagement with the brake-rod by means of a ratchet, whereby the brake may be applied by a to-and-fro movement of the handle.

741,171. Wheel Fender; Claud H. E. Schenck, Cleveland, Ohio. App. filed July 29, 1903. Details of construction.

741,433. Switch-Throwing Mechanism; Norval J. Anderson, Pittsburg, Pa. App. filed May 18, 1903. Two treads mounted in

a casing between the rails are connected with the switch point in such a manner that when one tread is depressed the switch will be thrown in one direction, and when the other is depressed the switch will be thrown in the opposite direction.

741,571. Railway Switch and Operating Means Therefor; Arthur J. Backer, Syracuse, N. Y. An electro-magnet is inclosed in a chamber in the switch point, the magnet being fixed with respect to the switch point and when energized attracts the latter and moves it.

ENGINEERING SOCIETY

The October meeting of the American Institute of Electrical Engineers has been assigned to the discussion of two papers on electric traction, namely, "The Conditions Governing the Rise of Temperature of Electric Railway Motors in Service," by Cary T. Hutchinson. Discussion will be participated in by John Balch Blood, Louis Duncan, A. H. Armstrong; and "A Graphic Recording Ammeter and Voltmeter," by A. H. Armstrong.

PERSONAL MENTION

MR. HOWARD B. RHOADS, general superintendent of the Columbia line of the Conestoga Traction Company, of Lancaster, Pa., has resigned. Mr. John G. Livingston is temporarily in charge of the line.

MR. J. P. CLARK, formerly manager of the Terre Haute Electric system for Stone & Webster, of Boston, and later representing the same interests at Dallas, Tex., is to become manager of the Indiana Union Traction Company's lines at Fort Wayne, Ind.

MR. LOUIS E. PELLISSIER has been elected treasurer of the Holyoke Street Railway Company, of Holyoke, Mass., to succeed Mr. William R. Hill, resigned. Mr. Pellissier has been with the company thirteen years, beginning work as a conductor and later becoming a bookkeeper.

MR. J. H. MERRILL, the retiring general manager of the Ohio Central Traction Company, was surprised a few evenings ago by a call from nearly all the employees of the company. As a token of their esteem the employees presented their former associate with a fine Morris chair. Mr. Merrill has become auditor of the Western Ohio Railway.

MR. J. W. BROWN, superintendent of the McKeesport lines of the Pittsburg, McKeesport & Connellsville Railway Company, has been appointed to succeed Mr. Thomas Elliott as general superintendent of the system, the latter going to England. Mr. Brown's headquarters will be in Connellsville. Mr. W. E. Moore will be general manager of the company.

MR. R. P. SCALES, formerly general manager of the Consolidated Car Heating Company, died last week. Mr. Scales had been identified with the Consolidated Car Heating Company for a number of years, having been the Chicago representative for five years, and general manager at Albany for two years. He retired from active participation in the selling branch of the company about a year ago. His death occurred in Boston.

MR. THOMAS FARMER, who recently resigned as superintendent of motive power of the Detroit United Railways Company, of Detroit, Mich., has become superintendent of the shops of the G. C. Kuhlman Car Company, of Cleveland, Ohio. Mr. Farmer was connected with the Detroit Company for a number of years, and was one of the organizers of the American Railway, Mechanical and Electrical Association, of which he was the first chief executive.

MR. H. A. NICHOLL, treasurer, general manager and purchasing agent of the Ithaca Street Railway Company, of Ithaca, N. Y., has accepted an offer to become general manager of the Cleveland & Southwester Traction Company's systems, with headquarters at Cleveland, Ohio, and will assume the position Nov. 1. Mr. Nicholl has been in the transportation business more than twenty years, and has had long experience on both steam and electric roads. He was connected with the Chicago & Northwestern and Illinois Central lines. From there he went East and became associated with several electric roads, a few years ago becoming manager of the Ithaca system. Mr. Nicholl succeeds Mr. F. T. Pomeroy, who was recently elected president of the system with the understanding that an operating man of efficiency should be employed to relieve him of the many arduous duties of management.

MR. W. O. WOOD, formerly general superintendent of the Rapid Railway System, of Detroit, Mich., which is the suburban system of the Detroit United Railway Company, has been appointed superintendent of the elevated division of the Brooklyn Rapid Transit Company, of Brooklyn, N. Y., succeeding Mr. Geo. W. Edwards, resigned. Mr. Wood has been connected with the Rapid Railway for some time and his experience extends as well to the operation of steam railroads. For ten years he was connected with the Illinois Central Railroad, as trainmaster and in other capacities, and was for several years secretary to Second Vice-President J. T. Harahan. His experience previous to this was gained with the Louisville & Nashville Railroad, with which he was connected for five years. Mr. Wood's first work in Brooklyn will be in perfecting and applying to the elevated lines the merit system of discipline recently adopted by the company, and in thoroughly working out for the elevated lines the system of train despatching recognized as standard by the leading steam railroads. Mr. Edwards, who is succeeded by Mr. Wood, has been connected with the elevated railways of Brooklyn intermittently since their beginning. For a long time he was assistant superintendent under General Manager Barton, of the Brooklyn Elevated Railway Company, and when the latter road was absorbed by the Brooklyn Rapid Transit Company he was made general superintendent of the entire system.

AN EXAMPLE of deserved promotion in recognition of ability and capacity is recorded in Mr. John A. Beeler, vice-president and general manager of the Denver City Tramway Company. Mr. Beeler has been in the street railway business since 1885, when he joined the Cincinnati Street Railway Company as rodman. In the summer of 1888 he went to Denver, Col., as assistant engineer for the Lane National Cable Railway Construction Company, in charge of construction of the Denver cable lines. On the completion of these lines in 1889, he joined the Denver Tramway Company as engineer in charge of civil engineering on the South Broadway overhead electric line. This was the first electric railway installed in Colorado, and was equipped with the Sprague system. Mr. Beeler continued as chief engineer of the Denver Tramway Company until 1891, when upon organization of the Metropolitan Railway Company to take over an opposition line, he was also appointed chief engineer for that company, and in that capacity built 35 miles of electric railway in Denver. Upon the organization of the Denver & Northwestern Railway Company he was appointed its chief consulting electrician, a position which he still holds. In 1902 Mr. Beeler was offered the position of general manager of the Denver City Tramway Company to assist President Curtis. The president's health failing soon afterward necessitated his retiring from the active management, and on the election of Mr. Wm. G. Evans to the presidency in the spring of 1902, Mr. Beeler was elected vice-president and general manager. In addition to these duties Mr. Beeler continues to act as chief engineer of the system. Mention should be made of the 72-lb. T-rail which he designed in 1892, for use on paved streets, a rail commonly known now as the "shanghai" section. In 1898 he found that the records of the track department did not show where the maintenance expense went, no record being kept of the work or of the distribution of the material used. He therefore prepared a system of daily reports, whereby the work of each foreman was tabulated, with separate accounts for each class of construction. From these reports weekly and monthly summaries were made. The result was that the foremen and even the men became personally interested in their work, as they were desirous of producing good reports, and a rivalry sprang up between the different gangs to do as much work as possible. To counteract the tendency to produce cheap work, a record was also kept of those who did the work, so that a piece of poor construction could be directly traced to the workman doing it. As a result of these daily reports, at the end of the first year, despite the fact that the men's wages were raised 16 per cent, the cost of doing all classes of work was reduced 45 per cent. The company was so well pleased with the system that it was gradually introduced into the various departments of the railway so far as practicable and has been in successful operation ever since.



J. A. BEELER

NEWS OF THE WEEK

CONSTRUCTION NOTES

EUFAULA, ALA.—At a regular meeting of the City Council a franchise was granted for a period of twenty years to the Eufaula Railroad Company. The company is composed of the following: J. P. Foy, B. B. McKenzie, R. A. Ballowe, C. A. Martin, H. C. Holleman and L. H. Brassell. It is proposed to construct a system of electric lines over the city and to extend it as far as Abbeville, and the Board of Revenue will be asked at its next meeting to grant the privilege of crossing the county. The project is meeting with every encouragement and is believed will be a success.

LOS ANGELES, CAL.—Petitions are being signed by property owners asking the City Council to advertise the sale of an electric arilway franchise on Eleventh Street, from Main Street to Hoover Street.

LOS ANGELES, CAL.—The Clear Lake Electric Railway Company, incorporated last March, in which Los Angeles capital is interested, has been formally granted a franchise to run a 40-mile electric railway from Cloverdale, in Sonoma County, to Lakeport, in Lake County. This line will open up a country of rich resources which has been held back because now all products have to be hauled out by team. The directors are: Dr. W. P. Prather, W. C. Phillips, H. C. Healy, Robert M. Hartwell and H. R. Bingham.

SAN JOSE, CAL.—The Board of Supervisors has passed a resolution of intention to grant to George Tourney, representing the San Jose Street Railway Company, a franchise for an electric railway from San Jose to Campbell.

WOODLAND, CAL.—Attorney N. A. Hawkins has made application to the Board of Supervisors and the City Trustees for a franchise to build an electric railway through the city of Woodland and Yolo county. The proposed route passes through Woodland to the head of Capay Valley, and touches the Sacramento River at Elkhorn and Knight's Landing, with branches at Cacheville, Blacks and Winters. Mr. Hawkins is counsel for the Yolo County Consolidated Water Company, and it is believed that corporation is behind him. The company owns nearly all of the water rights of Cache Creek, on the headwaters of which the proposed power house will be located.

NEW LONDON, CONN.—Judge Wheeler has granted a certificate of public necessity to the Groton & Stonington Street Railway Company, which proposes to build an electric railway from Groton to Westerly. The hearing on the application of the company showed that the project is well in hand. All the stock has been taken, and the testimony of the engineers of the company showed that the plans for construction are well in hand.

TORRINGTON, CONN.—At the annual meeting of the Hartford-Torrington Tramway Company the following officers were elected: President, M. C. Webster, of New Britain; vice-president, Walter Holcomb; treasurer, N. E. Pierce, of Bristol; secretary, D. B. Mansfield, of Harwinton. The directors are these officers, with C. B. Strong, of Hartford; Samuel Knous, of Terryville; D. A. Grannis, of Hartford; D. W. Clark, of Torrington, and E. G. Gibbs, of Hartford. A large subscription is promised soon, and the outlook is very promising. The trolley line to Terryville is now nearly completed, and a trip can be made from that place to Hartford by trolley and third rail. Only 12 miles is needed to complete the connection with Torrington. The charter of the company has been extended two years.

CANTON, ILL.—Incorporation papers have been granted to the Illinois Central Electric Railway Company to construct a street railroad at Canton, and interurban roads branching from that city. The incorporators are: Joseph David, of Cleveland, Ohio; James H. Lawrence, James S. Hopkins, Fred. A. Dolph and David J. Peffers.

CHARLESTON, ILL.—M. C. Thomas, of Homer, says there is every reason to believe that the proposed electric railway from Charleston to Homer will be built. At Homer the new line will connect with a road from Ogden, promoted by the McKinley syndicate.

EAST ST. LOUIS, ILL.—The East St. Louis & Columbia Electric Railway Company has been incorporated with a capital stock of $2,500. The incorporators are: P. J. Meyers, John Keckhain and C. J. Gorla.

EVANSTON, ILL.—The Chicago & Milwaukee Electric Railroad Company has asked the City Council to grant a fifty-year franchise, so that the southern terminus of the road may be at the Chicago city limits. The road now runs north from the heart of Evanston. It is desired to extend it south through Evanston as far as the Chicago city limits. The route proposed is through the western part of Evanston.

MOUNT VERNON, ILL.—Isaac A. Smith, chief engineer for the Southern Illinois Electric Railway Company, has finished the drawings for the main power house of the road, which will be located at Irvington.

O'FALLON, ILL.—The East St. Louis, O'Fallon & Lebanon Electric Railway has been completed east of this city to the Willard Range Works, and cars will be placed in operation at once.

ROCKFORD, ILL.—The Inter-State Electric Railway Company, which was incorporated some weeks ago for the purpose of building a line from Rockford to Madison via Brodhead, has been formally organized at Rockford. President, M. A. Beal, manager, Rockford Edison Company; vice-president, N. F. Thompson, vice-president Manufacturers' Bank.

SPRINGFIELD, ILL.—The City Council has passed an ordinance granting to the Consolidated Railway Company a franchise to extend its tracks and build certain switches and turnouts in the streets of Springfield.

SPRINGFIELD, ILL.—The Kankakee Interurban River View Railroad Company, of Kankakee, has been chartered with a capital of $2,500. The incorporators are H. T. Bonfield, E. W. Bonfield, Gordon Hannah.

FORT WAYNE, IND.—Attorney W. S. O'Rourke has announced that all the franchises outside the city of Fort Wayne through territory over which the Fort Wayne & Northeastern Traction Company is to construct its electric line connecting Fort Wayne and Bryan, Ohio, have been secured. The last of these was the franchise through Bryan, which has just been passed by the Council there, upon conditions which are acceptable to the company. The projectors now hold franchises through Allen County, DeKalb County, Defiance County, Williams County, the town of Hickville and the city of Bryan. Mr. O'Rourke stated also that the securing of these franchises had been the only matter which was delaying the company, and that the construction work upon the road would be advertised and awarded within a few weeks, so that actual work will be commenced in the spring, or earlier.

FRANKLIN, IND.—J. I. Irwin, president of the Indianapolis, Columbus & Southern Traction Company, has purchased a site in this city at Main Street and Madison Street, and will erect at once a three-story traction office building, station and freight depot. The offices of the company, now at Greenwood, will be removed to Franklin.

FRANKFORT, IND.—The Indianapolis & Northwestern Traction Company has the road now completed between Lafayette and Dayton. Construction trains are now running back and forth. The connection between the interurban and the street car company's tracks will not be made for a few weeks.

INDIANAPOLIS, IND.—The Indianapolis, Shelbyville & Southeastern Traction Road has been sold by Fletcher Hines and Dr. R. C. Light to the traction interests headed by Charles L. Henry. New officers were elected, George A. Ball, of Muncie, who is associated with Mr. Henry, being made president. It is announced that the extension from Shelbyville to Greensburg will be pushed through, but it is also understood that the road will stop at that point and that Mr. Henry will push his Rushville line through to Cincinnati, making it the only Indianapolis-Cincinnati traction road.

INDIANAPOLIS, IND.—There is considerable speculation concerning the purposes of the Appleyard syndicate's invasion of Indiana. It has developed that the syndicate proposes to build from Troy, Ohio, to Winchester, Ind., and thence to Richmond, to connect with the line the syndicate is promoting between Richmond and Columbus. But the enterprise is not to stop here. A line will be built to Evansville from French Lick. The syndicate is said to have an interest in the Southern Indiana Traction Company, and will get into Louisville over that line. From Columbus the syndicate cars will reach Indianapolis over the Irvin system, and thence over the Indianapolis Northwestern to Lafayette, from whence a line will be built to Chicago. The company has deposited bonds in Columbus, Greensburg, Connersville and Richmond, where franchises have been granted, to be forfeited if work is not begun within a year and the road is not in operation in two years.

INDIANAPOLIS, IND.—The Central Indiana Traction Company has been incorporated by L. A. Bookwalter, V. J. Drayer, S. J. Rock, W. C. Teeter, Aaron Miller and N. A. Teeter, of Dayton, Ohio, to build an electric railway from Wabash to Warsaw, by the way of North Manchester and Winona Lake, and from Connersville to Liberty and the Ohio-Indiana State line. The company is capitalized at $50,000. The Appleyard syndicate is believed to be back of the new company.

MARTINSVILLE, IND.—The Martinsville Rapid Transit Company has made arrangements with the Big Four Railroad to use 5 miles of its track between this city and Taggart. This plan will enable the company to operate its Bloomington extension without having to drill a tunnel through several hundred feet of rock.

NEWCASTLE, IND.—After grading 15 miles of track between Anderson and Newcastle the Union Traction Company has suspended work. The company did not get all its right of way before beginning work, and the farmers near Newcastle have combined and are asking $1,000 an acre for their land. The company will now proceed to condemn the right of way.

RICHMOND, IND.—The City Council has taken the necessary steps to raise the C. C. & L. bridge to permit the opening of through travel on the electric railways between Indiana and Ohio, arrangements for which have been completed for some time.

SEYMOUR, IND.—The Indiana Central Railway Company, which proposes to build an electric railway from Seymour via Columbus to French Lick, is asking a subsidy from every township through which the road is to pass. If these subsidies are all voted, the contribution will amount to over $200,000.

CEDAR RAPIDS, IA.—The work of surveying the proposed line from Cedar Rapids to Waterloo, in which Colonel W. G. Dows and Isaac B. Smith, of this city, are interested, and which was mentioned in these columns recently, has commenced. The surveying party, under Chief Reynolds, started out a few days ago, and has surveyed a line as far north as Jubilee, a point near the east line of Black Hawk County, and about 12 miles southeast of Waterloo, the terminus of the proposed line. The route surveyed lies about half-way between the Decorah and the Minneapolis & St. Paul divisions of the Rock Island Railroad.

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Value of Transfer Inspection

In a recent discussion of methods for preventing transfer frauds in which several managers participated, it was found that not a single road represented had any systematic plan for preventing the abuse of this privilege. It should be mentioned that, with one exception, all the companies represented were comparatively small concerns, the only large property interested being one which had consistently and persistently opposed the issuance of transfers and had generally succeeded. All of the other companies had made spasmodic attempts to check up their returns especially when abuses became too flagrant, but after a short period the investigation was discontinued on the ground that it cost too much. Most of the managers admitted that the companies suffered as soon as the system of inspection was discontinued, but they did not seem to think that the losses sustained through these frauds warranted them in organizing and developing a permanent inspection bureau. This, of course, is a matter for each management to decide for itself, but in reaching a conclusion consideration should be had for the fact that neglect to take cognizance of these conditions and remedy them cannot fail to have a very bad influence on the organization generally and encourage laxity in other branches of the service. When the management winks at pilfering, simply because it is believed the amount involved is less than the cost of detecting it would be, heavier losses resulting from the betrayal of its interests in other departments will probably follow, and every failure on the part of the company to investigate fraud and punish its perpetrators is an encouragement to others who may have opportunity to do likewise. In general, it may be said that the moral effect of strict inspection cannot be too highly valued.

Just a Little More Speed

We note with pleasure that our space-devouring friends at Zossen have not yet satiated their hunger for pace and touched the record the other day for no less than 140 m. p. h. They seem to be overcoming air pressure rather comfortably up to the present, and we have heard nothing about the motors failing or the pressure caving in the front end of the car. Perhaps the doubting gentlemen who figured on the motors burning out from overload at about 80 m. p. h. to 100 m. p. h. will now be convinced that higher speeds are both possible and practicable. One hundred and forty miles per hour is a decidedly hot pace, but it will more than likely be beaten before we go to press. It has taken a good many years to evolve the two-minute trotting horse, but this year we have him in triplicate, and just so it has been with electric railroading. Once the records began to break they fairly blew up and left only small fragments. One hundred and forty miles per hour, even if not outdone by a considerable margin, still means that the hundred-mile-an-hour train is much nearer to reality than it has ever been before. That speed is quite feasible whenever it is demanded, and it is, moreover, quite high enough to meet the requirements of humanity for some little time to come. Its real importance lies, as we have often remarked, in its application to long lines on which the saving of time would be material. Cutting down the running time to Flatbush or Hackensack may defer the dyspepsia of the commuter for another season or two, but it is not commercially important. It is cutting the time on long runs that counts—reducing the time to Washington to less than three hours, and converting the trip to Chicago into a mere night's run. It is now announced that the experiments have been conducted largely with the idea of the early application of the system to the railroad connecting Berlin with Hamburg, distant by rail 176 miles from each other, and that an early conversion of that line is by no means improbable. Somehow the hundred-mile-an-hour train looks nearer than it did a few months ago, and our spyglass is still trained in the direction of Germany.

The Fire Danger

The report on the Paris disaster which we published in our last issue, together with an unimportant accident in this city, to which some of the papers attached altogether too much sensationalism, has served again to bring before the public eye the subject of fire risk in electric cars. Ordinary electric roads need hardly be seriously considered in this connection, since exit from them is so easy, but elevated roads and subways undeniably present some new sources of danger. Fire is, of course, a possible contingency on any cars constructed of inflammable material, and any electric arc once started is an incendiary capable of producing a fire in anything that will burn at all. Once well started, a fire in a train is likely to spread as it did in the Paris instance, and the results, as there, may be

very grave. But upon reflection there seems no good reason why an electric train may not be thoroughly safeguarded. In the first place, the surroundings of the motors and their cables ought to be practically fireproof, and can easily be made so. In fact, many American cars are pretty well safeguarded in this particular. In the next place, if a motor car is used to draw trailers, this car can be of out-and-out fireproof construction, so as effectively to remove danger of a conflagration. Finally, all the cars could be of fireproof construction throughout without working any particular hardship on anybody. But quite aside from removing danger of electrical fires one must consider another set of precautions directed to ensuring the safety of passengers in case of an actual fire or such alarm of fire as might cause a panic. In the Paris disaster the means of exit from the stations appear to have been altogether inadequate. This direful lesson should be taken to heart in planning subway entrances and exits hereafter, and means should be provided for clearing a station with great rapidity in case of necessity. Next, on lines using the third-rail the danger from shocks in case of a rush from the cars should never be forgotten. It is not a difficult matter to use a protected third rail, especially on underground lines, and there seems to be no good reason why it should not be done. With such precautions taken, and general operative care of the excellent quality usual on American lines of the first magnitude, we see no reason to worry over the fire risk.

Proposed Electric Operation on the Boston & Albany

Some time ago we published an item in regard to the failure of a steam motor car to capture the traffic on the Newton Lower Falls branch of the Boston & Albany Railroad in the face of severe trolley competition. The Boston & Albany, as nearly everyone in the East knows, is a finely equipped steam railway system, leased by the New York Central & Hudson River Railroad, and the excellence of its suburban service is familiar to transportation experts the country over. It is now reported that the Lower Falls branch is shortly to be equipped for trolley operation, and if this work is soon carried out it will doubtless furnish an object lesson to Boston commuters which will result in a demand for more extended electric service.

The branch line in question is but 1.1 miles in length, and serves a comparatively small population. Nevertheless, it is a good place to show what electricity can do in the way of rescue work, as there are at present twenty trains per day over it in each direction, operating, it is said, at a loss financially. Wisely, the road will probably buy its power from a local electric company, as but a single car will be operated at first. The equipment will consist of a motor car divided into three compartments, one for baggage, one for smokers and one for non-smoking passengers.

The electrification of the entire Brookline and Newton circuit suburban loop of the Albany road has been a subject of discussion in railway circles for certainly a decade. With the advent of the third rail and the completion of the Southern Terminal Station, with its depressed loop tracks for suburban trains, prospects began to look brighter for the application of electricity on a large scale to one of the most interesting and favorable fields in the domain of transportation. While the Newton Lower Falls branch is but a feeder to the main circuit line, we cannot but believe that the adoption of even the overhead trolley marks a step toward the gradual realization of electric power in the entire suburban traffic of the Albany road about Boston. From time to time it has been authoritatively stated that the management has considered plans for this latter far-reaching change, with the great manufacturing companies, and this driving in of the outposts looks encouraging.

The Heating of Railway Motors

A recent Institute paper, by Dr. Hutchinson, brings again to the front the very interesting question of the rating of motors with respect to temperature, and the predetermination of the heating due to any particular kind of run. The paper itself does not permit of abstracting to advantage, and is of a highly technical character, but it suggests quite incidentally some very important questions. One of the most practical, it seems to us, is the possible effect of specialized means of ventilation on the final temperature of railway motors and on their useful working capacity. Every one who has followed the improvements in electrical apparatus knows well the great change for the better in the ventilation of generators, and the resulting lowering of cost and improvement in efficiency. But few outside of practical constructors know the great change for the better that can be made by even few and small apertures for ventilation in a machine of the iron-clad type. The early railway motors were not enclosed, and were pretty badly designed as well, so that the iron-clad motor was a welcome change for the better. But to-day, and most particularly in interurban service, the need of an extreme iron-clad construction is much less pressing that it once was, and we would much like to see the results of a less extreme enclosed construction. The practical question is merely how much ventilation can be introduced without material trouble from dust and moisture. We have already reported some experiments on ventilating devices that seemed to give excellent results, but these, tried on standard motors, were, of course, under less favorable conditions than if the motors had been deliberately designed to facilitate ventilation. The whole subject needs to be conscienciously gone over, for the possible gains are very considerable. It is a task for the designer, in particular, and we are more than half-inclined to think that a motor can be found which will do the work of the present machines at a materially reduced cost and with lessened weight of equipment, which is itself an end greatly to be desired.

Track Work

"If those who originally built street railways had to maintain them they might have been built differently."

This is how Mr. Wilson sums up the situation in his paper on "Track Construction and Maintenance" at the Syracuse Convention, and no doubt there is much truth and wisdom in the remark, but on the other hand may be cited instances to-day where experience, although dearly bought, does not seem to have left much of an impression, and very little, if any, improvement over earlier methods is shown. We are actually floundering about to-day without any fixed purpose and definite aim, and, consequently, the data available is not as conclusive as it should be at this late day. The trouble seems to be largely in failure on the part of the operator as well as the builder to appreciate the actual requirements of the service which the road is to perform. As in the cases cited by Mr. Wilson many promoters to-day do not know what class of service is to be given over the lines they project, and, besides, they do not possess sufficient experience to determine the character of equipment best adapted for their needs. A great many roads seem to be operated without regard for economical con-

siderations, and, consequently, it cannot be expected that their track construction and maintenance will be treated scientifically.

Mr. Wilson, of course, refers to a different class of properties, including roads whose present management has well defined ideas regarding the possibilities of properly operated electric lines. Many of these companies, especially those created by the consolidation of smaller systems, have been seriously handicapped by the condition of the property turned over by the promoter or builder, and they have not infrequently been put to the necessity of rebuilding the entire plant. How to avoid such faults in the future is the lesson of these experiences, and this applies to present roads as well as projected lines. It must be apparent to all that a careful investigation of this problem along scientific lines cannot fail to repay those who will engage in it. To-day there is no standard, no generally accepted method, but each engineer or manager follows his own inclination, and thereby contributes to the general confusion. Such an important subject is deserving of the best thought available.

The Business Outlook

It is a somewhat curious fact that while some of the leading capitalists of the country, such as the Goulds and Harriman interests, are proposing important betterments to their railroad interests in the Central and Western parts of the United States, while the aggregate clearing house exchanges over the entire country for the year, outside of New York City, are larger than those of last year, and while the railroads are taxed to their utmost to carry the goods bought and sold, stock exchange prices should have so long been low.

Judging from this latter fact alone, the opinion has been expressed in Wall Street that the country, having passed the summit of the great industrial prosperity of the last five years, the movement of trade has set very definitely in the opposite direction. It is important in discussing this question to consider, first, what are the actual signs of a commercial decline, and, second, whether they are sufficiently serious to suggest that we are likely in the near future to run into a period of positive business depression. The unpleasant symptoms which have gathered during the last twelve months are: an excessive advance in commodity prices, the exorbitant demands on the part of organized labor, which have led to an abnormal rise in wages, and increases more or less considerable in the cost of materials entering into manufacturing and trade in general. These circumstances, working in unison, have certainly cut heavily into the profits of capital, the result of which is that in various lines of industry, notably in iron and steel, demand has fallen off, prices have dropped, and production is being curtailed.

This appears to be the full extent of the facts upon which the notion of a retrograde movement is based. The overproduction which usually ushers in a real commercial crisis, plainly does not exist. Thanks to the concentration of administrative control, which is a part of our new industrial regime, prices have not been allowed to rise far enough to arouse new competition and so stimulate new production to what can be termed a dangerous degree. The unfavorable attitude of union labor has itself been a powerful additional check upon these unwholesome tendencies. If over-production is not present now, there is but one other way in which a serious revulsion in business could occur, and that is through a general curtailment of consumers' demands. It is true that higher prices have raised the cost of living and that for this reason a part of the population is able to buy less than it could two or three years ago. It is also true that high prices have caused some decline in foreign purchases of our agricultural products. On the other hand, our manufacturers have not lost any of their hold on the foreign markets, for our manufacturing exports are as large now as they were last year, and far larger than the average of recent years. The loss in agricultural exports, there is every reason to believe, will be easily recovered after prices of our wheat and corn and cotton have fully felt the influence of this autumn's enormous harvests.

With this much assurance for the foreign trade, the only anxiety is as to whether the buying power in our home markets will be sustained. We know that the great farming regions of the West and South have before them one of the most promising seasons in their history—that the corn crop is the largest but one on record, that the wheat crop has never but twice been exceeded, that cotton will be much more than an average crop, and that all this new wealth coming up out of the ground is going to be enormously augmented by the unusually high prices offered for all the products of the farms. What this means clearly enough is that the buying power of a large section of the country is not only not likely to diminish but is most likely to rise greater than ever, and that the prosperity of the agricultural West and South will reflect itself in unlessened degree in the demand for the products of the mercantile and manufacturing East. In our view of the case too little weight has been given to the fundamental and too much weight to the superficial elements in the situation. The only really serious feature now confronting is the unfriendly position assumed by organized labor. Labor unions pushing their claims too far caused the suspension in the building trades; the loss of this important custom has been the main reason for the decreased earnings of the steel trade, and it is still an open question whether it, also, is not the chief explanation for the reduction of the dividend on the Steel Corporation's common stock, which has served more than any other recent event to arouse the misgivings of the commercial community. All candid observers must admit the possibility of a crisis soon to be reached, where labor will have to choose between the alternative of working for less wages or going without any work at all. The issue will not be tried by strikes and lockouts, but by a frank statement on the part of employers that they prefer to suspend operations altogether rather than continue them on an unprofitable basis. The recent exposure of the mercenary objects of some of the leading labor leaders will do much to clear the labor horizon.

A sensible reaction in many lines of business has already appeared, and it is quite likely to go further. Where prices have risen too high they must come down, where production has gone ahead too fast it must be curtailed, and, finally, labor must be brought to recognize that its profits cannot keep up as they have been when profits of capital are declining. But the point we wish to emphasize is that what this calls for is a period of readjustment, not a period of real depression. The vital wealth-giving forces have not suffered from anything that has happened during the past twelve months. No collapse of the nation's buying power, such as happened in 1883 and 1893, is now at hand. The foreign outlets for our surplus products are not seriously impaired. Production has not so far exceeded its proper bounds that it cannot easily be brought back. In brief, the real underpinings of our great industrial prosperity remain as sound as ever.

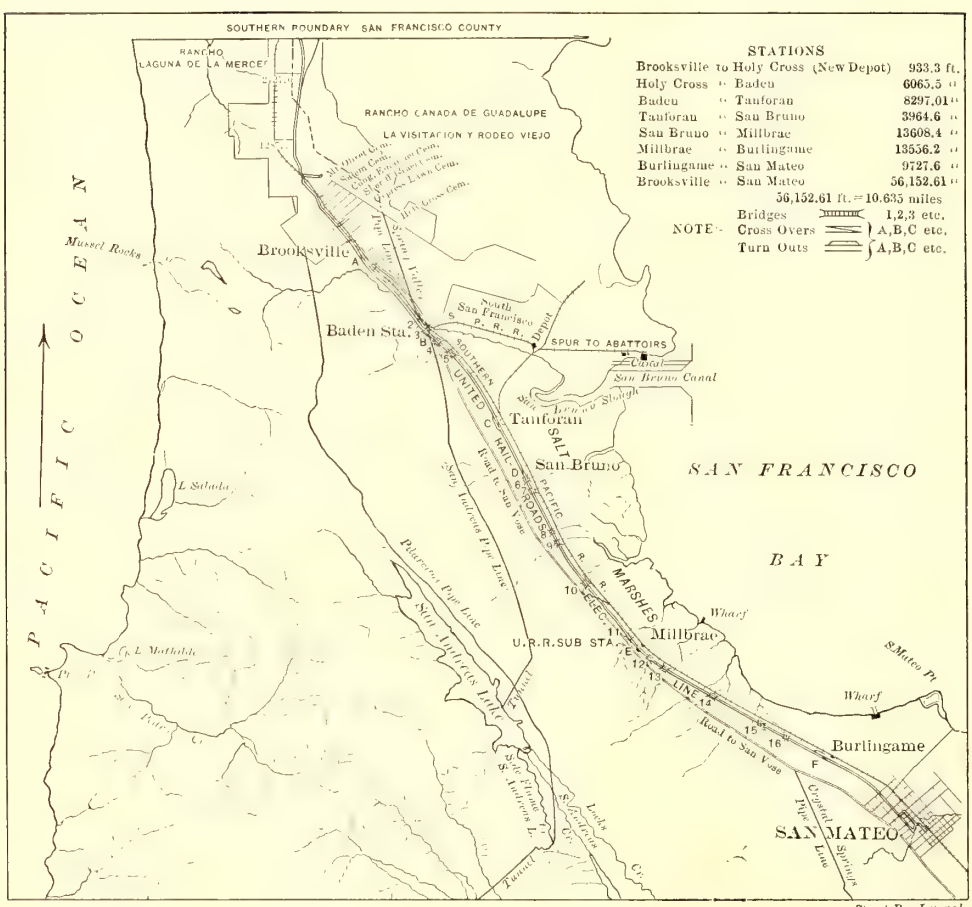
SAN MATEO EXTENSION OF THE UNITED RAILROADS OF SAN FRANCISCO

Isolated from the noises and apparent confusion which pervade a city like San Francisco, the pretty town of San Mateo, Cal., 'midst orange, olive and eucalyptus trees, palms, roses of every description, fuchsias and geraniums that attain the height of small trees and literally loaded with blossoms, caulilies, poppies and other beautiful and fragrant flowers, offers an ideal home for the business man or man of leisure. Here he may spend his evenings with his family and friends, far away from the crowds that throng the streets of San Francisco by day and night. There are other attractions that make this town popular. First of all, the climate is superb. Sheltered by mountains from the winds and fogs that sweep over San Francisco, and make overcoats and sealskins necessary in that city, one may gaily venture forth in a tennis suit in San Mateo. And yet, on account of its proximity to San Francisco Bay, it does not get uncomfortably warm.

Until recently the only means of traveling between San Francisco and San Mateo was by steam train or driving. The distance, 23 miles, made driving an impossibility as a regular means of going back and forth. Trains were rather few and far between. Shoppers had to devote a whole day in order to make a trip to the metropolis of the Pacific Coast. Theater-goers had to contend with the old bugbear—the last train—and to miss it meant spending a night in San Francisco, with incidental hotel expenses. Business men, if they missed their regular train, had to wait an hour or more for the next one.



TYPICAL SAN MATEO COTTAGE



MAP OF SAN MATEO EXTENSION OF THE UNITED RAILROADS OF SAN FRANCISCO

Besides, after one arrived in the city, via steam train, ten minutes or fifteen minutes were consumed in reaching the business or shopping district of the city by trolley. So, taken as a whole, with its many attractions and allurements, San Mateo was not regarded as a desirable place to live.

The high-speed trolley service which has solved the interurban problem so many times before, again came to the front and solved this transportation problem. To begin with, 11 miles of trolley line already existed, extending from the ferries in San Francisco to what is known as Holy Cross. About 4 miles of this was through the city. Seven miles was suburban line. A private right of way was secured from Holy Cross to Burlingame, through the outskirts of Baden, San Bruno and Millbrae. From Burlingame to San Mateo franchises were secured to run on the streets. There were, therefore, about 12 miles of interurban road to be built.

TRACK CONSTRUCTION

A map of the double track with cross-overs, switches, etc., from Holy Cross to San Mateo, and a sectional drawing showing roadbed construction, are presented. The ties are redwood, 6 ins. x 8 ins. x 8 ft. They are placed 2 ft. 6 ins. from center to center. The rail is a 72-lb. T-rail, on the private right of way. The joints are cast-welded, with an expansion joint every 1000 ft. Each cast-weld weighs 120 lbs. In the town of San Mateo a 9-in. girder rail is used. With the exception of a slight grade in San Mateo the interurban line is practically level. Several views, reproduced from photographs, illustrate typical cuts and fills. Except in San Mateo the entire interurban line is heavily ballasted with crushed rock. Track centers are 13 ft., and the gage is standard.

LINE CONSTRUCTION

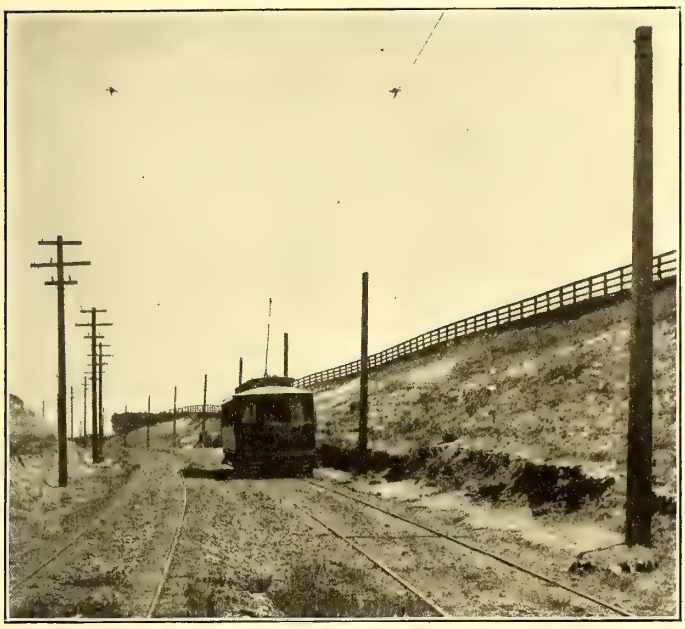
Wooden side-pole construction is used on the entire interurban section. The poles carrying high-tension wires are 7 ins. x 7 ins. at the top, 13 ins. x 13 ins. at the base, and 35 ft. long. The other poles are 8 ins. x 8 ins. at the top, 12 ins. x 12 ins. at base, and 25 ft. long. They are all of redwood, and that portion which extends into the ground was coated with crude oil. They are painted a dark green, with a mixture of linseed oil, yellow ochre and lamp black.

The cross arms are all made of Oregon pine, those carrying

the high-tension wires being 4 ins. x 6 ins. x 5 ft., and 4 ins. x 6 ins. x 7 ft. The three high-tension wires are arranged in a triangle on one side of the pole, making it possible to add another set if it is desired. One wire is carried on the upper cross-arm and two on the lower. The wire is No. 0, and is triple braided, waterproof. John Martin No. 100 brown porcelain, single-petticoat, iron-pin insulators are used. The cross-arms carrying the feeder wires are 4 ins. x 6 ins. Steel-pin porcelain insulators are used. There are at present five feeder wires from Millbrae substation, all being 500,000 circ. mils. The trolley wire is No. 00 hard-drawn copper. The span wires are



A FILL ON SAN MATEO LINE



A CUT ON SAN MATEO LINE



SAN MATEO'S MAIN BUSINESS THOROUGHFARE

5-16-in. galvanized iron strand wire. The ears are all soldered. The construction work on this line followed the same high standard as that adopted on other parts of the system.

POWER DISTRIBUTION

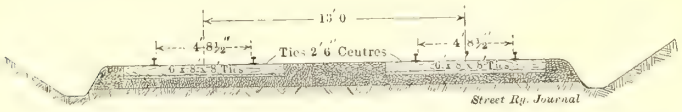
Power is furnished to this line as follows: From the ferries to Thirtieth Street, the Bryant Street power house furnishes direct current at 550 volts; from Thirtieth Street to Holy Cross, the Geneva Avenue sub-station supplies the power, and from Holy Cross to San Mateo the Millbrae sub-station is depended upon. The latter section, supplied by the Millbrae sub-station, includes almost all the interurban portion of the road, although the Geneva Avenue sub-station has sufficient capacity to supply both the suburban and interurban sections, and enable the Millbrae sub-station to be closed down when the rush hours are over, but this necessitates transmitting power for about 14 miles. It is being done, however, with fair success, through the aid of sufficient feed wire and a good return circuit employing cast-welded joints.

The Milbrae sub-station, illustrated herewith, is a substantial fireproof, red brick building, 40 ft. x 75 ft. The walls and foundations are built of brick and cement, the floor is of concrete, and the roof is covered with best quality California slate, nailed on cinder concrete. The station is well lighted by large



LINE TO TANFORAN RACE TRACK, SHOWING OVERHEAD CONSTRUCTION

windows. The walls and ceilings are painted with light, harmonious colors, thus presenting an inviting appearance. A waiting room is provided for passengers in the basement, the floor of which is on a level with the track. A toilet room, lockers, telephone booth, desk, neat work benches, supply



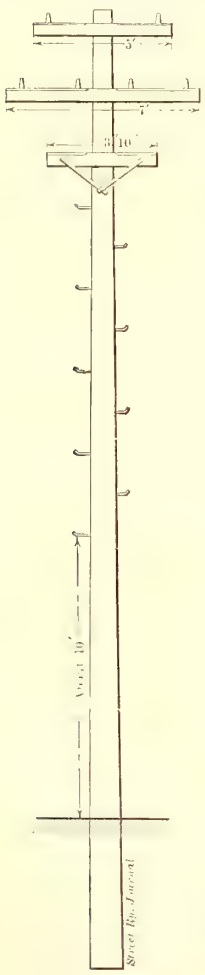
SECTION OF ROADBED ON SAN MATEO EXTENSION

closets, etc., are provided for the comfort and convenience of the men operating the plant.

The station is equipped at the present time with two six-pole, 500-kw, 600-volt compound-wound rotaries, operating at 500 r. p. m.; two sets of three each of 25-cycle, three-phase, 185-kw, 13,200-440-volt air-blast transformers; one blower set, consisting of one four-pole, 2-hp, 350-volt induction motor, directly connected to a Buffalo Forge Company 40-in. blower, operating at 750 r. p. m.; two motor-controlled oil switches, operated from a storage battery in the basement; two reactive coils, connected on the low-tension side of the transformers, and switchboard with the usual complement of instruments, circuit breakers and switches.

There are five feeders going out from the switchboard, all being 500,000 circ. mils. There is room enough in the station to double the present equipment if it is desired.

Alternating current is transmitted to Millbrae sub-station from the main power plant of the United Railroads at North Beach at 13,200 volts, over a distance of about 85,000 ft. At Millbrae the current is stepped down to 440 volts and then converted into direct current at 550 volts. The entire electrical machinery is of the General Electric type.



35-FT. POLE AND CROSS-ARMS

For the purpose of blowing out the rotaries a 10-hp, 550-volt, 1100-revolution Christensen automatic motor compressor has been installed.

A traveling crane, with an 8-ton Yale & Towne triplex tackle block for handling machinery is also a part of the sub-station equipment.

CARS

The cars are of the monitor deck pattern, with drop sash, cross seats, smoking compartment and vestibuled ends. They were built by the Laclede Car Company, of the following dimensions: Length over all, 45 ft. 9 ins.; length over body, 34 ft. 4 ins.; width over sills, 9 ft.; width over belt rail, 9 ft. 2½ ins.; width over drip boards, 9 ft. 6 ins.; width over steps, 9 ft. 8 ins.; height of car from bottom of bolster to top of trolley board, 9 ft. 4 ins.; bolster centers, 23 ft.

The framing of the car is made especially strong. The side sills are long-leaf Southern pine, 4¾ ins. x 7½ ins., plated on the outside clear around the end sills with ⅝-in. x 6-in. steel plate. On the inside the sills are plated with 6-in. channel iron. The two center longitudinal sills are 8-in. I-beams filled with wood. The end sills are 4¾-in. x 7½-in. Southern pine. The longitudinal sills are joined to end sills and plates with angle-irons securely bolted. The whole framework is securely cross-braced and tied together with eleven ¾-in. tie rods. The posts are all of straight grained white ash. The corner posts are 3¾ ins. thick, and the side posts 3¼ ins. thick. There are four



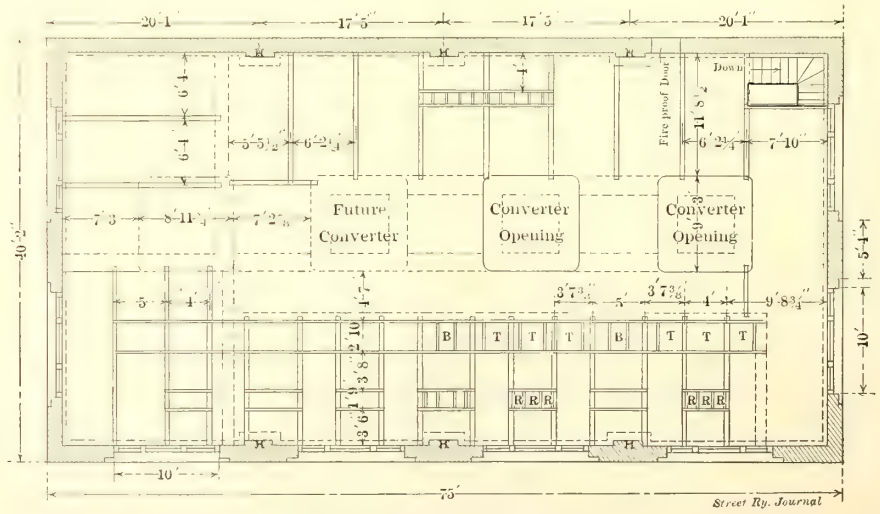
MILBRAE SUB-STATION

ash ribs between every two posts. The panels are of ½-in. dried poplar. All posts are fastened at the top to letter board by means of malleable iron-angle brackets. The car lines over each post are plated with steel. The roof is covered with No. 8 cotton duck, well laid in white lead and painted with three coats of "Trolley Top."

The platform sills are made of 6-in. channel iron, bent to the required shape and bolted to longitudinal sills. The bumpers are of 3½-in. x 6-in. x ⅜-in. angle-iron, with draw-bar cup set in. The dashers are made of No. 12 soft steel. The steps are covered with Universal safety treads. Vestibules are equipped with Wood folding gates, and the doors are of the mutually operating sliding type, having an opening of 36 ins. They are 1¼ ins. thick and made of cherry.

The sashes are made of cherry, and so arranged that they can be dropped and a small trap or shelf closed over them, thus not not only hiding them but also preventing passengers from throwing paper, etc., in the openings.

The ventilator sashes are glazed with chipped glass, and are hinged on the ends, so that by operating a small



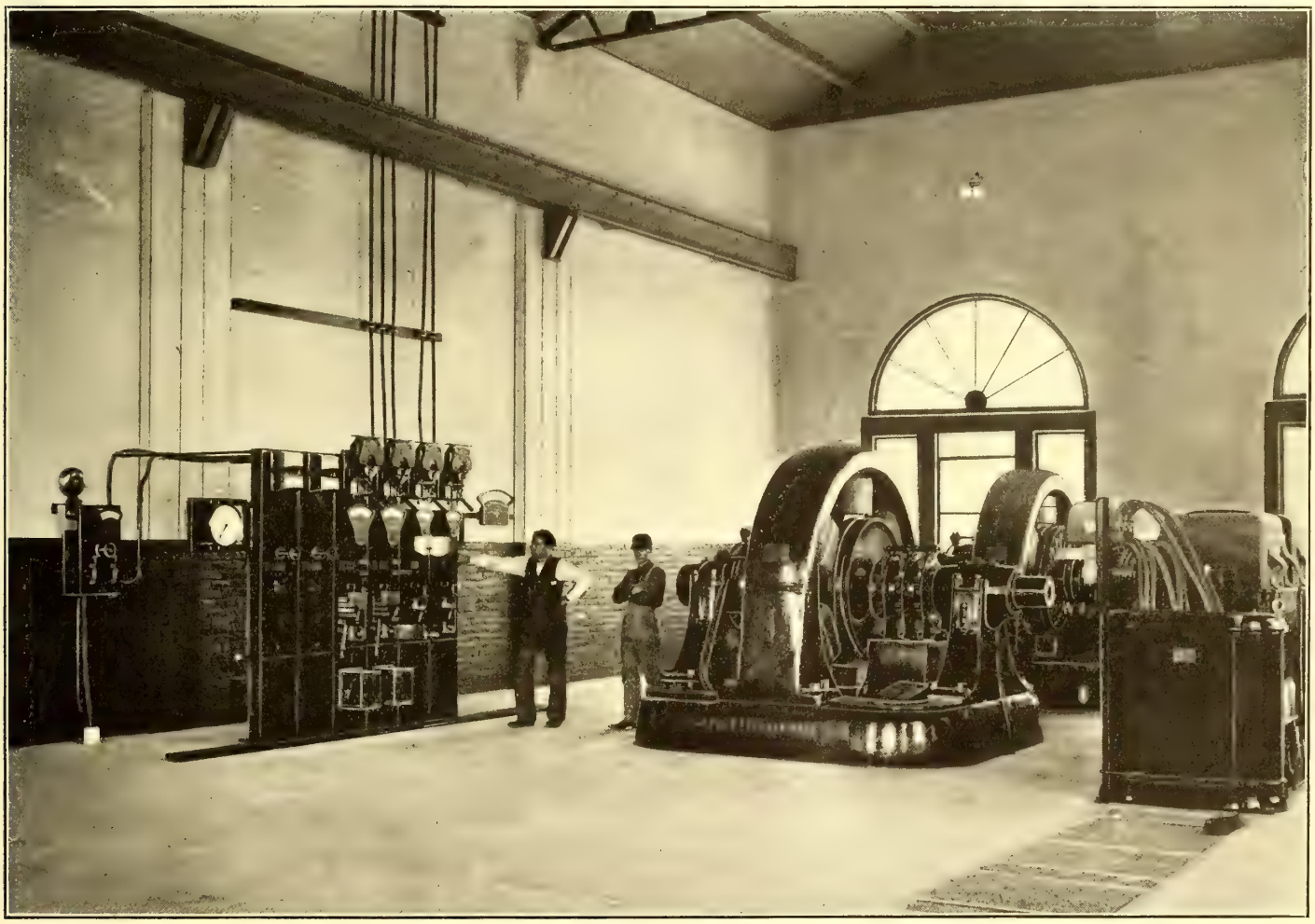
PLAN OF MILLBRAE SUB-STATION

brass handle two at a time can be thrown open. The seats are of the Hale & Kilburn walkover type, upholstered with rattan, and have a grab handle on the back. They are 37¾ ins. long and 18 ins. wide. A novel feature is introduced to keep people from sliding off the ends of the seats, and also providing more seating capacity on the seat by having a concave casting placed on the end, extending about 3 ins. above the seat. This casting can be seen on the seats in the interior view of the car presented herewith. This casting does not interfere with passengers, and adds greatly to their comfort. The aisle still has a width of 27 ins., so that these castings do not cut down this space to any extent. The legs of the seats are bent toward the sides of the car, leaving a space under the end for packages. There are eighteen seats in the main compartment and six in the smoking compartment.

gong, a Ham sand box, a Christensen air whistle and a Sterling hand-brake with Laclede 12-in. handle. Mosher detachable arc headlights and Railroad Signal & Lantern Company's oil signal lanterns are used. The cars are also equipped with Christensen straight air brakes. The brake rigging is an outside link-hung one.

The trucks for these cars are the Brill standard No. 27. The wheel base is 6 ft. The side frames are solid forged steel. The wheels are made by the St. Louis Car Wheel Company, are 33 ins. diameter; weigh 450 lbs., and have eight spokes. The treads measure 2¼ ins. and the flanges ¾ in. On account of passing over grooved rail in the city it was impossible to make the dimensions any larger. The axles are of Jones & Laughlin cold rolled steel, 4½ ins. diameter.

Each car is equipped with four General Electric 57-A



ELECTRICAL EQUIPMENT AT MILLBRAE SUB-STATION

The interior of the car is finished with selected cherry, and the ceilings covered with three-ply bird's-eye maple veneer, decorated with a single stripe of aluminum leaf.

There are twenty-five 32-cp lamps used for lighting, twelve being placed along the sides, six on each side, and three three-light clusters on the ceiling of the main compartment, and one two-light cluster in the smoking compartment. There are also two lamps on the back platform, so wired that the rear platform can always be lighted and the front platform kept dark. Two oil lamps are in the car to be used in case of emergency.

Pantasote curtains with spring rollers are placed over each window and also over the end doors, so as to prevent the light from being thrown on the vestibule windows and blinding the motorman. The door curtain rollers are placed under neat wooden boxes on the outside, and slide in grooves so as to prevent the curtains from flapping.

Each platform is equipped with a new departure rotary foot

motors, inside hung. The fields instead of being wound on brass spools are "mummified" so as to admit of the maximum insulation. K-14 controllers and grid resistances are used. The pinions have twenty-four teeth and the gears sixty-two.

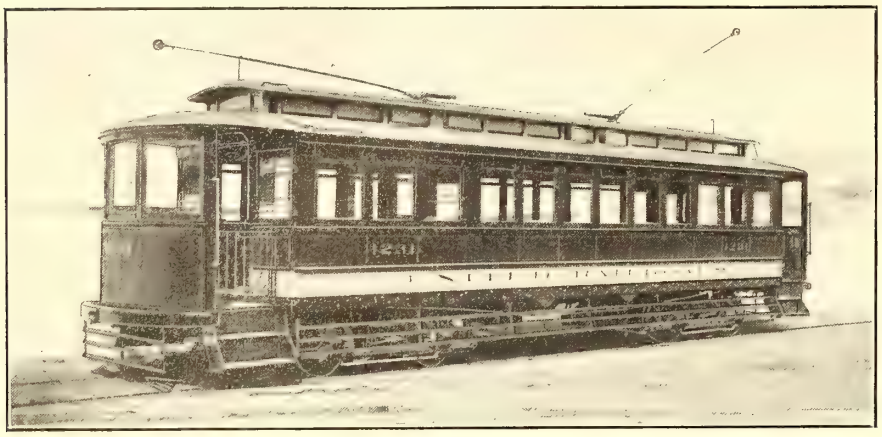
The trolley bases are placed 10 ft. from the ends of the upper deck. The trolley poles are 15 ft. long, and the wheels 6 ins. in diameter. Kalamazoo harps and wheels are used.

The wiring and making of the cables was done by the railroad company, and instead of nailing up the cables with leather straps they were screwed to the floor with large wooden cleats, to facilitate inspection. Particular attention was paid to making perfect splices and to the protection of all electrical apparatus from dirt and water.

The motor bearings are lubricated with oil. This is accomplished by fitting a thin brass shell cup into the grease cups. In the middle of this brass oil cup a ½-in. brass pipe runs up nearly to the top edge. An ordinary lamp wick leads from the

oil surrounding this ½-in. pipe down through the pipe to the bearing. The life of the bearing is thus prolonged to a considerable extent, as it is not necessary for the bearing to heat up before the lubricant starts to run.

In designing these cars it was not intended to spend any money on superficial decorations, but every effort was directed to make them strong, neat, roomy, comfortable and easy to keep clean and repair.



STANDARD CAR

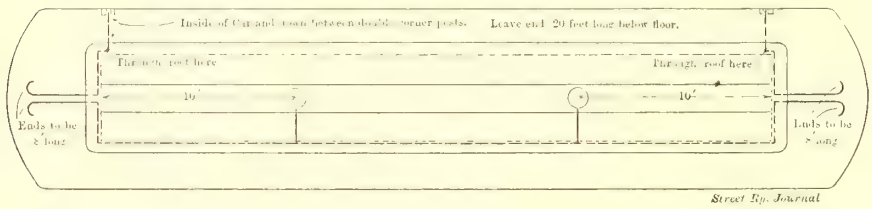


INTERIOR

PRECAUTIONS FOR SAFETY

In order to insure safety and to warn people of the danger on the private right of way, several precautions are taken.

In the first place, the private right of way is fenced in. At every point where a road crosses the private right of way cattle guards are put up, and signs reading, "Danger, Look Out For Electric Cars," are placed on each side of such crossings.



POWER CIRCUITS IN WIRING PLAN FOR 45-FT. CAR

Light clusters are placed over these crossings so that a clear view of the signs and of the crossing may be had at night. People who attempt to walk on the private right of way will find signs as follows: "No thoroughfare—Private Right of Way," staring them in the face. On all gates leading on the private right of way there are signs warning people to close them, otherwise making themselves liable to prosecution.

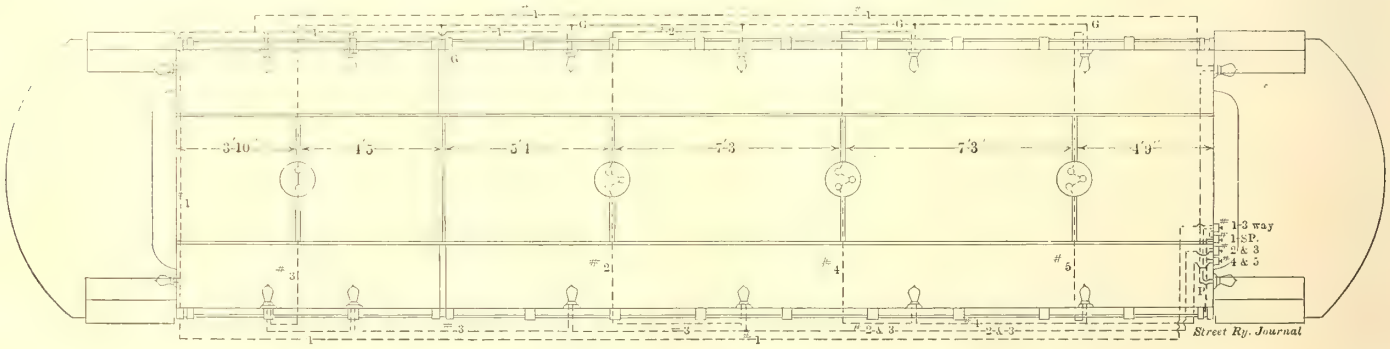
The arc headlight, air whistles and rotary gongs on the cars are used within their respective limits to give warning. The red signal lanterns on the rear and oil lamps in the cars were installed with a view of preventing collisions in case of cars becoming disabled at night.

SERVICE, FARE AND PATRONAGE

The cars at the present time are operated every half-hour from 5:30 a. m. to 8:00 p. m., and every hour from 8:00 p. m. to midnight. On Sundays and holidays cars are run every fifteen minutes or less, as the traffic requires. The time required to make the trip one way is one hour fifteen minutes, the distance being 23 miles. The running time, of course, could be greatly reduced were it not for the fact that one-half of the entire distance is either through the city or its suburbs. Here, of course, a greater speed than 8 miles or 10 miles is not allowed. On the private right of way a speed of 40 m. p. h. is attained.

The fare is 25 cents one way, entitling passengers to transfer to any part of San Francisco.

That these cars will be well patronized is already established. Besides the regulation passengers, such as business and workingmen, theatergoers, shoppers, etc., there are many other patrons. At Holy Cross and nearby there are situated all the cemeteries of San Franciso, numbering about eight. This class of travel alone is naturally very large. There are also a great many places of amusement along and near the line. Amongst these might be mentioned the Ingleside and Tanforan race tracks, Union Coursing Park, Burlingame polo grounds, duck hunting grounds, celebrated taverns, etc. San Mateo, with its charming surroundings, is a mecca for pleasure riders, and that city in common with the other towns along the line is already feeling the effects of this means of communication with San Francisco. Real estate and rents have advanced, and on all sides are evidences of increased prosperity.



WIRING PLAN FOR LIGHTING 45-FT. CAR

H. A. Everett's private car "Josephine" recently made a remarkable run from Toledo to Cleveland over the Lake Shore Electric Railway. From the city limits of Toledo to Norwalk, 61 miles, was made in sixty-six minutes, and the entire run to Cleveland city limits, 112 miles, was made in two hours and thirty-seven minutes, including stops.

SPECIAL TRACK WORK

The accompanying illustration is a reproduction of a photograph showing the special track work of the Colorado Springs & Interurban Railway in front of the car houses of the company at Colorado Springs. It will be noticed that an independent track is used for handling the cars when they are to be taken in and out of the car houses, thus leaving the regular lines free for the commercial service. There are nineteen tracks, extending into the car houses from this independent track, which runs along the entire front of the building, 14 ft. center to center, from the west track of the main line. There is a cross-over on the main line. This arrangement permits the company to handle the cars quickly without interfering with the regular traffic or blocking the service lines, and it is entirely satisfactory to the management, as it has proved a very economical and convenient method. The car houses are spacious buildings and are well arranged. They are all of steel and brick construction, with concrete flooring and division walls for fire protection. The combined storage capacity is seventy-two double-truck cars, and these can be handled quickly with the provisions here described. Each of the old car houses is 50 ft. wide, the new one being 80 ft., and all are 180 ft. deep. Each of the smaller buildings is provided with trackage for sixteen cars, and the new house can accommodate twenty-four. There are six tracks in the new building, three of which are provided with open pits. There are three open pits in the old houses, and at the north is a single-track wash house with concrete floor and open pit.



SPECIAL WORK AT CAR HOUSE OF COLORADO SPRINGS & INTERURBAN RAILWAY

The report of a prominent Swiss engineer on the advisability of substituting electricity for steam on Swiss railways favors electricity, and has already caused one company to apply for authority to use electricity on a trial road 12 miles long.

TWELVE HUNDRED-VOLT DIRECT-CURRENT RAILWAY IN FRANCE

The fact that there is a 1200-volt direct-current electric railway in regular operation is not generally known, but there is such a line in the Grenoble region in Southeastern France. The line is used largely for freight, and is of 1-m gage. Steam has been the motive power employed for hauling the empty cars up grades, which are 2¾ per cent for practically the entire distance from St. Georges de Commiers to la Mure, the two terminals, 20 miles apart. The present steam locomotives, which are of 37 tons and 41 tons weight, can haul up this grade only ten and fourteen empty cars, respectively. Another reason for the adoption of electricity was that water-power is abundant. A special feature of interest is that the portion of the road electrically equipped is on the three-wire system, so that the voltage between the outside wires is 2400.

The company has at present one electric locomotive, which is illustrated in the accompanying engraving. Fig. 1 illustrates the body raised, leaving the trucks exposed, while Fig. 2 very clearly indicates the appearance of the overhead line. As will be seen the overhead frogs are of wood, as in three-phase work.

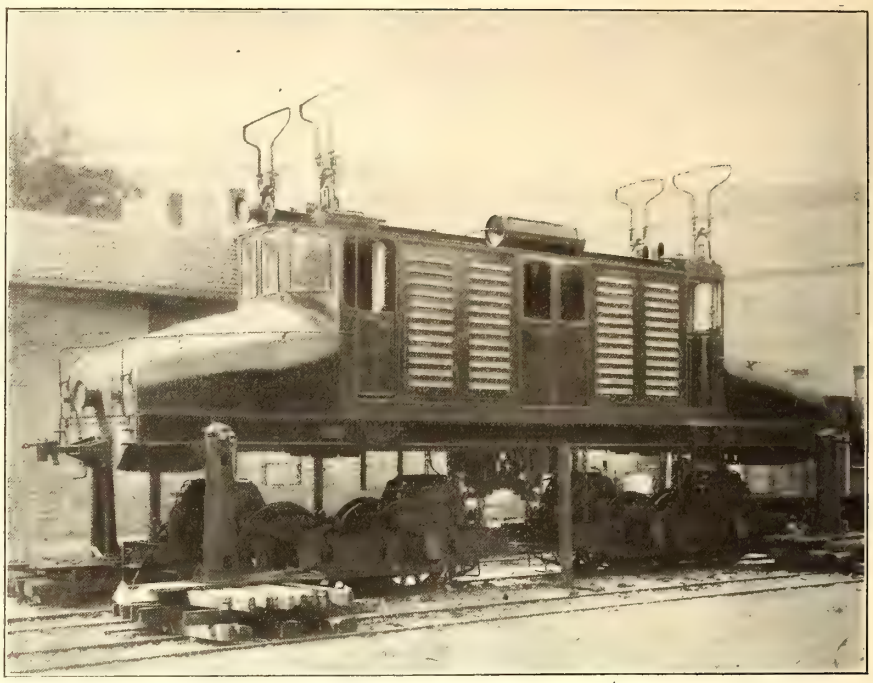


FIG. 1.—LOCOMOTIVE CAB RAISED FROM TRUCKS

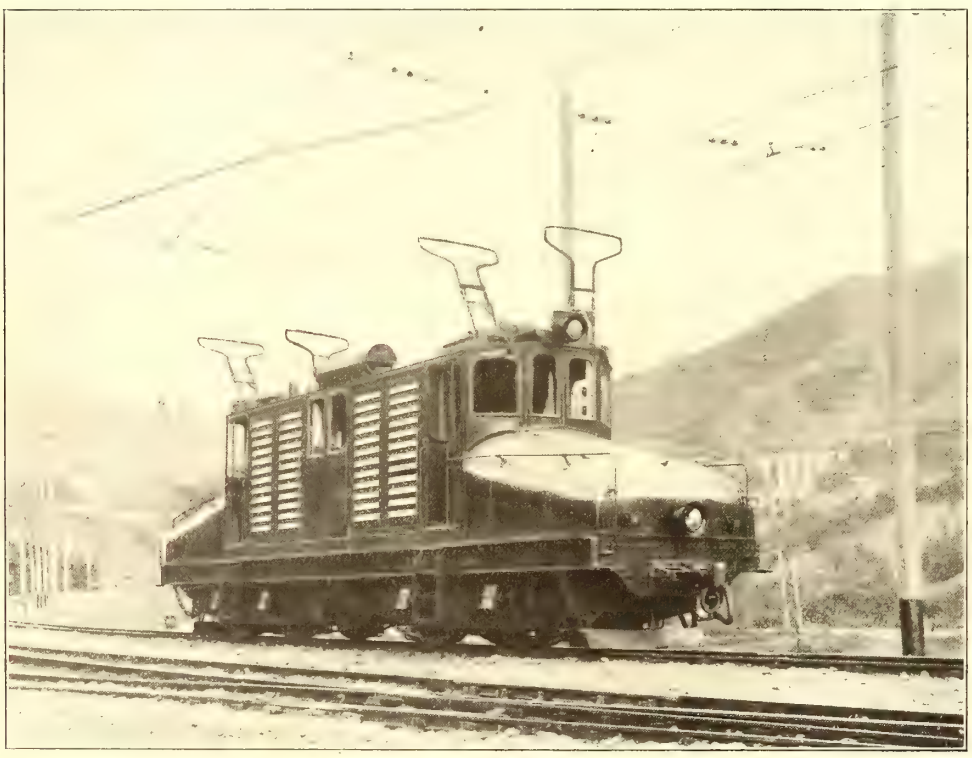


FIG. 2. OVERHEAD CONSTRUCTION FOR ELECTRIC LOCOMOTIVE

The locomotive weighs about 50 tons, and is of 500-hp capacity. This permits it to operate on the 2¾ per cent grade at a speed of from 22 km to 23 km an hour, hauling twenty cars having a gross weight of 111 tonnes.

The electrical construction was carried out by the Compagnie Générale de Construction of Saint Denis and the Compagnie de l'Industrie Electrique, owners of the Thury patents. The overhead line consists of two copper wires of figure-8 section and 114-mm cross section. The voltage used is 2400 volts between the outside wires, that is 1200 volts between each contact wire and the rail which forms the neutral. Siemens bow contactors are used. The upward pressure used is very light, being only about 2 kg.

The four motors are of 125 hp each, two on each truck. They are connected in series and work on 625 volts and 185 amps. As the trip down grade is made with loaded cars the motors are arranged to run as generators and act as brakes, being connected to the resistance. Oil switches are used for breaking the circuits. The general connections are shown in Fig. 3. The main dimensions of the locomotives are as follows:

Length of body	11.350	meters
Length over all	12.510	"
Length of motorman's compartment	7.300	"
Height of motorman's compartment above rail	3.720	"
Width of motorman's compartment	2.400	"
Diameter of wheels	1.200	"
Wheel base of each truck	1.850	"
Height of bows when completely raised	5.125	"
Number of trolleys	4	
Weight, empty	50,000	kg
Weight, complete, ready for operation	50,500	"

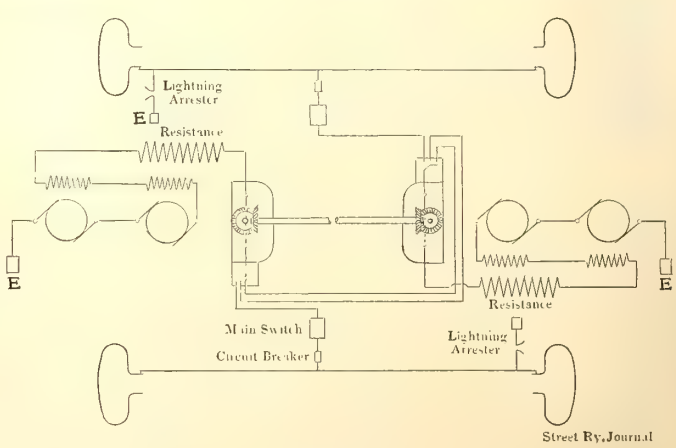


FIG. 3.—DIAGRAM OF CONNECTION ON THREE-WIRE LOCOMOTIVE

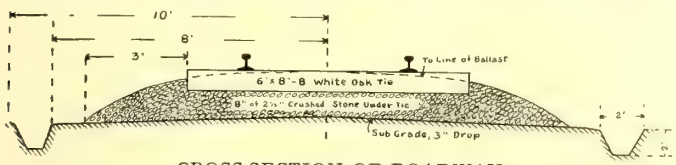
Weight per axle, ready for operation	12,625 kg
Revolutions of armature at normal speed	400
Reduction in gearing	1 to 4

One generator, operated by a Piccard turbine, is used. It is over-compounded, giving at full load and 250 r. p. m., 180 amps. at 2 volts by 1350 volts, and without load 2 volts x 1200 volts. It has two armatures mounted on the same shaft, and two sets of field coils mounted on a common base. The armature length is 550 mm, and the distance between opposite pole pieces 1250 mm. The commutators are 750 mm in diameter and 150 mm long. The shaft has a diameter of 52 cm on account of its length, 3.275 m between journals, and the weight of the armatures is 9 tonnes. The total weight of each half-revolving part is 33,400 kg, made up as follows:

Armatures	2 x 4500 = 9,000 kg
Shaft and bearings	2,700 "
Base and journals	2,500 "
Field frame	2 x 6600 = 13,200 "
Half of the fly-wheel clutch coupling	4,000 "
Total	33,400 "

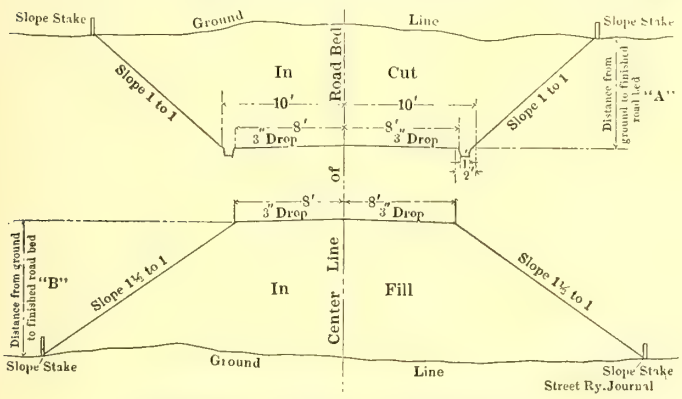
STANDARD INTERURBAN TRACK CONSTRUCTION OF THE INTERNATIONAL RAILWAY COMPANY

As the track construction of the International Railway Company, which controls the lines around Buffalo, is noted for its excellence, the accompanying diagrams, showing the arrangement of ballast and slopes of cuts and fills, will be of interest.



CROSS-SECTION OF ROADWAY

In cuts a slope of 1 to 1 is allowed, in fills a slope of 1½ to 1. The depth of the ballast is 8 ins. The sub-grade has a drop of 3 ins. in the 10 ft. from the center of the track to the gutter, and on the sub-grade 8 ins. of crushed stone is laid



STANDARD ROADBED CONSTRUCTION

In track location in cuts and fills, slope stakes are placed at every 100 ft., and are marked in three ways, viz.:

(1) Number of station.

(2) Distance from center line of roadbed.

(3) Depth of cut or height of fill from ground at foot of stake to finished roadbed at bottom of cut or at top of fill, as shown by distances "A" and "B" in accompanying diagram.

The Northern Ohio Traction & Light Company has ordered ten new interurban cars and will install a limited service between Cleveland and Akron. Other Cleveland roads are figuring on adopting this plan, which has been developed by the Cleveland, Painesville & Eastern Railway, and has been received with universal favor.

TRAIN CABLES ON THE AURORA, ELGIN & CHICAGO RAILWAY

Cars on the Aurora, Elgin & Chicago Railway are being equipped with train cables of sufficient capacity to carry the current required by the car motors, so that when two-car trains are run the contact-shoes on the cars can be connected electrically that there may be no interruption of the current at crossings which are narrow enough to be bridged by two-car trains. The interruption of the current supply, due to the omission of the third rail at highway crossings, causes considerable annoyance to passengers at night, because of the momentary extinguishing of the lights. As most of the highway crossings on this road are between Wheaton and Chicago, and all trains between Wheaton and Chicago are now two-car trains, much of the annoyance formerly caused by extinguishing lights at crossings will be obviated.

DEPARTMENT STORE'S BIG TROLLEY PICNIC

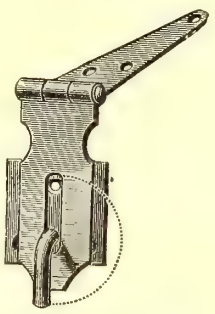
One day last summer the Broadway Department Store, of Los Angeles, Cal., gave all of its employees an outing at the seashore. The accompanying cut shows ten special cars of the Pacific Electric Railway Company as they looked just before they left the city with 600 happy excursionists for the gala day at Long Beach. The cars were decorated and festooned in a most striking manner, all bearing the two slogans of the store—"Don't Worry" and "Watch Us Grow." Flowers and bunting were used in great abundance. The wing-like decorations on the roofs of the cars were of white cloth latticed with red paint. The party was personally conducted by Hugh F. Stewart, assistant general passenger agent of the Pacific Electric Railway Company. Refreshments were served en route.



A CALIFORNIA PICNIC PARTY

FASTENING MOTOR LIDS

In a discussion at the convention of the American Railway Mechanical & Electrical Association, H. J. Lake, master mechanic of the Muncie, Hartford & Fort Wayne Railway Company, spoke of a method of fastening motor commutator lids on the motors to prevent their being torn off by the brake rods when rounding curves. The accompanying illustration of the hasp used may make Mr. Lake's method a little plainer. The device is an ordinary heavy hinge hasp, which is a staple article of hardware. It is riveted to the commutator lid, and the single swivel which locks it down is fastened to the motor case. The lid has thus practically nothing projecting above it.



HINGE HASP FOR FASTENING MOTOR LID

CORRESPONDENCE

PLATFORM SUPPORT FOR FOUR-MOTOR EQUIPMENTS

THE CONSOLIDATED RAILWAY & POWER COMPANY

Salt Lake City, Utah, Oct. 2, 1903.

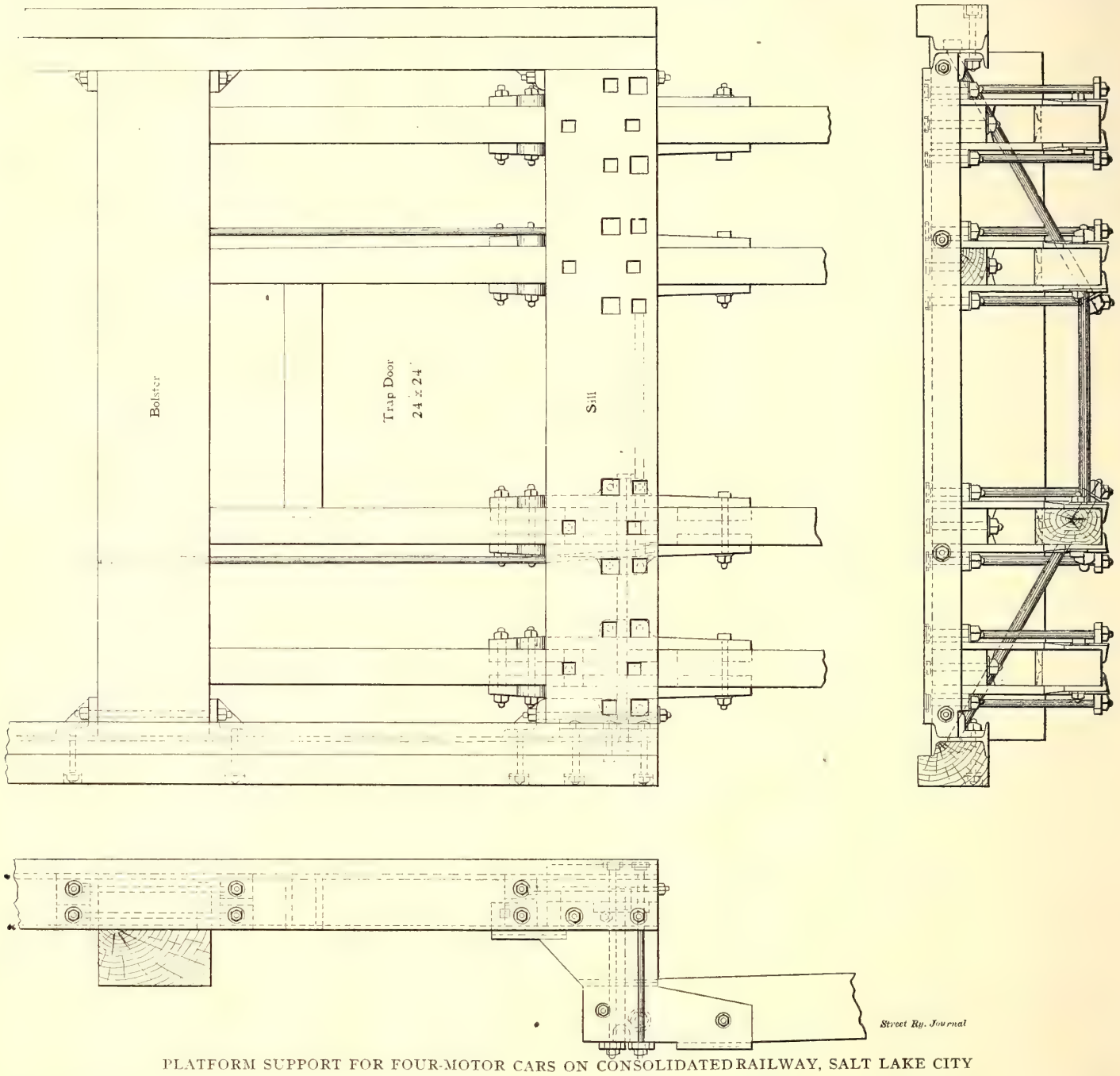
Editors Street Railway Journal:

The Consolidated Railway and Power Company, wishing to install double-truck, four-motor equipments on some of its new cars, found that in the ordinary construction of low-platform, single-step cars the draw timbers that support the platform and extend back under the car body prevent the placing of a motor on the front axle of each truck. In order to overcome this difficulty the writer designed the form of platform support illustrated in the accompanying drawings. As other car builders have undoubtedly met with the same difficulty, an explanation of the construction may be of interest.

It consists of eight cast-iron angle seats, or supports, which are bolted to the bottom of the end sill, and form seats for the ends of the four platform timbers, which only run back as far as the castings. The castings, which preferably should be made of malleable iron, have inside horizontal lugs to take the thrust of the platform beams, and two cross bolts are used to hold the beams in place. At the top and bottom of the castings, under the sill, are L flanges, through which are run 6-in. and 21-in. sill bolts. The back portion of the casting, where it rests under the longitudinal sill beams, also has flanges for distributing the thrust. The platform is made secure from side thrust by bolting the two center beams together and connecting them by oblique bolts with the I-beams of the car body.

This construction provides a 24-in. x 24-in. trap door for reaching the front motor and, at the same time, is strong and comparatively inexpensive. It was adopted by the St. Louis Car Company on eight new cars recently built for our company, and we are using it on six four-motor cars which we are building in our own shops from spliced cars.

W. S. Patterson, Master Mechanic.



PLATFORM SUPPORT FOR FOUR-MOTOR CARS ON CONSOLIDATED RAILWAY, SALT LAKE CITY

THE ADVANTAGES OF ASSOCIATIONS

Pillsbury-Washburn Flour Mills Company, Ltd.

Minneapolis, Minn., Oct. 20, 1903.

Editors Street Railway Journal:

I was much surprised to learn from your report of the Street Railway Accountants' Association, published in a recent num-

ber of your journal, that several companies had withdrawn from the Association during the year. I cannot understand how any company can fail to derive great benefit from a membership in the Accountants' and also the Street Railway Association.

I have often ished it were possible to have such an organization among the flour mills, but, of course, this is not possible. The millers do sometimes get together to discuss transportation, labor problems, etc., but when they begin to talk of the quantity of wheat they are using to make a barrel of flour, or the percentage of patent flour they are making, or the cost of manufacturing and selling per barrel, none believes what the other fellow says, and in this they are right. Of course, there is some reason for the miller not caring to tell all the details of his business to others, as they all come into competition with each other to a more or less extent, but this is not the case with street railway companies.

It must certainly be very profitable for an employee of any company to be able to meet others in the same line of business, and have a regular heart to heart talk on any, and all, of the many questions which are constantly arising, and I should think every street railway company in the country would secure membership in both organizations.

Although not engaged in the street railway business, I have been reading your journal for the last few months as a matter of general information, and find it very entertaining and instructive and wish you great success.

Jas. T. Perkins.

INTERURBAN TRAIN DESPATCHING

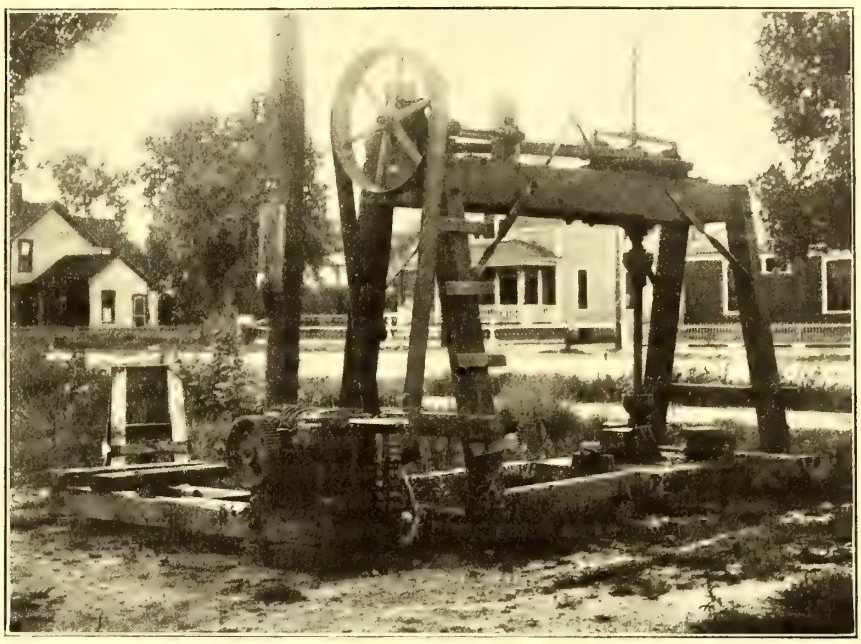
Boston, Oct. 20, 1903.

Editors Street Railway Journal:

I read with interest the paper and discussion on the subject of "Interurban Train Despatching," as given in your issue of Oct. 17. I notice that the remarks made on the paper related to a large extent to the question of cut-outs under the control of the train despatcher, so that in case of the detection of an error the cars affected could be deprived of current. The very insistence of such a question shows how keenly alive are street railway men to all questions touching the safety of their passengers. Several roads are experimenting with the cut-out scheme, but it seems to me that the whole merits of the question were put in evidence by a remark that on a Western road last summer the despatcher made a blunder, and being quick of wit telephoned to the sub-station to cut off the current. But the two cars were coming down into a valley from opposite sides, and having no power to stop, the cars came together in a head-end collision.

If the cars seeing each other did not have braking capacity enough to make a stop, they were clearly not running under proper control, considering the topography of the road, unless they were expected to rely on reversal of the motors as an emergency measure, in which case cutting off the current was risky. There seems to be very little information floating about as to the real value of reversal as an emergency braking measure. If it has a high value, then it should be more easily applied than is possible with most of the forms of controller. If brakes are the sole reliance they should be efficient enough, and the view along the track should be clear enough, to make them effective in preventing head-end or rear-end collisions, even if the desptacher blunders. When a road is going to run at high speeds on a blind track it is time to use a block system or its equivalent. First-class brakes, combined with well-trained motormen, who know when their cars are under proper control, will reduce accidents to an almost negligable quantity at any speeds proper to attempt on a single track without a block system.

A. P. Johnson.



CURVING RAILS FOR SPECIAL WORK.

RAIL CURVING MACHINE

Colorado Springs and Interurban Railway Company

Colorado Springs, Col., Oct. 8, 1903.

Editors Street Railway Journal:

The accompanying illustration shows a rail-curving machine which was built by us to do our special work during our reconstruction, and which is similar to a number of curvers throughout the country, with the exception of a few minor changes, which can readily be seen by the picture.. It is built upon a wooden frame 7 ft. high, 2 ft. wide and 9 ft. long, with legs spread to 5 ft. at the bottom. The main casting, which holds the rolls, sets on the bottom timbers of the frame, and the shafting and gears running the driven roll are set on top of the frame. The rolls have bearings of 4 ins. x 4 ins. in Magnolia babbitt, two rolls being stationary and one fixed in a sliding head, which can be adjusted in curving a rail while the machine is running. The running roll is connected by a double ball-and-socket coupling and is connected through a horizontal bevel gear, running twenty-two revolutions to one revolution per roll. The bevel gear is 36 ins. in diameter, and the shaft connected to the motor has two loose pinions traveling on a shaft running across the bevel gear, with a slide sleeve on the shaft, which engages with either pinion to reverse the rolls. When the sleeve is midway of the pinion it stops the rolls without stopping the motor or engine which may be driving it.

With this machine we roll 75-lb. rail with 100 ft. radius at the rate of 30 ft. to 50 ft. per minute.

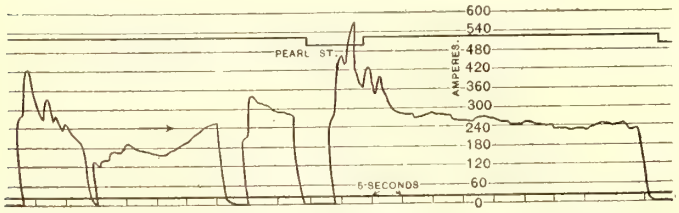
We have just completed one of these machines for the new Moffatt Short Line road, from Denver to Salt Lake, and it is giving very good satisfaction.

D. L. Macaffree, General Manager.

A GRAPHIC RECORDING AMMETER

A new type of recording ammeter for use in making tests of current consumption on cars was described at the meeting, last week, of the American Institute of Electrical Engineers, by A. H. Armstrong, of the General Electric Company. The object aimed at was to secure an instrument capable of registering accurately the violently fluctuating current readings, and one which would not be affected by the vibration on high-speed cars, due to more or less imperfect track. This made it necessary to have an instrument which should be thoroughly balanced, and one in which there would be no friction between the marking instrument and the paper over which it traveled. To secure the required torque, a dynamo construction was employed in which the current to be measured is carried by the fixed element, and the moving element carries a constant current, supplied by a small storage battery. The moving coil is a small rectangle of several strands of wire surrounding an iron core and carries about 1 amp. The ampere turns in the moving coil are about 80, and that in the fixed coil about 2400, so that the torque at the end of the scale is about 200-gram centimeters. This is from 80 times to 200 times the torque usually employed in a measuring instrument in which the indications of the pointer on a scale are observed, and from 3 times to 15 times that employed in the usual integrating of curve drawing instruments. With this high torque the friction due to the pen moving over the paper is practically negligible.

The pen consists of a capillary tube supplied from an ink reservoir by a siphon. The paper is about 3½ ins. wide, and is usually run at rate of 6 ins. per minute. The instrument



CURVE OF FOUR-MOTOR EQUIPMENT ON HEAVY GRADE

replaces the labors of several men required by the old method of two-second readings, and gives results of greater accuracy. It is, therefore, a simple matter to run a full day test upon a railway motor, and determine its copper loss quickly and accurately. The instrument weighs about 100 lbs., and measures 32½ ins. x 13½ ins. x 11¼ ins. The same construction is equally applicable to voltmeters and wattmeters.

The accompanying diagram shows a curve made by the ammeter on one of the Schenectady & Albany cars equipped with four General Electric 73-motors. This car was climbing a heavy grade and the motors were in series.

PLATFORM MEN IN KANSAS CITY

The Metropolitan Street Railway Company, of Kansas City, Mo., is trying the experiment of having a regular conductor and an extra on its cars in the retail district during the rush hours, in order to make better time. The regular conductor takes a position inside of the car and devotes all of his time to collecting the fares, while the extra takes up a position on the back platform and there facilitates the ingress and egress of passengers and attends strictly to the operation of the car. The extra conductor simply makes a run from the heart of the city to the district where it is not likely that many more passengers will be taken on. He then leaves the car, returns to the city and again resumes his work as an extra. The policy has been adopted by the company of collecting the fares as soon as the passengers are properly seated.

NEW SHOPS AT LOS ANGELES

Increased demands upon the capacity of the Huntington railway shops in Los Angeles, Cal., have made the joint arrangement now existing between the Pacific Electric Railway Company and the Los Angeles Railway Company no longer practicable, and it is announced by General Manager Muir that the Los Angeles Railway Company is soon to have its own shops, at a cost of about $300,000. These shops will be located on South Park Avenue, between Fifty-Third Street and Fifty-Fourth Street. They will adjoin the big car houses now in course of construction in the same locality. The site for the new shops will have a frontage of 700 ft. In addition to headquarters for Superintendent Aikin and reading rooms for the trainmen, the scheme involves storerooms, machine shops, blacksmith, repair and paint shops and a car building shop. Cars in their entirety will not be constructed at the beginning, but after a time all such equipment needed by local Huntington-Hellman lines will be manufactured in Los Angeles. Plans are being prepared for the buildings, and in a general way they will be a duplicate of the Pacific Electric Railway shops on Central Avenue, and will contain a turn-table for car-moving purposes. When the old shops were opened about two years ago it was supposed their capacity would be sufficient for many years to come, but the new shops now planned are badly needed. The new enterprise will give employment to about 300 men.

TOLEDO AS AN INTERURBAN CENTER

The development of the interurban lines around Toledo has resulted in making that city one of the most important interurban centers in Ohio. At the present time 136 electric passenger trains, operating on regular schedules, enter and leave the city daily. The number of freight trains entering and leaving on regular daily schedules is twelve. As a rule one car constitutes a train.

The above count is divided among the various lines as follows:

	Passenger		Freight	
	In	Out	In	Out
Maumee Valley Ry. & Light Co.	47	47	2	2
Lake Shore Electric Railway	22	22	2	2
Detroit, Monroe & Toledo Short Line	17	17	2	2
Toledo & Indiana Ry.	11	11	2	2
Toledo, Bowling Green & Southern Trac. Co.	21	21	0	0
Toledo & Western Ry.	18	18	4	4
	136	136	12	12
Total trips	272		24	

Total passenger and freight trains, 296.

In addition to the above there are under construction the following lines: Toledo & Port Clinton Railway, Toledo & Ann Arbor Railway, and Cincinnati, Dayton & Toledo Railway, all of which are to be in operation before the expiration of the year. The completion of these lines will bring the total number of cars entering and leaving Toledo to 325.

THE PROPOSED SALT LAKE & SUBURBAN RAILWAY

The Salt Lake & Suburban Railway Company, of Salt Lake City, Utah, has franchises for about 40 miles of interurban railway, radiating in three branches from that city and covering the small towns and farming territory south of the city. Work is about to be begun on 13 miles of railway, entering the city on Second East Street and terminating on that street at First South Street.

This line will run to Murray, 7 miles south, and to the large ore smelters in the vicinity. Connecting with the smelters will be a line to Mill Creek Canon, where the company controls a large and excellent limestone quarry. This quarry has been but little developed, and it is stated that the company already has assurances of orders for 1000 tons of limestone daily from the smelters. This will comprise the main business of the company, but there is also said to be a splendid field for the development of a fruit and dairy, and of a small freight business in the territory tributary to the city, as it is a rich farming section and has insufficient shipping facilities. It is also expected that a good passenger business will be developed. The road will be built with 70-lb. rails, after the best suburban railway practice. The power supply has not been definitely determined upon, but it is thought the company will erect its own plant in Mill Creek Canon, using both water and steam power. Electric power will be used for operating the machinery at the quarry. The officers of the company are: Fred. M. Steele, of Chicago, president; A. V. Taylor, of Salt Lake City, vice-president and general manager; Charles Fury, of Chicago, second vice-president; L. W. Pitcher, of Chicago, secretary. Guy Sterling, of Salt Lake City, did the preliminary engineering work for the company.

THE WARREN ROTARY ENGINE

The accompanying illustrations refer to an interesting type of rotary engine designed by E. C. Warren and made by the Rotary Engine Company, of Philadelphia.

Fig. 1 is a perspective view of this engine direct connected to electric generator. The cross-section view, Fig. 2, shows that the engine consists of a concentric piston wheel and shaft mounted between two abutting rollers, which are in close contact with the periphery of the piston wheel, and revolve in a direction opposite to that of the piston. As shown in Fig. 3 the piston wheel carries a broad flange at each end, and a web in the center. The driving vanes are located between these flanges and the web, and their outer edges, as indicated in Fig. 2, run in close contact with the surrounding casing.

The main bore of the casing is slightly tapered from end to end, and the diameter of the piston wheel, as measured over the web, flanges and vanes, is tapered to correspond. The steam admitted to the interior of the piston wheel passes through ports alongside the vanes into the spaces between the drum and casing, thus driving the drum. The slight difference between the diameter at the ends of the piston causes a moderate end-thrust, which tends to force the tapered wheel further into the tapered bore of the casing, thereby preserving a close joint between the flanges, vane and casing. A small thrust bearing is provided outside the casing, to prevent the tapered wheel from being pushed in far enough to cause excessive friction. This bearing is adjustable along the axis of the shaft, and enables the accurate determination of the position of the piston wheel within the casing.

Grooves are provided along the peripheries of the abutment rollers, and the shafts of these rollers are geared to the shaft of the piston wheel so that the roller grooves come opposite to the piston vanes when these reach the abutting rollers. These rollers are mounted on shafts having bearings in the counterbored end-plates of the abutment chamber, and provision is made in these bearings for the application of elastic pressure toward the main shaft to offset the outward pressure of the steam which tends to force the abutment rollers away from the piston wheel and open up the joints. This pressure is applied on small pistons or diaphragms, to which steam is delivered from the interior of the engine, and is just enough to overbalance the outward pressure, whatever the latter may be.

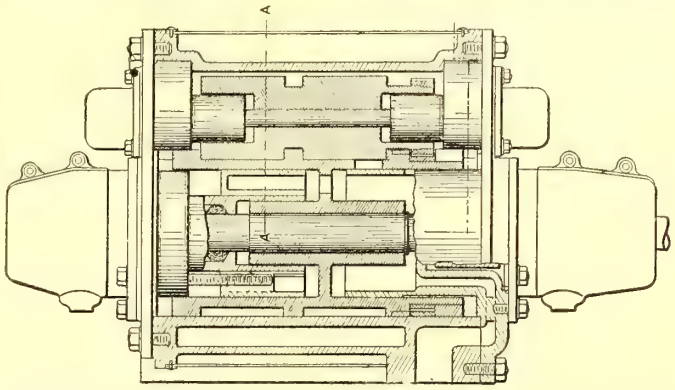


FIG. 4.—LONGITUDINAL SECTION OF WARREN ROTARY ENGINE

The exhaust openings are indicated in Fig. 2 at E-E, from which it will be evident that steam is admitted behind the vanes (between the piston drum and casing) when the piston drum is about in the position shown, the direction of revolution being clockwise. The admission of steam through the ports in the periphery of the piston drum is controlled by drum-shaped valves within the piston drum and mounted on hubs projecting from the heads of the casing. It is maintained that it is not necessary to maintain a perfectly tight joint between the valve and the interior surface of the piston drum, as leakage past the valve simply raises the expansion line in the working space and adds a slight superheat during the latter stages of expansion. The valve is, therefore, machined merely for a running fit. In the simple type of engine shown the point of cut-off is fixed and speed regulation is accomplished by throttling.

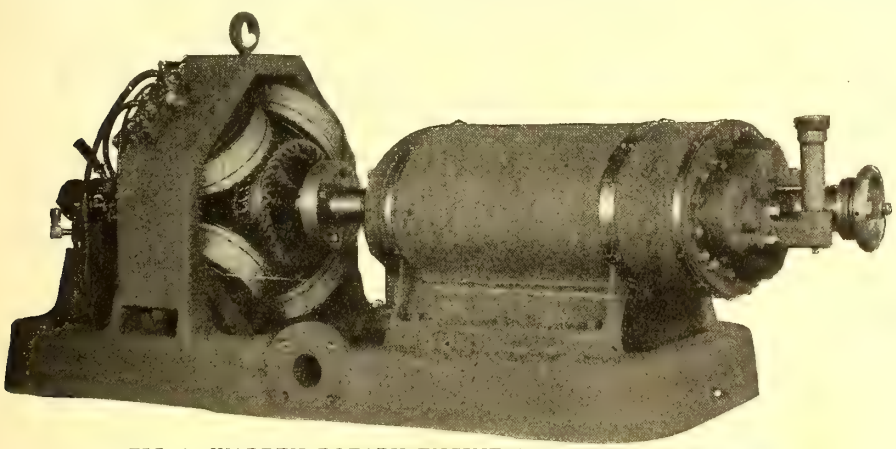


FIG. 1.—WARREN ROTARY ENGINE DIRECT CONNECTED TO ELECTRIC GENERATOR

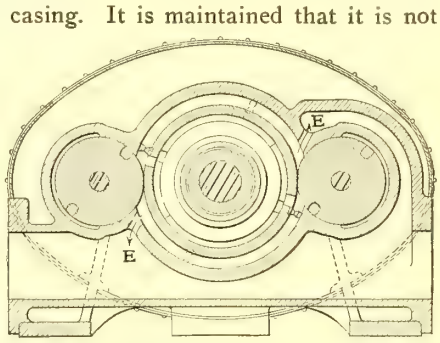


FIG. 2.—CROSS-SECTION OF WARREN ROTARY ENGINE

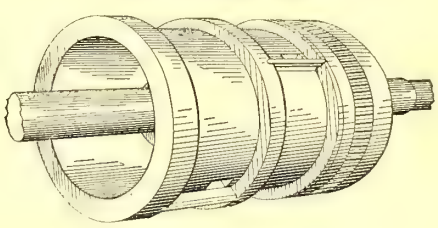


FIG. 3.—PISTON WHEEL

It should be noted that the respective diameters of the piston drum and the abutment rollers do not coincide exactly with the pitch diameters of the gears through which the three shafts are connected together; consequently, there is a difference between the surface speed of the piston drum and that of the abutment rollers, which amounts to about 600 ft. per minute under normal conditions. This produces a sliding contact between the periphery of the drum and the abutment rollers, which is said to cause the three surfaces to wear away in harmony with the advancement of the abutment rollers toward the piston drum, due to the normal wear upon the journals of the rollers. The seats in the casing against which the peripheries of the abutment rollers rub are also worn away, but at a very slow rate. It will be evident from the illustrations that the piston drum is inherently balanced; the abutment rollers are balanced by means of holes drilled in the sides opposite the longitudinal slots.

CARS FOR EASTERN OHIO TRACTION COMPANY

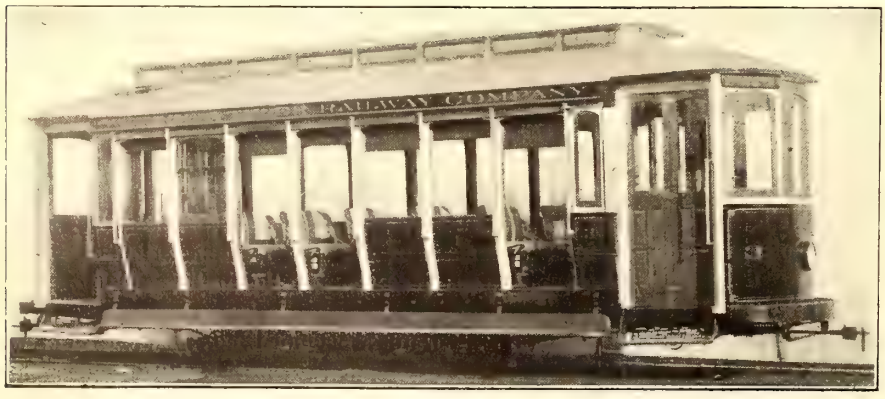
The accompanying illustration shows one of a lot of eight handsome interurban cars built for the Eastern Ohio Traction Company by the G. C. Kuhlman Car Company, of Collinwood, Ohio. These cars have extra large windows extending the length of two seats, and are equipped with sash balances. The trimmings are all of oxidized bronze with oxidized bronze electroliers. The construction is the regular Kuhlman standard with a few additions. Railroad men who have seen this car have pronounced it to be of the finest cars running into the city of Cleveland.



INTERURBAN CAR FOR CLEVELAND, OHIO

CONVERTIBLE CARS FOR WEST VIRGINIA

The Wetzel & Tyler Railway Company, of Paden City, W. Va., has received three convertible cars from the J. G. Brill Company like the one shown in the illustration. The length of cars over end panels is 20 ft. 7 ins., and over vestibules 30 ft., from panel over vestibule 4 ft. 8 ins., width over sills and panels 6 ft. 1¼ ins., over posts at belt 7 ft. 9 ins., sweep of posts 5 ins. The end sills are 4¼ ins. x 6 ins., and the side sills 5¼ ins. x 6⅞ ins., with ⅝-in. x 6-in. plates. Thickness of corner posts 3¾ ins., of side posts 3⅜ ins. The seats are of spring cane, with reversible backs; they are substantially connected with the posts, and together with the round-corner seat-end panels stiffen the posts. The posts are unusually well tenoned to the sills. A broad and thick panel of ash connects the heads of the posts on the inside and is secured to each post and car line with two large bolts and three 4-in. screws; each post is gained into the panel. At the corners of the car are double posts, or rather heavy side posts are connected with the side posts by solid panels. This arrangement forms a firm upper structure so that the panels and sashes always slide up and down from the roof pockets with great ease. The interiors are finished in natural cherry, with ceilings of three-ply birch veneer; ratchet brake handles, radial draw-bars, angle-iron bumpers, "Dumpit" sand boxes and "Dedenda" gongs are among the patented specialties of the builder's make with which the cars are equipped. The cars are mounted on Brill 21-E trucks having wheel base of 7 ft., wheel 33 ins. diameter and 4-in. axles. The trucks are equipped with 55-hp motors.



CONVERTIBLE CAR FOR WEST VIRGINIA, PARTLY CLOSED

A NEAT INTERIOR CAR FINISH

In these days, when increasing attention is being paid to simplicity and excellence in interior car finish, instead of elaborate moldings and complicated designs, the car interior herewith illustrated is of special interest. This is one of the trail cars recently built for the Fonda, Johnstown & Gloversville Railway by the St. Louis Car Company.

It is coming to be realized more and more by street railway men and car builders that simple interior finish is the best. This does not mean a cheap finish, but one that has few corners to catch and hold dust, and which will not look cheap and shoddy after a few years of use. What few cracks and corners are necessary in the construction are reduced to the smallest possible dimensions in the car here illustrated. Cars of this class of finish are much more easily cleaned, and the same amount of care bestowed on them keeps them much more attractive than a more elaborate type.



INTERIOR OF FONDA, JOHNSTOWN & GLOVERSVILLE CAR

QUESTION BOX OF THE PENNSYLVANIA STREET RAILWAY ASSOCIATION—II

OPERATION AND MAINTENANCE OF EQUIPMENT.

101. With roads not larger than twenty-five cars, how extensive a machine shop is advisable and what machine tools should be included? If possible state approximate cost.

We suggest a planer, a drill press, a lathe large enough to swing the largest motor armature, an emery wheel and a blacksmith's outfit. The approximate cost would be $1,800.—A. F. Rexroth.

102. To what extent is compressed air used in cleaning and repair work? What equipment is necessary for and what is the approximate cost of a compressed air outfit suitable for small and moderate sized roads?

Compressed air has by no means been used to the extent justified by its special adaptability for certain classes of work,—cleaning apparatus, etc., in power houses and car barns, operating machine tools, and in foundry work. For both of these latter uses the General Electric Company uses compressed air extensively and with great economy and success.—R. E. Moore.

Mr. Ellicott—For this service, we usually install either a small steam or motor driven compressor. Automatic devices are provided, which start or stop the compressor as the pressure falls or comes up in the reservoir. By a relatively small amount of piping, nozzles can be placed at various points in the plant for hose connection, making the air available for general service. For the special service around car houses and on the road we have supplied a portable compressor. This consists of a small air compressor and two reservoirs approximately 14 ins. x 48 ins. with a capacity of about 80 cubic feet. This outfit is especially desirable where electric current is available and it is not desired to completely pipe the plant. Among the special applications, there is a device used by the Pennsylvania Railroad Company for cleaning the plush seats in the cars, consisting of a flat nozzle with a comb in front of a number of holes. The teeth of the comb are pushed over the plush, loosening the dirt and raising the nap, and the air blows the dirt out thoroughly.

President Davis—Can you give some idea as to the average cost of a compressor outfit for car barns?

Mr. Ellicott—The cost of a stationary compressor and pipe within a radius of 30 or 40 feet, would cost about $375.00 for the electrical outfit. If high pressure steam was available, the steam compressor would reduce the cost to about $200.00.

Mr. Hammett—Where independent compressors are used on the cars in connection with the air brakes, a special hose connection is made, so that by operating the compressor the necessary air for cleaning and other work about the car can be obtained.

Mr. Power—A number of companies using our equipments on their cars, have an arrangement by which they attach a hose and clean their motors by means of the compressor in service on the car.

Mr. O'Toole—Our equipment consists of a second hand 8-in. standard Westinghouse compressor, such as is used on locomotives. We purchased our compressor for $10.00 from the Pennsylvania Railroad Company, which is discarding the 8-in. size and installing the 9-in. The total cost, including the station piping, hose, regulating valve and reservoir, was just about $25.00. We use it for cleaning generators, switchboard, etc., and for work on our boilers with pneumatic tools.

104. With maximum traction trucks, what proportion of the weight should be put on the pony wheels to insure reliability in operation?

To insure good traction to the drivers, the pony wheels should have sufficient weight to keep them from mounting the rail; say about 25 per cent.—Chas. H. Smith.

Various large users of these trucks advise percentages varying from 60 per cent to 75 per cent of total weight placed on drivers. The mode of adjustment we follow is as follows: With the compression post at height to just touch compression plate, we compress the spring 1½-ins. With 1¼-in. compression, running is claimed to be reliable; but with 1½-in. adjustment, it is sure.—C. T. Herrick.

Our experience has been, to obtain the best results with a Brill maximum traction truck, it was necessary to put 20 per cent of the total weight of the car on the pony wheels.—A. F. Rexroth.

105. With maximum traction trucks, what is the best method of placing brake-shoes—both inside, outside, or alternated?

On the outside; more convenient for repairs.—Chas. H. Smith.

Our experience has been to place the brake-shoes alternately, on the outside of the driving wheel and on the inside of the pony wheel. This reduces the wearing parts to a minimum.—A. F. Rexroth.

107. What is the cause for wheels, apparently in first-class condition, breaking down or collapsing in service?

This has occurred with us several times and an examination of the wheels developed no apparent reason for breaking.—Chas. T. Herrick.

108. What has been the experience relative to wheels becoming loose on axles?

Think this is due to the fact that they were originally put on too loosely.—Chas. T. Herrick.

In ten years we have had perhaps one-half dozen wheels get loose on the axles, and in each case we found it to be due to the fact that the wheels were not put on the axle with sufficient amount of press.—A. F. Rexroth.

109. What pressure is used in pressing wheels on axles?

We use from 35 tons to 45 tons.—Chas. T. Herrick .

110. Is there any form of wheel gage for use in accurately locating wheels on axles, and suitable for use in pressing on or subsequent inspection?

I do not know of any.—Chas. T. Herrick.

111. What are the specifications for car wheels for city and interurban systems?

We use a wheel with a 2½-in. tread and ⅝-in. flange for city service.—Chas. T. Herrick.

We use 33-in. wheels, 2¼-in. tread and ¾-in. flange.—A. F. Rexroth.

112. What grade and treatment of steel is the best for axles?

We use cold rolled steel.—Chas. T. Herrick.

113. Is it advisable to use a smaller axle than 3¾ ins. diameter?

No—makes them too weak for the load and work they have to perform.—Chas. H. Smith.

Think not, for the reason that anything smaller has a tendency to bend or break under heavy service.—Chas. T. Herrick.

114. Are any of the types of brake-shoes, using special inserted material or pieces, more reliable or economical than solid brake-shoes, taking into consideration both wheel and brake-shoe wear?

We get the best results from a solid casting. We find the cast-iron shoe made from good material to give the best results.—Chas. H. Smith.

We have used a brake-shoe with steel insertions, but we found it wore too much on the wheel to be an economical shoe.—C. T. Herrick.

The most reliable shoe for all parts of the system is the ordinary cast-iron shoe; but on hilly roads, the expense of maintenance has been enormous, and we have adopted the "Compo" for all suburban hilly roads, and the diamond "S" shoe for city work.—A. F. Rexroth.

115. What has been the experience with track brakes, either mechanical or magnetic?

Our experience has been they are not suited for making service stops. As an emergency device or for use on very long steep grades, there may be some small field.—R. E. Moore.

116. What results have been obtained in the use of emergency brakes?

The Bonta brake, as incorporated in our emergency reversing switch for controllers, fills the requirements for an emergency brake. It is simple and positive in its action, carrying the braking effect fully up to the slipping point on the wheels.—R. E. Moore.

117. Above what speed and weight of car is it the best practice to use air brakes?

In my judgment, it is advisable to use the air brake on any cars over 18 ft. in length, and making a speed of more than 10 miles an hour. We think the time saved in stopping and starting, and avoiding accidents, will more than compensate for the cost of the air brake equipment.—A. F. Rexroth.

We consider that air or some other form of power brakes should be used on cars weighing 15 tons or more, and operating at speeds of 25 miles per hour or over; and on cars weighing 25 tons, operating at any speed.—R. E. Moore.

118. Are independently operated compressors necessary for reliability with air brakes?

We do not consider that independently operated air compressors are necessary for reliability of air brakes on single cars. The use of individual compressors depends upon the character of the service which the cars are required to perform.—R. E. Moore.

DISCUSSION ON QUESTIONS 116 TO 118, INCLUSIVE, ON AIR BRAKES

Mr. Musser—We have about twenty-four equipments, which have been in operation various terms up to three years. Mr. Rexroth, our master mechanic, has definite information as to the operation and maintenance costs.

Mr. Rexroth—Our early troubles were principally in connection with the brackets on the governor. The improved form now made has reduced this difficulty materially. We also had some trouble with water getting in the pipes and freezing. This we obviated by putting in drip cocks.

Mr. Herrick—Have your brakes ever failed? If so, why?

Mr. Rexroth—We have never had a case where the air brake failed. The only reason I have ever known for failure, was where something went wrong with the governor and it failed to work.

Captain Lanius—We have experienced no trouble on the three suburban lines which are equipped with air brakes.

Mr. Faller—We have only two equipments. These have been in operation three years and have given us practically no trouble.

Mr. Power—We have furnished air brakes for both single and double truck cars. The Lancaster system has been operating a number of single truck cars, equipped with our brakes, and they are entirely satisfactory. The majority of equipments are naturally installed on double truck cars; but it is my experience that regardless of the size of car, the air brake deserves careful consideration on the score of safety and reduction of accidents.

As to the merits of axle and independent driving, my advice is to stick to the independently driven compressor.

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119. What is a reasonable power consumption per car mile for 25-ft. closed cars mounted on maximum traction trucks and equipped with two motors about 40-hp each?

A 25-ft. car body usually weighs about 8400 lbs.; weight of maximum traction trucks about 1350 lbs. each; weight of double 40-hp equipment about 5710 lbs.; seating load of 36 passengers 4900 lbs. This makes the total estimated weight of cars equipped and loaded 12.85 tons.

For a car of the dimensions given and in averave service, the watt hours per car mile would probably average about 1400.

In comparing wattmeter readings taken on cars operating on different roads, all of the factors, such as number of stops per mile, coasting, schedule speeds, duration of stops, etc., should be taken into consideration.

Regarding the relative power consumption of double truck cars equipped with two and four motors respectively, would state that with motors of equal efficiency geared to the same speeds and giving the same torque with the same total input to the car, the four-motor equipment should not take any more power when used in exactly the same service as the two-motor equipment, except for the slight increase in weight of the four-motor over the two-motor equipment. This increase in weight is a very small proportion of the total weight of the car equipped and loaded. On account of the grinding of wheels on the track during acceleration and when ascending grades, it is quite likely that the power lost in this way with two-motor equipments more than offsets the increased power required due to the slight increase in weight of the four-motor equipment.—R. E. Moore.

120. What is relative power consumption of double truck cars equipped with two and four motors respectively?

The power consumption with double truck cars equipped with four motors is about one-third higher than where the same trucks are equipped with two motors.—Charles T. Herrick.

With motors of equal efficiency geared to the same speeds and giving the same torque with the same total input to the car, the four-motor equipment should not take any more power when used in exactly the same service as the two-motor equipment, except for the slight increase in weight of the four-motor over the two-motor equipment. This increase in weight is a very small proportion of the total weight of the car equipped and loaded. On account of the grinding of wheels on the track during acceleration and when ascending grades, it is quite likely that the power lost in this way with two-motor equipments more than offsets the increased power required due to the slight increase in weight of the four-motor equipment.—R. E. Moore.

121. With double truck cars, equipped with only two motors, on which axle should motors be mounted?

I would not suggest using two motors on double truck cars. Our experience has been that the best results have been obtained from using four motors of less horse power per motor; but if a double truck car is to be equipped with two motors, the best way would be to mount the motors on the outside axles.—A. F. Rexroth.

122. What special grade or quality of metal gives the lowest cost per car mile for gears?

Steel gears, when steel pinions are used.—Chas. H. Smith.

Our experience has been that the best results can be obtained by using steel gears and steel pinions, run in oil and in regular gear casing.—A. F. Rexroth.

123. What are the relative merits of four-bolt and eight-bolt gears?

We find that the eight-bolt gear is more satisfactory under very severe conditions; but for ordinary conditions four bolts answer very well.—Charles T. Herrick.

Our experience has been that for all service it is best to use an eight-bolt gear, as it is impossible to draw four-bolt gear tight enough to stand a heavy strain. We have some four-bolt gears in stock that we are having drilled for eight bolts, rather than take the chances of the four-bolt gears giving way.—A. F. Rexroth.

124. What are the relative costs per car mile for rawhide and steel pinions?

We find that the rawhide is the more expensive as regards price, but it gives results that we cannot get with steel, in as much as requiring no lubrication, grease is not distributed along streets.—Charles T. Herrick.

125. What is a reasonable car mileage for motor bearings? What grade of babbitt is used?

We use the best babbitt. Using two parts babbitt to one of tin —mileage approximately 15,000 for both armatures and axles.—Chas. H. Smith.

We use genuine babbitt metal, or the same formula as used by the General Electric Company. We have been able to get 15,000 miles to 18,000 miles on armature and axle bearings on suburban lines, and from 18,000 miles to 20,000 miles on the city cars.—A. F. Rexroth.

Fifteen thousand 1 iles.—Charles T. Herrick.

126. What is the average mileage of armature bearings?

Fifteen thousand miles.—Charles T. Herrick .

128. What is the best material for journal bearings?

Brass; gives loi ger life and requires very little attention.—Chas. H. Smith.

Brass or bronze.—Chas. T. Herrick.

We have used the Lumen bearing metal, brass and bronze, but our experience has been that bronze gives the longest service. —A. F. Rexroth.

129. What methods of lubrication are employed in railway motors?

On the city cars we use grease entirely. On the long road cars we use grease on the axle-box; but on the armature bearings we fill the grease-box with wool waste, and depend on the oil for lubrication. To use oil on the armature boxes requires no change. Our reason for using oil on this particular line is that the line is considerably overloaded, and the voltage very low at end of line, resulting in the motor heating up more or less, and thereby causing the grease to melt and run away.—A. F. Rexroth.

During several years the General Electric Company has manufactured a large number of motors larger than 50 hp which use oil instead of grease for lubrication of both axle and armature journals. Motors of this class are in general use on elevated and suburban lines. More recently the General Electric Company has manufactured the General Electric 74-motor, rating 65 hp and the General Electric 70-motor, rating 40 hp, which have oil lubrications. The bearings in these motors are lubricated by means of oil and waste packed around the journal in a manner similar to that used in standard car journal boxes. This system of lubrication has given universally good results. I would also state that there are several devices on the market whereby a motor designed for ordinary grease lubrications can be fitted for oil lubrications instead. These devices usually consist of a cast-iron cap which is placed inside of the regular grease chamber and having some device for allowing the proper amount of oil to be fed to the journal. Reports from several roads indicate that the use of oil on these motors has given good results, both as regards cost of lubrication and wear of the bearings.—R. E. Moore.

132. Is there any cheap and reliable outfit by which car motors can be tested in place during inspections, and which can be operated by regular repair men?

In a statement made by the repair department of one of the large Western roads, which has tried the Conant motor tester, it is claimed that the great difficulty is in obtaining reliable results with the telephone method where such observations must be made in noisy places. They found it very difficult to determine the silence point accurately when tests were made in the car house because of the noises due to repair and other work.—C. H.

It is our experience that the testing of motors can be done rapidly and with ample accuracy by a system using an auxiliary trolley wire in connection with a regulating rheostat, ammeter and voltmeter. Our practice is to place the trolley of the car to be tested on the auxiliary wire. Cut out one motor entirely at the controller and short circuit either the armature or field of the remaining motor, depending on whether you desire to measure the field or armature resistance. With motors so arranged, the controller handle is moved to throw a notch on the motor to be tested, and by means of a water rheostat the current which passes through this

circuit is limited to twenty amperes approximately. The pit man then touches the ends of the field terminals or the armature terminals, as the case may be, with a cable which is connected to the voltmeter in the testing room. From the indication of the voltmeter in connection with the current passing, the resistance of either armature or fields is determined, and if the value so obtained is lower than the standard for that particular type of motor, the separate field coils are tested and the low resistance ones picked out. We have used this method, which is strictly a drop of potential method, for some years, and find that very little experience is necessary to manipulate the apparatus and to determine accurately the condition of the field coils. This method, as practiced by us, does not take into consideration the varying temperatures of the motors tested, but with comparatively little experience any of our men will detect evidences of faulty field coils. The cost of the outfit complete, exclusive of the labor of installing and connecting up the wires, is not over $60.—Charles T. Herrick.

The Conant motor tester operates on the principle of separately comparing the individual motor field coils in the two motors ordinarily installed on the car. It picks out those which are the weakest in magnetic strength. The coils do not have to be disconnected nor the motor opened for the test, as the leads can be readily reached through the hand holes of the motor case. Two of the prominent companies using them have in all twenty of these instruments in operation. Where proper instruction has been given the car house men there is no difficulty in their using the instruments.—R. W. Conant.

It is our practice to test all motors in place, by disconnecting each motor, and forcing ten (10) amperes of current through the resistance, and measuring the fields and armature separately, with a low reading voltmeter. This mode of testing can be done by any shopman and in a few minutes' time.—A. F. Rexroth.

In the Harrisburg repair shops, the following method for testing armatures for short circuits has been devised by Mr. Rexroth and has proven practically sure: In making test, pass a current of about ten amperes at 500 volts through it, with the aid of a yoke with adjusting contacts, so as to make connection with the bars on which the brushes should be set. Use a voltmeter with low reading dial so that two volts will read 600. With the terminals from the voltmeter, test the adjoining bars from one contact to the other, and when one space is tested, move the yoke to the other part of the commutator, so as to test all bars. If bars are free from short circuit, they will read about eight points on the voltmeter, but if a drop of two or more points occurs on any bar, you may look for a light short circuit. If meter does not read any figure you will find a dead short circuit. A coil of iron wire is used for resistance, or where this kind is not at hand, a water resistance can be used, as it only takes a few minutes to test an armature and the water will not have time to become hot.—Editor.

133. What is the average life of field coils and armatures in modern enclosed motors such as General Electric 57, Westinghouse 68, etc.?

We have never used the Westinghouse No. 68 motor, but have used some General Electric No. 57 motors for three or four years, and up to this time have not had occasion to replace either armature of field coils.—A. F. Rexroth.

It is a difficult matter to make a just comparison of the life of different field coils and armatures. In general the life of the windings of a railway motor depends upon the temperatures in service. The temperature of the winding depends upon many variable factors, such as schedule speed, weight of car, and other factors which vary power consumption as noted above. With a certain definite weight car and type of motor, making a certain definite schedule and stops per mile, the temperatures might vary greatly and hence the life of the windings by simply changing the gear ratio of the motors. Our experience has shown that in a great many instances the temperature of windings can and has been greatly decreased by a change in gear ratio, the same or practically the same schedule being maintained as before the change of gearing. It will therefore be seen that the conditions under which motors operate are so varied that it is almost impossible to make a statement as to the life of the windings which could be compared with the life of the windings on other motors operating under entirely different conditions.—R. E. Moore.

134. What is the average life of field coils and armatures in motors of the Westinghouse No. 3 class and size?

Two and one-half to three years.—Chas. T. Herrick.

From two (2) to three (3) years, averaging 160 car miles per day.—A. F. Rexroth.

135. Have any improvements been adopted in rewinding Westinghous No. 3 armatures tending to diminish the trouble by grounding at the ends of the slots?

We have devised an improvement in rewinding Westinghouse No. 3 armatures which has reduced our trouble account with this type armature about 40 per cent over the old style form wound coils. The difficulty with form wound coils is the liability of injuring the insulation in putting them in place, as it is impossible to put them on without using a hammer, and when the armature is put under heavy load it is liable to ground at the defective point and burn out. The present plan obviates this difficulty entirely. In the new system of winding, one sheet of fiber and one sheet of mica paper, each 1/32 of an inch thick, are used in lining the slots of the core, making the insulation 5/8 of an inch longer than the core of the armature. The fiber paper is dampened so that it can be bent in shape and fitted in the slots. The winding is the same as with the form coils from slot one to twenty-five. When the section is started put the left-hand lead in slot twenty-six until the section is finished in one and twenty-five. Then put a piece of lead cover on both leads the length of the core so as to make a good insulation between the sections. This is done so as to bring both leads out at the top of the section. On the ends of the armature one thickness of muslin or linen is enough on each section. The time of winding armature in this way is somewhat longer than with form coils, but the greater durability warrants the expense. The armature connections are the same as with other winding. The ends of the armature are much smaller with this system.—A. F. Rexroth.

136. Is there any brush holder for Westinghouse No. 3 motors, which overcomes the troubles with standard type brush holders, getting loose, damaging springs and causing sparking and beating of armatures?

We have had no experience with anything different from the original brush holder furnished by the Westinghouse Company. Frank Wambler, master mechanic of the Union Traction Company, Philadelphia, at the Sixth Street repair shops, has improved a brush holder, that, when used, will overcome the trouble referred to. This device is similar in construction to that brush holder and works similar to the brush holder on the General Electric 800-motor.—A. F. Rexroth.

137. Can a small road, not over twenty-five cars, save any money by rewinding all burned out armatures and field coils in its own shop?

Yes, if done by one of the car house employees who should be familiar with this kind of work.—Chas H. Smith.

We think not at the present time, but are willing to be convinced that we are wrong.—C. T. Herrick.

Yes, I think it would repay any road of ten cars and over, to do its own rewinding of both armatures and field coils.—A. F. Rexroth.

138. What is the best method of connecting motor terminals to car cables on double track cars?

Fasten your cable as near the kingbolt as possible and run from there to the motor.—Chas. T. Herrick.

We place lead wire from the main cable over to the motor, in the form of a cable, encased in cotton hose same as main cable, which is cleated to the floor of the car, leaving an end of about eight inches hang below the cleat. To this the leads from the motors are connected by means of a two-way connector. The wires from the motors are encased in a circular loom to prevent the insulation from wearing through on the truck.—A. F. Rexroth.

We use a split connector, one-half of which is soldered to the motor lead and the other half to the lead from the car wiring cable, the connection between the two halves being made either by clamping screws or by clamping effect produced by turning the connector through an angle.—R. E. Moore.

140. What has been your experience with flexible, stranded and solid wire for car cable? Also advantages of single, double and triple braiding?

We have used both stranded and solid wire for main cable in closed and open cars, and have found from experience that the cheapest and best is the stranded for the main cable, and the flexible for leads, using triple braided insulation in all cases.—A. F. Rexroth.

141. Is there any advantage in placing a hood switch at each end, and connecting so that throwing off hood cuts off trolley connection from controller at the end?

Yes, very useful in case of emergency; making repairs or examinations to motors, controllers or other parts of the circuit.—Chas. H. Smith.

We think there is.—Chas. T. Herrick.

We think it advisable to put a hood switch at each end of the car, connecting it independently, so that by throwing either of the switches the trolley wire is disconnected from the controller at the end of the car.—A. F. Rexroth.

We do not consider that there is any advantage in connecting hood switches at the two ends of a car in multiple so that throwing one switch cuts off the connection only from the controller at

the same end of the car. Such an arrangement would either necessitate a considerable amount of extra wiring, or the use of separate fuses and lightning arresters for each controller; and there would be, in our opinion, no compensating gain. Where the hood switches are connected in series, throwing either switch cuts off both controllers.—R. E. Moore.

142. What are the weights and designs for trolley wheels for city and interurban service?

We use the standard 4½ lb. wheel.—Chas T. Herrick.

We use the standard 3-lb. trolley wheel for city work, and for long line and suburban work we use the 6-in. trolley wheels, made by the Star Brass Company, Kalamazoo, Mich.—A. F. Rexroth.

143. What is most economical pressure of trolley wheel against the wire?

Depends upon the condition of the track and height of the trolley wire from the rail—usually 18 pounds.—Chas. H. Smith.

From 16 pounds to 20 pounds, depending upon the style of the trolley.—Chas. T. Herrick.

From 18 pounds to 20 pounds, depending upon the style of the trolley wheel.—A. F. Rexroth.

145. What average mileage is obtained from trolley wheels?

We think from 5000 to 8000 is a good average mileage.—Chas. T. Herrick.

From 5000 to 8000 is the average for the 3-pound wheel; but on 6-in. wheels we have been getting from 12,000 miles to 15,000 miles.—A. F. Rexroth.

146. Do you consider any form of trolley catcher or retriever commercially successful?

We have used the Wilson trolley catcher, with splendid results, for about two years.—A. F. Rexroth.

We consider that some form of trolley retriever is of great value on high-speed equipments. The retriever is much preferable to trolley catcher, as it immediately pulls the trolley pole down as soon as the wheel leaves the wire, thus insuring a minimum damage to the overhead construction.—M. O.

147. What size and kind of trolley rope is best for general service?

Three-eighths of an inch. When trolley catchers are in use, ¼-in. rope is the heaviest we can use.—Chas. H. Smith.

Three-eighths and ¼-in. Samson spot cord gives us the best results.—A. F. Rexroth.

148. How often should cars be completely repainted, assuming cars are varnished and retouched annually?

We have cars in service four years without repainting. We avoid this by giving them a coat of good varnish every year.—Chas. H. Smith.

We have found it advisable to varnish our cars at least once every year, and to completely repaint a car once every four years; but in repainting, where the coats are not cracked or grazed, we simply sandpaper the top coat off, leaving a smooth surface underneath, which saves the cost of a ground coat. We put on three priming coats of whitelead, mixed with a little Tuscan red. Then we add a dead coat of color, stripe and letter, and put on one coat of rubbing varnish and two coats of finishing varnish. The filling coats are not rubbed down. The cost under this system is about $40 per car.—A. F. Rexroth.

DISCUSSION ON QUESTION 148, CAR PAINTING

Mr. Ohmer—In car painting, one of the troubles is surface cracking. This is attributable to two reasons:—putting on the coats too rapidly, the foundation coat not having sufficient time to thoroughly dry; and the use of inferior varnish. If ample time is allowed for each coat to dry, and the best grades of finishing varnish used, there should be no necessity for burning off every four years, if cars are regularly varnished each year. The foundation painting should be good for seven years or eight years.

Mr. Wendle—On our road this work has been done by contract; not only painting, but getting the car ready, dismantling, and other operations not strictly defined as painting. For this work our expense is about $80 to $85 per car. When I compare this cost with what other roads are doing, it seems exorbitant; but I have been unable to pick out just which of our operations was the luxury. In looking up the subject, I have received statements of labor costs alone, varying from $24 to $52 per car for burning off and completely repainting inside and out. This is a wide discrepancy for what is presumably a carefully conducted department of the business. The question comes to what each of the roads is getting for its money, and whether the requirements of street car service are as well met by the $24 job as the $52 one, and in order to place this matter on a more definite basis, I would suggest that our members keep a detailed record of what is actually done, how much time is required for each particular operation, and how much and the cost of each kind of material used in each coat. Such data, covering the roads controlled by our members, and others, would permit intelligent comparisons to be made and revision of methods adapted, if deemed advisable.

150. What is the most economical and serviceable color for car bodies?

Chrome yellow.—C. T. Herrick.

Tuscan red.—S. W. Rhen.

Chrome yellow, with dark brown or green striping and lettering.—A. F. Rexroth.

152. Assuming an 18-ft. or 20-ft. closed body, what is a fair cost for the following:—Burning off and repainting from the wood; retouching and varnishing exterior?

Twenty to 25 feet closed car bodies—(A) to burn off old paint and glazed with white lead, paint and varnish (including inside varnishing), and painting roof and floor, $32.50 per car; (B) burn off old paint and use wood filler, primer, etc., approximately $46 per car. As we find the first method very satisfactory, we have adopted it.—A. F. Rexroth.

153. Is it advisable, from a business standpoint, to decorate and letter sides of cars liberally, or simply stripe in color and number, omitting lettering and useless decorations?

It is useless expense and no profit gained. We use a plain stripe and number, omitting lettering and useless decorations.—Chas H. Smith.

Have cut out all fancy gold scroll work and lettering, as we do not think it is necessary.—C. T. Herrick.

In our judgment, the plainer the car can be made, the richer and better it will look, and the more serviceable it will be. Our system is to paint the car in plain colors, using a simple stripe, with number put on plainly, and small initials of the company painted in plain lettering at one end of the car.—A. F. Rexroth.

154. In a road where the amount of painting is not sufficient to keep one man regularly engaged, what is the best method of handling this work cheaply and properly?

We hire a painter in our town as we need him, paying 20 cents per hour.—C. H. Smith.

156. Which is the best system of operating registers, rod or cord pull?

We consider the rod pull the best.—Chas. T. Herrick.

157. What is the best size and material for register strap?

Five-sixteenth inch tannite.—Chas. T. Herrick.

Five-sixteenth inch oak tanned leather cord, cut with edges champed off.—A. F. Rexroth.

158. What kind and size of signal rope is most satisfactory?

One-quarter inch with wire center.—Chas. T. Herrick.

We use the same rope for the signal bell as we do for the register cord.—A. F. Rexroth.

159. What is the most durable covering for upholstered seats?

I think rattan.—Chas. T. Herrick.

Rattan is cleaner, and I think more serviceable.—A. F. Rexroth.

160. How do you clean your closed cars? Do you use hot or cold water? Do you use soap or any other special preparation in cleaning?

Warm water and soap.—Chas. H. Smith.

Cold water in summer and luke warm water in winter and a mild soap.—C. T. Herrick.

We use cold water in summer and luke warm water in winter, without any kind of soap.—A. F. Rexroth.

DISCUSSION ON QUESTION 160, CAR CLEANING

Mr. Herrick—At Saratoga, the washing of cars was thoroughly discussed, and the use of linseed-oil soap was recommended by several members. Mr. Lake, of one of the Western roads, stated that a little linseed-oil soap dissolved in the cleaning water was absolutely necessary to clean the oil and dirt from his cars. His road operates through an oil territory and the grease and grime collect on the cars so rapidly that daily cleaning is necessary. In spite of daily cleaning, he reported no evidence of damage to varnish by the linseed-oil soap. Other large companies reported a similar experience. On account of the importance of proper car cleaning, I would ask whether any of our members have had experience with this soap or can advise me where to get it.

Mr. Ohmer—From a long experience in wood finishing, let me advise you—"Don't ever use soap of any kind in car cleaning." The soap contains lye and disintegrates the varnish. If you cannot clean with plain water, put a little wood alcohol in the water. This will clean off the grease and dirt and at the same time will stiffen up, or rather support the varnish, instead of cutting it away.

Mr. Wendle—While we are on the subject of car washing, will the members state the system they are using in car washing? How often are the cars gone over, and how many men are actually employed in washing cars exclusively?

Mr. Rexroth—We have some men who clean cars at night; they do some washing, but not very much. The main car washing,

namely, from the windows down, is done in the day time by seven special men. With this force, we generally get our sixty cars washed once a week.

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161. Is there any tread for car steps which will prevent slipping in winter?

We cover our steps with a strip of corrugated rubber.—Chas. H. Smith.

Corrugated rubber, we think, is good, and there is a safety tread manufactured with lead inserted that is very good.—Chas. T. Herrick.

162. Are car circuit breakers preferable to enclosed fuses?

I think they are.—Chas. T. Herrick.

Car circuit breakers are more reliable and convenient than enclosed fuses.—A. F. Rexroth.

For all equipments with a total capacity of 90 hp or over, operated only as single cars, we consider that the use of circuit breakers is preferable to the use of fuses, as they are much quicker in their action and consequently minimize the damage in case of short circuits on the apparatus. Circuit breakers also accomplish the double purpose of an overload interrupting device and a hood switch; and the circuit is more easily and quickly re-established than where fuses are used. It must be considered, however, that the circuit breaker is necessarily a piece of apparatus that must be carefully inspected. A fuse used in series with circuit breakers provides an additional factor of safety, but it is not necessary if the circuit breakers are carefully inspected and kept in proper operating condition.—R. E. Moore.

163. What type of headlight is best for city service?

Electric—cleaner and economical.—Chas H. Smith.

We think oil headlights, for the reason if anything gets loose or breaks in connection with the trucks, you can use the headlight about the car.—C. T. Herrick.

Electric headlights, with 16-cp incandescent lamps, are more reliable and economical.—M. A. H.

164. What has been your experience with fenders?

We think it economical to use fenders.—Chas. T. Herrick.

165. Do you have any system of reporting electrical and mechanical defects in cars by conductors, motormen or other employees, especially when defects are not serious enough to take a car out of service? What method is used to check up such reports?

Our employees are instructed to report to the car house defects of any kind that come before their notice.—Chas. H. Smith.

We have a blank which we furnish each crew at the car house, when the cars are turned in for the day. Upon this blank the conductors and motormen are instructed to report any repairs necessary to the car, or any shortage of tools or equipment kept upon the car.—A. F. Rexroth.

Our system is as follows:—Special report forms, bound cheaply in a manner similar to the Western Union books of telegraph blanks, are placed in each car by the car repair department. These forms are ruled and printed to make two columns. In the first column, the various items which affect the comfort or safety of passengers are listed, and the conductor indicates and briefly explains nature of defect. In the second column, items affecting the equipment or operation of the car are listed, and the motorman similarly marks and explains. This report is signed by both the conductor and motorman in their respective columns. At the time original report is made out, carbon paper is placed to give copy. The original copy of report is deposited with the repair department and the carbon copy with the despatcher. It is the motorman's special duty to see that these reports are properly made out and deposited before leaving the car house after turning in the car.

On receipt of report, the repair department is expected to remedy defect, if possible, before the car is again placed in service; and in order to check up whether repairs are promptly and properly made, the despatcher looks up all reported cars which are again placed in service, and if defects still exist, he reports such fact daily when his copies of reports are turned into the main office. This enables the management to keep close supervision on the condition of cars; and the efficiency of the repair department is determined by comparison of these reports with the daily labor and material reports from the car repair department.—Editor.

166. What is the maximum length of closed body, mounted on single truck, 7-ft. wheel base, which will give satisfactory service to the public and reasonable maintenance cost on track and body?

I think any car body over 18 ft. in length too long to be mounted on a single truck.—A. F. Rexroth.

169. What popularity has the semi-convertible car as compared with regular cross bench open cars, especially with reference to pleasure riding?

The semi-convertible type has given general satisfaction.—A. F. Rexroth.

170. Are accidents less with cross seat cars of the semi-convertible type than with twelve-bench or fifteen-bench open cars?

Very much less with the cross seat, semi-convertible type.—A. F. Rexroth.

171. What is the minimum satisfactory width over all for semi-convertible cars?

Our semi-convertible cars run from 8 ft. 2 ins. to 8 ft. 4 ins. wide over all, and give a satisfactory width of aisle.—A. F. Rexroth.

172. To what extent have track scrapers of the Van Dorn-Dutton, Root, and similar type, been a commercial success?

Would not be without them. They are excellent for removing snow and dirt from the rail.—Chas. H. Smith.

173. Is there any satisfactory device, attachable to each car, which will scrape packed snow from girder rails, especially along paved streets?

Where the scraper can be set on top of the rail we find the Dorner or Brill type very useful; but where the track is laid in asphalt with granite blocks which stick above the top of the rail inside and outside, this type of scraper is of practically no use for cleaning out snow and sleet from the tracks.—Mr. Wendle.

We have Dorner and Brill scrapers, and we also have a device on our combined snow scraper and plow, made by the Thomson-Houston Company a good many years ago, consisting of a spring track scraper which is kept sharpened and held against the rail by compression. This works very satisfactorily on a straight track as long as the joints are tight, but it would not be at all satisfactory for the entire service.—Mr. Musser.

TRACK AND ROADWAY

201. What are the practical advantages of "Trilby" girder rails in paved streets?

I think none. While we use "Trilby" and side-bearing girder rails, the T-rail of proper height is best for paved streets.—A. F. Rexroth.

Very little of the "Trilby" rail has been in service sufficiently long to develop its defects. One of the New England roads, in connection with the municipal officers, looked into this matter, and their report on New York City results was that the pavement was not especially preserved by this special form of rail. The modified form, used in Philadelphia, has not been reported on. From best information we can get, the advantages of the "Trilby" type are largely theoretical. Practically it has the faults common to all grooved rails and is by no means the salvation of municipal pavements.—Editor.

202. What is the advantage in using girder rails higher than 7 ins. in streets paved with brick or asphalt?

If concrete foundation or beam construction is used, with welded joints, there is no advantage in using over 7-in. rails. On standard ballasted track, with mechanical joints, the 9-in. girder rail is most satisfactory.—T. J. King.

204. Has any satisfactory method been devised for attaching metal pieces to existing girder rails to change the head to a shape similar to "Trilby" or grooved rails? Has such change of form been voluntary or because of conditions imposed by the municipality? What results have been obtained?

We have had some experience in the use of Buckland blocks which are intended to transform the ordinary tram head rail into a grooved head rail. These blocks are made of short cast-iron, and when they are first placed in service seem to fill the bill quite nicely. They, however, wear out rapidly in the groove, due to the abrasion caused by ordinary street traffic as well as that caused by full-flanged wheels. In my opinion they are, at best, a makeshift which may be used in order to tide over the necessity of replacing rails for a short period. The cost of these blocks is about 20 cents a foot of rail or 40 cents a foot of single track. To this expense must be added the expense of splicing the same.—Norman McD. Crawford.

205. What is the experience with special rail joints, such as the Weber, Continuous, Atlas, etc., in regard to reducing maintenance and depreciation charges on track?

We have had some old rails, with pounded joints, reclaimed to some extent by using Weber and continuous rail joints.—A. F. Rexroth.

We have used the Weber joints and some few Continuous. The track on which we used Weber joints had been worn considerably and the rails were pounded down at some of the joints; after the new joints had been in service for some time, we found that the ends of the rails had smoothed out to some extent. It was not expected that the pounding would be entirely removed, but the rails were very much improved. It is our experience that these joints are economical in fixing up old track, where you do not

want to disturb the pavement for several years. We are now using these joints on a stretch of new work, but this has not been in service a sufficient time to determine results. On one street we used the continuous joint and at the end of a year's service we find it very satisfactory.—Mr. Musser.

208. Is there any way by which the hammered ends of girder or T-rails can be smoothed and trued up without taking up the rails?

By taking up sufficient pavement to permit sawing off the battered ends, and then cast-welding in a short piece of good rail of the same shape. By extending casting mould, it would be possible to complete the joint casting at one operation. In case work is to be done in connection with repaving, it is best to take up rails, saw off the defective ends and use a mechanical joint of Continuous or Weber type. This was done on about 1 mile of badly battered rails, Continuous rail joints were used, and from present indications, at least seven years or eight years additional life will be obtained from rails. In three years the maintenance cost in this stretch has been very low and riding is reasonably smooth.—T. J. King.

209. In resurfacing old track on which double truck cars are run exclusively, how much above the general level of the rail can the joints be raised without making the riding rough or seriously hammering the rail ends?

In resurfacing old track, laid with even joints, the joint can be raised ¾-in. above the general rail level. This elevation does not cause any annoyance to passengers or unusual wear on track or cars. If this work is done in connection with a general track repair, and joints thoroughly tamped, no attention should be required for three years, unless the joint becomes loose. With broken joints, it is not advisable to raise the joint very much above level.—T. J. King.

210. What is the proper safe distance between the inside rails on double track or in turnouts, to provide for passing of modern type of cars?

Sufficient to allow a space of 1 ft. or more between the running boards of open cars.—Chas. H. Smith.

Not less than 5 ft., and if possible, 6 ft. between inside gage lines.—Meade Coulton.

Our gage is 5 ft. 2½ ins. We make all our double track 10 ft. from center to center.—A. F. Rexroth.

211. Where girder rails are laid in dirt streets which are kept in repair by the company, what is the best method for preventing the continual cutting away of dirt immediately outside the rails, especially at curves, by wagon traffic?

We find it profitable to pave all track, and at places where the street is not paved, we pave between the tracks and 9 ins. outside of the rails with cobble stones. This preserves the ties and prevents water getting under, and at the same time avoids the continual expense of filling up with broken stone.—A. F. Rexroth.

Where girder rail is 6 ins. or higher, or on chairs, we find paving with cobbles or roughly dressed stones along the outside of rail to be most satisfactory and durable construction. By carrying paving out about 10 ins. to 12 ins. and ramming well, the stones remain in place even where the wagon traffic is heavy. Where paving cannot be done, we have had good success with tamping in the cinders from our power houses. In a comparatively short time these form a hard, compact bed and raise very little objection from city authorities.—M. Coulton.

212. What satisfactory substitute has been found for planking inside and outside of the "T" rails laid in dirt streets?

We use stone macadam and find it more economical and better than planking. Not affected by frost.—Chas. H. Smith.

We use cinders wherever possible, and where teaming is light, have been able to meet requiremnts of city and county suprvisors. —M. Coulton.

213. What is the average life of modern hardened center special work?

Our experience is that this work will by no means last as long as the abutting rails. Examination of special work on our system in use about three years, shows material signs of wear with an average of about 400 cars passing over it per day.—Meade Coulton.

214. What is the average life of steam railroad crossings, made according to the Pennsylvania or Reading Railroad standard? What improvements can you suggest that will tend to lengthen life?

215. What are the relative costs of the following track constructions: Broken stone foundation, wood cross ties 2 ft. centers, and 70-lb. girder rails; concrete foundation, wood cross ties and 2 ft. centers, and 70-lb. girder rails; concrete beams, with track mounted thereon and bedded in concrete, and held to gage by iron tie-rods; rail 70-lb. girder?

Basing costs on first class of construction, and calling this 1.00, the relative costs are approximately as follows: Second type, 1.4; third type, if built in paved street, using no forms, 1.1; and third type, new work, requiring forms, 1.25.—T. J. King.

216. What is the minimum depth of concrete or broken stone required for permanent track construction in paved streets?

Not less than 4 ins. of concrete or broken stone.—A. F. Rexroth.

Where city has compelled back filling of trenches, etc., with sand or gravel, and subsoil is gravelly or sandy, with natural drainage, 6 ins. to 9 ins. of concrete. If clay or poor subsoil, concrete should extend below the frost line.—T. J. King.

217. What is the experience in using the cheaper grades of cement for concrete foundation work?

We substituted Rosendale for Portland cement on about ½ mile of new track work, paved with brick. A year's service has developed no difficulty whatever.—M. Coulton.

Rosendale does not seem to set up in air as well as Portland cement. For foundations of piers or abutments, below the water line, Rosendale seems as good as Portland. In paving, in order to obtain equal strengths of concrete, Rosendale at 85 cents per 300 pounds barrel is almost equal to Portland at $1.50 per 400 pounds barrel.—T. J. King.

218. What precautions must be observed in laying track on concrete beams without the usual cross-ties, in order to secure satisfactory track construction?

Provisions should be made as follows: First, to clamp or tie rails to concrete beam and at the same time hold the rail to line and surface. Second, to prevent rails expanding or contracting widely during the setting up of the concrete, otherwise rails are apt to become loose in the concrete. Third, to be so placed that rails are butted for welding joints. Fourth, to use welded joints so that wheels run perfectly smooth over joints, as any type of mechanical joint leaves a ridge, which in rigid construction of this type, will result in pounded rail ends. Fifth, to anchor each rail to concrete beam so that on grades there will be no creeping of rails, and rails will expand evenly in both directions and return to original position.—T. J. King.

The most important point is that concrete be brought up tightly against the bottom of rail. After concrete is properly tamped, it is advisable to pour a grouting of strong cement and fine stone. It is essential to use a good grade of Portland cement in the construction of the beam.—A. F. Rexroth.

219. In streets which are to be paved with asphalt, what is the most serviceable pavement to lay between the rails?

Brick, as it can be opened and replaced without impairing pavement, is not rotted by grease dropping from motors, and is relatively smooth for driving.—M. Coulton.

220. What form of cover plate and system of openings is best for track drains where wagon traffic is heavy?

We use cast-iron plates of the plane convex pattern.—Chas. H. Smith.

We have tried several types of track drain covers, including narrow rectangular slots; raised ridge tops with slots between; and flat smooth top with a series of round holes, ½-in. diameter, distributed over same. With all forms except the last, we have had considerable trouble with the caulks on horses' shoes getting caught in openings, and injuring the horse or pulling shoes loose. —M. Coulton.

BONDING DEPARTMENT

250. In testing bonds against the connected rails with Conant or similar type of testing outfit, what length of rail is accepted as the equivalent of a first-class bond? What equivalent length of rail as read on the instrument, is regarded sufficient to condemn the bond?

A bond resistance equal to 3 ft. of rail is usually considered very good. If equal to 4½ ft. of rail, it is fair. If it equals 6 ft. or more of rail, it ought to be condemned. If the rail is bonded to the full capacity, and bonds of such a character as will maintain their initial efficiency are used, the resistance of the bond should be the same as clear rail of a length occupied by the bonds, and should remain so.—A. H. Englund.

In testing a rail bond, several conditions are necessary in order that the work of repair may render the return circuit the most effective for the least expenditure of money, and consequently the resistance of a bond in terms of the length of the rail, which would be called good, bad or indifferent, will depend on what portion of the rail return system this bond occurs. The current density on the rail being the important factor in determining what will be the permissible drop, and on this basis should the effectiveness of the individual bond be judged. Assuming that the maximum return drop that we wish to allow for a given stretch of road from the power station serving that road, we would just determine the current flow that the rails have to carry back to the power station. The voltage being taken by drop tests or computed for the maxi-

mum load of half the track distance. Assuming that a 60-lb. rail measures .0052 ohms per 1000 ft., this gives us the drop that will occur with the current flowing through the rails, considering it a continuous rail system, with a drop of 20 volts. Subtract the drop thus found from 20 volts and divide this difference by the number of joints occurring to the points on the rails where we assume our drop, this will give the potential difference on the average joint and also give us the length of rail for the average bond, which will be required to be maintained in order to give the drop on the rail joint, which will bring us within the desired potential loss on the return system. There are other considerations that cannot be neglected in this proposition. Where the equipment is large the acceleration becomes an important factor in the copper head and the bonding of the rail return in order that undue heating may not result, and that the schedule may be maintained without over-speeding the equipment on high pressure portions of the system. The foregoing treatment of the bond question leads to a tapering bond as the power station is approached, and this is the correct method where a given amount of money only may be expended in bonding to give the least possible drop. Consequently it is impossible to arbitrarily fix any length of rail in terms of bond resistance without knowing the conditions under which the bond is to be used.—A. B. Herrick.

My opinion is that 3 ft. of rail and joint should be bonded so as to test equal to 6 ft. of rail and that any joint that tests over 12 ft. of rail should be rebonded; this applies to moderately heavy conditions of traffic, but there are very few roads to which these conditions do not apply. Joints which test between these limits should not be allowed to pass if the traffic is extremely heavy, but may be if the traffic is light.—E. W. Conant.

We use a milli-voltmeter, with double needle and scale, and compare the drop between 3 ft. of solid rail and 3 ft. across the joint. When the joint reading is ten milli-volts higher than the solid rail reading, we condemn the bond and replace it.—P. F. Gerhart.

First question, 3 ft. Second question, 5 ft.—R. E. Moore.

251. What is the best method of rebonding tracks in paved streets with the minimum disturbance of pavement, tracks consisting of 6-in., 7-in. and 9-in. girder rails? What is the total cost per joint for such rebonding, exclusive of cost of removal and replacement of pavement?

We have perfected hydraulic punches and compressors for bonding girder rails in paved streets. The punch cuts a tapered hole in that part of the tram projecting beyond the edge of the joint plate. The compressor forces the bond terminal back into the hole against the taper. In asphalt streets, with the usual Belgium blocks against the inside of the rail, it is necessary to remove but two of the Belgium blocks to make room for the hydraulic tools. There are over 100,000 joints bonded in this manner in Philadelphia. Unofficial costs given us by the bonding department show that the Belgium blocks can be removed, two bond holes punched, the bond inserted and compressed, and the Belgium blocks properly replaced for about 18 cents per joint, exclusive of the cost of the bond. This method of bonding has been employed in Harrisburg, York, Norristown and Tacony, Pa.—A. H. Englund.

The method of rebonding track in a paved street economically has not yet been proposed, but from my experience a radical departure has to be made for this class of track work, and I think the solution is to be found along the following lines: Instead of removing the track, to use a cutter or pneumatic tool which will cut away the pavement for ¾-in. from the ball of the rail and cut a slot in the pavement for about 6-in. long. Then a U-shaped bond made of ribbon, the edges of which are presented to the ball of the rail and electrically soldered to the rail, giving a U-shaped loop projecting into the slot cut in the pavement and bridging the joint of the rail. I am designing tools to produce this kind of a bonding arrangement, and I believe that I can reduce the time necessary to put in a bond to less than two minutes and expenditure less than 30 cents. The tools, soldering transformer, being portions of the bonding car, so the work can be done most expeditiously, and after this bond is placed and connected, the slot is to be filled with asphalt or equivalent compound to restore the pavement to its original surface. It is found that disturbing the pavement around a joint disturbs the track at its most critical point, and that patching the paving never restores it to as strong a condition as the original pavement.—A. B. Herrick.

We use a 6-in. tram bond, with a ¾-in. terminal, made by the Protected Rail Bond Company, who furnish us with hydraulic punches and compressors for putting them in place. By this system it is only necessary to open a space on the inside of the rail 6-ins. wide and 18-ins. long; punch the two holes in the rail, insert the bond and compress it. We have only used this type of bond on 6-in. side bearing rails, on streets paved with cobble-stones. The cost of removing and replacing cobble, punching and inserting the bonds is 15 cents per joint. The bonds cost approximately 55 cents each.—P. F. Gerhart.

252. What average life can be expected from bonds put in according to the most modern methods? In what way is the maintenance expense for bonding handled to provide for general overhauling and renewal?

A "Protected" bond, of the proper design, length and cross-section, applied under the plate of any modern "T" or girder rail, should last not less than five years. If the joints are kept up in strictly first-class condition, a "Protected" bond will last as long as the rail.—A. H. Englund.

I have tested bonds which, at the end of five years, showed practically no depreciation, less than 1/5 of 1 per cent of them being defective. The elements surrounding the installation of a bond largely affects its life. Poor track foundations, defective ties and splice-bars which do not fit the rail, and too short a bond to allow for the expansion and contraction of the rail, are causes which contribute to the uncertainty and make bonds succeed in one installation and fail in another, where they are identical in construction and application. I find the same bond in pavements with concrete construction and the rail well grouted, gives much longer service than the interurban track when ballasted according to the Pennsylvania Railroad specifications. Moreover, a longer bond must be used in exposed rails and nothing under a 6-in. expansion should be used in a concealed type of bond, as the contraction and expansion of the rails are passed through the fish-plate and more latitude must be given at joints for expansion and contraction than theoretical considerations would dictate. I believe the test for maintaining bonds are best made by means of pressure wires; in any city where the railroad owns its own telephone system, these wires can be used with pressure wires by placing the telephone wire upon the track, plugging around the exchange by means of the station telephone wires and connecting to the negative bus. This gives the aggregate drop, including the rail and all the bonds, and a criterion of the condition of the ground returns. If a railroad company took these records once a month on each line, it would be in a position to say with surety on what lines the rebonding should be done with the greatest profit and the saving of energy delivered to the cars. When it has been decided to rebond a road, the bonding foreman should be instructed thoroughly in the use of the milli-voltmeter, and should determine for himself the condition of every bond and renew those which show a rail length greater than that which would be determined in applying the rule in answer to question 250. The most economical maintenance of the bonding or railway return is by continuous tests and inspection of these bonds from month to month as an aggregate, by the method here described.—A. B. Herrick.

After two years' to three years' use of compressed terminal bonds, we found no bad joints in the bonds. Where bonds are compressed and rail joints kept in first-class condition, the bond should last as long as the rail.—P. F. Gerhart.

Average life depends on soil, traffic and various other conditions.—R. E. Moore.

253. For new work, are short flexible bonds either under the fish-plates or base of rail more durable than the solid bonds outside the fish-plates?

The fact that flat wire flexible bonds placed under joint plates, or on the base of rail have almost entirely replaced solid bonds outside of the plates, must argue that they are equally durable, and more so.—A. H. Englund.

Flexible bonds under the fish-plate over 6 ins. long are more durable relative to their conductivity and less liable to be stolen than exposed bonds. Bonds under the fish-plate give better life than those under the base of the rail.—A. B. Herrick .

We use flexible bonds on tram and under the fish-plates, and have found them most durable.—P. F. Gerhart.

Yes.—R. E. Moore.

254. Are soldering bonds as satisfactory as the expanded terminal or compressed terminal types?

Soldered bonds, where the edges of the laminations are soldered to the rail, and soldered in such a position that the blow on the rail is given vertically to the lamination, show less drop in their connection as compared with their cross-section than expanded terminals, and the total drop across the bond in this type of bond is less than the compressed terminal.—A. B. Herrick.

We have used only the compressed bonds and have found them to meet our requirements in all cases.—P. F. Gerhart.

No.—R. E. Moore.

255. Can a pin-expanded bond terminal be installed so as to maintain, during a period of five years or the life of the bond if longer, as reliable and as low resistance contact with the rails as a solid copper terminal bond expanded by a hand or hydraulic compressor?

In a pin-expanded bond terminal, it would be absolutely necessary, in order to make a perfect contact, to have the diameter of the terminal exact, and the hole in the rail reamed to exact size

to fit the terminal. Under this condition, the full limit of the expansion of the pin would be obtained, and a good job would result. In practice, however, it is found that hardly any two terminals are exactly of the same diameter, and it is a well-known fact that in rails bored at the mill, there are no two holes exactly the same diameter; and further, many of the holes are not round. To clean out the holes, in order to get them round and free from rust, they are enlarged to such an extent that the bond terminal fits too loosely, and as the expansion of the terminal in the hole is limited to the maximum taper of the pin, it follows that the average contact in pin-expanded terminals is bad. The compressed terminal can always be made to fill the hole, as compression need not stop until the hole is filled.—A. H. Englund.

The comparison of the different modes of connecting bonds to rails rests largely with the man putting the bond in and his ability to do honest work. Under practical operation bonds show an enormous difference in their conductivity in the different parts of the country, so that it is extremely hard to differentiate between them, but a large amount of trouble has arisen from ignorant and cheap labor installing the bonding, and not being instructed in the method of testing the results of their work.—A. B. Herrick.

We had been using the expanded terminal bond for about two years, and on making a test on track that had been bonded with them a few months ago, we found the terminals had become loose in the rail and made very poor contact, and have replaced them with compressed bonds.—P. F. Gerhart.

Yes.—R. E. Moore.

256. Of what value is treating bond holes and bonds with Edison plastic alloy? Will such methods prevent the deterioration of contact surfaces and reduce contract resistance?

The application of Edison plastic alloy to a bond where the bond service is rough is an improvement, and seals and prevents the access of moisture, which will by capillary action eat around the terminal when interstices are left between the shank of the bond and the hole in which it is inserted; but with a smooth shank to a bond and the use of a compressor its use is not to be advised.—A. B. Herrick.

According to our experience, treating bond holes and bonds with Edison plastic alloy is of no value.—R. E. Moore.

258. What is the best method of covering, coating or otherwise protecting bonds against corrosion?

A good weatherproof and insulating paint is a desirable coating for copper rail bonds, providing such paint does not possess ingredients that will deteriorate the copper.—A. H. Englund.

Any good asphalt will do it.—R. E. Moore.

The bond under the fish-plate does not need any protection. The exposed bond, if painted with hot asphalt paint, has its life greatly prolonged; but coating with coal tar compounds is a detriment. Some roads practice the method of boxing the bonds where the soil conditions show active corrosive qualities. They groove one piece of board long enough to contain the straight portion of the exposed bond, fill with hot asphalt and nail on a ½-in. capping. The soil conditions that corrode the bond when of copper are where the filling has organic matter in it and exposed to moisture from sub-surface sources.—A. B. Herrick.

259. How frequently should tracks be crossbonded?

Cross-bonding should be done according to the amount of current carried. By using No. 0000, the usual and most satisfactory method is as follows: For 150 amps., cross bond each 1200 ft.; 250 amps., 1000 ft.; 500 amps., 900 ft.; 1000 amps., 540 ft.; 1500 amps., 360 ft.; 2000 amps., 240 ft.—A. H. Englund.

In interurban work cross-bonding should be practiced on single tracks a great deal more than it is, and for a four-motor 50-hp equipment, at least five times a mile, especially where sub-stations and rotary transformers are used, for if the bonding is defective near the sub-stations, it throws the load unequally on the sub-stations. I have recently found two sub-stations adjacent to each other, one operating normally at one-half load and the other at 40 per cent overload. The whole cause of this unequal distribution between sub-stations was due to defective bonding and no cross-bonding. The critical portions of an interurban road, where the bonding becomes defective, is at switches and turnouts, railway crossings and derailing switches, and the only satisfactory solution for bonding around this portion of the track, is to bond in supplementaries having an aggregate section equal to the section of the bonds employed and completely surrounding the special work by the supplementary, tying the four tracks of the turnout together and the two tracks of the main line with this jumper, and at steam road crossings to connect the rail with electric road abutting the steel track. It is well to assume that the bonding between electric rail and steam rail cannot be maintained. Bridges are critical points, and a supplementary wire or double bonding should be used across bridges; but do not use, in case of double bonding, two bonds of the same type. A concealed and an exposed bond in this location gives better results with time than two bonds of the same kind.—A. B. Herrick.

Depends on the number of cars in service. Four to the mile will do for interurban work.—R. E. Moore.

260. What is the best practical method of testing condition of bonds?

The new T-pole testing instrument, made by R. W. Conant, is very popular and seems to meet all requirements for rapid and accurate bond testing. We think so much of it that we have invested in several ourselves, for the purpose of testing out bonds on such of the small roads as do not feel that they can afford to invest in one of the instruments. We have found it extremely satisfactory and entirely accurate.—A. H. Englund.

The aggregate drop method constitutes the best form of inspection of the bonding, but to locate the bonds which are bad and their condition, the milli-voltmeter method, comparing a length of rail with the joint, is effective; also, the Conant method where it is certain that a current flows in the rail while making a test. It is very hard to determine whether a current always flows in the rail, and neither system is useful where the rail is dead. It is very important in my work to determine these conditions, and the method I use may be of interest. On my test car, I use two brushes on each track to take the drop from the rail, as the car moves along about five miles an hour. I use a motor-dynamo transformer, which gives me about 100 amps. through each rail as the car moves along. I automatically record the movement of the Weston milli-voltmeters, one for each track, without touching the hands of the same, on a record which moves at the rate of 1 in. per 100 ft. of track. I have in connection with the drop circuit also a very sensitive automatic, which can be adjusted to work for any relation between rail drop and joint drop. This relation being varied for different portions of the road, depending upon the current density in the rail. This automatic moves a pen on the record where a bond is passed over exceeding a fixed length of rail. In interurban work, when this pen moves it also closes the circuit through an electrically controlled valve, and squirts paint on the track at the defective bond. All intersections of the streets, turnouts, private crossings, are marked by a third pen on the record and a number telegraphed on the record corresponding to this intersection on the list. From this record the resistance of every bond is given, the current flows and its direction on the rail and any bond can be located by scaling from the last intersection or station at the scale of 1 in. to 100 ft. After testing over 1000 miles of road in different parts of the country with this test car, I find I can get the most reliable results and a permanent record, from which rebonding can be done with surety. Another important object for getting up this apparatus was to get a record for the railroad companies in electrolysis cases which could be produced as a court record.—A. B. Herrick.

The Conant rail joint testing instrument is now being gradually conceded to be a very practical, rapid and accurate means of testing the condition of the bond and requires no special skill to operate it. With it an ordinary man can test 100 joints per hour, which covers the ground as rapidly as ordinarily could be desired. —R. W. Conant.

A double milli-voltmeter, as described in my reply to question 250.—P. F. Gerhart.

261. What is the cheapest method of drilling holes in rails for bonds or bolts? What lubricant do you find best for this class of drilling?

For drilling bond or bolt holes in the web of rails, under all ordinary conditions, we do not believe there is anything better or more economical than a good modern powerful hand drill, such as the Buda or Millers-Falls. Where there are a great many holes to drill, a power drill will no doubt prove more economical. If trolley current is available, an electric drilling plant is very satisfactory, but it is hardly economical for less than 5000 holes, if the investment in the plant is to be charged up as part of the cost of drilling.—A. H. Englund.

For drilling holes for rail bonds, both soap, water and oil (heavy mineral oil) are generally used. I find that with either of these lubricants being used, if the hole is carefully cleaned immediately after drilling, it does not affect the resistance or the life of the bond; but the bond should be inserted and fixed in its position as soon after the hole is drilled as possible. No drill hole should be left over night, and this work should not be carried out in damp or foggy weather, as a film of oxide forms on the freshly drilled surface of iron almost immediately and seriously affects the resistance of contact between the bond surface and the rail.—A. B. Herrick.

For our work we use Sweet's hand drill, polish the terminal with sandpaper, and insert and compress bond terminals immediately after drilling the holes. We use no lubricant of any kind. —P. F. Gerhart.

First question, any good track drill will do; second question, soap water.—R. E. Moore.

262. What is the best method of treating bondholes in order to be certain that contact surfaces are thoroughly dry and clean? Is there any merit in smearing bond terminals with thin white lead before inserting in bondholes?

No. Better clean the hole with gasoline.—R. E. Moore.

The best and surest way of getting a good contact for bonds is to ream the holes immediately before placing the bonds, care being taken that no oil or moisture is left on the walls of the holes. If the holes are round and smooth, but rusty, a simple way of removing the rust and getting a bright surface is to take coarse gunnysack, cut into strips about 4 ins. wide, twisting one of these into a rope. Insert one end of this through the hole, and pull the material back and forth rapidly all around the hole. This will produce a result almost the same as a file, and with much more ease and rapidity.—A. H. Englund.

In holes that have been bored or old holes to be rebonded, a reamer is the best method of cleaning this hole, and a reamer which has on it a miller which cleans the surface of the rail against which the head portion of the bond will be compressed, decreases the resistance of contact between the bond and the rail about 40 per cent. The importance of this additional contact is apparent when one considers that in a properly installed cast head concealed bond, 6 ins. long, the resistance at the contacts of the two terminals of the bond average about 75 per cent of the total bond resistance of a No. 0000 stranded bond with ⅞-in. shank. The application of white lead to the bond before inserting is not advisable, and has been abandoned by the railroad companies who instituted it. Plastic alloy in the case of a rough bond being the only intermediary used between the shank and the hole that increases the conductivity of a bond. The alloy should never be used with a bond having anything but a pure copper head, as it will rot out any compound of copper with zinc or tin, as mercury in this case permeates into the body of the bond and destroys its mechanical structure.—A. B. Herrick.

263. What results have been obtained in welding bond terminals to the rails? What equipment is necessary and what precautions must be observed in operation? What is the cost per bond installed?

Welding bond terminals to the rail is the ideal method, especially in the case of electric weld, yet this method has been so surrounded by patents and litigations that the railroad companies are deprived of utilizing this method. The soldered bond can be applied to some rails and not others. The bond underneath the foot of the rail requires suspended joints, and a number of the rail splices used are not adaptable to the use of this type of bond without a special joint being made for the purpose; but the type of soldered bond, soldered to the ball of the rail, gives the ideal method, and I understand the cost is about 35 cents per bond complete. This type of bond has the objection of being exposed and stolen, but I have suggested coating with a paint containing arsenic, so very little value can be obtained where this copper was melted for reduction.—A. B. Herrick.

264. Has practical experience with cast welded rail joints shown that separate rail bonds are unnecessary?

Cast weld joints since 1896 do not require any bond around them, as they average lower than the rail resistance itself. This is the case with the Twin City Railway, Milwaukee Railway, Indianapolis Railway, Rochester, N. Y., Grand Rapids, and other towns where I have investigated this matter, and the same is true of the electric weld made since 1898. Bonding and cross bonding should both be employed where expansion joints are used, but with a concrete grouting rich in lime between the rail and adjacent pavement, assuming that there is a concrete base upon which the rail is laid, either beam or tie construction, no movement of the rail takes place with the temperature changes and expansion joints are unnecessary. Particular care should be taken to maintain the effectiveness of the cast weld rail return at special work by supplementaries at steam road crossings, for I frequently find more drop at a steam road crossing in a cast weld track, than I have in 6000 ft. of track adjacent to this crossing.—A. B. Herrick.

In most cases bonds are necessary.—R. E. Moore.

DISCUSSION ON BONDING

President Davis—I would ask Mr. Gerhart, who is in charge of the bonding department of the Harrisburg Company, to open the discussion on this subject.

Mr. Gerhart—We have been doing considerable bonding. Where we rebond old tracks, we use the bonds in various lengths from 6-in. trams to 42-in. regular bonds. Wherever it is possible we try to use the 6-in. tram bond. In new work we use bonds which are placed under the fish-plate, but in repair work, we frequently have to carry the bond around the fish-plate. We do not run any separate return wire, but depend entirely upon thoroughly bonding the rails. We consider it a waste of time and money to run any return wire where bonding is properly done.

President Davis—How do you bond in and around special work?

Mr. Hammett—In every case that I have seen, we have been able to use a cross bond, and tie cross bonds together around the special work. You can set your cross bond back far enough to get into the single rail, and a T splice, placed at the center of each cross bond, enables you to tie all the sections together.

Mr. Gerhart—We do that. But the long bonds offer a higher resistance as compared to the rails. It seems to me that there should be some short bond device by which every joint in the special work could be thoroughly bonded. With such short bonds at the joints and the addition of the long cross bonds properly cross connected, a great deal of the trouble with drop in the return circuit would be cut out.

Mr. Hammett—There should not be much difficulty in providing special bonds for this service, provided there is a sufficient demand for them. In my experience, I have had no such demand. The majority of roads seem to prefer cross bonding and then tieing the cross bonds together. In this connection I would like to call attention to our special tram bond. With this bond it is only necessary to remove three Belgian blocks in the pavement. The bond hole is made in the tram of the rail with a hydraulic punch, which makes a tapered hole with the large end of the taper at the top of the rail. The bond is then compressed, using a hydraulic compressor giving about forty tons. With this bond it is unnecessary to remove the fish-plates, and the actual cost of installation, exclusive of the bond itself, is from 17 cents to 18 cents each.

President Davis—Does that cost include anything except labor?

Mr. Hammett—The cost covers removal of Belgian blocks and replacing them, and installation of bond.

President Davis—Mr. Gerhart, can you give us the cost of installing the tram bond?

Mr. Gerhart—With the 6-in. tram bond, where we have to open only a small space, the cost is just about 16 cents per joint for labor. This cost was possible where the paving was cobble-stones and easily taken up and replaced. In other places it cost from 45 cents to 50 cents per bond, depending on the type of pavement and foundation of same.

President Davis—Is it your practice, Mr. Gerhart, to test your bonds periodically?

Mr. Gerhart—We have a double milli-voltmeter that we use very successfully in testing bonds. We have a contact device that simultaneously connects the voltmeter terminals to 3 ft. of solid rail and 3 ft. in which the joint is included. If the instrument readings are the same, the bond section is equal in carrying capacity to the solid rail and is regarded as first class. If the reading across the joint is three or four times as high as the reading on the 3 ft. of solid rail, then the bonding is regarded as bad, and a new bond is put in.

Mr. Faller—I would ask why it is necessary to take a reading of the rail as well as the joint. I use a plain milli-voltmeter, and if the reading exceeds three or four milli-volts, the bond is replaced. In connection with this test, we arrange to have a car run so that we are sure of getting current across the joint.

Mr. Hammett—Mr. Wendle spoke to me a short time ago, relative to a special arrangement for insuring current when testing with the Conant instrument. What results were obtained with this scheme?

Mr. Wendle—We have been unable to complete our arrangement for making a complete test of our bond system, and I am unable to furnish any definite results. Our difficulty was the delay in getting current reading for test, and the uncertainty of the results when made by comparatively inexperienced men. We proposed to equip a small cart with a resistance which would give approximately 15 amps. or 20 amps. when connected to the trolley circuit and the rail. The idea was to have one man observing with the Conant instrument, and the other man was to make the trolley and rail connections. By this means there should be no delay in getting definite results, since current could be applied at the joint tested and the work could be pushed along without the expense of operating a special car back and forth near the test point, and which would more or less interfere with the regular cars on single track.

OVERHEAD LINE

300. How can trouble with sleet be overcome?

We use sleet wheels, tying them fast to the harp with wire to keep them from rotating. The wheels give longer life and better results. Water being a lubricant, it does not injure the wire.—Chas. H. Smith.

The Easton Transit Company, of Easton, Pa., avoids the use of sleet cutting trolley wheels and trouble from sleet on the trolley wire by greasing the trolley wire late in the fall, which prevents the water from adhering to the wire. The grease is best applied by driving the construction wagon under the trolley wire and having a man apply a stiff lubricating grease by dipping his gloved hands into the grease and letting the trolley wire slip through his hands as the wagon is driven along. In this way two men can cover about 10 miles of wire per day, and one application will last all winter and obviate all sleet troubles.—M. A. M.

We use the regular ice cutting trolley wheel, although this is not entirely satisfactory. We tried greasing the wire some years ago, but found the grease held dust, etc., and gave poor contact at times when there was no sleet.—P. F. Gerhart.

With the trolley wire use sleet wheel; on the third rail use paste made for the purpose.—R. E. Moore.

301. Are any of the so-called preservative paints of any real value for preserving butts of poles? What method of treatment or setting will prolong the life of pole sufficiently to warrant the extra cost?

At present prices of chestnut poles, we have failed to find any treatment that warranted the expense. Our practice has been to use poles 5 ft. higher than actually required, and after the butt has rotted badly, reset pole. On this plan we expect to get about five years to six years' more service, without changing any wires except span wires. We have tried concreting from 3 ft. below ground line to ground surface, but do not find results except in case of expensive junction poles warrants expense. Our pole life has been longest in clay soil, and in case large poles are set in gravelly ground, we consider it desirable to fill the space around butt thoroughly with clay, thoroughly tamped.—J. Shultz.

Tar is good.—R. E. Moore.

303. Does double galvanized seven-strand suspension cable last enough longer than single galvanized to warrant the added cost?

Our experience is that double galvanized pays.—J. Shultz.

Double galvanized pays.—P. F. Gerhart.

No.—R. E. Moore.

304. Does modern safe construction require a strain insulator in span wire on each side of trolley wire, where wooden poles are used?

Yes.—P. F. Gerhart.

305. What size span wire is regarded best practice?

One-quarter inch, 7-strand, No. 14 double galvanized wire.—P. F. Gerhart.

We use 5/16-in. 7-strand, double galvanized wire.—J. Shultz.

306. Are metal-top trolley hangers or bells of the West End or Keystone type more durable than the cap and cone type?

Yes. There is not as much danger of hanger dropping from span wire and being carried off, as with caps and cones.—J. Shultz.

Yes, the Keystone type hanger is more durable, as the insulation is protected from the weather and bell cannot get loose from cross suspension.—P. F. Gerhart.

307. On single track interurban roads with turnouts, is the use of two separate trolley wires more satisfactory than a single wire of the same total carrying capacity, with turnout wires and overhead switches?

Yes, two wires are more satisfactory. The conductors do not have to bother with the trolley while entering or leaving turnouts. It also saves the extra cost of repairing trolley wires at overhead switches and the wear and tear on overhead switches.—P. F. Gerhart.

308. Is grooved or figure 8 trolley wire more durable than regular round wire of the same gage?

Figure 8 wire offers advantages in smooth running and in furnishing more contact with the usual narrow groove trolley wheel as compared with plain round wire. This surface contact amounts to about one-third more with figure 8 than round. By using U-shaped groove, the surface contact is further increased.—Editor.

Grooved wire best of all.—R. E. Moore.

309. Does the use of grooved or figure 8 trolley wire cause less wear on trolley wheels than round wire?

Yes.—R. E. Moore.

310. What type of ear is the most satisfactory for grooved or figure 8 trolley wire:—Regular soldered; mechanical with paired halves screwed together; or mechanical with interlocking helves which are forced tight by special mechanical devices?

Two halves secured together.

311. What length of mechanical ear gives the best service on grooved or figure 8 wire?

We use a 9-in. ear on straight track and two short ears coupled together for curves. This combination holds 2-0 General Electric grooved wire without bad kinks and provides ample supporting surface.—J. Shultz.

Five inches to 7 ins. on a straight line; 9 ins. to 12 ins. on curves.—R. E. Moore.

312. What are the relative advantages of plain malleable, galvanized malleable and brass for mechanical trolley ears?

Plain malleable ears rust and break; while brass stands exposure indefinitely without serious deterioration.—P. F. Gerhart.

313. In trolley hangers of the West End or Keystone type, are brass tops worth the excess cost over galvanized malleable tops?

We do not think so.—P. F. Gerhart.

No.—R. E. Moore.

314. How frequently should lightning arresters be placed on trolley lines?

We use four to the mile.—Chas. H. Smith.

Five to the mile is a safe number.—P. F. Gerhart.

315. What type of line lightning arrester has given the best service?

The Garton arrester is giving us good results.—P. F. Gerhart.

Our experience has been principally with various types of Westinghouse and General Electric arresters. With the Wurt's non-arcing arrester, we have had difficulty with arcing across and grounding the system; but with the General Electric magnetic blow-out type, we have had no occasion to cut or replace arresters due to breakdown.—J. Shultz.

316. Are splicing ears as satisfactory as splicing sleeves for joints in trolley wire?

We find splicing sleeves give better satisfaction than ears.—Chas. H. Smith.

No.—P. F. Gerhart.

With splicing ears, we had trouble with the wire breaking at the upward bend in ear, due to bend somewhat and weakening of wire because of trolley wheel pounding it. We now use hard drawn copper splicing sleeves exclusively and find no difficulty with wire breaking or pulling out of sleeve. Further, the trolley wheel moves over the sleeve smoothly.—J. Shultz.

317. What is the best form of strain ear or hanger?

We use the General Electric form of strain ear, with very good results.—P. F. Gerhart.

We have experimented some with the Strain Platetype made by the Ohio Brass Company, and so far our results have been satisfactory.—J. S. Shultz.

318. Which is the better practice in anchoring trolley wire at the ends of curves—anchor all four ways at each end or only two ways, both toward the curve, tending to hold all slack in curve?

We anchor our curves at end of curves two ways, to hold the curves.—Chas. H. Smith.

On level track we anchor two ways toward the curve, keeping slack in the curve. On grades, we anchor all four ways, keeping slack in curve.—P. F. Gerhart.

319. How frequently should trolley wire be anchored on straight line?

Our lines are anchored every ten poles, both ways.—Chas. H. Smith.

We anchor every half mile.—P. F. Gerhart.

Every 1000 ft.—R. E. Moore.

320. What is the most accurate method for locating overhead switches?

We use a tower car for construction work on the lines, and test each switch location with the trolley on that car.—P. F. Gerhart.

The variation in length of poles, freedom of movement of trolley base, and other considerations in actual operation of cars, is so wide that cut-and-try is about the only practical method available. In the majority of cases we find it advantageous to cut some off of the pan end of the straight out-going tongue of switch, leaving the side turnout tongue full length and giving the side tongue the advantage in catching the trolley wheel.—J. Shultz.

321. What type of section insulator is most satisfactory as regards durability and ease of renewal of wearing part?

We find the General Electric section insulator entirely satisfactory.—A. F. Rexroth.

We have tried the Macallen, General Electric and H. W. Jones' Philadelphia types, and find that the later type of Philadelphia section insulator meets our requirements and at less cost than any one of the other makes.—J. Shultz.

322. Of what value are systematic insulation tests on the overhead system?

We test frequently at night when all load is off the line, and are able to locate grounds, which, if allowed to go, would result in continuous loss of current.—P. F. Gerhart.

323. What is the relative cost per mile of iron poles as compared with wooden poles? What is relative depreciation on the two kinds?

The cost of placing iron poles is about five times greater than wooden poles. The life of wooden poles is about seven years. We have lately moved iron poles which have been in the ground eleven years, and there was no evidence of deterioration.—P. F. Gerhart.

324. Is it advisable to connect the various sections of trolley

line together through 100 amps. to 150 amps. fuses at section insulators? What difficulties are experienced?

I do not think it advisable. If any of the circuit breakers should open at the station, that section would take current through the fuses at section insulators, which would blow these fuses, rendering them useless.—P. F. Gerhart.

The advantage of inter-connecting various trolley sections is in obtaining the full benefit of all feeder copper. In our tests, we found that with a fuse of size sufficient to materially realize the advantages, when trouble came on any section, it resulted in pulling out the feeder and generator circuit breakers at the station. This condition we considered was due to the relatively small size of our generating plant. In a station with large units and ample power, there should be no more difficulty in inter-connecting trolley wires than with Edison three-wire networks, especially if time limit circuit breakers are used on the generators.—Editor.

325. What is the most economical repair or construction equipment for line repair department on small roads, twenty cars to thirty cars?

I think a line construction car, with an adjustable tower platform, with a place to carry 1 mile of trolley wire, and equipped with ladders, pike poles and tools of all kinds, the most economical kind of construction and repair car.—P. F. Gerhart.

MANAGEMENT

350. What is the experience relative to carrying United States mail? What is a proper basis of charge to ensure a fair return from this service?

The United States Government have adopted a uniform rate for carrying mail, which is very low; but in our case, we handle two routes by simply carrying the pouch on the front platform, which causes us very little trouble.—P. F. Gerhart.

351. What is a fair annual charge per man to be made the government for carrying mail carriers while on duty?

A contract was made to carry regular and substitute carriers, "while in uniform and on duty," for $250 a year, and special delivery letter messengers for $15 a year each, in a town of 35,000 population. During the year ending June 30, 1903, twenty-one carriers and two special messengers used 26,386 tickets, or an everage of 1147 rides per employee per annum, at a charge of about one cent a ride. Evidently the contract has been abused. Contracts should be limited to transportation of carriers while on duty and with mail pouch. From a business standpoint, it would be difficult to make a contract with the government at profitable figures.—Ernest H. Davis.

352. Is there any reasonably cheap method by which the improper use or issuance of transfers can be checked and surely detected?

We have no system in daily use. Periodically, attempts have been made to check up transfers for three or four consecutive days with some benefit, but the results have not been very satisfactory.—Ernest H. Davis.

353. Should conductors be required to note on their reports at the end of each trip the number of transfers issued and the number of tickets, transfers and passes received? If so, why?

Yes. Conductors should be required to note on their reports at the end of the last trip—the number of transfers issued and collected, and all transfers collected and deposited in envelopes at each trip end. In this way you can compare the number of cash fares on any particular trip with the number of transfers he issued. —P. F. Gerhart.

354. Should conductors be required to deposit at the end of each trip a bag or envelope containing all tickets, transfers and passes received during said trip? If so, how should checking be managed and what system provided for conductors running on lines not passing the receiving station?

This is not our practice. The method specified should be beneficial, especially if some cheap way of daily checking the transfers, etc., deposited per trip, could be enforced.—Ernest H. Davis.

Under our system every car on the line passes our office on each trip. The conductors deposit an envelope at the end of each trip, consecutively numbered, and marked with his car number, time trip ends, route and name. In this envelope he deposits all the transfers and tickets collected on the trip. In this way we are able to see if he accepts dead transfers.—F. B. Musser.

355. What conditions can a company agree to fulfill for a franchise in small cities and boroughs?

Depends upon local conditions. All companies are subject to the usual police regulations and taxes, which may amount to considerable. In addition, paving between the track, and to the ends of the ties, and keeping such parts in repair, should be the limit, except under unusual conditions.—Ernest H. Davis.

A fair consideration on the part of the company for a franchise in a small city or borough would be to keep in repair the part of the street occupied by its tracks and ties; and perhaps a small tax per pole for all poles used.—F. B. Musser.

356. In interurban roads, less than ten miles long, and running through a district not heavily populated, is a half-hourly service too much or too little?

Half-hour service is too often. We give hour service to suburban homes, except on special days, when we increase to half hour. —Chas. H. Smith.

I would say hourly service would be ample, except during the summer months, when half-hourly service would probably pay. This would depend upon the amount of traffic.—F. B. Musser.

357. Where interurban roads connect one or more towns, what provision, if any, has been found advisable to make for carrying packages, trunks, sample cases and traveling men, and similar articles?

We carry packages on regular cars, charging the usual fare.—Chas. H. Smith.

We do not carry packages expect when accompanied by a passenger; but it would be profitable business for a company to do. I see no reason why this traffic cannot be properly handled by running a car, especially equipped for the purpose, every two or three hours.—F. B. Musser.

358. What additional expense, if any, should be incurred in the construction of an interurban road, to secure a private right of way in preference to the use of part of a highway?

As much as possible, private rights of way are preferable, especially if the road in time is likely to be part of a through system. The higher the speed, and the greater the mileage, the cheaper the operating expense, and the greater the receipts per car mile. The proportion of extra construction cost justifiable must be determined by local conditions.—E. H. Davis.

All would depend upon local conditions; but when a road can be kept upon a private right of way, adjacent to a highway, a fair price to pay for such right of way would be from $1,000 to $1,500 per mile of track.—F. B. Musser.

361. Is it customary or advisable to charge extra fare for late running cars? If so, how much and under what conditions?

We charge $2 per car per hour besides the regular fare for cars after midnight.—Chas. H. Smith.

We make it a rule to charge double fare on cars that leave the city for suburban town after 12:30 a. m.—F. B. Musser.

362. Is it better to punish an employee for breach of rules by suspension or fines—or to warn first and then discharge upon being satisfied as to his indifference or incompetency?

We suspend our men for breach of rules—discharged when reported too often.—Chas. H. Smith.

I think it better to warn first; then if no sign of improvement is shown, dismiss.—F. B. Musser.

363. Is the offering of premiums or extra pay conditioned on good service and freedom from accidents, conducive to satisfactory results? What has been your experience in this matter?

Our experience has not been very satisfactory. It is very difficult to keep the record of employees so as to avoid dissatisfaction on the part of those who do not share in the bonus, but who think they are entitled to. Give the employees longest in the service the best runs, and pay a fair rate of wages, is the practice we have adopted.—E. H. Davis.

364. Should conductors and motormen be rated according to length of service or quality of service? How should such rating be rewarded—more pay or better runs?

We promote our men to the best runs.—Chas. H. Smith.

I think men should be rated according to length of service and rewarded by graduated pay and selections of runs.—F. B. Musser.

365. What has been your experience with the Brown or other merit system of rating employees? How do you carry out system in practice?

We have never tried the Brown system.—F. B. Musser.

366. What is the maximum number of hours per day conductors and motormen should be called to work regularly?

Our cars work eighteen hours each day; three men to a car, each making twelve hours, allowing them take their meals at home; changes every week, i. e., their hours are changed.—Chas. H. Smith.

The men on best runs make about ten and one-half hours per day. We prefer to have our men on best runs work not more than eleven hours.—E. H. Davis.

368. Is it advisable to charge an employee with damages caused by gross or ordinary carelessness? If so, to what amount in dollars?

I do not think it advisable to charge an employee for damage, as it is apt to cause him to neglect to report accidents which might lead the company into lawsuits.—F. B. Musser.

Our men are held responsible for all damages caused by their neglect or carelessness.—Chas. H. Smith.

370. To what extent are sprinkling systems used in car houses? Are the interest and maintenance charges on a sprinkler system greater than the saving in insurance?

Sprinkling systems have been applied to car houses with considerable reduction in insurance rates. This is a matter that I think can be profitably looked into.—E. H. Davis.

A DISCUSSION ON ECONOMIZERS

A discussion on the relative value of economizers took place at the meeting of the New York Railroad Club on Oct. 16. The first paper was read by E. B. Katte, who claimed that in an installation of economizers with a mean output of 7250-kw, the net annual gain by the use of economizers would be $200. The reasoning followed is as follows:

He assumed that 10 per cent of the steam generated would be used in the feed-pumps, air-pumps, etc. Taking the vacuum of the condenser at 28 ins., the equivalent temperature of the condensed water in the hot well is 98 degs. If 10 lbs. of feed-water at 60 degs. is mixed with 100 lbs. of water from the hot well at 98 degs., the resulting temperature is 94.5 degs. The efficiency of the auxiliary feed-water heaters is taken at 95 degs., and since each pound of exhaust steam liberates 965.7 B. T. U., the total feed-water temperature is 186.2 degs. Allowing 3 degs. for radiation, the final temperature is 183.2 degs. The boiler installation is assumed to be 19,200 b.hp, and as 3.25 sq. ft. of economizer surface is allowed for each boiler hp. there will be a total of 62,400 sq. ft. Assuming 20 lbs. of gas per pound of combustible, 30 lbs. of feed-water per b.hp, 3.7 lbs. of coal per b.hp per hour, and an initial temperature of gases in the stack of 548 degs., the economizers will raise the feed-water temperature 84.7 degs.; 33,305 B. T. U. per b.hp the saving from an increase of 84.7 degs. is 1305 hp. If economizers are not used, the additional coal required to heat the feed-water to this temperature, with coal at $2.52 a ton, would be $14,350. Assuming 19 lbs. of water per kw-hour, 30 lbs. of water per b.hp-hour, a 30,000-kw normal output of six generating units, and 27,000 kw the peak of the load, the economizers will save at the peak 1305 b.hp. The cost of economizers is assumed at $15 per tube, or $72,000 for a total of 4800 tubes. The additional floor space required for the economizers is assumed at 4000 sq. ft, which at $5 per sq. ft. is $20,000. The writer then figures out the height of each of four stacks required to give 0.70-in. draft at boiler wall, with and without economizers, and assumes with economizers a 220-ft. stack 10 ft. in diameter, and without economizers a 140-ft. stack 11 ft. in diameter. The addition in cost for each stack would be $5,000, or a total of $20,000. The total cost of the economizer plant is then made up of economizers, $72,000; additional piping, $5,200; additional floor space, $20,000; additional stack capacity, $20,000, making a total of $117,200. The additional amount of boiler if economizers were not used would be 1450 b.hp., which at $18.25 per b.hp equals $26,500. Adding the additional floor space (1040 sq. ft. at $5) would make a total of $31,500. Estimating interest, depreciation, operation, taxes, and insurance at 19 per cent for the economizers, piping and boilers, and 13 per cent for the stacks and floor space, gives the value of coal saved annually by the economizers as $14,150, as compared with $14,350 value of coal saved by them.

Summing up the other advantages, Mr. Katte points out that the economizers secure less wear and tear on the boilers due to higher feed-water temperature; provide a large storage for hot water to take care of a sudden increase of load, and catch some of the impurities in the water at a point where they are not subjected to extreme heat and are consequently easily removed. The disadvantages are "additional complicated apparatus to get out of order."

A. H. Blackburn, in discussing the subject, differed from the first speaker in several points. He estimated first that the steam used in the auxiliaries should not exceed 5 per cent of the total, and that if the heaters are done away with, their piping, the piping thus dispensed with, would equal approximately that required with the economizer. The heat of the less amount of exhaust steam would be, of course, lost, but this would be partially offset by the increased effect attained in the economizer due to the lower temperature at which the feed would enter. He also disagreed with the basis of 3.25 sq. ft. per b.hp required for the economizer and in the amount of space required by the economizer. He presented a number of diagrams showing different arrangements of economizers with the cost of economizer construction worked out on the basis of the same capacity assumed by the first speaker and showed a net saving in fixed charges, due to the use of the economizer rather than additional boilers, varying from $1,320 to $190. He then figured out the saving from the use of an economizer of 4800 tubes with an average station load of from 7250 to 10,000-kw, amounting in the case of 10,000-kw to $5,320. He then discussed a different arrangement of economizers by which much greater economy could be secured, varying from 13 per cent to 33 per cent of the total investment.

William Downs then made a comparison between the Seventy-Fourth Street station of the Manhattan Elevated Railway with the plant of the Clark Thread Mills, at Newark, N. J. In the former the boilers are of 520-hp, arranged with four to the battery, with which is installed a fuel economizer of 512 pipes. In the thread mills the boilers are of 205-hp, and each boiler has an economizer of 240 pipes. The cost and the fixed charges in each case were given.

R. D. Tomlinson then gave some particulars of the economizers of the Manhattan Railway power station, which he reported during August effected a saving in the coal bill of 9.17 per cent, or a return on the initial outlay of 30.5 per cent.

J. E. Moulthrop also gave some particulars of the economizer plant of the Edison Electric Illuminating Company, of Boston.

OCTOBER MEETING OF NEW ENGLAND STREET RAILWAY CLUB

On Oct. 22 the New England Street Railway Club met at the American House, in Boston, and enjoyed a neatly served luncheon, after which Professor A. H. Sabin, of New York, gave an interesting lecture on "Paint and Preservatives." He took up the subject of varnishes, paints and japans, described the elements which enter into their composition, and showed how each is affected by contact with the atmosphere. Pieces of oxydized linseed oil were passed around among those present, to illustrate the fact that this substance oxydizes when it comes in contact with the atmosphere, becoming entirely different from its original composition and forms. Pieces of rosin were also passed around to give an idea of the form and appearance of this substance as it comes from the trees which produce it. The composition, mixture, thickness, durability and different uses to which paints and preservatives are put were entered into with minute thoroughness. A very interesting discussion on Professor Sabin's lecture followed, during which several questions were asked by members of the club and answered in a lucid and thorough manner by Professor Sabin.

There were about 150 members of the club present, as well as a goodly number of supply men. President H. E. Farrington, of the club, presided.

ELEVATED ROAD AND SUBWAY ORDINANCE IN ST. LOUIS

An ordinance was introduced in the City Council of St. Louis on Oct. 23, authorizing the construction and operation of an elevated railway and a subway. The proposed route is a subway, extending from Third Avenue and Washington Avenue, and then an elevated structure westward to Taylor Avenue and ultimately extending to Watson Road. The compensation offered to the city is $25,000 a year for the elevated franchise and $5,000 for the subway. Those mentioned in the bill as interested in the project are: H. K. Gilman, of the Western Electric Supply Company; J. E. Longworth, of the American Storage & Moving Company; S. L. Langsdale, a retired capitalist, and H. S. Doyle, a civil engineer.

ANOTHER NEW RECORD ON THE ZOSSEN LINE

On Friday, Oct. 23, the astounding speed of 140 miles an hour was attained on the Berlin-Zossen experimental railway. Dr. W. H. Siemens, who was on the train, is quoted as saying: "I don't think an attempt at any higher speed is desirable. No system of installing yet invented could insure safety even at the speed we have just traveled. It was like fifty thousand hammers at work to us sitting in the car, which was simply bounding along the joints of the rails. It needs a continuous and perfectly smooth rail to make such a rate of traveling comfortable or possible. Speed really is not any longer the question to be considered; it is safety and practicability."

The cable report of the run says that the car when traveling at the highest pace was scarcely visible as it flashed past the onlookers; that it came suddenly into sight, grew larger and larger as it thundered and clattered along the track, seemingly enveloped in flame, and that electric sparks flew out all around, while the overhead wire was a continuous stream of fire like a huge torch.

FINANCIAL INTELLIGENCE

Wall Street, Oct. 28, 1903.

The Money Market

The developments of the week in the money situation have scarcely added any fresh material for comment. In all respects conditions remain about as they were a week ago. Bank reserves, contrary to general expectation, showed a further improvement in the report of last Saturday, cash holdings keeping stationary, loans decreasing and surplus reserve gaining another $800,000. It was the general opinion that the Saturday figures were altogether too favorable and that the actual position of the banks was not as strong as it was made out to be. Nevertheless the present surplus stands at the highest level reached at this particular period since 1898, and quotations for the use of money are taking their cue accordingly. Call loans are easily obtainable on the Stock Exchange at 2½ per cent. Sixty-day money is quoted at 4½, while loans for three months, which carry over the first of the year, are being made freely at 5 per cent. Partly owing to these easy money rates, and partly owing to the heavy European selling in our stock market, sterling exchange has recovered rather sharply. There is still some talk that later in the season we shall get gold from Paris, but there is certainly no warrant for any such expectation so far as the immediate future is concerned. The plain fact is that with our own money market as easy as it is now the movements of international exchange and the fluctuations of the markets abroad have lost their practical interest. What our situation is more particularly concerned with is the question of the interior demands during the next two months. At length the outgo of currency, so long and mysteriously delayed, has set in, in its normal volume. Yesterday alone $1,125,000 was transferred through the Sub-Treasury to New Orleans, St. Louis and Chicago. New York exchange at all these centers has fallen very rapidly during the last ten days, indicating that from now on the demands upon this city will be very heavy. Not all the cash that is now going out is designed for crop-moving purposes; part of it is undoubtedly due to the desire of the interior markets, which have become entangled in unfortunate speculative committments, to fortify themselves against any extraordinary demand. At this writing trouble is reported in St. Louis of a similar nature, and due apparently to similar causes, as have been witnessed already in Baltimore and Pittsburg. In their present unusually strong position, the New York banks can look forward, even to a very heavy outflow of currency, with equanimity. Some more or less substantial decrease in surplus reserve, and some hardening of money rates in consequence are quite to be expected during the next few weeks. But these changes are only temporary. In the judgment of all competent observers the money market is shaping itself for a period of decided ease, which will be prolonged indefinitely.

The Stock Market

The really important event in this week's financial markets has been the continued activity at rising prices in the bond department. There is a good deal of significance attaching to this circumstance, because it was the cessation of demand for high-grade bonds which first gave warning of the retirement of investment capital from the market twelve months ago. At that time it was explained that investors were no longer willing to put their money into securities paying only 4 per cent and 4½ per cent, while money interest rates were ruling continuously around 6 per cent. Not only did it seem then that the higher money level would last indefinitely, but a great many people feared that with the course of the present autumn a severe stringency would develop in the money market, and that capital, if held in readiness for this contingency, could be used much more profitably than if it were tied up in bonds and stocks. Remembering all this, it is fair to assume that the resumption of investment purchases in the bond market indicates both that the fear of a money stringency has entirely passed, and what is more, that people with ready money believe that the conditions have been so far reversed that from now on the market for securities offers the more tempting field for employing the funds. Past experience teaches that an upward movement, such as we have seen during the last fortnight in high-grade bond issues is often the forerunner of a similar movement in the general stock market. To infer this much amid the present complications of the financial situation would, however, be quite unwarranted. All that may safely be said of the recent movement in bonds is that it has done much to restore confidence, and that it gives the whole Wall Street position an appearance of greater strength than it has enjoyed at any previous time this season. So far as the general stock market is concerned the present disposition is plainly to proceed with the utmost caution. The public is not ready to buy, that is clear enough, and the large financial interests seem content to let things take their course. As a result, the current dealings have resolved themselves into a simple trial of strength between two sets of professional operators, one of which is trying to put prices up, while the other is opposing the advance. The bull party has had the best of it this week, thanks to the fact that the outstanding short interest had extended itself further than it should. There is no doubt that the petty speculators had committed themselves pretty generally to the short side, and it has not been difficult to force their retreat. An advance, however, based almost entirely on short covering and manipulative buying cannot be expected to go very far. Few people really expect a much further improvement at the present time. The conservative idea is that the market is entitled to an interval of rest, and that while the low prices for the season have undoubtedly been seen, no considerable movement in the opposite direction is probable yet awhile. The money problem may be said to have been eliminated in the sense that present bank reserves are sufficient for all ordinary purposes. But there remains the fact that business through the country is slowing down, that many of the railroads are preparing themselves by dint of reducing expenses, for a less prosperous season, and that a general demand must be made very soon upon labor to accept lower wages, the consequences of which appear by no means certain. Until it can be seen just how serious these portents of commercial reaction are likely to be, a waiting attitude on the part of the market seems by all odds the safest.

The local traction stocks have benefited as much, if not more, than any other group by the change for the better in the general situation. Metropolitan Street Railway has had the sharpest rise of any, because the position of the short interest in this stock has been exceptionally weak. The speculative theory for Monday's rapid advance was that it measured the somewhat more promising outlook for a Tammany victory at next Tuesday's election. This view, of course, was the superficial one, and simply reflected the usual disposition in Wall Street circles to accept the explanation lying readiest at hand. Covering purchases were the basis for most of the advance in Brooklyn Rapid Transit. The strength of Manhattan Elevated gave the impression of being more genuine than that of any of the other traction stocks.

Philadelphia

All the local Philadelphia traction stocks have shown decided strength during the week. There is no especial reason for this in developments affecting their individual properties. But for some time past it has been apparent to watchers of the market that the position of the traction group was unusually strong, and that a quiet accumulation of all these shares was in progress, which must lead to higher prices as soon as the pressure of liquidation had ceased in other quarters. Union Traction has risen on the week from 42⅞ to 44¼, Philadelphia Rapid Transit from 11¾ to 12⅜ and Philadelphia Traction from 93¾ to 94. Philadelphia Company stock sold down from 36¾ to 35⅝, when the suspension of the Federal Bank of Pittsburg was announced last Wednesday. The selling was not heavy, however, and the stock has since recovered to 36⅜. The preferred after selling at 44 declined to 43¼. Other Philadelphia sales for the week include American Railways at 41¾ and 42, Consolidated Traction of New Jersey at 60, and Chicago Union Traction common from 5½ to 7½.

Chicago

Dealings on the Chicago Stock Exchange have been somewhat more active than they were last week. The principal feature was the advance in Union Traction, which rose from 4½ last Saturday to 7½ yesterday. To all appearances the move originated on the New York Stock Exchange, where the stock for a time was unusually active. There is no reason to believe that the rise was anything more than a piece of market manipulation, but some attempt was made to connect it with the announcement that the traction interests of Chicago are ready to take up the question of a franchise with the city, and that so far as they know there is

nothing to hinder a speedy adjustment of this vexed controversy. The bondholders of the underlying companies of the Union Traction now say they will not aid in bringing about a reorganization unless the negotiations are carried on unequivocally in their interests, which they claim are paramount. It may be noted that sales of North Chicago stock were made as low as 99 this week, which is the low record for the season. Union Traction preferred rose from 30 to 32, Metropolitan common sold at 78, the preferred at 57, City Railway at 170 and South Side Elevated at 92. On the somewhat surprising announcement of a receivership for the company, Lake Street Elevated sold down from 4¾ to 4. This action has given a sudden and severe blow to the plans for reorganizing the company, which were seemingly well on their way to completion.

Other Traction Securities

All the Boston traction specialties have moved forward smartly during this week's general recovery. Boston Elevated has been the feature at an advance from 138⅜ to 140½. Massachusetts Electric common also rose sharply from 19 to 20½ and the preferred, after selling as low as 77¼, rallied to 78. West End common improved a point from 90 to 91, but later lost its gain. The preferred sold at 109. In Baltimore the strongest issue on the list this week has been the United Railways general mortgage 4s, which are up a point from 90 to 91. The junior securities of the company have been rather inclined to hold back. The stock has changed hands between 8¾ and 9 and the income bonds between 58 and 58⅝. Other Baltimore sales include City & Suburban of Washington 5s at 90, Anacostia & Potomac 5s at 89⅞ and 89¾, Knoxville Traction 5s at 101, and Baltimore Traction conversion 4s at 91. There has been no particular feature in the traction division on the New York Curb. Single transactions have been reported in St. Louis Transit at 16, Interborough Rapid Transit at 83, New Orleans preferred at 28½, Washington Traction preferred at 29 and Brooklyn Rapid Transit 4s at 77½.

Detroit United was practically the only active issue at Cincinnati last week. About 700 shares sold in small lots, opening the week at 61, striking a low mark at 58½ and closing the week at 61½. There is a strong demand for this stock whenever it goes below 60, as it has been doing at intervals during the past few weeks. Cincinnati Street Railway was firm at 128. One lot of Toledo Railways & Light sold at 18½ and another at 20—remarkably low figures compared with quotations of a few months ago. Cincinnati, Dayton & Toledo 5s were firm at 82 and three lots sold. It is common talk that C. W. Wetmore, president of the North American Company, of Philadelphia, was here recently for the purpose of disposing of 4000 shares of Cincinnati, Newport & Covington Light & Traction preferred, and that it was offered to large local stockholders of the company. The local people are said to have expressed a willingness to buy, but at a considerably lower price than that at present asked on the local market—84½. The deal has not yet been effected.

Cleveland Electric again was the feature in Cleveland, about 500 shares selling at 65 to 67. It appears that the stock is being taken up by large holders to protect its value. Northern Ohio Traction & Light was in good demand at 15 to 15½, but only 185 shares were dislodged at these prices. A small lot of Northern Texas Traction sold at 30¼.

Security Quotations.

The following table shows the present bid quotations for the leading traction stocks, and the active bonds, as compared with last week:

	Closing Bid	
	Oct. 20	Oct. 27
American Railways	41¾	41¾
Aurora, Elgin & Chicago	—	12
Boston Elevated	137	140
Brooklyn Rapid Transit	33½	34⅞
Chicago City	170	169
Chicago Union Traction (common)	3½	7¼
Chicago Union Traction (preferred)	25	32
Cleveland Electric	65	64
Consolidated Traction of New Jersey	60	60
Consolidated Traction of New Jersey 5s	103¾	104½
Detroit United	58	60¼
Elgin, Aurora & Southern	a45	a56
Lake Shore Electric	5¾	—
Lake Street Elevated	4	3½
Manhattan Railway	133¼	134¾
Massachusetts Electric Cos. (common)	18¾	19
Massachusetts Electric Cos. (preferred)	77	77½
Metropolitan Elevated, Chicago (common)	18	17
Metropolitan Elevated, Chicago (preferred)	55	55
Metropolitan Street	105½	110
New Orleans Railways (common)	7½	7¼
New Orleans Railways (preferred)	28	a28½
North American	73¾	75
Northern Ohio Traction & Light	15⅛	15
Philadelphia Rapid Transit	11¾	12⅛
Philadelphia Traction	93⅝	94
St. Louis Transit (common)	14½	14
South Side Elevated (Chicago)	90¼	92
Syracuse Rapid Transit	—	—
Syracuse Rapid Transit (preferred)	73¾	—
Third Avenue	103	105
Toledo Railway & Light	17½	18¼
Twin City, Minneapolis (common)	83	86
Union Traction (Philadelphia)	42⅞	44¼
United Railways, St. Louis (preferred)	61	61

a Asked.

Iron and Steel

The movement to restrict the output of pig iron continues to be pushed with much vigor, particularly in the central West, where it is now said a further reduction to about 40 per cent of the former product is being considered. Less is being done in the East in the way of forced curtailment, but a considerable number of furnaces in this section are reported to have shut down. The only drawback upon the efforts to reduce the output of pig iron has come through the disruption of the old Southern selling pool and the consequent lowering of prices in that market. Some of the principal Southern companies have decided that it is better under the new conditions to run at full capacity, proposing thereby to lower the average cost of production. A little anxiety is felt lest the railroads will curtail their orders for new steel rails unless some concession is made in prices. As for the other branches of the iron industry, a satisfactory business is reported in structural material, but against this some depression is noted in the plate and bar trades. Attempts are being made to stimulate the export trade as the best means for keeping down the surplus product at home, but according to the best authorities the relative position of home and foreign prices is not favorable to this endeavor. Quotations are as follows: Bessemer pig iron, $15.85; Bessemer steel, $27, and steel rails, $28.

Metals

Quotations for the leading metals are as follows: Lake copper, 13¾ to 14 cents; tin, 26¼ cents; lead, 4½ cents, and spelter, 6⅛ cents.

NEW COMPANY TO TAKE OVER CHICAGO UNION TRACTION

The rumor of a new company in Chicago to take over the Union Traction Company, of that city, was confirmed on Wednesday, Oct. 28, by R. Govin, receiver of the Union Company. The report is that a new company, headed by Alfred Skitt, of New York, will be formed next week to lease or act as trustee of the Chicago Union Traction and underlying companies, and will make franchise agreement with the city regarding the operation of the street railways on the north and west sides. The new company is said to be backed by ample capital from Gould and Rockefeller interests. The plan for reorganization as at present reported embraces the following points:

1. The new company will, by arrangement, take over whatever rights Union Traction and underlying companies have.

2. It will obtain from the city a twenty-year franchise for streets now covered by Union Traction system.

3. Provision will be made by which the city can terminate the operation of the franchise at any time by paying the leasing company the equivalent of the sum actually invested.

4. The new company will, by means of capital backing it, at once install modern equipment.

5. The new company will greatly simplify the traction situation by acting as intermediary between the city and the old companies, and could go before the Council and ask for a franchise on terms which the city says it is determined to exact.

There would be no question of waiving the ninety-nine-year claims, because there would be none to waive. The company would have no franchise rights of any kind more than those given it in any ordinance the Council might pass. By virtue of this ordinance it would have authority to operate.

STRIKES AT WACO AND SAN ANTONIO, TEX.

The strike of the employees of the Citizens Street Railway Company, of Waco, Tex., has been broken. The full quota of cars is now in regular operation, but patronage is light, because of the threats of intimidation made by the strikers and the open violence that has been resorted to. The City Council actually lent the employees aid. In the face of public opinion, soon after the declaration of the strike, the Council passed an ordinance requiring that motormen have thirty days' experience in operating cars. The courts thwarted the action of the Council, however, by granting a temporary injunction, restraining the ordinance from being made operative. Judge Surrat, before whom the application for an injunction was brought by the company, said that when a law was not reasonable, it was unconstitutional.

The strike at San Antonio against the San Antonio Traction Company has also been broken. The company filled the places of the strikers at once, and immediately resumed service. There has been considerable disorder, but the high-handed practices resorted to at Waco have not been attempted.

SENATOR FORAKER ON THE ROGERS LAW

Senator Foraker, of Ohio, has sent to the chairman of the Ohio Republican State executive committee a long letter of explanation of the Rogers law. In transmitting his letter, the Senator says he was urged to action by the many misrepresentations of the act by Tom L. Johnson and others who have attacked the amendment. The condition of affairs in Cincinnati when the act was passed was similar to that in many other cities to-day. The operating street railway companies held some twenty franchises granted under different administrations, and these grants all expired at different times. Some one of them expired almost every year, yet the maximum of expiration of the last grant was twenty-one years. All the companies to which these various franchises were made had since that time been brought under one management, and as the conversion of the lines was being urged by the city and the company was fully awake to the advisability of the change, the passage of the ordinance was absolutely necessary in order to raise the funds with which to make the change.

It was, therefore, provided by the Rogers law that the municipal authorities should have the right to extend all the franchises by so much time as might be necessary for each one to make them all expire fifty years after the date of the passage of the law. The average the different franchises, taken altogether, had to run at the time the law was passed was sixteen years. Consequently, the Rogers law extended the franchises not for fifty years, but only for thirty-four years. Fares ranging from 4¼ cents to 8 cents per ride were charged, but under the new act provision was made for a uniform fare of 5 cents, and a transfer system was required to be established.

Before the passage of the Rogers law the company paid taxes on all its property according to a tax valuation fixed by appraisement just the same as all other property is appraised, and in addition, on some of the routes the company paid to the city 2½ per cent on its gross earnings and also a car license fee. Under the Rogers law the company was required to pay, not only on all its property the same as anybody else, but also to pay 5 per cent on its gross earnings to the city, and also the same car license fee, in lieu of which latter tax, under a law passed recently, the street railroad now pays to the city an additional 1 per cent on its gross earnings, making a tax of 6 per cent altogether on its gross earnings. It also pays to the State what is called an excise tax of 1 per cent on its gross earnings, making a total, in addition to the regular tax on its property, of 7 per cent on its gross earnings.

While the Rogers law provided all these requiremnts and imposed all these burdens, it also further provides that at the expiration of twenty years from the time when the Rogers law was passed the city shall have the power again to revise all the terms and conditions of the grant, including the rate of fare to be charged, so as to make it less if the city officials then in office shall think it right and proper to do so, and this revision by the city at that time is to take effect and go into operation, and continue in operation, whether the company is satisfied or not, unless the company shall see fit to sue in a court of equity, and it shall be held by such court, upon full hearing upon both sides, that the changes made by the city in the terms and conditions of the grant are unreasonable.

This revision at the end of twenty years has all the effect of a new grant, except only that the company is saved from public bidding for the right to remain in the streets against would-be competitors, and this revision, which the city is thus authorized to make, and which is the equivalent of a new grant, since the city is authorized to make any changes it sees fit to make, is to come only four years later than the expiration of the average time of sixteen years that the grants already had to run when the law was enacted.

It is further provided in the Rogers law that every fifteen years after the first revision there shall be another revision of the same character, and with the same consequences.

The street railway company is obligated to pave and keep paved and in condition the streets between its tracks and for a foot and a half on each side beyond their outside rails.

ELECTRICAL COURSE FOR BROOKLYN RAILWAY MEN

As stated in the Street Railway Journal of July 11, the Brooklyn Rapid Transit Company has opened an evening school at the Jamaica Avenue headquarters for the use of its employees. The most interesting and important feature of this school will no doubt be the course in practical electrical engineering which has been established.

The course embodies a training in the principles, handling and testing of electrical apparatus especially applicable to street railway work. The instruction is given in the form of experimental lectures, recitations and laboratory work, the time being divided into two nights of laboratory work to one night of recitations. All of the electrical measurements are made with controller storage batteries on the 550-volt circuit.

Instruction began Oct. 5, and so far fifty-two students have registered. To handle this number of men at one time in the laboratory it has been necessary to select four assistants from the classmen. The laboratory is large, well lighted and can accommodate one hundred men. It has been equipped from stock apparatus of the Brooklyn Rapid Transit Company.

The first half of the year will be spent considering instruments, motors, circuits, etc. For the latter part of the year an elaborate series of train tests have been prepared, during which speed time curves will be taken and the results calculated. The course is being supplemented by separate instruction in practical mathematics. It is open only to Brooklyn Rapid Transit men, and the tuition is $6.00 for the complete course of forty-eight evenings.

This course is under the direction of Sydney W. Ashe, B. S. Mr. Ashe is a graduate of the Cooper Union Institute, New York, is instructor in physics and electrical engineering at the Brooklyn Polytechnic Institute, and has had considerable practical experience in engineering work, making him well fitted for the important work which he has undertaken.

LAKE STREET ELEVATED OF CHICAGO IN RECEIVER'S HANDS

The Lake Street Elevated Railroad Company, of Chicago, was placed in the hands of the Equitable Trust Company, of Chicago, as a receiver, on Oct. 24. The receiver was appointed by Judge Tuthill, of the Circuit Court, upon application by James Bolton and Daniel F. Crilly, both large stockholders. The bill applying for the receivership was rather sensational in its nature, charging gross mismanagement of the road and an attempt to wreck the property on the part of those in charge of the management, so that the minority stock could be purchased at a low figure.

Among the specific charges made in the bill applying for the receivership were that Charles T. Yerkes and associates still have a controlling interest in the stock of the Lake Street Elevated and are attempting to wreck the property. President Knight, of the Lake Street Elevated, was named as the personal representative of Mr. Yerkes. Mr. Knight claims, however, that Mr. Yerkes does not own any stock in the company. Blair & Company, of New York, are large bondholders, and it is believed that the receivership will be opposed by them and by President Clarence A. Knight. T. A. Walton, representing the Equitable Trust Company, took possession of the property of the road, and established offices at once in the rooms of the Equitable Trust Company, at 152 Monroe Street.

It is claimed that the application for a receiver was made to secure to the Lake Street Elevated stockholders certain rights in connection with the north side of the Union Loop, which was originally built by the Lake Street Elevated Railroad and turned over to the Union Loop by agreements made in 1894 and 1896. By these agreements it is claimed that the Lake Street company obtained no better terms for the use of the Union Loop than the other companies using it, although it owned a part of the loop mileage.

REMARKABLE INCREASE IN INTERURBAN EARNINGS

Among the remarkable financial statements issued recently is that of the Chicago & Milwaukee Electric Railroad Company. This road has been in operation several years, under approximately the same conditions as to mileage and territory. The earnings for the first nine months of 1903 are 32 per cent higher than for the same period of 1902. For the month of September the gross earnings showed an increase of 90 per cent over September, 1902. During last September, however, it should be said, by way of explanation, that a 6 mile branch to Libertyville was in operation. This company operates from Evanston to Waukegan, serving the suburban towns along the shore north of Chicago. It is paralleled by the excellent steam road suburban service of the Chicago & Northwestern Railway. The earnings are as follows:

	1903	1902
Gross earnings	$40,921	$19,347
Expenses	9,820	6,988
Net earnings	31,101	12,350
From Jan. 1 to Sept. 30, 1903—		
Gross earnings	194,636	137,407
Expenses	66,935	59,847
Net earnings	127,700	87,559

NOTTINGHAM MUNICIPAL TRAMWAY

In a report to the Department of Commerce and Labor, United States Consul Mahin, at Nottingham, England, says the electric railway service of that city is an illustration of what is possible, though not always accomplished, in municipal ownership.

Electric cars have now been in use in Nottingham about two years. Previously, horse cars and omnibuses were in use. The present system is well constructed, and covers practically the entire city. The cars are large double-deckers, kept scrupulously clean and run at intervals of three to six minutes at the rate of 8 miles to 10 miles an hour. The fares, varying with the distances ridden, are about 2 cents a mile. The length of route is now 15½ miles, with 30 miles of track. During the year just past the cars carried nearly 25,000,000 passengers—a traffic equal to the transportation of the whole population (250,000) twice a week throughout the year.

The receipts for the year were $560,733, of which the operating expenses were slightly over 50 per cent. The gross profit was 11.41 per cent of the capital employed. After deducting loan charges, the net profit amounted to $150,141, from which the rates received $87,597 and the reserve fund the balance. During the two years the railway has contributed $145,995 to the city rates and has established a reserve fund of $98,089.

Power for operating the system is provided by the city's electric supply plant.

STREET RAILWAY PATENTS

[This department is conducted by W. A. Rosenbaum, patent attorney, Room No. 1203-7 Nassau-Beekman Building, New York.]

UNITED STATES PATENTS ISSUED OCT. 20, 1903

741,613. Third Rail Conductor; Frank T. Bailey and Charles S. Michey, Baltimore, Md. App. filed March 4, 1903. A conductor apparatus consisting of an insulated conductor way and insulating material held by tie-clamps which are adapted to be fastened to the ties of a railway.

741,644. Mechanism for Operating Railway Switches; George W. Fernside, Hartford, Conn. App. filed Oct. 28, 1901. Means for throwing the switch from the car platform regardless of whether the car is going forward or backward.

741,662. Electric Heater for Cars; Edwin M. Herr, Pittsburg, Pa. App. filed Feb. 14, 1901. The heating coil constitutes the controlling resistance of an electric car, and is movable from its position inside the car to another outside, depending upon whether or not it is desired to heat the car.

741,719. Electric Railway; Frederick W. Rochler, New York, N. Y. App. filed May 6, 1903. Relates to means for regulating the friction between the contact-shoe and third rail and means for securing the shoe to its supporting arm.

741,744. Automatic Switch; Melvin D. Van Why, East Stroudsburg, Pa. App. filed April 1, 1903. A device for locking and unlocking the switch throwing mechanism, from a car or train.

741,785. Non-Arcing Clamp; Henry L. Fritz, Jersey City, N. J. App. filed March 6, 1903. Consists of an inclined clamp for trolley wires forming a hood to prevent ice from gathering on the wire.

741,786. Trolley stand; John J. Goodrich, Methuen, and James H. McPherson, Haverhill, Mass. App. filed Nov. 20, 1902. An arrangement of springs whereby the upward pressure on the pole is maintained uniform regardless of the angular position of the pole.

741,917. Car Truck; Frederick W. Luedke, Philadelphia, Pa. App. filed June 25, 1903. A car truck having a non-revolvable axle with hubs thereon, wheels rotatable on the hubs and means for holding the hubs and wheels out of transverse alinement with each other.

741,955. Electric Railway Signal; Howard Brooks, Wheaton, Ill. App. filed Nov. 14, 1902. Details.

741,971. Inclosing Casing for the Driving Gear or Car Dynamos; Patrick Kennedy, New York, N. Y. App. filed April 27, 1903. Details.

PERSONAL MENTION

MR. C. O. ANDERSON has been appointed superintendent of the line department of the Los Angeles Railway Company, of Los Angeles, Cal.

MR. E. M. WALKER, of Boston, has accepted the position of general manager of the Bristol Gas & Electric Company and the Bristol Belt Line Railway Company, of Bristol, Tenn.

MR. F. A. BOUTELLE, formerly superintendent of the Hudson Valley Railway, of Glens Falls, N. Y., has been appointed superintendent of transportation of the Columbus, Buckeye Lake & Newark Traction Company, with headquarters at Newark, Ohio.

MR. WILLIAM AKINS, formerly with the Western Ohio Railway, has succeeded Mr. J. M. Merrill as general manager of the Ohio Central Traction Company. Mr. Akins was general manager of the Tuscarawas Traction Company, of New Philadelphia, Ohio, up to the time that property was sold to Tucker, Anthony & Company, of Boston.

DR. HANS GOLDSCHMIDT, who is a large maufacturer in Essen, Germany, and who is also inventor of the "Thermit"process of rail welding by means of powdered aluminium, is to visit this country during November. Dr. Goldschmidt has accepted an invitation, while in this country, to deliver a lecture on the "Thermit" process at Columbia University.

MR. HENRY C. FOGLE, a prominent business man of Canton, Ohio, died at Chicago of a stroke of paralysis, a few days ago. Mr. Fogle founded the street railway system in Canton and between Canton and Massillon. From 1896 up to two years ago, when the property was sold to Tucker, Anthony & Company, of Boston, Mr. Fogel was general manager, purchasing agent and superintendent of the Canton-Massillon Electric Railway Company.

THE MEMBERS of the Royal Commission on London Traffic sailed for home last week, after a six weeks' visit on this side. They inspected the electric railway systems of New York, Boston, Philadelphia and Chicago. The party included Lord Ribblesdale, Sir John Poynder Dickson-Poynder, Sir George Christopher Trent Bartley, Mr. George Stegman Gibb (general manager of the Northwestern Railway, whose suburban traffic is to be handled by electricity), and Mr. Lynden Macassey, secretary. An exhaustive report will be drawn up by them, which will be read in due course in the House of Commons.

PROFESSOR R. H. THURSTON, whose death was reported at Ithaca, N. Y., last week, was for many years one of the most prominent writers and lecturers on steam engineering in this country, and deservedly ranked high as an instructor in that branch. Dr. Thurston was director of Sibley College, Cornell University, and was sixty-four years old on the day of his death. While awaiting the arrival of Mr. Andrew D. White, Mr. Dean Huffcut, Professor Hewitt and other colleagues who were to celebrate his anniversary by taking dinner with him, he sank into a stupor and passed away before medical aid could be summoned. The deceased was a native of Providence, and received his education at Brown University. He served in the engineering corps of the navy during the Civil War, and at its close was assigned to the faculty of the Annapolis Naval Academy. In 1871 he became professor of engineering at Stevens Institute of Technology, and in 1885 went to Cornell to take the directorship of Sibley College, then being organized. He was the author of many engineering treatises and was a member of the leading scientific societies of Europe and America. Dr. Thurston early recognized the possibilities of the steam turbine, and gave this subject special attention long before it attracted the general interest it commands to-day. One of his most valuable contributions was a paper on this subject, read before the American Society of Mechanical Engineers at the New York meeting in December, 1900.

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Infractions of the Rules

There are two principal methods of enforcing discipline on street railways. In one the offender is penalized by suspension from work for one or more days without pay; in the other, the Brown system, there is no suspension, but a record is made of the offense, and if a man's misdeeds, after or within a certain period, are greater than a certain standard, he is discharged. There is no doubt that the tendency of street railway companies, at present, is toward the adoption of the Brown system in some form or another.

The old method of "lay-offs" has a great many disadvantages, yet it has one important merit—the punishment quickly follows the offense. In the Brown system this is not so. The notification of the demerit marks or the reprimand are promptly delivered, and, of course, make an impression on most men. There are some, however, to whom no penalty, provided it is far enough off and by no means certain at that, carries much weight, even if it is expulsion from the company. Men of this kind require to be impressed with the fact that they have violated the rules of the company, in other words, to be brought up with a sharp turn occasionally, but if this is done give as satisfactory service as could be desired.

A combination of the two methods, except that the ordinary lay-off is not employed, has been used on some roads with satisfactory results. A motorman or conductor who, through carelessness, has violated some important operating rule of the company, is required to "break in" again for a day or two. That is, he is obliged to serve for this period without pay on a car with an experienced motorman or conductor, just as he would if he had never had charge of a car before. It is needless to say that a man in this position receives an unmerciful amount of guying from his comrades and rarely forgets the lesson. The practice also has the advantage over that of the ordinary suspension in requiring the time of the employee. To some men the lay-off involves no particular hardship, especially if the fishing about that time happens to be good, and instances have been known where men have committed some petty fault in order to secure a short holiday. But to assume again the position of learner is a different matter, especially to an experienced employee. A man who is obliged to act as "student" again cannot complain that the punishment is not logically correct for one who disregards the rules, but one or two experiences of this kind are usually enough to make the man remember the rules.

Electrical Canal Haulage

Elsewhere in these columns will be found a full account of the regeneration of the Miami & Erie Canal, a work which is of peculiar interest, both as the first attempt at mechanical canal haulage in this country, and as the first serious application of three-phase traction motors on this side of the water. Both phases of the innovation are noteworthy. As to the first, electric haulage has been talked about and feebly promoted off and on for the past decade, but nothing, save blue prints and wind, has come of it. It has remained a mere subject of talk, like the use of polyphase motors for traction, until now. A broad mechanical canal haulage has been successfully introduced in several different forms, and alternating motors have for some years past been successfully applied to electric traction, but foreign examples are at the present time rather wasted upon us. However, in the present instance one engineer was able to break away from the chains of custom, and the result is a highly interesting plant which gives excellent promise of usefulness.

Briefly, the plan of operation is the haulage of tows of eight or ten canal boats by a locomotive running on a track beside the canal. The locomotive uses three-phase motors for traction, and takes current from a pair of trolley wires at high voltage, which is reduced by transformers on the locomotive itself. Here, again, our congratulations to the engineer for escaping (a) a multiple-unit control of the tow with motors and propellers on each boat; (b) half a dozen reducing stations, with nice slow-speed rotaries (the slower the better); (c) low-voltage trolley wires and reducing stations every 40 rods; (d) divers other things to be found in the canons.

The requirements of canal haulage are decidedly special. The speed cannot be high, because of the model of the boats and danger of wash on the banks of the canals. For simplicity any towing scheme must include the towing of a considerable chain of boats so that the local loads are rather heavy. Also locks and other sources of delay render it quite common for several tows to bunch together, forming a very

severe local load. The speed, however, is naturally uniform, stops are rather infrequent, and the rate of acceleration is a matter of indifference. It will be noted that these conditions are the very antipodes of those formed in ordinary interurban railroading, and the engineers had the good sense to see the point and to act accordingly. The transmission of power is over a long stretch, 244 miles being the length of the whole canal, and 68 miles that of the section between Cincinnati and Dayton, the major part of which is now in operation. All the necessities of the case indicated the use of high-voltage working conductors, fed by a relatively small number of sub-stations, and feeding in their turn alternating-current motors upon the locomotives. Briefly, the arrangement of the system is as follows: Power for the section now constructed is taken from the lines of the Cincinnati Gas & Electric Company, as a matter of convenience. This power, as 4200-volt, 60-cycle, three-phase current, is received in a motor-generator station, which changes the frequency to 25 and separates the haulage system from the local lighting and power system. Part of the output, at 390 volts, feeds directly the first section of working conductors. The remainder is stepped up to 33,000 volts, and transmitted along the canal bank. At four reducing stations transformers receive the 33,000-volt current and deliver it to the working conductors at 1170 volts. The locomotive receives this current and transforms it to 390 volts for use in the motors. There are, of course, two trolley wires of the grooved No. 0000 description, the track serving as the remaining conductor.

The principal interest of the system centers in the locomotive itself. This is of the compact type designed for mining work, and weighs 55,000 lbs. It has four 33-in. wheels mounted on 6-in. axles with 5-in. journals, and to each axle is geared with a double-speed reduction an 80-hp three-phase induction motor. These two motors are normally operated in tandem. The primary winding of the first motor is connected to the transformer secondaries, its secondary winding to the primary of the second motor, and the armature of this last is closed through a controller and a set of iron-grid resistances. This controller serves for reversal and speed variation when required, although the motors in tandem are designed to give the 3 m. p. h. to which the speed is, at present, limited by statute. In this normal operation the motors give 40 hp each, and a horzontal effort with 25 per cent coefficient of adhesion of 9600 lbs. The locomotives have not only hooks for making fast the towing cable but M. C. B. couplers for the direct haulage of freight cars whenever desirable. As the track is well-laid with 70-lb. rails such haulage is quite feasible. On the whole the system seems to be well worked out, and it ought to be an object lesson of no small value in the use of alternating motors for electric traction. The trolley-wire voltage in this case strikes one as perhaps ultra conservative, but the necessary situation of the line and the large number of bridges and locks to be passed, some in very contracted quarters, rendered extra precautions desirable. We shall be greatly interested to learn the financial results of this proposition. How far can the canal, generally regarded as an obsolete means of transportation, be regenerated by modern methods of traction? No one yet knows from experience, although foreign experiments have given hope of success. But whether canal traction, as such, can continue to hold its own under improved conditions is a matter of less importance than the final success of long-distance electric freight haulage on which the plant here considered will give very valuable information.

Physical Examination of Motormen

The outcome of the controversy between the Interborough Company and the motormen employed on the Manhattan Railway over the order of the management directing the men to submit to a physical examination might have been anticipated by the men. It was certainly expected by the public, and while the company is to be congratulated upon having escaped a strike the patrons of the L road should appreciate their good fortune in having this important transportation service controlled and directed by men of convictions, integrity and moral courage. An examination of the requirements specified must prove convincing to any unprejudiced mind that the tests prescribed were in the interest of the public and the employees as well, and that the company could not demand or accept less and discharge its duty. No question of wages, hours or other details was injected to affect the issue. It was plainly a test of the qualifications of the present employees to continue in their old places. The exacting nature of the service, the high speeds and the headway maintained call for unusual experience and exceptional ability on the part of motormen on L trains; they must be quick, alert, watchful, and in perfect command of all their faculties. A man with a weak heart, impaired vision or defective hearing is not to be trusted with an L train, nor with a trolley car, either, for that matter.

To the layman it must seem strange that the employees should object to such a rational and reasonable demand as that made by the Manhattan management, but the fact, plainly stated, is that many of the men who had long been in the service feared that they would be disqualified. They had not been examined for years, and they shrewdly suspected, no doubt, that the test awaiting them would probably confirm the suspicion that had been haunting them and which they had fought against. It was the old story of the infirmities of advancing age, which the victim persistently refused to recognize. They were all right when they entered the service, and, they argued, they felt as young and fresh as ever. They had deceived others about their failings, especially in the matter of hearing and seeing, and they had tried to deceive themselves, but now they found the old fear coming over them again when summoned for the test. The results of the investigations already made prove the wisdom of the company's claim that periodic examinations should be made of men occupying such positions. Most electric railway companies and steam lines require applicants to submit to a medical examination, but we do not know to what extent the practice of requiring periodic examinations is carried.

It should not be assumed that the examination prescribed is an unusual one; on the contrary, it is not more severe than the requirements on steam lines of prominence. It deals merely with the eyesight, hearing, color sense and general physical condition of the employee—surely not an unreasonable test.

The tendency of modern railway operation is to provide against every possible contingency that might interrupt the service and endanger life; hence the employment of despatching systems, electric signals, derailing switches at grade crossings, quick-acting power brakes, and all the numerous details and accessories that have been worked out for the protection of the traveling public, both on steam and electric lines. But in order to prove effective, reliable and operative, the cooperation of competent engineers, motormen and trainmen is essential; those afflicted with defective sight or hearing, or color blindness cannot be depended upon. It should not be difficult for anyone to appreciate the fact that, because of the dependence placed upon this combination of human and me-

chanical elements, these provisions for safety may become a source of positive danger if men are employed as engineers or motormen who are not entirely competent and physically qualified to pass every test prescribed in this examination. This is particularly true of such service as that furnished by the Manhattan Railway, and it is because of these considerations that the management very properly insists upon its employees submitting to a physical examination which will not only indicate their present condition but enable the proper department to keep track of the men who are liable to fail.

Comparing Notes on Track

We were favored recently with an expression of opinion by a well-known manager, active in the affairs of the American Street Railway Association, who was thoroughly worked up over what he considers the indifference shown in the discussions of that body to the matter of track construction and maintenance. And we are not sure that his indignation was not warranted. He pointed out that the largest investment made in any one department of an electric railway goes into the track, and yet this important factor probably receives the least attention in the proceedings of the electric railway organizations. There is no subject upon which exchange of experience between street railways would represent a greater saving in dollars and cents than in matters relating to track. Defects in rolling stock or power houses and possible improvements in equipment are evident after a much shorter period of use than are needed changes in track construction. The lessons taught by experience in this department are the kind which it takes years of trial to obtain. Every company has probably learned several things about track construction which are not a matter of common knowledge among its neighbors, and if all could benefit by the experience of each one what an improvement there would be in methods of track construction and maintenance.

When the American Railway Mechanical and Electrical Association was first organized it was thought that electric railway track men might be admitted, and that the new organization would cover track work in its papers and discussions, but there appears to be a general understanding among members that it is not to take up track work, and, in fact, some members expressed themselves at the last convention as decidedly opposed to such a move. It is probably just as well that this organization should confine itself to rolling stock and power houses. To broaden its work too much might defeat the ends it has in view. The time is coming, and, in fact, is already here, when there is need for an organization of electric railway track superintendents and engineers, conducted as are the accountants' and master mechanics' organizations. It is not likely that there will ever be a thorough discussion of track matters by the practical men most acquainted with the subject until there is some such organization especially for track men. Experience has demonstrated that master mechanics, who would never think of taking part in discussions in meetings of the American Street Railway Association, where presidents and general managers are principally in evidence, will take a very active and helpful part in the discussions in an organization of their own. The same would be equally true of track superintendents and engineers.

It was thought a short time ago that electric railway track construction was settling down to certain standard forms, and that soon there would be little of interest in the discussion of track matters. Affairs have taken exactly the opposite turn, however. Just now there are a dozen questions which are undecided about almost every detail of electric railway track construction. First, there is the ever-present joint question. Is the cast-welded or the electrically-welded, or some form of bolted joint, best? The practice of the leading roads of the country, as shown in our last souvenir issue, lacks uniformity, so much so in fact that it can still be considered entirely open, although there was a time when it was thought closed. Then there is the tie question, or rather the question whether to use ties at all. The tendency, as we have before pointed out, has been recently in the direction of laying track on concrete foundation without ties; but the first road to adopt this construction in the United States has recently abandoned it. Other roads which have adopted it more recently may find that their confidence in this construction has been misplaced, or time may demonstrate that it is possible, after all, with proper workmanship, to maintain a track on a concrete bed without ties.

Millions of dollars are going into track construction every year, and thousands can be saved by a frank exchange of experiences on these points. The only thing that cannot be brought out in this way is the care and attention to details given to track construction and maintenance by the companies contributing to this exchange of experience. Track laid according to the same specifications by different track engineers and foremen may give widely different results, simply because of the lack of attention to details in one case and strict attention to them in another case. Nevertheless, one of the results of such an exchange of experience would be to call attention to the importance of these details which are often forgotten, so that they might be incorporated in the specifications and rules of track construction, and would be looked after. There are hundreds of details which the uninitiated never think of that occur to the experienced and thoughtful track man and are made use of in his daily work.

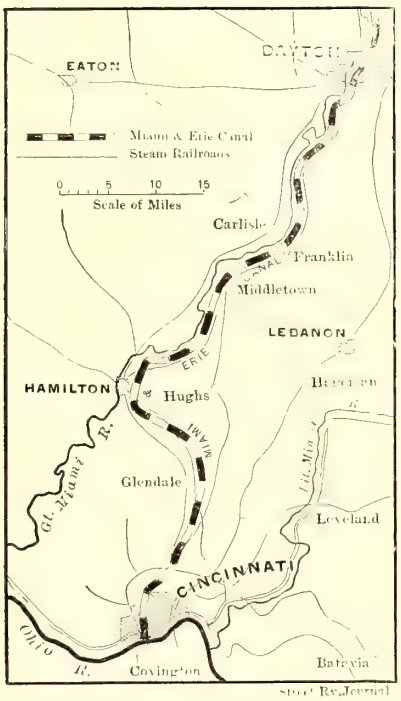
Car Finish

There was a well defined sentiment at the recent Saratoga Convention in favor of painting and varnishing cars in such a way as to produce a somewhat elastic finish, rather than attempt to secure a highly polished surface similar to that given to fine carriages. This is in accordance with common sense, as the ordinary electric railway car does not demand an extremely high finish. The high degree of polish and extremely smooth surface on expensive carriages is secured by means of brittle varnish which chips and cracks easily and is not suited to electric railway service. The idea to be carried out in modern car painting should be first to preserve the wood, and second, to preserve the surface so that it will be presentable in appearance. Very few people give the painting and finish of an electric railway car a close inspection, and it is judged mainly by the general appearance at a distance of several feet. There is not enough difference between an extremely high finish and one less smooth, but more durable, to make the cost of putting on and maintaining the high finish worth while. The Saratoga discussions also brought out the fact that an economical way to maintain the rolling stock finish in good condition is to give the finish a little attention frequently, rather than to wait until both paint and varnish have gone before running a car into the paint shop. In other words, it is an easy matter to apply a coat of varnish frequently enough to keep the car looking well, but if the matter is neglected until both paint and varnish are partially gone, not only does the car look badly but the entire work of painting and varnishing must be gone over from the bottom. It is simply another instance where a "stitch in time saves nine."

ELECTRICAL EQUIPMENT OF THE MIAMI-ERIE CANAL

BY CHARLES W. RICKER

During the last year a strong effort was made to have all the canals belonging to the State of Ohio abandoned, on the ground that the tolls were not enough to pay for their up-keep. A few months later the Legislature of New York voted $101,000,000 to improve the canals of that State, subject to the approval of the electors at the State election Nov. 3. In view of the discussion of the value of canal transportation, caused by this great appropriation, the opening of a new system of canal operation on the Miami & Erie Canal of Ohio is of especial interest.



MAP SHOWING PORTION OF MIAMI & ERIE CANAL WHICH HAS BEEN ELECTRICALLY EQUIPPED

The Miami & Erie Canal was built by the State, and opened for traffic in 1828. It was built from both ends, and was completed from Cincinnati to Toledo in 1844. In early days it was the principal carrier in Western Ohio, and largely determined the development of that region, the largest towns of which grew up along its course, so that now it passes through eighteen cities having a total population of over 650,000 persons. Some conception of the great though varying importance of this canal may be drawn from the following statement of gross receipts from tolls during the periods indicated:

1828-43.	Total.....	$891,825	Average annual.....	$55,714
1844-60.	Total.....	4,018,440	Average annual.....	236,379

In 1861 all the Ohio canals were leased to a private corporation for a yearly rental of $20,050, the lessee to maintain the canals. This lease was abandoned in 1877, and the canals were returned to the State, but they had been so neglected by the lessee that they had suffered injuries that have never been fully repaired.

In 1879 the tolls of the Miami & Erie Canal amounted to $112,090, and since that time they have steadily decreased, so that in 1900 they were only $61,896.

Along the canal are many and large manufactories, which were located there to secure the benefits of canal transportation or the use of water for power or manufacturing purposes, and which can ship a large amount of freight by the canal if reasonable facilities are provided for handling it. For many years this business has been neglected; no money has been appropriated for canal improvement, and though local canal transportation near Cincinnati has been profitable on a small scale the impression is general that the canal is played out.

In 1900 Thomas N. Foredyce got permission of the Board of Public Works to build a track along the canal, and run on the same an electric locomotive towing several canal boats, to show on a working scale the practicability of such a mode of operation. The trials were made for Mr. Foredyce by the Westinghouse Electric & Manufacturing Company, and were considered successful, so that on March 29, 1901, Mr. Foredyce was given a contract and lease permitting him to occupy and use any and all State lands adjoining the canal, for the purpose of building and operating thereon an electric railway for towing canal boats. This franchise is good for thirty years from the beginning of operation, and requires that the canal shall be equipped from Cincinnati to Dayton within two and one-half years after the date of the grant, and from Dayton to Toledo within four years thereafter. The franchise also provides that the speed of towing shall not exceed 4 miles an hour, foreign boats must be towed for a reasonable charge, and the ordinary operation of the canal must not be interfered with. All construction is made subject to the approval of the Board of Public Works, and in case the franchise lapses or is abandoned the owner may remove all his materials and apparatus from the canal lands.

To carry on this work the Miami & Erie Canal Transportation Company was organized and took over the franchise. The Cleveland Construction Company, of Akron, Ohio, was engaged as engineers, and under its direction active work on



VIEW ALONG CANAL, SHOWING LINE AND TRACK

the Cincinnati-Dayton section, 68 miles long, was begun in July, 1901. This is nearly complete, and is now in operation from Cincinnati to Middletown, about 42 miles.

THE CANAL

From	To	Distance Miles	Width in feet Water line	Bottom	Depth Feet
Cincinnati	Dayton	66	40	26	4
Dayton	Junction	114	50	36	5
Junction	Toledo	64	60	46	6
Cincinnati	Toledo	244	..	..	..

There are ninety-five locks, 90 ft. long and 15 ft. wide, with wood swinging miter gates, operated by hand. There is but one summit level, which is 395 ft. above Lake Erie and 512 ft. above the Ohio River, and is 23 miles long, beginning 100 miles north of Cincinnati.

Three artificial lakes supply the high levels. The Lewiston and Loramie reservoirs, containing 9000 acres of water, feed the summit level, and the Grand reservoir, containing 17,000 acres, empties into the canal about 7 miles north of the summit, at St. Marys. Water is also received at a number of other places from rivers.

The canal once communicated with the Ohio River at Cincinnati, passing through what is now the business part of the city, and descending 120 ft. to river level by ten locks. This

connection was abandoned in 1863, and there is now only an overflow, the water passing through which is used for power by lease from the State.

The foregoing were the original dimensions of the canal and reservoirs, but they have been much impaired by the neglect of the lessees and the State. Recently the State, with the assistance of the transportation company, has cleared out the canal bed and repaired the banks and other works in the Cincinnati-Dayton section, but more work is needed even there.



CANAL IN NORTHERN PART OF CINCINNATI, SHOWING SHEET PILING BANK PROTECTION

GENERAL METHOD AND EQUIPMENT

The method of operation adopted by the transportation company consists in towing a number of canal boats in a string by a locotive running on a track built on the tow path. The saving in running cost over animal towage must be effected by the lower cost of mechanical power, lower labor account and higher speed. In the old manner each boat required for twenty-four hours' operation a crew of two steersmen, two drivers and one cook, in all five persons, and five mules, and was towed at an average speed of about 2 m. p. h. With the new method each boat has only two men and the locomotive four men for the same period, while the speed is uniformly 3 m. p. h.

Tows must contain as many boats as possible, but owing to the crooked and irregular channel and frequent locks, it is probably impracticable to operate more than ten in a string. About 200 ft. of line is used between the motor and the first boat and 50 ft. between boats, the boats are 80 ft. long, so with ten boats each "mule" would drag a tail 1500 ft. long. The longest tows used in regular traffic during the writer's connection with the company contained only five boats, and were operated without difficulty.



VIEW ALONG CANAL, SHOWING LINE AND TRACK

The conditions governing the choice of the power distributing system may be stated briefly as follows:

The transmission of power is for long distances in a single line.

The load consists of a small number of heavy train units, which, owing to traffic conditions, may become bunched. The power demand of each unit is steady and continuous instead of intermittent with high maxima, as used with interurban traction lines.

If the whole length of the canal is to be supplied from a moderate number of generating stations, it is evident that the principal transmission must be by alternating current at high tension, with reducing sub-stations at intervals along the line.

Owing to the small number of large units forming the load and their liability to bunch, the sub-stations must be far apart, or some of them will be idle a large part of the time, involving a low all-day efficiency. The average demand per unit is high, involving a high average line loss. All the foregoing considerations made a high trolley voltage desirable.

It is evident that the conditions are favorable to alternating-current motors. With them the trolley voltage may be as high as desired, and static transformers on the locomotives will keep the motor pressure low. The sub-stations need contain no rotary machines and need no attendants, so their original and operating cost are both diminished and the all-day efficiency much improved.

The running conditions readily allow the use of induction motors. Stops are infrequent, and as a string of boats must be set in motion slowly and gradually, to prevent breaking the tow lines or damage to the boats, the lower starting torque, as compared with series motors, is not a serious objection. The higher trolley voltage possible assures good regulation and good starting torque without excessive expense for overhead copper.

Economy of speed control is not important, as the acceleration periods are brief compared with the runs which usually last several hours at uniform speeds.

The Cleveland Construction Company, as engineers, recommended an alternating-current system throughout, and a con-

tract was made with the Westinghouse Electric & Manufacturing Company to furnish and install the same. The locomotives are equipped with three-phase induction motors, and energy is supplied to them through a three-conductor line, consisting of two overhead trolley wires and the track.

This is the first application of alternating-current motors to traction purposes in the United States, and has developed problems new to American railway practice, and with all pos-



CANAL BOAT AND CINCINNATI FREIGHT HOUSE

sible care new and unforeseen conditions may be expected to arise during the early operation of the plant which may, and indeed have already, require unexpected modifications in the apparatus and methods used, which were kept as near those used in standard railway practice as possible.

CONSTRUCTION

A construction department was organized, which, directed by the engineers, purchased and installed all material and apparatus for the complete equipment, except that the Westinghouse Company installed the electrical apparatus furnished under its contract.

Track and pole line material was distributed by canal boats drawn by mules. The track and overhead construction were carried on together, and as soon as a section of line was completed it was supplied with 550 volts continuous current from neighboring railway lines, and construction trains were used to distribute ballast and filling and transport laborers.

The construction locomotives were flat cars equipped with two Westinghouse 35-hp motors, one trolley and one controller, and weighted with rails. The trolley poles were of hard pipe, 2½ ins. in diameter, iron shod at both ends and set in No. 1 United States bases. The trolley wire varied from 6 ft. to 22 ft. above the rails, and though the contact was rather light at the high places the service was reliable. The whole equipment for 66 miles consisted of four small motors like the illustration, two eight-wheel flat cars with the same equipment, six 6-yd. capacity side-dump cars and thirty-four 10-ton capacity center dump cars.

The construction motors were also used to tow canal boats for transporting both construction material and in the regular freight traffic before the alternating-current equipment was ready, a barrel-water rheostat being used to cut the speed down to 4 m. p. h.

The overhead line gang contained from 100 men to 150 men, and was quartered in a floating hotel of three canal boats, with sleeping and mess fittings and a store room boat. The bonding gang also lived in houseboat, which followed their work.

ROADBED AND TRACK

The track is built along the tow path, with the finished surface 2 ft. above water level. Between Cincinnati and Hamilton the canal is mostly along hill sides with the tow path on the outer bank, which is about 16 ft. thick at water line, with slopes of 1¾ to 1, so sub-grade is 12 ft. wide. The center line of the track is about 6 ft. from the water's edge.

The ties are white oak, from Southern Ohio and Kentucky, inspected at point of shipment, and are 6 ins. x 8 ins. x 8 ft. The rails are 70-lb. A. S. C. E. section with standard four-bolt angle-bars.

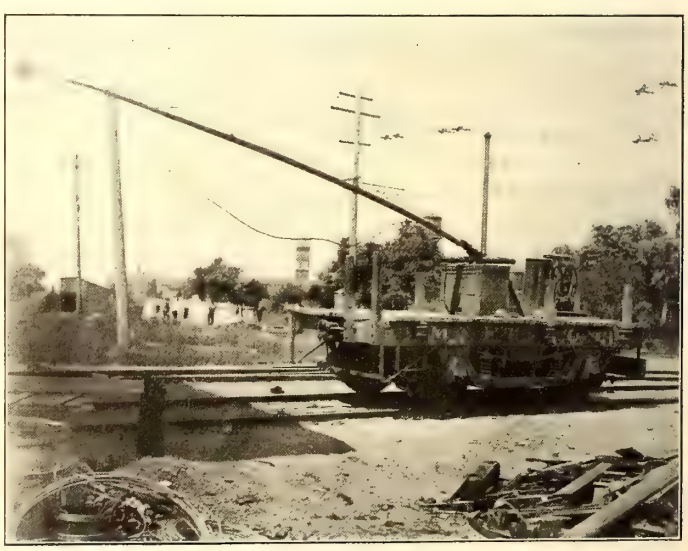
Gravel of excellent quality is found in several places along the line, and a minimum thickness of 4 ins. was tamped under the ties. The entire track was then filled, so that when the gravel is compacted its upper surface shall form a smooth and level roadway, as required by the franchise, which forbids the transportation company to interfere with the ordinary operation of the canal.

To protect the roadbed from wash and support the slope in narrow places, about 12,000 ft. of pile and plank shore protection was built. Oak piles were driven 3 ft. apart and 8 ft. deep and cut 2 ft. above water, and 3-in. oak planks spiked to the land side of the same, and the space behind filled and tamped with earth.

Along the main line the maximum curvature is 25 degs., though in Cincinnati there are sharp curves which require a very short wheel base for the locomotives. The only grades are at locks and depressions under low bridges, and the steepest slope is 2 per cent.

In the Cincinnati-Dayton section 134 bridges cross the canal and tow path. The clear height over the tow path was seldom over 9 ft., and sometimes as small as 6 ft., as they were built only high enough to allow unloaded boats to float under.

Railroad bridges and street bridges within city limits could not be raised, so that track under them had to be depressed to or even below water level to allow the locomotives to pass. At such places concrete walls have been built outside the track and the hollows drained to remove surface and seepage water. These walls are 8 ft. high, 1½ ft. thick at the top and 3½ ft. at the bottom, and extend from 2 ft. above water level to 2 ft. below the canal bottom. The track has been depressed in this



CONSTRUCTION MOTOR

manner under fourteen bridges, using about 1 mile of concrete wall. The concrete was mixed of a coarse gravel from pits along the canal and Portland cement, rammed in water-tight wood moulds without draining the canal. The greatest depression is 4 ft. below water level.

The clearance between bridges and rails is at least 10 ft., save under the first seven in Cincinnati, which are in important business streets, where only 6½ ft. could be had. The trolley wires are 6 ins. below the bridges.

The track and retaining walls are built not less than 2 ft.

above water level, because it is found that a string of boats towed at 3 miles to 4 miles an hour raises the water more than 12 ins. several hundred feet ahead.

At three places the towing track crosses the canal and draw-bridges have been installed, which must be opened immediately after the motor has passed to allow the boats to float through, so that quickness of movement is important. At Twelfth Street, Cincinnati, an ordinary swing bridge is used, at present hand-operated. At Carthage and Flocton there is not room for a central pier, and an unusual type was selected. One end of the bridge is pivoted at the bank and the other rests upon a circular track on the bottom of the canal.

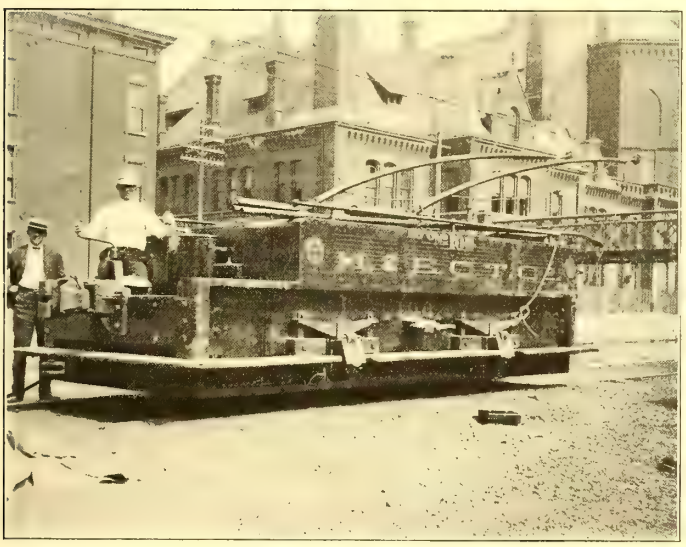
The bridges are to be swung by an induction motor, which, through a train of gears, operates a pinion engaging in a rack at the bottom of the canal beside the submerged rail. A water jet from a rotary pump, driven by the same motor, keeps the track and rack clear of mud. The span is 60 ft. obliquely across the canal. All draw bridges are deck-plate girders, designed by Cooper's specification for a live load of 3500 lbs. per foot.

During construction an ingenious temporary swing bridge was used in such places. One end of the movable span was pivoted to a timber bent near one bank, and the other end when closed was stepped upon a similar bent at the opposite side, and when open was floated on a scow. The draw was 16 ft. long, composed of two 12-in. x 14-in. oak timbers, framed together to support the rails directly.

At convenient points along the canal double-ended sidings with spring split switches are placed to allow locomotives and construction trains to pass.

BONDING

The track rails are connected at each joint with one No. 0000 copper bond, 10 ins. long, with terminals 7/8 ins. in diameter and flexible shanks. Most of the bonds are the American Steel & Wire Company's United States bond, having a shank made

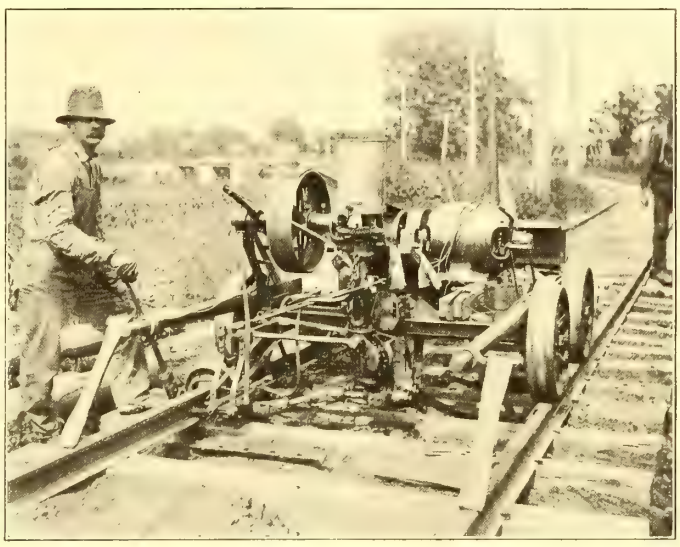


SWITCHING LOCOMOTIVE

up of copper ribbons hot-welded to the terminals, but later in the work the one-piece all-wire bonds, having cable shanks and drop-forged terminals, made by the Ohio Brass Company, were used.

The bonds are placed under the joint plates with the shanks embracing the two bolts nearest the joint and equally divided above and below the bolts, with especial care that they are not pinched by the plates. The bond holes are drilled through the rail web at the same height as the bolt holes and the terminals expanded into them with the usual screw press. The presses have a compression screw of tool steel, 1 3/8 ins. in diameter, with a wedge-shaped thread. At first wrenches, 40 ins. long, were used to operate them, but the compression of bond terminals was not enough to make complete contact between the copper and steel, and this length was increased to 66 ins., which resulted in considerable compressor breakage but much better bonding.

In all cases where the bond holes are made with a portable drill after the rails are in the track, the holes are slightly larger at the side from which they are drilled, usually the inside, and



TRACK-DRILLING MACHINE

as it is harder to expand the head part of the bond terminal than the tip, there is frequently a ring of imperfect contact at the inner edge of the rail if the bond is placed inside the track, as it usually is. In this work better results were obtained by placing the bonds on the outer sides of the rails.

The track rails are cross-connected every 1000 ft. with one No. 0000 solid copper bond, 6 ft. long, with Crown terminals.



TIMBER DRAW-BRIDGE USED IN CONSTRUCTION

Only the outer rails of turnouts are bonded, and switches and frogs are jumped with special long bonds made by brazing joint-bond terminals to lengths of annealed trolley wire. All cross and jumper bonds are buried as completely as possible to protect them from too enthusiastic collectors of copper and from injury by the mules using the tow path, and all joints in the same are brazed to prevent corrosion.

The bond holes were drilled by a Gosling portable power track drill. This is mounted on a four-wheel truck, and is light enough so that the ordinary bonding crew can easily lift it from the track to allow trains to pass. It drills two holes at once, spaced by a jig. At first a gasolene motor was used, but as the track and line were in temporary operation for construction trains it was found advantageous to replace it with an

electric motor, taking power from the trolley. A 3-hp, type C. E., General Electric Company motor was used, and drilled two holes 7/8 in. in diameter through the rail web, 9-16 in. thick, in one minute, with an average use of 3 amps. and a maximum of 4 amps. at 550 volts, the drills making about 100 r. p. m.

With this machine a crew of ten men and a foreman could unbolt, drill, bond and rebolt an average of 170 joints per day without interfering with the construction trains, and as many as 200 joints per day were done. When driven by a gasolene motor the engine, after the manner of its kind, required much more attention than an electric motor, and frequently delayed the work. The gasolene motor was also heavier than the electric. In cases where bonding is done before the overhead work is ready for use the gasolene motor has been found very valuable.

POWER DISTRIBUTION

As the transportation company did not want to build a steam power plant for the first section of the canal, a contract was made with the Cincinnati Gas & Electric Company for the supply of power from its station, situated on the canal near its terminus.

Three-phase, 60-cycle current at 4200 volts is delivered at the switchboard and transmitted over the transportation company's line to Station No. 1 at Spring Grove, 5 miles distant, and just within the northerly city limit. This is a motor-driven generating station and supplies the first trolley section extending from the Cincinnati terminus northerly 7½ miles, at 390 volts, three-phase, 25 cycles. Static transformers raise the pressure for transmission along the canal to the other stations, where it is reduced to 1170 volts for the three-phase trolley circuit.

There are to be four reducing stations, about 12 miles apart, the most northerly about 6 miles south of Dayton. Station No. 2, at Rialto, is complete, and is supplying temporarily the trolley from 4 miles south of Lockland to Middletown, about 33 miles in all, and 23 miles in one direction. The remaining stations are expected to be ready during the current year.

THE STATION BUILDINGS

The stations are fireproof buildings of uniform construction, of one story and basement with flat roofs, and are 60 ft. x 25 ft. inside. The main story is 18 ft. high and the basement 7 ft. high. Station No. 1 also contains another room, 33 ft. x 30 ft., built against one end of the standard station building and of similar construction, in which is placed the motor-generator set.

In all the buildings the foundations are of gravel concrete, moulded in place, and the walls are brick, carried 2 ft. above the roof and finished with tile coping. The main floors consist of flat arches, 12 ft. square, between steel 12-in. I-beams, and are of gravel concrete reinforced with No. 10 gage-expanded metal. The roofs are of the same construction, 4 ins. thick, and covered with prepared felt and asphalt roofing. The basement floors are concrete and are drained by tile sewers, which also receive the water from a tile extending around the outside of the foundation footings.

To secure partial insulation from ground a covering floor of narrow white oak is laid 2 ins. above the concrete floors of the transformer rooms with openings for ventilating the space below it.

In all stations the static transformers are set upon the concrete main floor, which was stiff enough to carry them without appreciable deflection after hardening five weeks. The motor-generator set in No. 1 is set on a gravel concrete pier extending from the level of the building footings to the main floor, and a similar foundation is provided for another unit to be added later.

STATION EQUIPMENTS

At Station No. 1 the 4200-volt, three-phase transmission line runs to two 150-kw, 60-cycle, oil-cooled transformers, the sec-

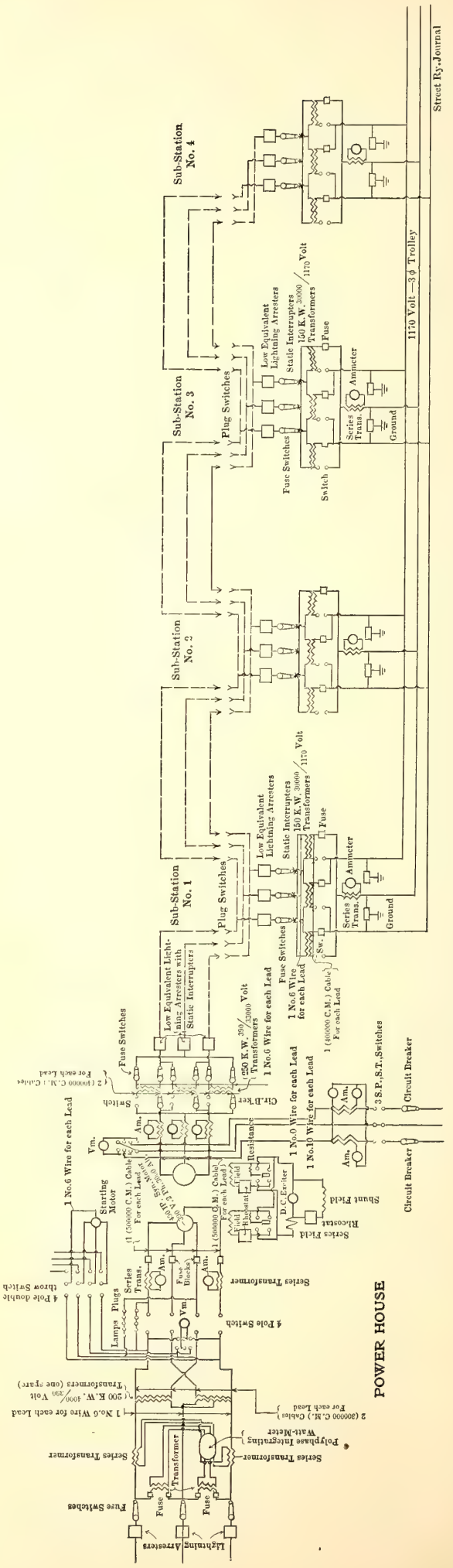
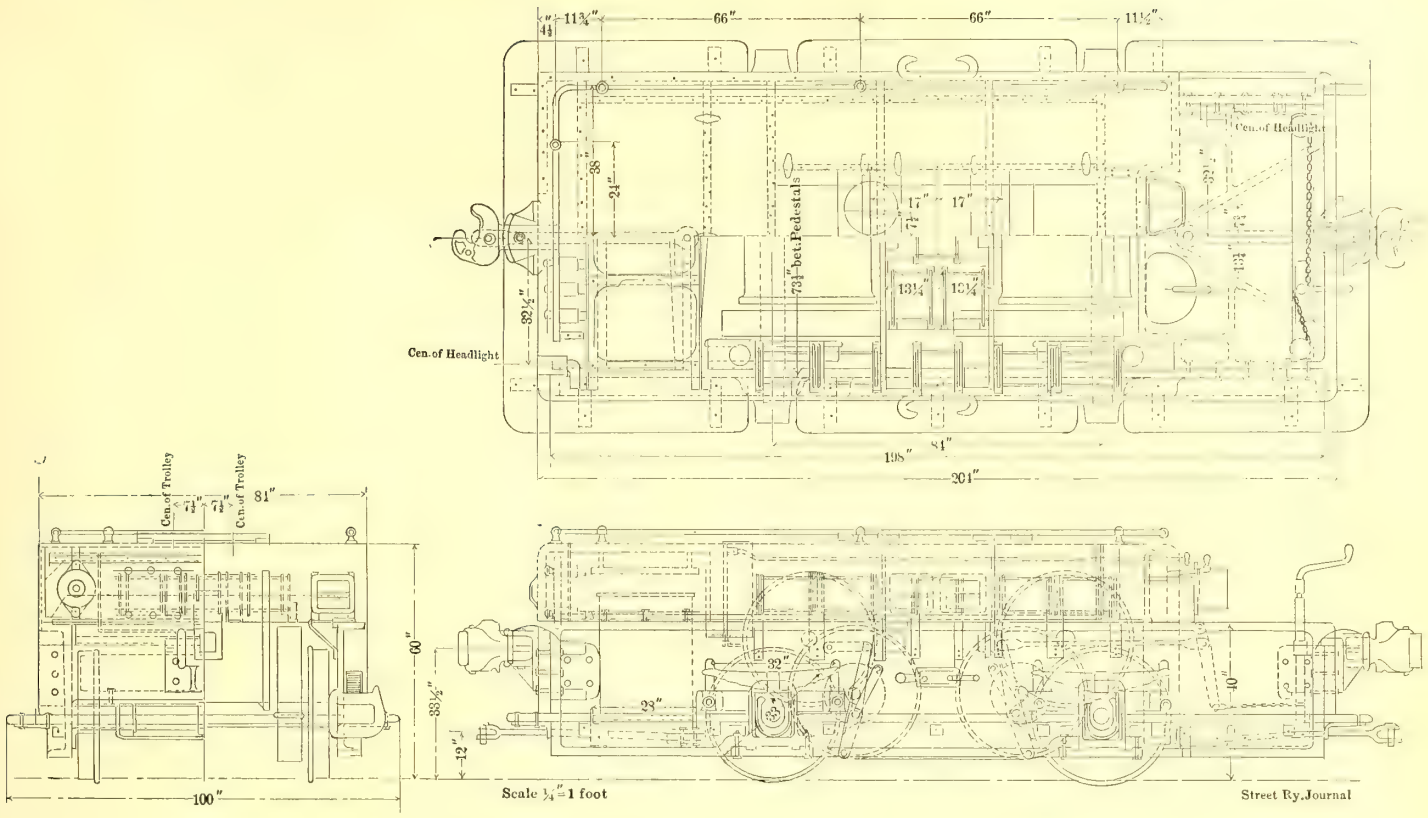


DIAGRAM OF CINCINNATI, MIAMI & ERIE CANAL ELECTRIC SYSTEM



PLAN AND SECTIONS OF SWITCHING LOCOMOTIVE

ondaries of which are connected by the Scott method for two phases. There is another like transformer set and wired so it can be connected in place of either of the others in case of trouble. All are protected by low-equivalent lightning arresters, with reactance coils and fuse switch circuit breakers in the primary leads.

These transformers supply a 450-hp, 390-volt, quarter-phase synchronous motor, which drives through a flexible shaft coupling a 300-kw, 390-volt, three-phase, twenty-five cycle compound-wound generator.

The starting motor for the set is a 40-hp, two-phase induction motor, connected to the pulley overhanging the outer bearing of the large motor by an endless leather belt, 10 ins. wide by 5-16 ins. thick, arranged so it can be thrown off after starting. This is a liberal starting motor and holds the larger unit steadily at speed so synchronizing is very easy. The

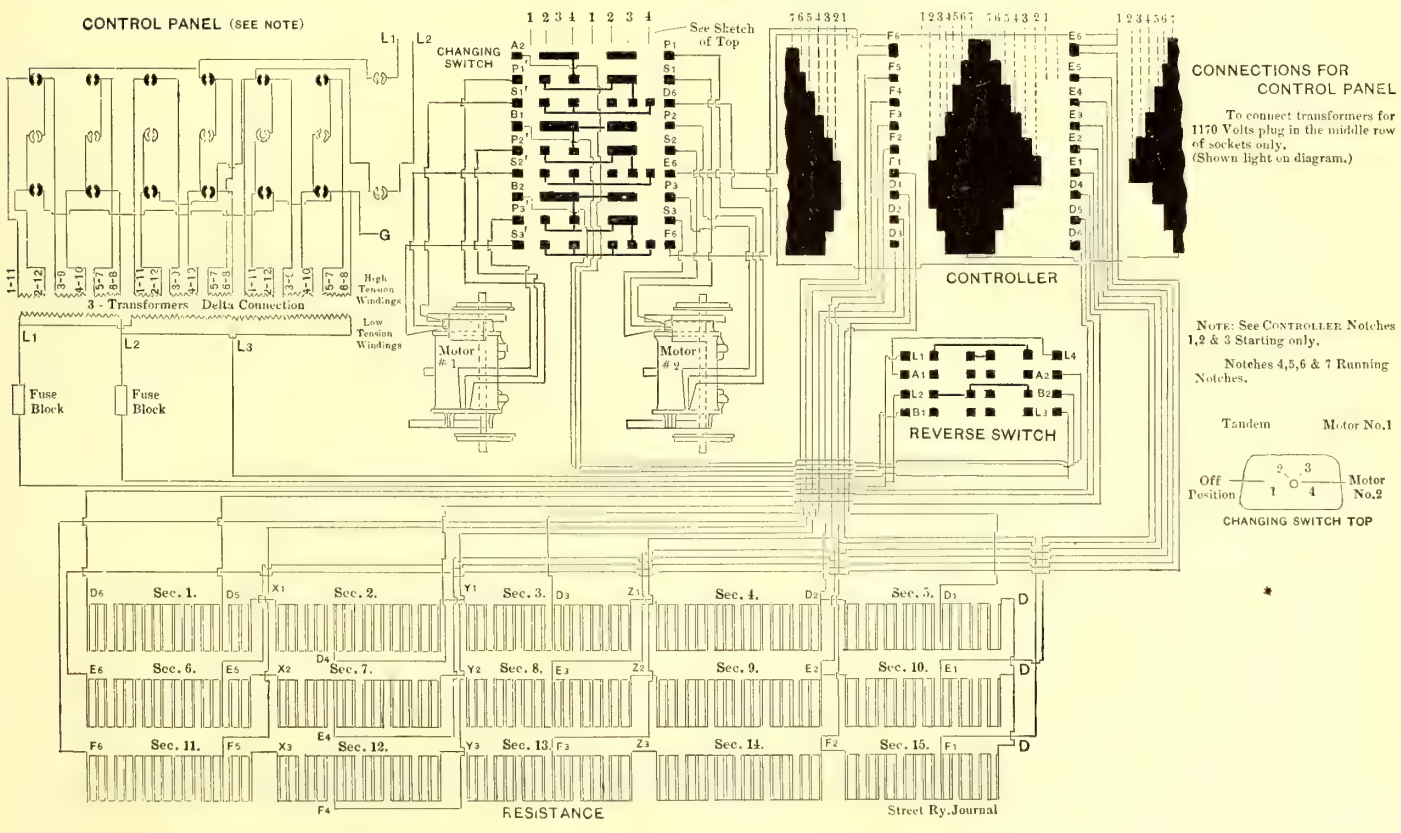
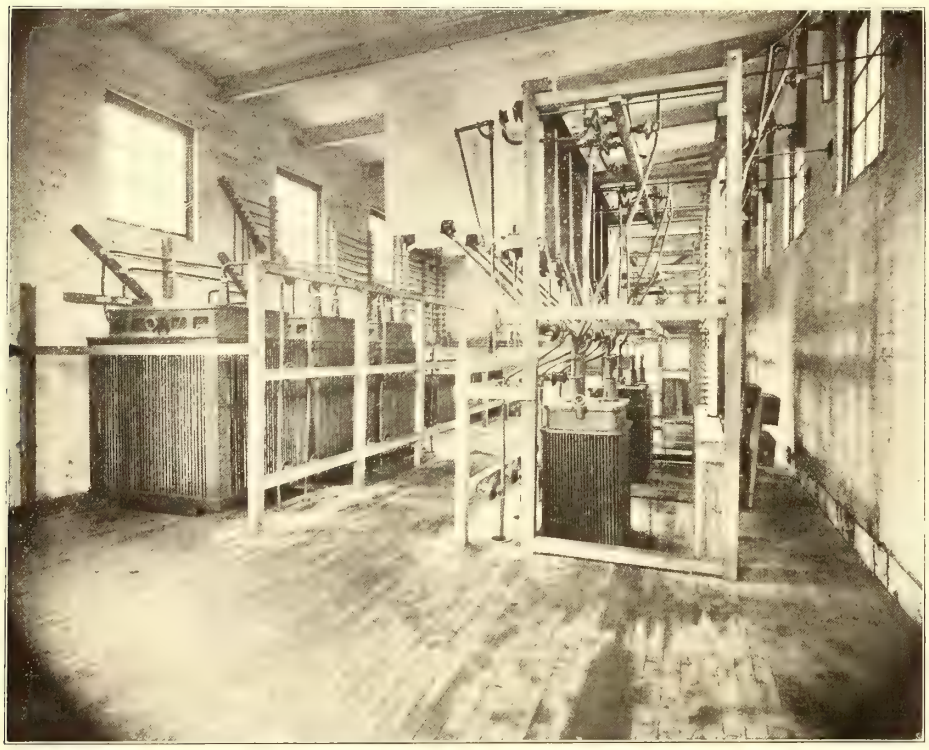


DIAGRAM OF CONNECTIONS OF ALTERNATING-CURRENT LOCOMOTIVE

exciter is a 15-kw, 125-volt continuous-current generator, belted to the large unit. The starting motor and exciter do not show in the illustration, as they could not be got within the field of the camera; the nearer machine is the 450-hp synchronous motor.

The switchboard for this apparatus consists of two marble



INTERIOR OF SUB-STATION NO. 1, SHOWING RAISING TRANSFORMERS AND HIGH-TENSION SWITCHBOARD

panels, shown in the illustration. The generator panel contains a three-phase time limit circuit breaker, three ammeters and a voltmeter on a swinging bracket with a plug switch to connect same to any phase. The motor panel contains two ammeters and a voltmeter with a plug switch, and the usual lamp synchronizing device which indicates similarity with the lamps dark. Under the motor panel is mounted a polyphase recording wattmeter connected to current and pressure transformers in the 4200-volt, three-phase mains, so as to measure the entire input of the station.

The three-phase generator supplies the Cincinnati trolley section through the temporary feed panel shown beside the generator board, and which is to be replaced by a marble panel now building.

The principal output of the generator is carried to three 250-kw oil-cooled transformers, which raise it to 33,000 volts for transmission along the line. In both primary and secondary circuits the transformers are connected in delta and both leads of each coil are carried to the switchboards, so that any single transformer may be cut out there and the line operated by the remaining two. In each of the 33,000 volts leads is connected a fuse switch circuit breaker, six in all, separated by marble barriers, and beyond the circuit breakers the delta is formed. Each outgoing line then passes through a static interrupter, beyond which is connected a low equivalent lightning arrester.

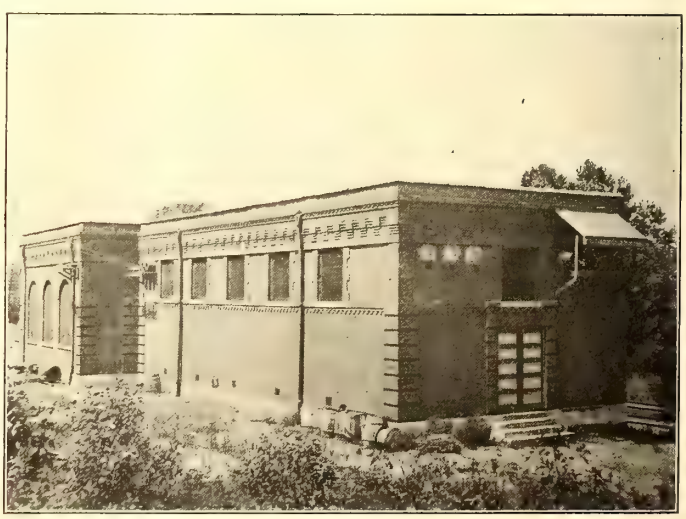
The 33,000-volt conductors inside the building are of No. 4 copper with 16-32-in. rubber insulation and a protecting braid and are supported not less than 12 ins. apart on porcelain insulators like those used on the high-tension line. Where the wires pass through the floor they are supported at the centers of 6-in. vitrified tiles.

The 33,000-volt aluminum transmission cables enter the building at one end and are supported in a vertical row against the side wall 18 ins. from each other and from the building, and pass over and along the aisle behind the circuit breaker rack, where the insulated wires are connected to them by brass "T" clamps.

Where the aluminum cables leave the building they pass through the centers of 12-in. vitrified tiles set in the wall and projecting both sides, the inner ends of which are closed by discs of ¼-in. plate glass strung upon the wires, the downward inclination of which makes the plates rest against the ends of the tiles. Outside the building are steel brackets with inclined roof and gutter to protect the lines from drip and icicles. The roof is tinned and made smooth as possible to reduce the accumulation of snow.

Two ground plates of No. 12 sheet copper, each 4 ft. square, are buried one at each end of the station, and are brazed to each end of a No. 0000 copper conductor, which runs into the transformer room and along one side of the same just above the floor in plain view. Each static interrupter, lightning arrester and transformer case is connected by a No. 6 copper wire running under the wooden floor to the ground wire, so that both ends of each connection are in plain view. A similar arrangement is used in all the other stations.

Station No. 2, at Rialto, may be described as a type, as all the other reducing sub-stations are to be exactly like it. The building is of the standard size and construction described before. The equipment consists of three 150-kw, 25-cycle, 33,000-volt to 1170-volt, self-cooling oil transformers, connected in delta in both primary and secondary. The incoming transmission line is connected to a set of three plug switches, from which bus-wires run across the top of the circuit breaker rack, shown in the illustration, to another set of similar plug switches connected to the outgoing transmission line. Between these

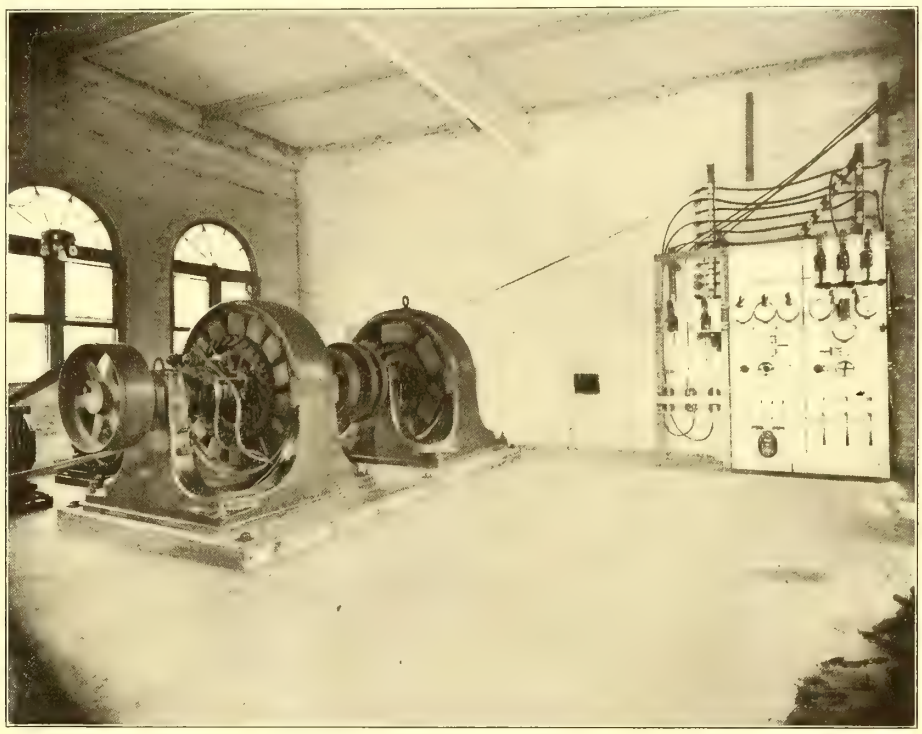


EXTERIOR OF SUB-STATION NO. 1

two sets of plug switches the primary taps of the transformers are taken off and pass through three fuse switch-type circuit breakers, and then through static interrupters to the delta formed by the transformer primaries. Low-equivalent, type-lightning arresters are attached to these taps on the line side of the circuit breakers. The sub-station contains one marble panel for the three-phase feeder to the trolley circuit, having 1 ammeter and voltmeter, Wurts lightning arrester and expul-

sion-type fuses. Each sub-station is placed at the middle of the trolley section which it is to supply. At the end of each trolley section is a section insulator, across which is connected a jumper containing a double-pole automatic circuit breaker, which is normally closed, making the trolley continuous.

The object of this arrangement of lines is to secure a continuous transmission line and trolley wire, from which any section may be cut out for repairs without disabling the system. By opening the circuit breakers at both ends of a trolley section and opening the sub-switch that section is completely disconnected, but this does not interfere with operation of any other section. In case of trouble in any section of the transmission line the plug switches at both ends may be opened, leaving the section dead, while the sub-station at the further end is fed through the trolley circuit from the next sub-station south, and in turn supplies the transmission line beyond it, so that the operation of the system will not be entirely suspended.

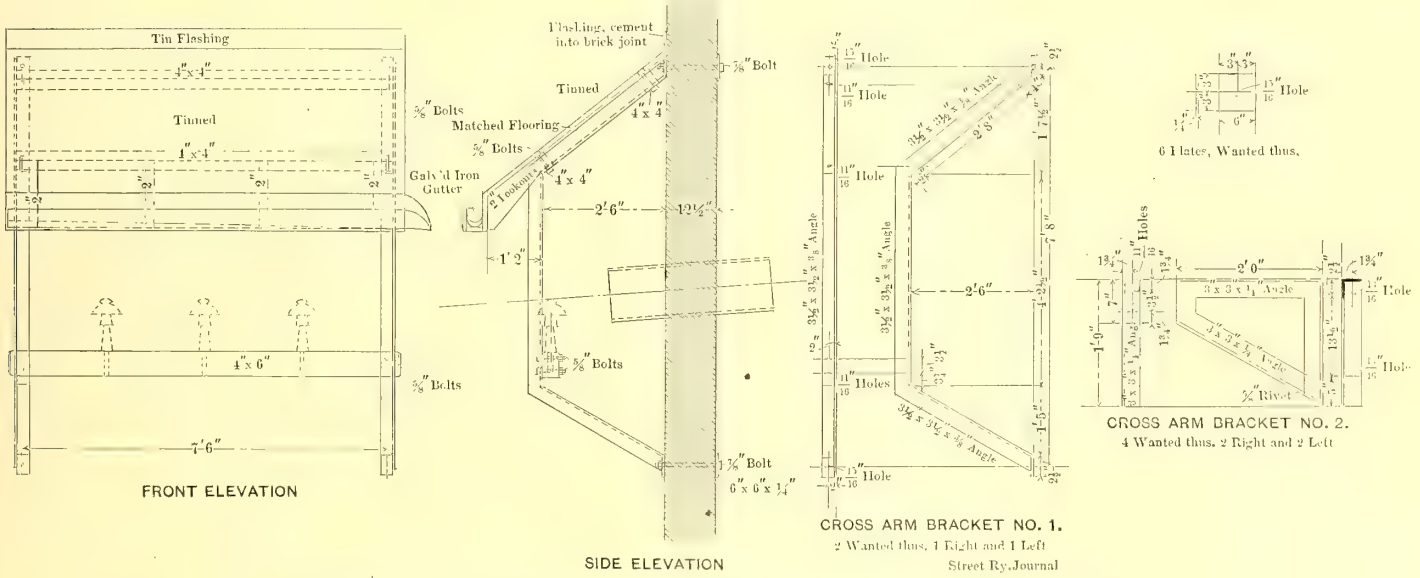


INTERIOR OF STATION NO. 1, SHOWING MOTOR-GENERATOR SET

TRANSMISSION LINES

The 33,000-volt transmission line from the transportation company's station No. 1 consists of three aluminum cables laid up of seven strands of No. 6 wire, which, with a guaranteed conductivity of 62 per cent of copper, is equivalent to one No. 0 B. & S. copper conductor. These are arranged in the form of a triangle at the top of the poles, as shown in the illustration, with one wire above and two below, and spaced 30 ins. apart. Several different joints were tried but the best success was had with an ordinary laced cable splice similar to that commonly used with standard copper conductors, and this was adopted. The cables are transposed spirally one-third of one turn every 2 miles.

The pole line consists of Southern cedar poles, 40 ft. long, lower one 4½ ins. x 5½ ins. x 8 ft., and the upper one 4 ins. x 5 ins. x 5 ft. 6 ins., and are bolted to the pole 22 ins. apart with one ⅝-in. bolt each. The lower arm is further supported by two braces of ⅜-in. x 1½-in. iron 28 ins. long, bent to fit against the sides of the pole instead of the face. Between the upper and lower arms are struts of yellow pine, 2½ ins. x 2½ ins. x 22 ins., which support the ends of the upper arm. The insulator pins are oak creasoted under high pressure, about 8 lbs. per cubic foot, so that they are completely impregnated. Those in the lower arm are 14 ins. long, while the one in the upper arm is 16 ins. long. The shanks are 2 ins. in diameter. The insulators are of brown porcelain, Victor type, without gutters, made by the F. M. Locke Company. The outer petticoat 7 ins. in diameter. The lower wires are supported halfway between the upper and lower arms.



BRACKETS FOR HOLDING HIGH-TENSION WIRES, SPRING GROVE STATION

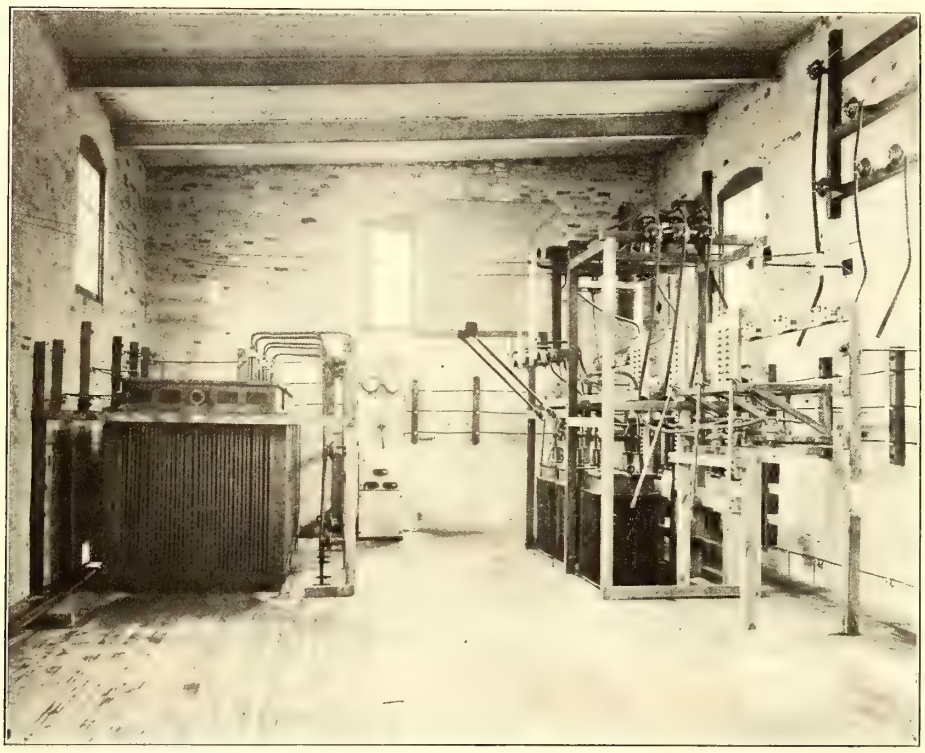
with 7-in. tops, set about 90 ft. apart on tangents, but owing to the large number of curves average 72 per mile. The poles are set 6 ft. deep in the ground, but not concreted except in special cases where the soil is loose or soft. The distance between the center line of track and the poles is 7 ft.

The transmission line cross-arms are of yellow pine, the

Along the tops of the poles is carried a ground wire of No. 6 galvanized B. B. iron, supported upon glass insulators, divided into sections one-third mile long and grounded every tenth pole.

The ground connection is not run down the transmission pole but runs horizontally from the ground wire to anther pole, usually across the canal, down which it is carried and soldered to an iron pipe driven 6 ft. into the earth.

About 10 ft. under the lower transmission arm two telephone circuits are carried on a 4¼-in. x 3¼-in. x 5-ft. cross-arm. They are strung with No. 8 B. W. G. galvanized B. B. iron wire, supported on double petticoat glass insulators and each circuit is transposed on every fifth pole.



INTERIOR OF TYPICAL REDUCING STATION (STATION NO. 2)

The 4200-volt transmission line from the generating station to the transportation company's station No. 1 is strung of the same cable as the 33,000-volt line, and the construction is similar in all respects except that the pins are ⅝-in. steel with wooden tops, and the insulators are Locke No. 17 glass.

It was originally intended to equip the 33,000-volt line with the Locke No. 17 glass insulators and steel pins, but it was later decided to use the Victor porcelain insulators mentioned above, as they were considered more reliable, and the F. M. Locke Company filled the order.

All bolts, washers and cross-arm braces used in the line are galvanized. The cross-arm bolts are fitted with a plate washer 3 ins. square at each end, and the brace bolts in the arms with one similar washer.

OVERHEAD WORK

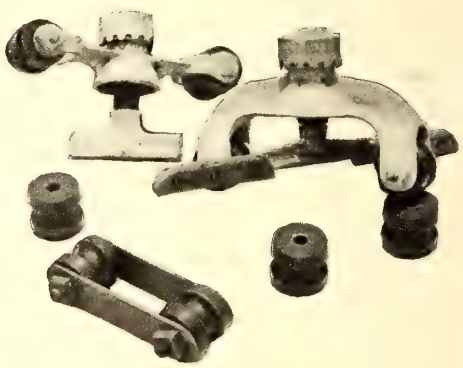
The overhead trolley circuit consists of two No. 0000 General Electric groove hard-drawn copper wires, supported 15 ins. apart by special double insulated hangers from flexible brackets. At curves and over crossings switches span-wire construction is substituted for the brackets.

The trolley wire hangers were designed and made for this work by the Ohio Brass Company, and consist, as shown, of that company's standard type D. W., with the addition of an insulator compound spool in a clevis, attached to each side of the hanger body, to which spool the span wires are attached. These double insulated hangers have given very satisfactory service except in some long spans and pull-overs, in which the tension exceeded 1000 lbs., where the spools crushed and had to be replaced. This is an excessive pressure for the span strand upon moulded insulating compound, and to make the insulation secure it will probably be necessary to reinforce the spools with metal brushings and thimbles, to distribute the stresses where it is necessary for them to exceed 1000 lbs. For straight line work the type D. W. galvanized ear is used, and on curves a brass clamp ear about 12 ins. long.

The brackets are of 2-in. extra heavy structural steel tubing 9 ft. long, supported by overhead brace rods.

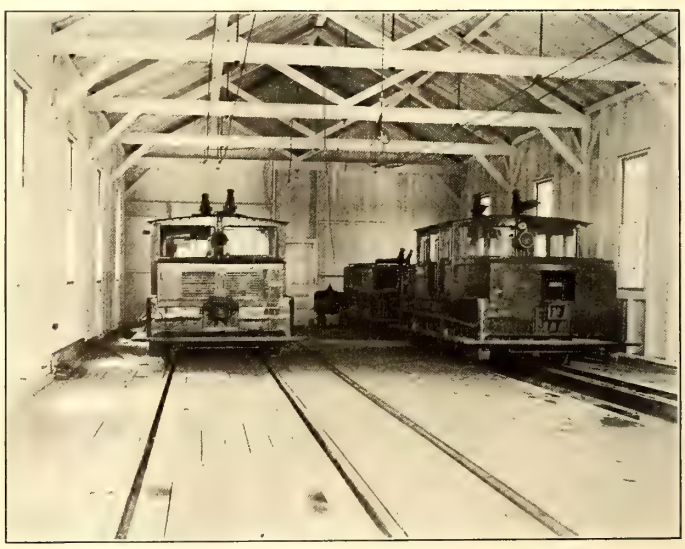
Garton-Daniels lightning arresters are connected to each trolley wire every one-half mile, and grounded with No. 6 galvanized iron pipes driven 6 ft. in the ground. Copper wires were first used for the ground connections, but were stolen so fast that they could not be depended upon.

The overhead trolley wires are divided into sections, each being fed from a sub-station at or near its middle point.



SPECIAL TROLLEY-WIRE FITTINGS

The trolley is interrupted by section insulators of ordinary pattern, with a break 27 ins. long. Around each section insulator is a jumper, into which is connected a special automatic circuit breaker, made by the Cutter Electric Company, of Philadelphia, for this work, and arranged so that excessive current in either wire will open both breakers so that any trolley section which becomes grounded or crosses will automatically cut itself out of the circuit.



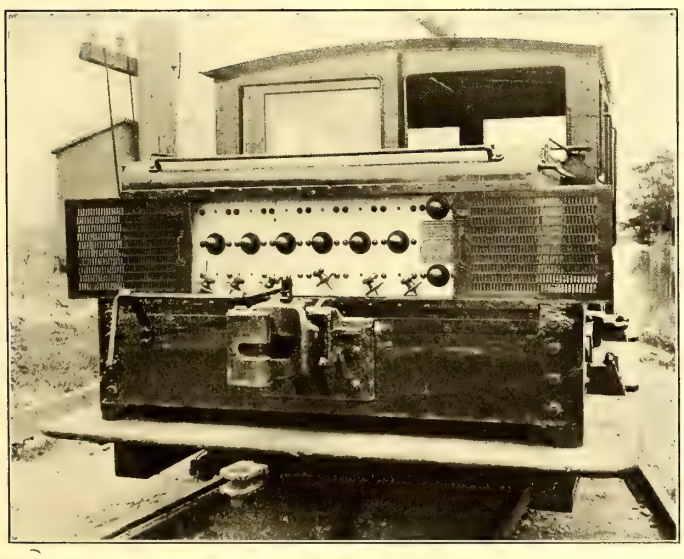
LOCOMOTIVE REPAIR SHOP

No auxiliary feeders are used if parallel with the trolley wire of the 1170-volt section, but in the 390-volt section in Cincinnati an aluminum cable, equivalent to No. 0000 copper, is in multiple with each trolley wire 2 miles north and 4 miles south of Station No. 1.

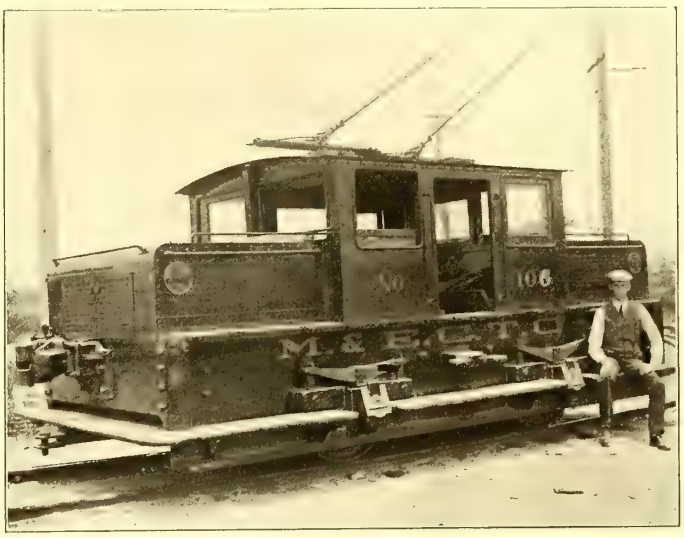
Ultimately the 390-volt section will be of the same length as the other section—12 miles—and extend from Lockland to the southern terminus, and at Lockland will be placed a set of equalizing transformers connected across the 1170-volt, three-phase trolley circuit on one side, and the 390-volt circuit on the other side, so that either trolley circuit may feed the other. This is designed particularly to hold up the voltage at the extreme end of the 390-volt section. These transformers are not yet in place, and it was found impracticable to operate at the lower voltage to Lockland, which is 6 miles north of substation No. 1, so the section point was moved 4 miles further south, making the Station No. 2 at 1170 volts feed 10 miles through the trolley circuit, which it did successfully. It is rather interesting to note that the load upon the three phases is almost exactly equal with any number of locomotives in operation, and that the drop between the two overhead conductors is equal to that between either of the same and the track, from which it would appear that the conductivity of the return circuit is considerably less than for continuous currents.

ELECTRIC LOCOMOTIVES

The original equipment consists of seven four-wheeled locomotives of mining type, each weighing about 55,000 lbs. Each locomotive is equipped with two 80-hp induction motors, delta connected, of a normal speed of 720 r. p. m., rated on a temperature rise of 75 degs. centigrade above the surrounding atmosphere for ten hours' run at full load. These are connected to the axles through double reduction gearing, and when operating in tandem propel the locomotive at about 3 m. p. h., which is the towing speed selected. Either motor alone will propel the locomotive at double this speed, but under the State law boats cannot be towed at the higher speeds. Each locomotive contains three 25-kw self-cooling oil transformers, which reduce the trolley voltage from 1170 volts or 390 volts to 200 volts for the motors. The motor changing switch, similar in pattern to an ordinary railway controller, serves to connect the two motors in tandem, or connect either one to the line and cut out the other or both. When connected in tandem the stator of the first motor is connected to the secondary circuit of the locomotive transformers, its rotor to the stator of the second motor, while the rotor of the second motor is closed upon a ventilated rheostat built of iron grids. A controller, similar in form to the changing switch, serves to vary the resistance of the rheostat in circuit and to operate the reversing switches, so that the movement of the controller handle in one direction operates the locomotive ahead and in the other direction reverses it at the middle position of the handle. At one end of the locomotive is a plug switchboard, by which the primary connections of the locomotive transformers are changed to suit the trolley voltage when passing between the high-tension and low-tension sections. To facilitate this change the high-tension and low-tension trolley wires are run side by side for about 100 ft., and all four trolley wires are dead-ended, so the locomotive must be stopped and the trolleys changed from one pair of wires to the other before it can proceed, at which time the switchboard connections are changed. Having to dismount to change the trolley poles the driver is not likely to forget the switchboard.



END OF LOCOMOTIVE, SHOWING PRIMARY SWITCHBOARD



STANDARD LOCOMOTIVE

The locomotives were built by the Baldwin Works; the electrical equipment for the same were forwarded by the Westinghouse Company to Philadelphia and installed in the Baldwin Works.

The locomotive side frames consist of very heavy cast girders of channel section, framed across at the ends with similar castings. The axles are 6 ins. in diameter with 5-in. journals, and the wheels are 33 ins. in diameter, of standard railroad pattern, with 1¼-in. flanges and 4-in. tread.

At the extreme forward end of each locomotive is the plug switchboard, behind that the transformers, then one motor, then the cab, with the controllers, then the second motor and behind that the rheostat, which fills up the rest of the space.

The locomotives are 14 ft. long, 8 ft. 4 ins. wide, and have a wheel base of 7 ft.

Owing to the large number of low bridges, which it was impracticable to raise, the extreme height of the standard locomotives was limited to 8 ft. 6 ins., and the extreme height of the switching locomotive, to be used at the southerly end of the line in Cincinnati, was made only 5 ft. 6 ins. In this last, to save head room, the cab was omitted, and a cockpit provided for the motorman at the rear end, as in common practice with mining locomotives.

The height of the trolley wires above the rail varies from 6 ft. under some bridges in Cincinnati to 22 ft. over railroad crossings, and is ordinarily 18 ft. Under the bridges north of the first half-mile in Cincinnati the minimum height of the trolley wire is 9 ft.

Each locomotive is provided with a double hook at the middle of each side for the attachment of the towing rope. In addition thereto there are two standard M. C. B. couplers, which may be used to pull ordinary railroad freight cars. As it is proposed to do a through business, in the course of which freight must be transferred from cars to boats, and vice versa, it is convenient to be able to handle cars with these locomotives.

The locomotives are guaranteed, when operating on level track with clean dry rails, to exert the following horizontal effort, based on an efficiency of 95 per cent for each pair of

gears, and a tractive resistance for the locomotives of 20 lbs. per ton and the coefficients of adhesion as stated:

Co-efficient of adhesion. Per cent.	Horizontal effort. lbs.
25	9,600
20	7,600
16	6,350

Starting and running continuously at 3 m. p. h., with the motors connected in tandem and developing 40 hp each. The motors when operated in tandem are guaranteed to have practically the same efficiency as direct-current series motors operating in series, and when running singly at full speed of 6 m. p. h., full load, at 80-hp per motor, are guaranteed to have as high an efficiency as direct-current series-wound motors at full load.



TREATMENT OF CANAL TRACK UNDER LOW BRIDGES, SHOWING CONCRETE RETAINING WALL

The unusually high voltage largely increased the difficulty of insulating the trolley bases. As the locomotive cabs and housings are of sheet iron and completely grounded the insulation of the bases from each other and from ground must be perfect, and the supports strong while the head room is very limited. When received the trolley stands were secured to hard wood strips, supported upon other strips crosswise, bolted to the cab roof, trusting for insulation to the long surface over which leakage must take place. The first hard rain grounded both trolleys and disabled the locomotive for the time. To remedy this saturated wood blocks smaller than the upper board were placed between it and the lower strips, so that the upper projected over the blocks all around, and an apron of rubber packing was tacked around the edges of the upper boards to form a drip, so that its under side and the supporting blocks were kept dry. The small carriage bolts which passed through the three thicknesses of wood were insulated from the cab roof by countersinking the heads in the lower strips, filling the holes with melted shellac and placing sheet mica and sheet rubber packing between the same and the iron roof. This raised the trolley stand only 7/8 in. and was effective.

In each trolley rope, about 2 ft. below the wheel, is placed an ironclad bell insulator, similar to those used for hanging arc lamps. This insulation is good, but the ironclad bell weighs 2 lbs., which is a serious load at the end of the trolley pole, and it is proposed to have similar bells made of hard wood boiled in paraffine oil, which will be quite as effective and much lighter and cheaper.

The first three cab locomotives have No. 8 United States trolley stands with steel poles 18 ft. long. The other three, shipped later, have No. 1 United States stands, so that the poles may be reversed without walking them around in a horizontal plane, as must be done with the No. 8, for in some places the track embankment is so narrow and steep that there is not a fair path outside the running boards of the locomotives. The ordinary springs sent with the No. 1 stands proved too weak for the long poles and great range required, and had to be replaced with springs of 5/8-in. diameter steel rod. When swinging the poles around in the dark the trolley man would sometimes carry them around one at a time, especially if the bank were narrow and he had to use one hand to steady himself. On several occasions while doing this a trolley pole was allowed to touch the telephone wires, which promptly put the switchboard out of business.

On the switching locomotive Larry No. 2 stands were tried to save head room, but were not able to hold up the long poles, so the United States No. 8 stands, originally sent with this machine, were replaced. Wood poles were substituted for the steel poles in the switching motor, because in passing under the low bridges they lie very close to the cockpit, and one rainy day a motorman allowed his hat to touch one of the steel poles, causing him much discomfort, but fortunately no serious injury. The use of wood poles also simplifies the problem of insulating the trolley stands from the locomotive frame.

The writer is strongly in favor of wood trolley poles for locomotives where the trolley voltage is high enough to be dangerous to life, as electric locomotives usually have iron housings which are grounded, and a man climbing over them can easily come in contact with the long horizontal springs used with the ordinary types of trolley stands, especially if the springs happen to project before or behind the cab roof.

Another and more serious danger of high-tension trolley circuits using a track return is referred to in the editorial pages of this journal in the issue of Aug. 22, 1903. In case the locomotive becomes insulated from the track by a film of sand or dry snow over the rail the whole frame is raised to trolley voltage, and as the iron parts are exposed it is dangerous to touch. This was the cause of one most distressing accident within the experience of the writer.

TELEPHONES

Two telephone circuits extend the whole length of the line and terminate in a switchboard in the Cincinnati building, into which are also connected telephones in the various offices in that building.

One of the two lines is used for despatching, and telephones connected to this are placed at frequent intervals along the line in large wood boxes on the poles. In the connection to each telephone and inside the box is a double knife switch, placed

so that the door of the box will knock it open when the same is shut, so that all these telephones are disconnected when not in actual use, which protects them from lightning and heavy current crosses and avoids overloading the line. Locomotive drivers report to the despatcher at all such pole telephones. Each locomotive has also a portable telephone with a hook pole, which can be attached to the line anywhere in case of trouble. The other telephone circuit is used by the freight offices and for the general business of the company.

At places about 6 miles apart both lines are looped to telephones with switches on both sides of each telephone, so that



FREIGHT HOUSE AT HAMILTON

the lines may be opened in either direction and trouble located between two test stations.

BOATS

The standard boat is 80½ ft. long exclusive of rudder, 13½ ft. wide and 9 ft. high, measured over all. Most of them are decked, leaving a clear height of 7 ft. 8 ins. in the hold. There are some open boats for coal, gravel, empty barrels and other coarse and bulky freight.

Loaded to a draft of 3 ft. such boats can carry about 65 tons, but in the present condition of the canal bed it is seldom practicable to load deeper than 30 ins., at which they carry about 50 tons of freight.

The transportation company has now about twenty serviceable boats, acquired with a canal packet company which was purchased, and which also included a dry-dock and boat yard at Lockland, 12 miles north of Cincinnati, in which the company now builds and repairs boats. There are now three boats on the stocks, and the yard is able to turn out about two boats per month. The present fleet and yard capacity are altogether too small for the business offered, even at the beginning.

DEFECTIVE WIRING FOR RAILWAY BUILDINGS

A source of constant complaint among insurance inspectors is the carelessness displayed in the wiring of car houses and shops, and even in power plants, where the importance of complying with rules should be appreciated fully. Generally speaking, the original wiring plant is all right, or, at least, it complies closely with the requirements of the code, but in the structures mentioned there is a constant demand for temporary work in supplying light and power, and sometimes important changes are made from the original plans without sufficient consideration. It is in work of this kind that the chief trouble arises, and because of this tendency to resort to makeshifts that inspectors are required to be ever vigilant. An examination of the notebook of one of these inspectors, who has been engaged very largely on railway properties, disclosed a number of common defects, most of which might be said to be of little importance themselves yet sufficient to cause trouble, and because of the frequency of the reports it would seem that those in charge of the properties did not realize the danger to which they were exposing the structure and its contents. Following is a list of defects noted in incandescent and arc wiring and attachments, incandescent lamps, arc lamps, motors and resistance and heaters:

INCANDESCENT WIRING AND ATTACHMENTS

1. Insulation and supports of wires entering building, not standard.
2. No bushings at entrance, through floors and partitions.
3. No entrance fuse.
4. No entrance switches.
5. Circuits not fused.
6. Bare fuses.
7. Bare fuses over combustibles.
8. Bare wire resting on woodwork.
9. Wire on woodwork throughout.
10. Wiring in moulding.
11. Not protected against mechanical injury.
12. Concealed in places.
13. Carrying capacity too small.
14. Smaller than No. 14 used.
15. Wires too close together.
16. Twisted pair used for light circuits.
17. Flexible cord used throughout.
18. Cluster lighting used.
19. Wires in danger of contact with other wires.
20. Wires exposed to moisture.
21. Switches broken and unapproved.
22. Fused rosettes not approved.
23. Insulators for wire supports not approved.
24. Pit wiring not in conduit.
25. Joints not approved. Not taped in places.
26. Connections to trolley in building not approved.
27. Wires in contact with trolley not approved.
28. In contact with iron-work, piping, etc., not approved.
29. Unguarded incandescent lamps in contact with woodwork and combustible materials.
30. Unapproved lamp sockets.
31. Wiring could touch floor in case of break.
32. Wires stapled or strapped to woodwork.
33. Arc wiring smaller than No. 12.
34. No fuses for arc circuits.

INCANDESCENT LAMPS

1. Sockets not weather-proof.
2. Lamps in pits, storerooms and other points in contact with combustible material, without wire guard to protect same.

ARC LAMPS

1. Without outer globe.
2. Without any globes.
3. Single globes without wire netting.
4. Not properly fused.
5. In position to be constantly struck by trolley poles.

MOTORS

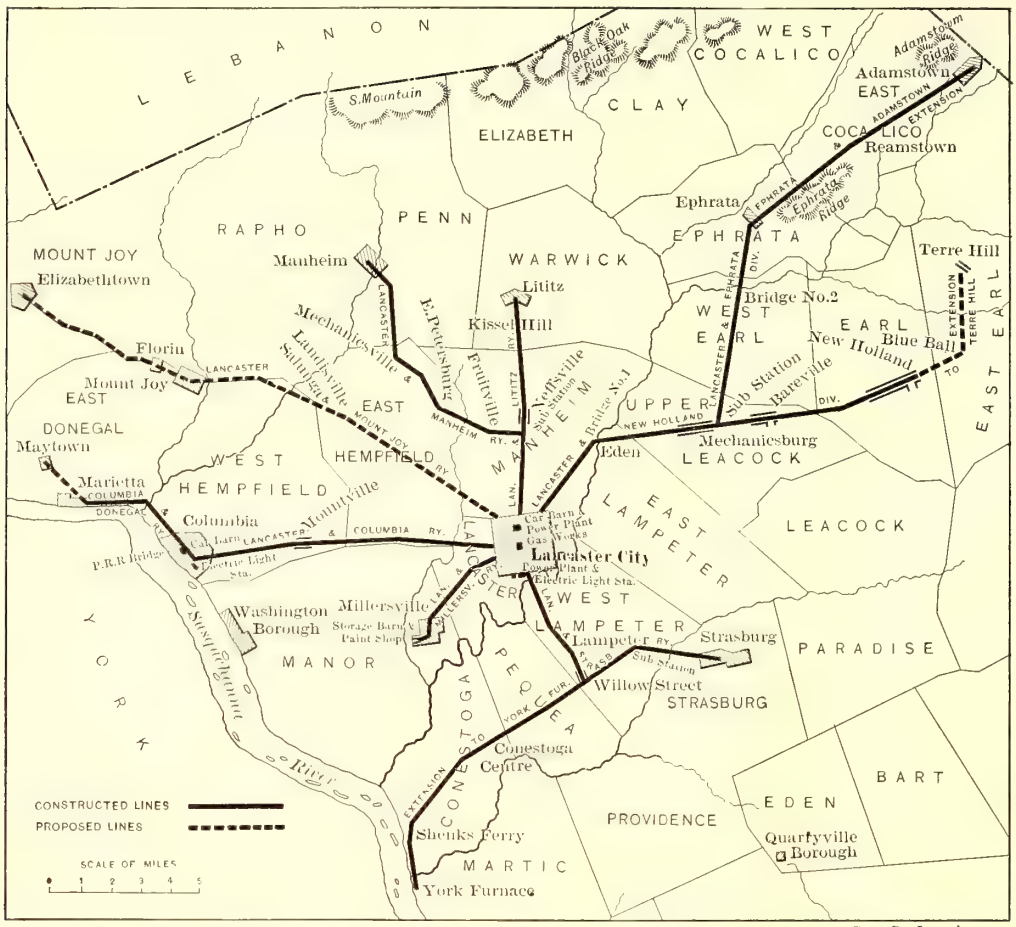
1. Dirty and, in instances, covered with oil.
2. In pits in woodworkers, surrounded by shavings.
3. Wiring for same on floor unprotected and in wood mouldings.
4. Canopy switches unapproved.
5. Open fuses unapproved.
6. No drip-pans provided.
7. Under-load switches not provided.
8. Several instances of no fuses or circuit breakers.

RESISTANCE AND HEATERS

1. Water resistance not approved.
2. Regular cast-iron grid resistance resting on combustible floor—covered in instances with combustible materials.
3. Wiring to resistance resting on floor and otherwise unprotected.
4. Wire spirals on insulators on wood frame not approved resistance.
5. Resistance mounted in merry-go-rounds and the like should be enclosed in fireproof box.
6. Heaters made of spirals, on wood frame, not approved.
7. Heaters mounted on wood surface and in proximity to combustibles, unapproved.

THE CONESTOGA TRACTION SYSTEM

The city of Lancaster, Pa., and the surrounding country within the boundaries of Lancaster County enjoy excellent transportation facilities through the establishment of the electric railway system operated by the Conestoga Traction Company. This section of the country was almost entirely without transportation facilities prior to the construction of the electric lines, and, consequently, a great change has been wrought in the last few years. Indeed, much of the prosperity of this region may be rightly attributed to the advantages afforded by the establishment of this comprehensive system of electric railways.



MAP OF CONESTOGA TRACTION LINES

and the surrounding counties, and has several fine buildings owned by that sect. The town is located along the foot of the Ephrata Hills, 15½ miles by trolley from Lancaster, and is reached through a very picturesque country. It is also famous as a health resort, and has a beautiful park and picnic grounds. The State Normal School, located at Millersville, has 1000 pupils. Manheim, which was settled by Baron von Stigel, is another important point. Here the Feast of Roses is celebrated each year, and is an event of considerable importance throughout that region.

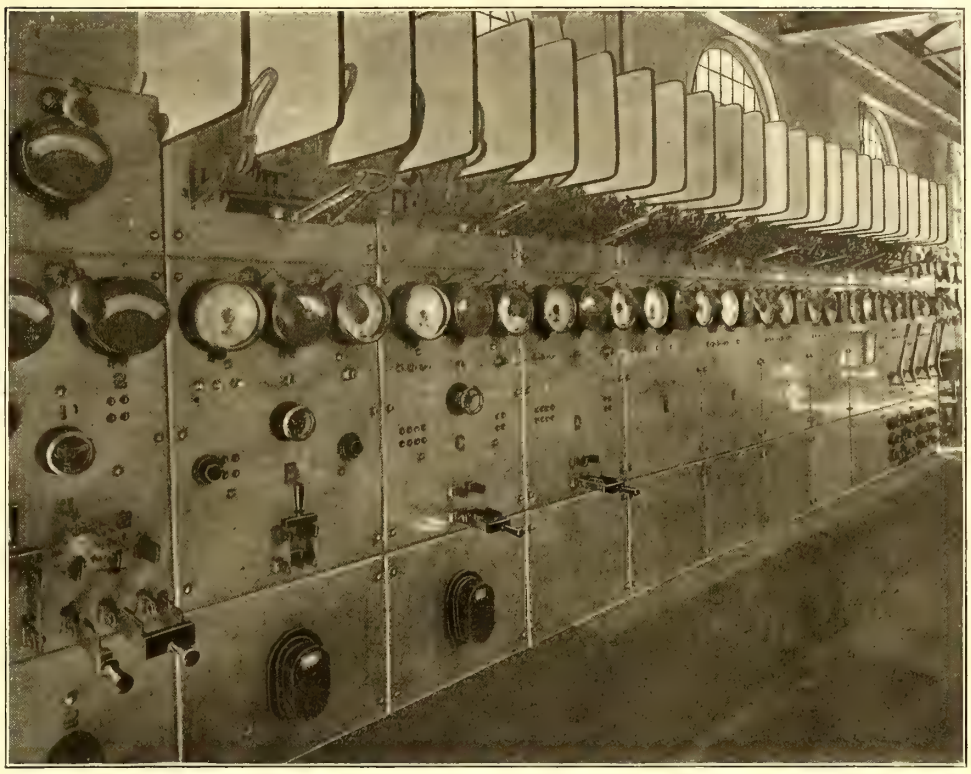
The traction company is particularly fortunate in having several very attractive parks, picnic grounds and pleasure resorts along its lines in the immediate vicinity of Lancaster. Rocky Spring is probably the best known of these. It is situated on Conestoga Creek, and enjoys one of the most beautiful locations in the State. It comprises about 45 acres, and has a theater with a seating capacity of 2000 persons, a dancing pavilion, a large merry-go-round and several other attractions and buildings such as are usually found in resorts of this character. The park is not owned by the railway company, but is in the hands of friendly interests, and an arrangement has been made for operating harmoniously. Chickies Park is another beautiful spot, and contains 90 acres of woodland, situated on a bluff 300 ft. above the Susquehanna River, and overlooking the famous Donegal Valley. This park is reached from all points along the lines of the Conestoga Traction Company, and during the summer season cars are run

The city of Lancaster is the center of the system, the lines radiating for a distance of 20 miles in all directions, with numerous branches, forming a network covering the entire county. Some of the points reached are of considerable local interest and importance, Lititz, for instance, being the headquarters for the Moravian settlement, and containing a fine church edifice and seminary of that denomination. Lititz Springs have more than a local reputation, because of the curative powers of the waters. This resort is in a beautiful park of about 7 acres, and is visited by large numbers of people of that section. Ephrata is the headquarters for the Seventh Day Baptists of Lancaster



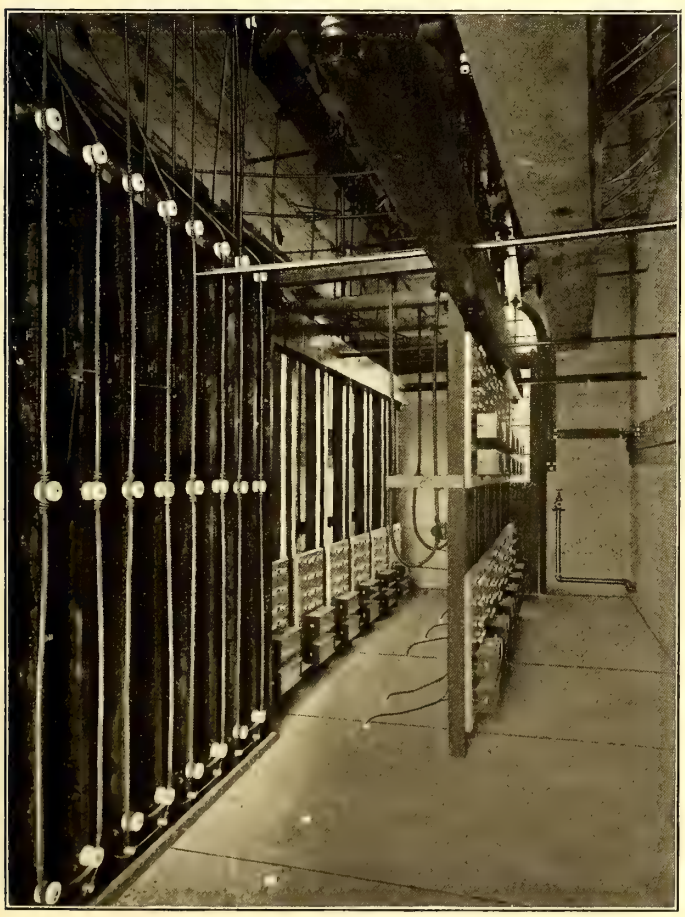
TRANSFORMER HOUSE

to it on a half-hour schedule. Lancaster City itself has a population of about 45,000, and the county, according to the census report of 1900, contains 159,241. Last year the company carried 5,500,000 passengers, and also did considerable light freight and express business. This is a very prosperous community, and Lancaster County claims to be the wealthiest agricultural section of the United States. The freight business consists principally in handling agricultural products, cigars, tobacco and milk. The company for some time has operated a freight car between Lancaster and Columbia, making regular schedule trips. Small packages are also carried on combination express and passenger cars.



MAIN SWITCHBOARD AT ENGLESIDE POWER HOUSE

At the present time all of the light and power interests as well as the railway lines in Lancaster County are controlled by the Lancaster County Railway & Light Company, which is a holding corporation chartered under the laws of New Jersey. Through its ownership of the securities of the Conestoga Traction Company, Lancaster Gas Light & Fuel Company, Edison Electric Illuminating Company and the Columbia Electric Light & Power Company, this corporation controls the electric railways and electric lighting of Lancaster County and the only gas company in Lancaster City, thus virtually securing a monopoly of the lighting, power and transportation service of the entire community in the district served. A brief resume of the operations in this territory and the successive steps which finally culminated in the formation of the present system and its development, will be of particular interest at this time, in view of the recent changes in the control and personnel of the management.



LIGHTNING ARRESTERS

The Edison Electric Illuminating Company has been furnishing electric power and light in the city of Lancaster since 1889, and now has a contract for lighting the streets as well as a very large commercial patronage. It has also acquired, and now utilizes, the 400-kw distribution plant of the Lancaster Electric Light, Heat & Power Company, which was formed as an independent company. The Columbia Electric Light & Power Company occupies a similar position in the borough of Columbia to that of the Edison Company in Lancaster, furnishing all the current for commercial service and also having a contract for lighting the streets of the borough, as it is the only electric light company of that place. The Lancaster Gas Light & Fuel Company furnishes all of the illuminating and fuel gas used in the city of Lancaster.

The Conestoga Traction Company was organized Dec. 12, 1899, and it now controls, through ownership of securities and by lease, the following electric railways in Lancaster County:

Lancaster City Street Railway, into which the Lancaster & Millersville Railway, the West End Street Railway, and the East End Street Railway were merged, 17.12 miles of track.

Lancaster & Columbia Railway, 9.16 miles.

Lancaster & Lititz Electric Railway, 10.10 miles.

Lancaster, Mechanicsburg & New Holland Railway, 23 miles.

Columbia & Donegal Railway, 5.67 miles.

Columbia & Ironville Street Passenger Railway, 3.59 miles.

Lancaster, Willow Street & Strausburg Railway, 11 miles.

Lancaster, Petersburg & Manheim Railway, 8 miles.

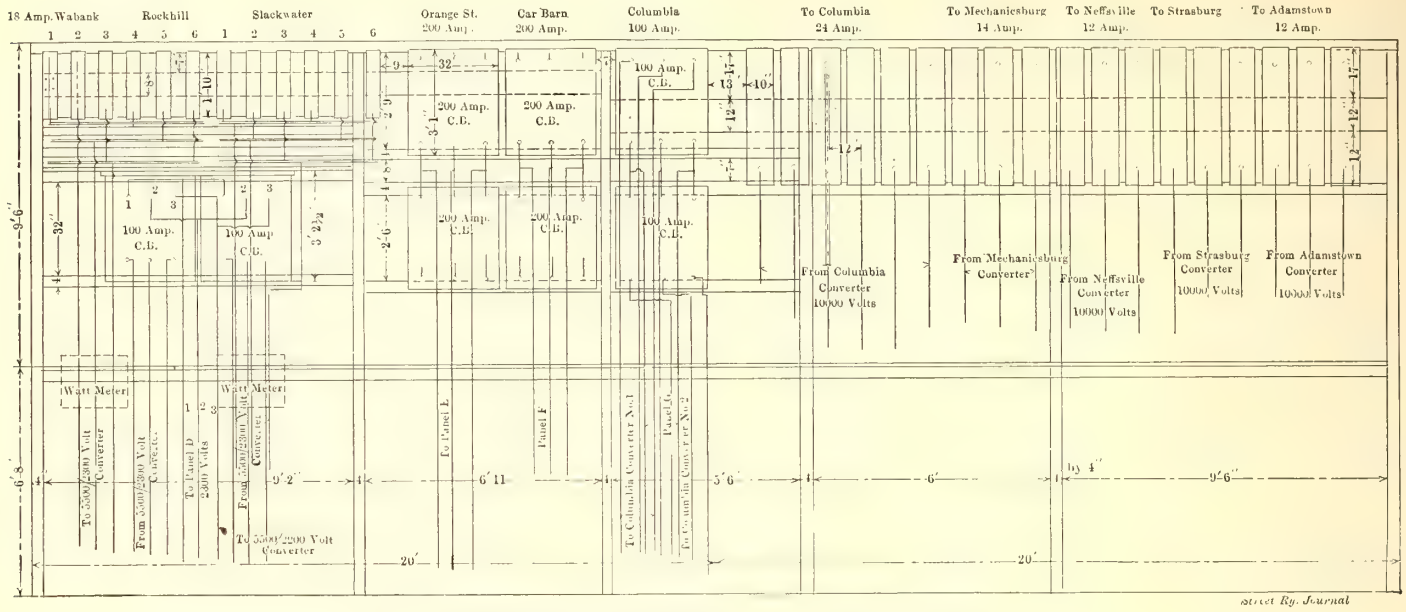
Ephrata & Adamstown Railway, 8 miles.

Lancaster & Rocky Springs Railway, 5 miles.

Lancaster & York Furnace Street Railway Company, 12 miles.

The latest acquisitions include the Ephrata & Adamstown Railway and the Lancaster & Rocky Springs Railway, both of which were completed last year and leased by the Conestoga Traction Company.

The Ephrata & Adamstown Railway extends from Ephrata Borough to Adamstown, and the construction of this road completes a through line of electric railway from Lancaster to

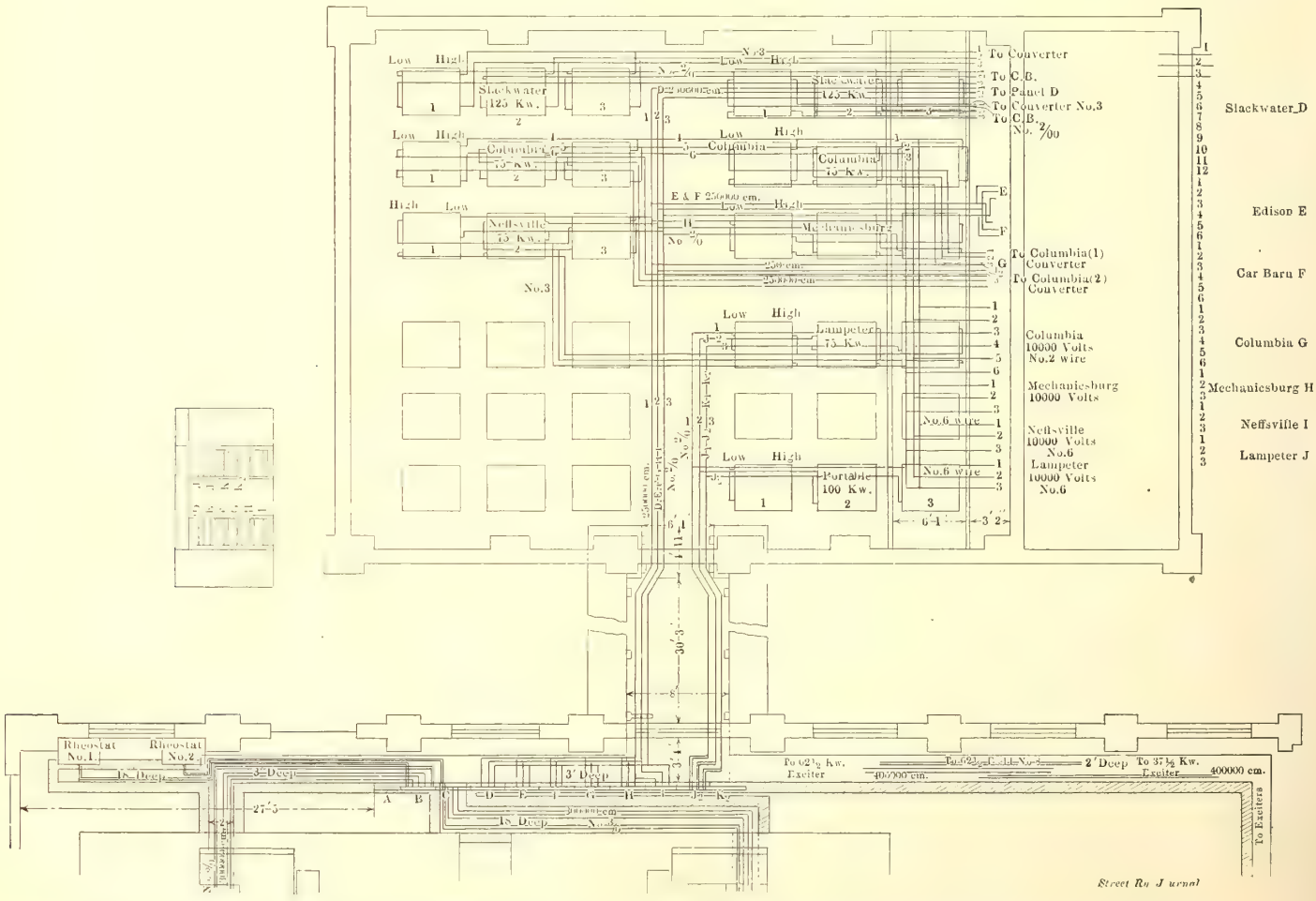


PLAN OF WIRING SWITCHBOARD IN ENGLESIDE POWER HOUSE

center of Lancaster to Rocky Springs Park, which has already been mentioned, and is intended principally for accommodating pleasure traffic.

Reading. From Adamstown to Reading the railway will be owned by the United Traction Company, of Reading, and work on this section has been about completed. The route from

During the last year the Lancaster & York Furnace Street Railway Company has made considerable progress with the building and equipping of an electric railway from Millersville



PLAN OF WIRING, SHOWING UNDERGROUND SUBWAY CONNECTING SWITCHBOARD OF POWER HOUSE WITH DISTRIBUTION SYSTEM

Lancaster to Adamstown, a distance of 23 miles, is now fully completed and in operation, but it is expected that when the other end of the line is opened the traffic will be much heavier.

The Lancaster & Rocky Springs Railway extends from the

to York Furnace, which will traverse the southwestern part of Lancaster County, and will form an important feeder to the Conestoga system. This line is controlled under contracts providing that the Conestoga Company shall carry the passen-

gers between Millersville and Lancaster City, and also furnish current for the operation of the entire line to York Furnace. It is also proposed to operate a line between Lancaster and Mt. Joy, by way of Roherstown, which is projected by an independent company.

Several of the lines here mentioned are constructed along township roads, which are controlled by the company through leases of a perpetual character. These include the Lancaster & Columbia Railway, which is built along the Lancaster and Susquehanna Turnpike, the Lancaster, Mechanicsville & New Holland, the Lancaster & Lititz, the Lancaster & Manheim, and the Lancaster & Millersville, which follow the respective turnpike roads of these districts.

The original companies which were consolidated in this system had a checkered career. The Lancaster City Street Railway Company, which formed the nucleus of the present organization, was incorporated Nov. 28, 1883. The next line to be projected was the East End Passenger Railway Company in 1886, and the West End Passenger Company at the same time. The West End Street Railway Company was incorporated two years later.

The first extension of the Lancaster City lines was made when the Lancaster & Millersville Railway Company was formed in 1890. This was followed a year later by the Lancaster & Columbia Railway Company, and about the same time by the Columbia & Ironville Street Passenger Railway Company, and the Lancaster & Strausburg Railway Company. The Columbia & Donegal Railway Company was formed early in 1893, as was also the Lancaster Traction Company. The Lancaster & Lititz Electric Railway Company was not established until 1894, and the Lancaster & New Holland Railway Company was projected the same year.

Meanwhile, the Pennsylvania Traction Company was organized, July 19, 1893, with a view of consolidating in one system the several companies here mentioned. Before this time, however, the work of merging and transferring these properties had begun. The East End Passenger Railway Company and the West End Passenger Railway Company had been absorbed by the Lancaster City Street Railway Company in 1890, and the Lancaster & Millersville Railway Company was leased to the West End Street Railway Company early in 1892, the latter corporation in turn being merged in the Lancaster City Street Railway Company before the end of the year. In 1894 the Lancaster Traction Company and the Lancaster City Street Railway Company were leased to the Pennsylvania Traction Company, as were also the Lancaster & Columbia Railway Company, the Columbia & Ironville Street Passenger Railway Company, the Columbia & Lititz Electric Railway Company, the Lancaster & Terre Hill Street Railway Company, and the Lancaster & New Holland Railway Company, thus consolidating all the existing traction interests of the county under one management.

The Pennsylvania Traction Company, however, became involved in financial difficulties, and on Nov. 30, 1896, William B. Given was appointed receiver of the entire property by the Circuit Court of the United States for the Eastern District of Pennsylvania. After passing through foreclosure proceedings the entire property was reorganized and acquired by a syndicate comprising the Conestoga Traction Company, which was incorporated on Jan. 16, 1900, with a capital of $4,000,000.

This company has since been engaged in developing and improving the property, and during the last few years has expended large sums for power house, sub-stations and equipment, rolling stock and extension and improvement of lines.

The fact that the roads follow the highway prevents the operation of the interurban lines at high speeds. The company during the last two years has rebuilt a large part of the roadbed and overhead work, with the view of securing better construction and material, and establishing a uniform standard, so that the entire system is now in excellent condition. The average grade is only 2 per cent, and the highest maximum grade, which is on the Donegal division, is 8 per cent. Late additions to rolling stock are all standard equipments, and the old cars have been brought up as nearly as possible to present standards by introducing improvements, and in some cases by practically rebuilding them.

The most important improvement undertaken by the company was in the construction of a new power house and the rearrangement of its transmission and distribution systems. The old systems had several generating plants scattered throughout the county, but it is now proposed to generate all the current used for lighting, power and railway operation in one main power house and establish sub-stations at convenient points for transforming and distributing it.

MAIN POWER PLANT

The new power house is located at Engleside, in Lancaster County, on the banks of the Conestoga Creek, just outside of the city of Lancaster, and was designed with a view of furnishing sufficient current to operate all the railways and lighting of Lancaster, Columbia and other points in the county. The structure is of stone and brick, and is divided into boiler and storage room and an engine room by means of a brick wall running through the building. At the extremity of the division wall is a chimney, 175 ft. in height and 96 ins. in diameter. It is a self-supporting steel plate structure. Diagrams are presented herewith showing the general layout of the plant, the arrangement of the boilers, superheaters and engines and the piping system, also the details of the wiring system.

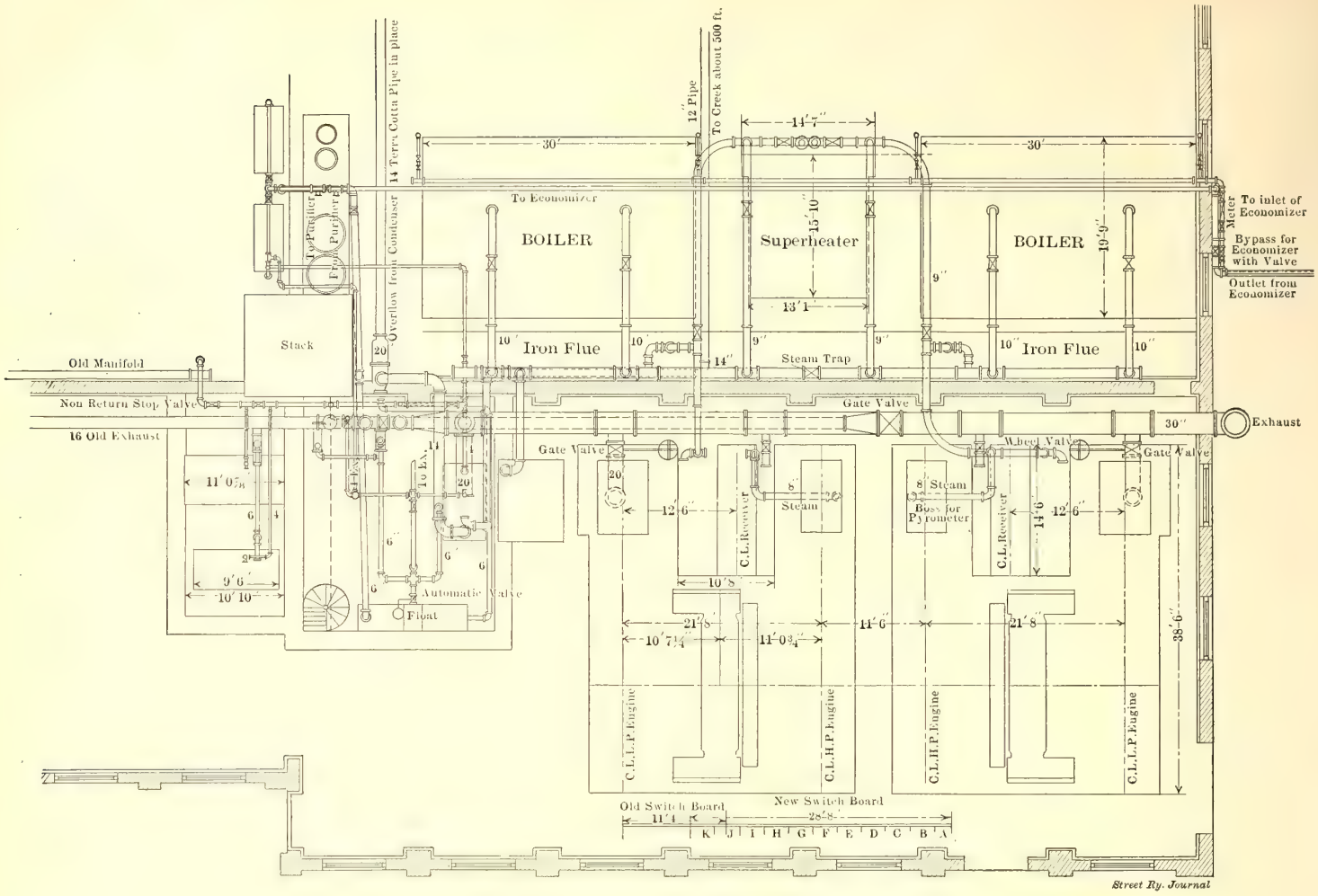
The boiler section contains four 520-hp Babcock & Wilcox boilers, arranged in two batteries, designed for a working pressure of 160 lbs. The boilers are hand fired. Coal bunkers have been arranged immediately in front of the boilers, and coal will be dropped into these bunkers from cars which are run into the power station on heavy trestle work immediately over the coal bunkers. An abundant water supply is always assured from Conestoga Creek. The steam plant includes a Green economizer, having 9792 sq. ft. of heating surface, one Worthington horizontal duplex jet condenser, 18 ins. x 22 ins. x 18 ins., two 12-in. x 7-in. x 10-in. Worthington horizontal duplex outside-center packed brass-fitted pumps, and one 4-in. Worthington hot water meter, designed for a working pressure of 185 per square inch.

ENGINE ROOM

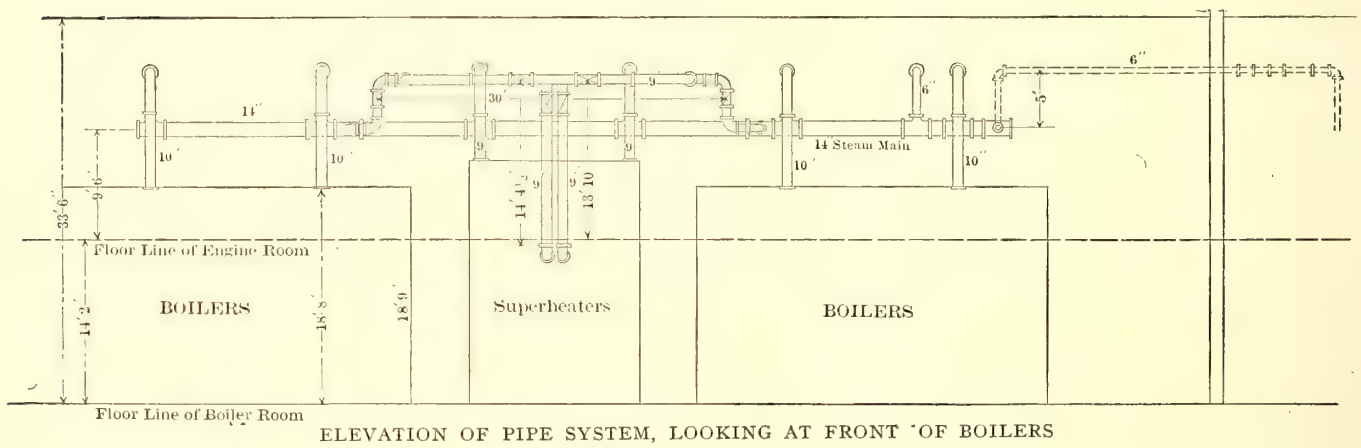
In the engine room provision has been made for three units, each comprising a 1000-kw alternator, directly driven by a 1500-hp engine. Two of these units have already been installed, and space has been provided for the third.

The engines are of the Rice & Sargent horizontal cross-compound condensing type, and were designed to utilize steam superheated to a temperature of 650 degs. to 750 degs. The cylinders are 26 ins. and 50 ins. in diamter by 48-in. stroke. They operate at 94 r. p. m., and the fly-wheels are 18 ft. in diameter, weighing 100,000 lbs. The boiler pressure is 150 lbs. The high-pressure cylinders on these engines are provided with poppet valves and with a special valve gear which, it is claimed, embodies some features of simplicity not possessed by similar engines abroad operating these valves. The clearance which usually in poppet valve engines is two or three times as much as in the Corliss type, in this case has been reduced to about the same figure without introducing any disadvantageous conditions. The poppet valves are so designed that they remain tight whether operated under saturated or highly superheated steam, the expansion of seat and valve being so balanced as to produce this effect.

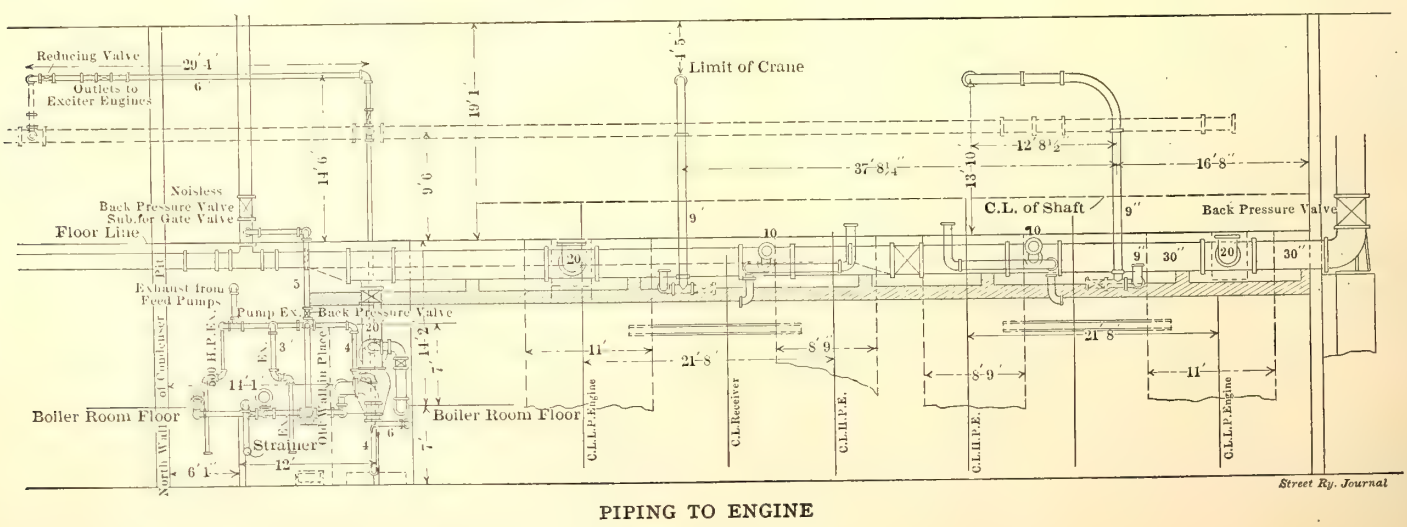
There are a number of special features on the high-pressure cylinder designed to overcome any difficulties which might be experienced in ordinary construction by the use of the high



PLAN OF STEAM PIPING FOR ENGLESIDE POWER HOUSE



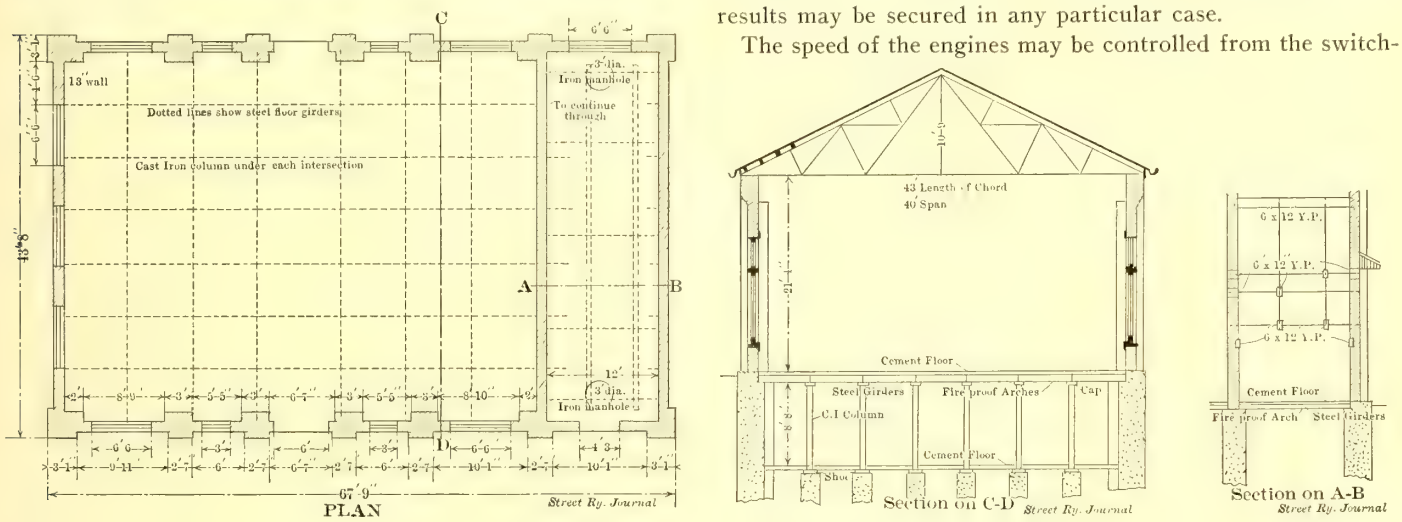
ELEVATION OF PIPE SYSTEM, LOOKING AT FRONT OF BOILERS



PIPING TO ENGINE

temperatures, including the arrangement of packing for piston rod and valve stems, construction of the piston and its packing and the design of the cylinder.

The principal feature of the engine, however, is the intermediate receiver, which has two functions; namely, to dry and superheat the steam passing from the high-pressure cylinder to the low, and to remove a portion of the superheat from the high-pressure cylinder, and give it up to the low-pressure cylinder. By this means the temperature in the high-pressure cylinder is kept down to a point which does not cause trouble from the defective lubrication or otherwise, and the temperature in the low-pressure cylinder being correspondingly raised, the efficiency of this cylinder is very much increased. To this end the main steam line is brought to the intermediate receiver before going to the high-pressure cylinder, and the receiver is provided with a valve which automatically by-passes a portion of the main steam through the coils of the receiver, where the superheat is taken from it, and the steam is then returned to the main steam line; mixing with the highly superheated steam and reducing its temperature. This reduction of



PLAN AND SECTIONS OF STANDARD SUB-STATIONS

temperature is greater for the late cut-offs than for the early ones. It was found that it was not possible to operate with late cut-offs at such high superheat as with early cut-offs—say 1-5 stroke or 1-6 stroke. The temperature in the low-pressure cylinder varies exactly in the opposite direction; that is, when the load is heavy, the low-pressure cylinder gets a higher superheat than when the load is light. This is possible, because at heavy loads the receiver pressure is higher, and, consequently, the temperature range in this cylinder is greater, permitting of a higher superheat.

The low-pressure cylinders are also provided with special packing pistons, etc., to utilize the temperatures met with, although this is not so necessary in the low-pressure cylinder as in the high. The valves and valve gear of the low-pressure cylinder are of the usual Rice & Sargent construction.

The Schmidt direct-fired superheaters are used with independent furnaces. The superheaters in general consist of coils of steel tubes, arranged so that they have absolute freedom of expansion and contraction, and all joints are kept out of contact with the flame or hot gases. These coils are secured to steel manifolds, which take the steam from the boiler, lead it to the tubes, and take it from the tubes to the engine.

The vital principal in this arrangement is the manner in which the steam is circulated through the two sets of coils, upper and lower. The upper set being of comparatively low temperature, the steam flows in them contrary to the flow of the gases; that is, the coldest steam meets the coldest gases. In the lower coils the circulation is reversed; that is, the coolest steam meets the hottest gases, and at the center where the two sets of coils meet the steam is taken out in a highly superheated condition. The object of this reversal of circulation is to protect the lower coils from burning out. If the hottest steam were allowed to be present in the tubes exposed to the hottest gases, the tubes would soon burn out; whereas, by protecting them with cooler steam the life of these coils is indefinitely prolonged.

The furnaces of these superheaters are arranged to ensure that the gases be thoroughly burned in a large firebrick combustion chamber immediately behind the grate, after which they are forced through a passage of fire-brick from the back to the front of the superheater, and there admitted to contact with the coils. In this way no flame is allowed to reach the tubes, and they are simply surrounded with hot gases in such a way as best to utilize the heat which these gases contain.

Tests of the superheater in active service have shown a very high efficiency, and the use of a separate furnace which can be operated to advantage gives not only very high efficiency of operation but also permits the superheat to be very exactly adjusted to the temperature at which, it is estimated, the best results may be secured in any particular case.

The speed of the engines may be controlled from the switchboard so that they may be regulated to take equal loads when the two alternators are operating in parallel.

ELECTRICAL EQUIPMENT

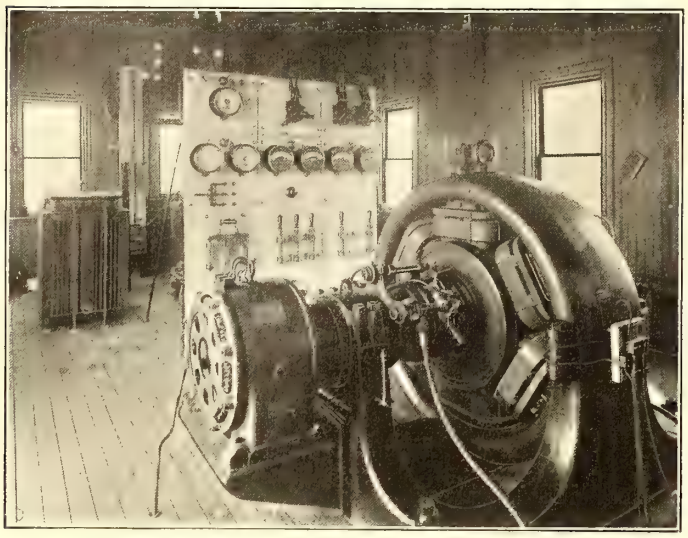
The generators are of the Westinghouse engine type, with rotating field, the rotating part being built upon a spider and arranged to be pressed upon the engine shaft, and thirty-two poles, designed for operation at 25 cycles, three-phase, developing 1000 kw at 7500 volts under normal conditions. The external frame is in a horizontal plane, and is movable parallel to the shaft to allow access to both field and armature winding. The field is designed so that the entire magnetic circuit shall pass through laminated sheet steel, and the pole pieces and field winding are especially proportioned so as to reduce the armature reaction and self-induction. The field coils are wound with strap on edge, and the armature winding also consists of strap-wound coils formed and insulated before being placed in the slots, and capable of withstanding a breakdown test of 5000 volts alternating current.

A load of 251 amps. per terminal at 2300 volts and at 100 per cent power factor may be thrown off, and the pressure will not rise more than 8 per cent, the speed and excitation remaining constant. The machine is capable of operation for twenty-four hours at full load with a rise in temperature not to exceed 40 degs. C., and at 25 per cent rise not to exceed 50 degs., 50 per cent overload bringing the rise up to 60 degs.

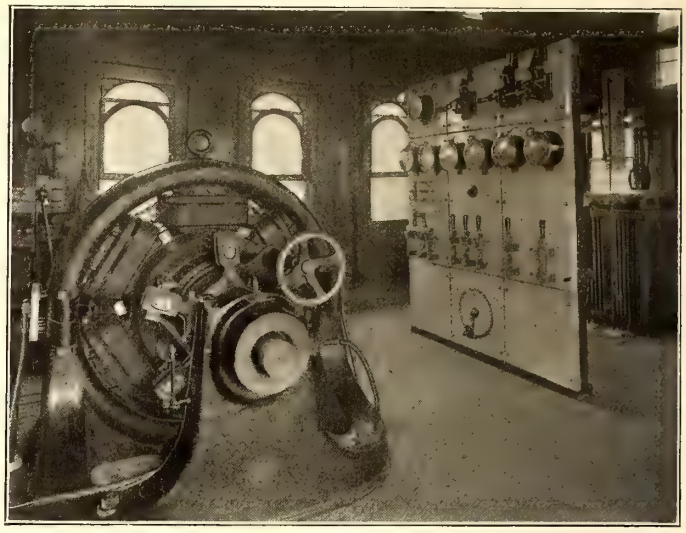
TRANSMISSION AND DISTRIBUTION

Alternating current is used for lighting, power and railway work. It is taken from the main power house and transformed

into direct current by means of rotary converters, and utilized for incandescent lighting throughout the city of Lancaster.



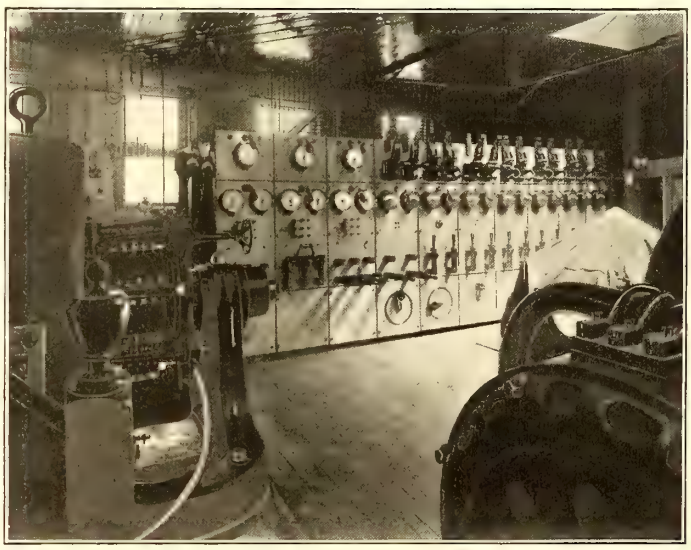
LAMPETER PLANT FOR STRASBURG LINE



NEFFSVILLE STATION

The alternating current from the power house is also used to operate induction motors, located in the factories in and about Lancaster. The greater part of the power, however, is distributed throughout the county for the operation of railway lines.

The generating station and the transforming apparatus are housed in independent buildings, each designed for its particular purpose. The leads from the generators are carried to the switchboard through non-automatic circuit breakers, which are directly connected to the bus-bars, and from the bus-bars through automatic circuit breakers to the feeder switches, and from there are carried through an underground tunnel, supported on petticoat insulators to the transformer house, which is in a separate building about 30 ft. from the main power house. Here it is connected with Westinghouse oil-cooled transformers, stepping up the voltage to 10,000 volts, then passing through high-tension circuit breakers and from there conductors are carried through a 12-in. wall to the lightning arrester room, which is entirely separate from the transformer house, and thence out on the line to be transmitted to the sub-stations, and distributed to the trolley feeders.

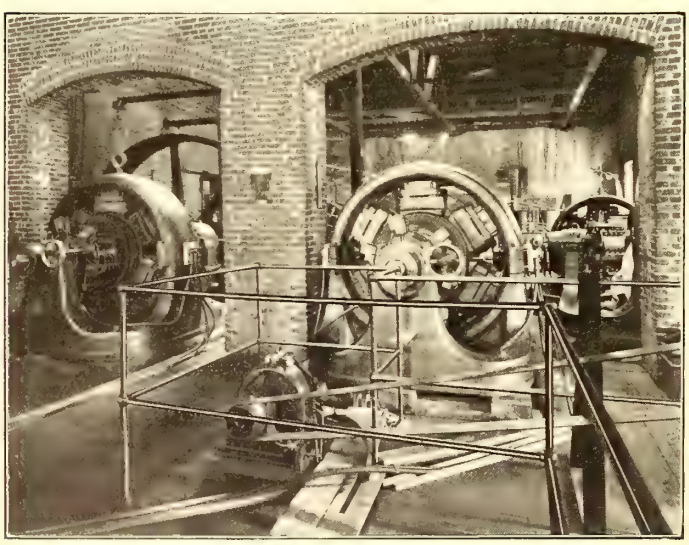


ORANGE STREET SWITCHBOARD

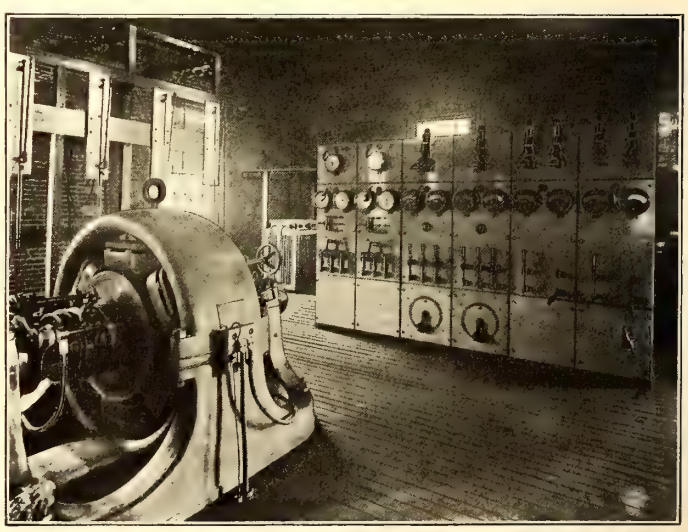
SUB-STATIONS

Sub-stations have been established at Lampeter, Mechanicsburg, Neffsville, Columbia, Reamstown and in the old power house and car house at Lancaster. The company also has a portable sub-station, which has been found to be a valuable adjunct, the equipment of which is fully illustrated herewith.

The main railway sub-station is located in the center of the



TEMPORARY PLANT AT CAR HOUSE



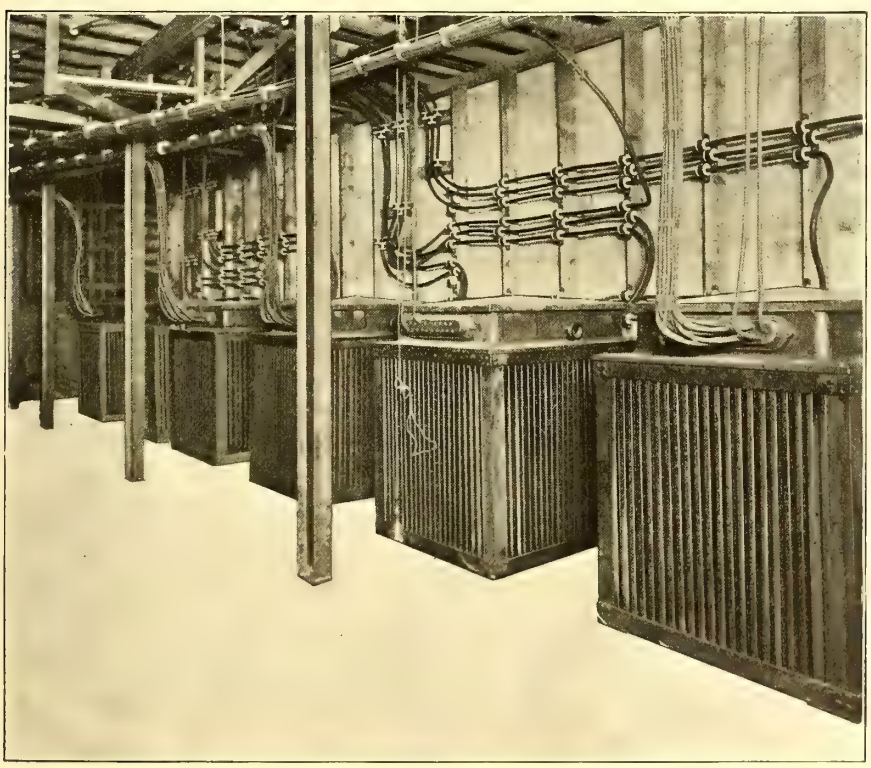
SIX-PANEL SWITCHBOARD AT MECHANICSBURG

TYPICAL SUB-STATION EQUIPMENTS

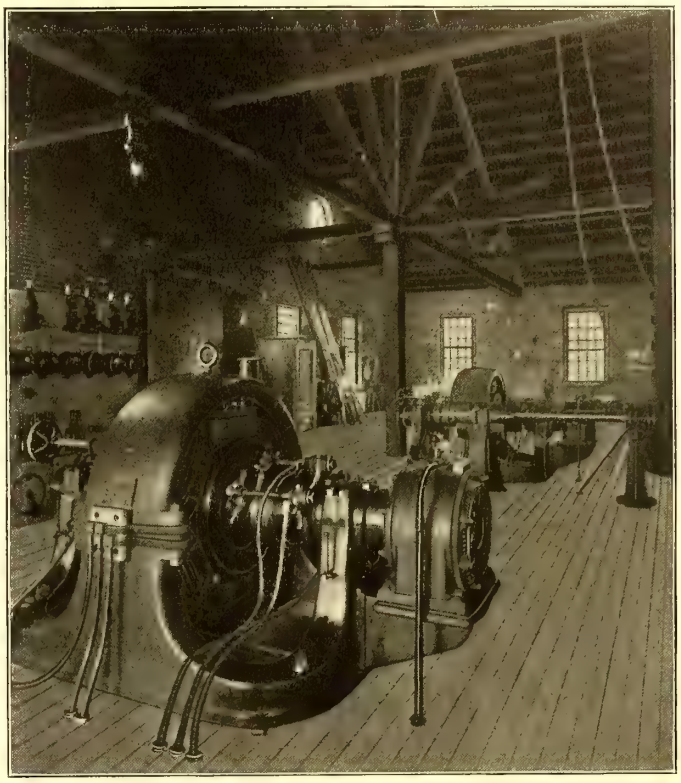
city of Lancaster, and is known by the name of the car house sub-station. It contains three 300-kw rotary converters, also a belted 350-kw, two-phase, 3000-alternation, double-current generator, with the necessary transformers and switchboards to control the feeder circuits. The Orange Street sub-station is 1½ miles from the power house and contains two 300-kw rotaries. Located at Columbia, Pa., is the Columbia sub-station, which contains two 200-kw, three-phase, rotary converters, with the necessary transformers and switchboard. The sub-station at Neffsville feeds the Lititz and Manheim lines, and contains a 200-kw rotary with the necessary step-down converters, circuit breakers and arresters. A similar sub-station is located at Mechanicsburg of 250-kw capacity, to feed the Ephrata and New Holland lines. A 200-kw rotary sub-station is also located at Lampeter, which is operated in connection with the Strasburg line.

Miles of Track from Lancaster to	Sub-station; Number and Sizes of Machines	Track to	Miles from P'w'r H'se
Near ends of all suburban lines	Car-barn sub-station—three 300-kw rotaries Orange St. station—two 300-kw rotaries.	City Lines 18.18 miles Rocky Springs 4.64 miles Millersville 5.07 miles	2 1½
4.92 miles from Lancaster-Center Sq. to.....	Neffsville, 1-200 kw	5.21 miles to Lititz 8.01 miles to Manheim	6
7.22 miles from Lancaster-Center Sq. to.....	Lampeter, 1-200kw	4.74 to Strasburg	5
10.62 miles from Lancaster-Center Sq. to	Columbia, 2-200kw	6.50 to Marietta 2.00 Columbia Belt Line	11
7.87 miles from Lancaster-Center Sq. to.....	Mechanicsburg, 1-250 kw	7.33 to Ephrata 5.56 to New Holland	9
3.33 miles from Ephrata to...	Reamstown, 1-300 kw	4.67 to Adamstown	20

The company's portable sub-station of 250-kw capacity with step-down converters, circuit breakers and arresters, can be utilized at any point on the road where there is an unusual demand. This station is now operating on the Ephrata and Adamstown line. It has a 250-kw rotary, and the high tension is now controlled by a 10,000-volt oil-circuit breaker mounted on two marble slabs back of the other switchboards. The old 300-kw double-current machine will later replace the temporary equipment at Reamstown. All the electrical apparatus for the main power house and sub-stations was furnished by the Westinghouse Electric & Manufacturing Company.



TRANSFORMER COMPARTMENT, ORANGE STREET SUB-STATION



ROTARIES AT COLUMBIA

The accompanying table shows the size of each of the rotaries employed, the name of each sub-station and approximately the number of miles of track fed by each one. The feeders from all the sub-stations run into the bus-bar at the car house, and all run in parallel with the three machines in the car house station. The average load at the power house during the morning is about 700 kw to 900 kw, and sometimes there is a demand for 1200 kw to 1300 kw for a short time. In the afternoon the load will average 500 kw to 600 kw on each machine, and 800 kw to 900 kw in the evening, with all the lights on. There are sometimes demands of 1200 kw on each generator.

The distance from Lancaster to the principal points reached are:

	Miles
Ephrata	15.20
Adamstown	23.11
New Holland	13.46
Lititz	10.13
Manheim	10.93
Strasburg	11.96
Columbia	11.46
Marrietta	16.69

ROLLING STOCK

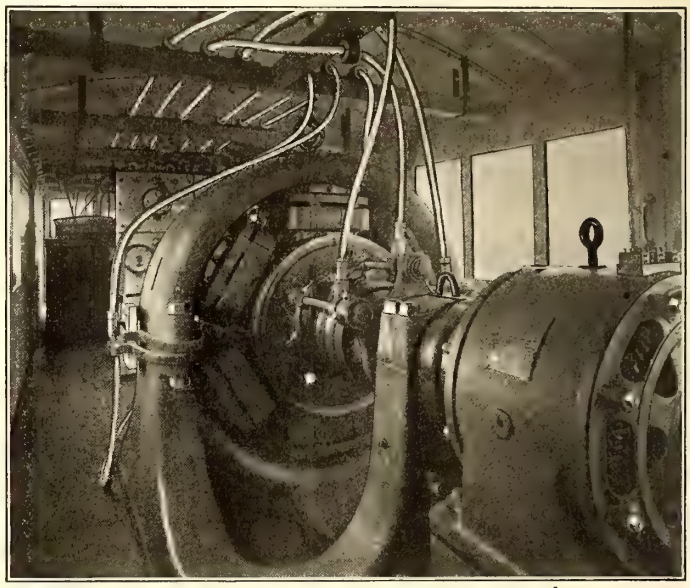
During the last two years the company has endeavored to standardize the equipment throughout, and much of the rolling stock has been overhauled with this in view. The cars for the several lines differed considerably in many particulars, the equipment comprising half a dozen different types and nearly all the prominent manufacturers being represented among the

builders of the cars. A recent inventory showed that the company had forty-eight closed cars, ranging from 24 ft to 41 ft. in length, 32 open cars, 25 ft. to 36 ft. long, nine work cars and snow plows, and nine ballast trucks. The latest equipments include semi-convertible and open cars of the Brill pattern.

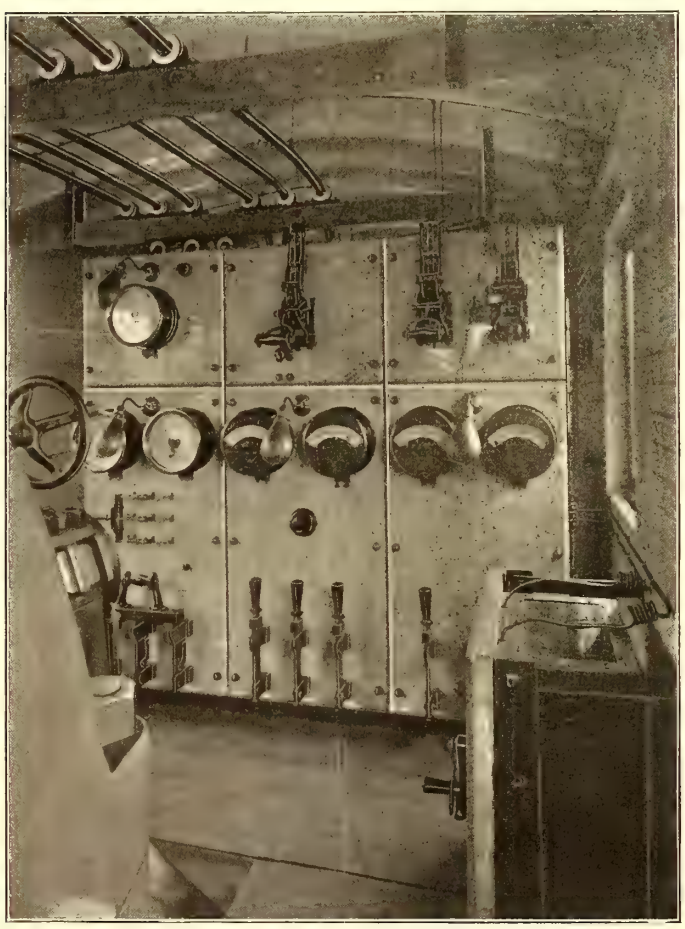


PORTABLE SUB-STATION

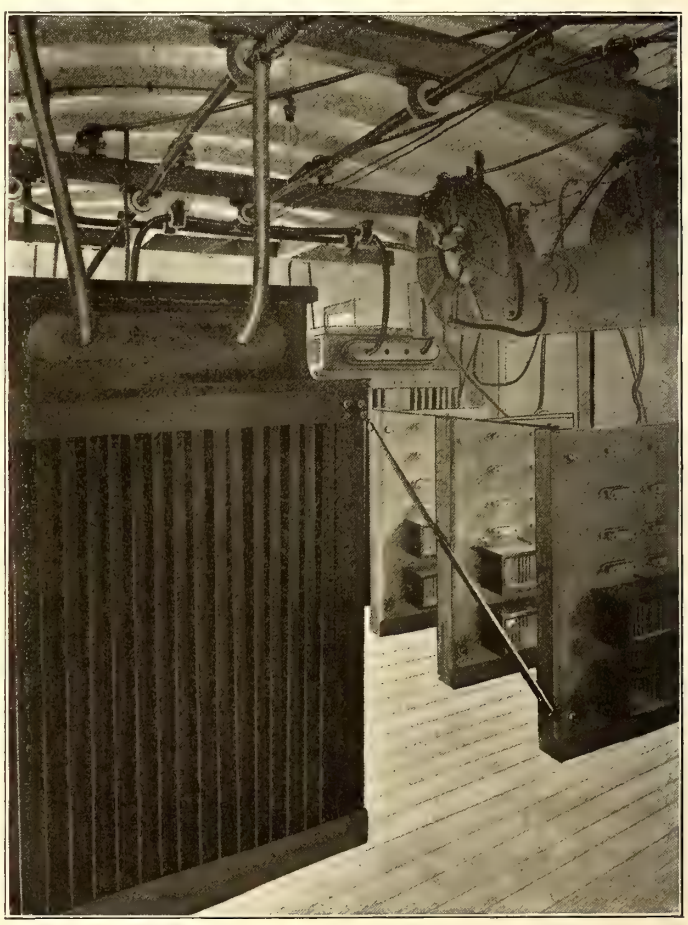
The company's semi-convertibles include four combination and eight passenger cars. These are 41 ft. long over all, and each car is equipped with four 30-hp Westinghouse motors, K-12 controllers, electric heaters, electric headlights and Christensen air brakes. The general dimensions of the two semi-convertible cars recently ordered for the Lancaster & Rocky Springs division are as follows: Length over end panels, 28 ft.; over crown pieces, 37 ft. 5 ins.; width over sills, 7 ft. 10½ ins.; over posts at belt, 8 ft. 2 ins.; sweep of posts, 1¾ ins.; center posts, 2 ft. 8 ins.; side sill, size, 4 ins. x 7¾ ins., plated, ⅜ in. x 12 ins.; end sills, 5¼ ins. x 6⅞ ins.; thickness of corner posts, 3¾ ins., of side posts, 3¼ ins. The inside finish is in natural cherry with decorated birch ceilings. The cars are mounted on Brill 27-G trucks, with 4-ft. wheel base, 33-in. wheels, 4-in. axles, and are equipped with four 30-hp motors and K-12 controllers. The general dimensions of the four ten-bench open cars are as follows: Length over crown pieces, 28 ft. 8⅜ ins.; center corner posts over crown pieces, 4 ft.; width over sills, 6 ft. 6 ins.; over posts at belt, 7 ft. 4½ ins.; sweep of posts, 5 ins.; centers of posts, 2 ft. 8 ins.; side sills, size, 3¾ ins. x 7 ins., plated, ½ in. x 7 ins.; thickness of corner posts, 3⅝ ins.; outside posts, 2¾ ins. These cars have cherry and ash finish and decorated birch ceilings. They are mounted on Brill 21-E trucks with 7-ft. wheel base, 33-in. wheels, 4-in. axles, and are equipped with two 30-hp motors and K-10 controllers.



ROTARY IN PORTABLE SUB-STATION



SWITCHBOARD IN PORTABLE SUB-STATION



TRANSFORMERS AND LIGHTNING ARRESTERS

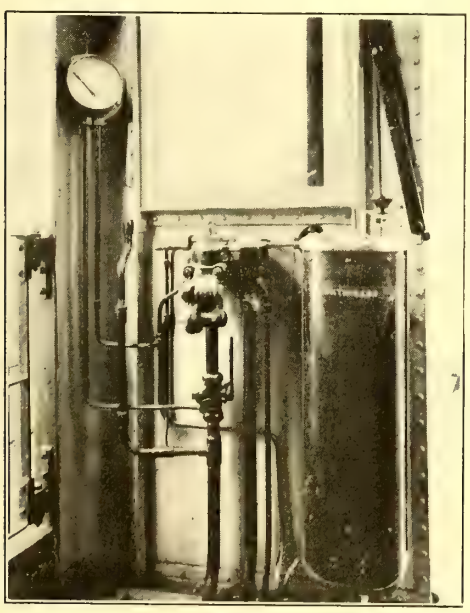
FIREPROOF CARS ON THE CENTRAL LONDON

Announcement was made in this paper last year of the decision of the Central London Underground Railway Company to adopt motor cars in place of locomotives. The change was made partly to avoid vibration, due to the uncushioned weight of the motors on the axles of the locomotives and partly to secure better acceleration. The old locomotive train had a maximum acceleration of 1.4 ft. per second per second, and an average acceleration of 0.7 ft. per second per second, while with a motor-car train, consisting of two motor cars and five trail cars, the maximum acceleration could be increased to 2½ ft. per second per second, and the average acceleration to 1 ft. per second per second. Owing to the limited amount of head room a special design of motor car had to be built, and that finally selected was illustrated in the STREET RAILWAY JOURNAL for Oct. 11, 1902 (International edition for October). Two experimental trains of this kind, consisting of two motor cars and four trail cars, and equipped with the type-M controller system, have been on trial on the Central London Railway for the past eighteen months, and have been adopted as standard for the future operation of the line, except that as a rule five trail cars will be used with two motor cars to make up a train.

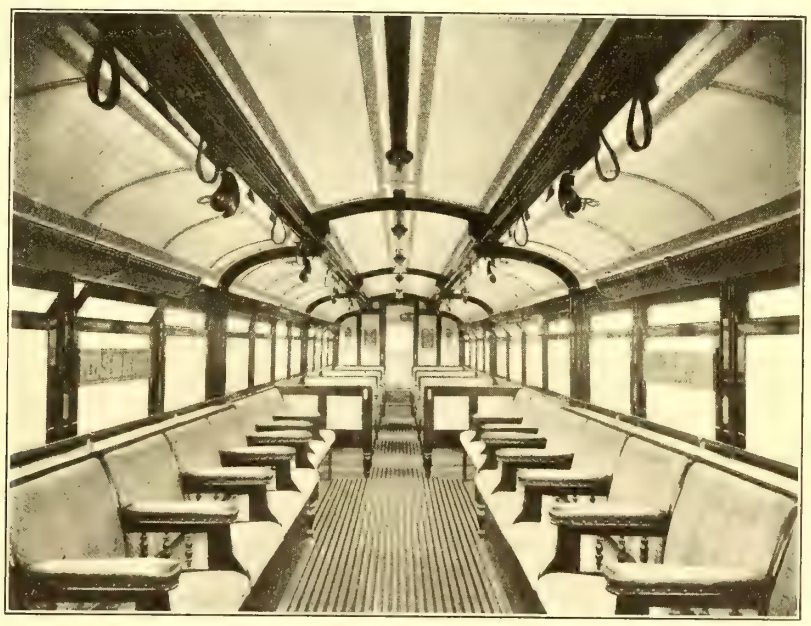
The motor cars are equipped with two 125-hp motors, supplied by the British Thomson-Houston Company. Both motors are mounted on the same truck, which is equipped with 34-in. wheels, and which is at the front end of the car in the case of the forward motor car or at the extreme end in the case of the rear motor car. The wheels on the trail trucks of the motor cars and on the trail cars are only 29 ins. in diameter.



TRAIN OF FIREPROOF CARS ON THE CENTRAL LONDON



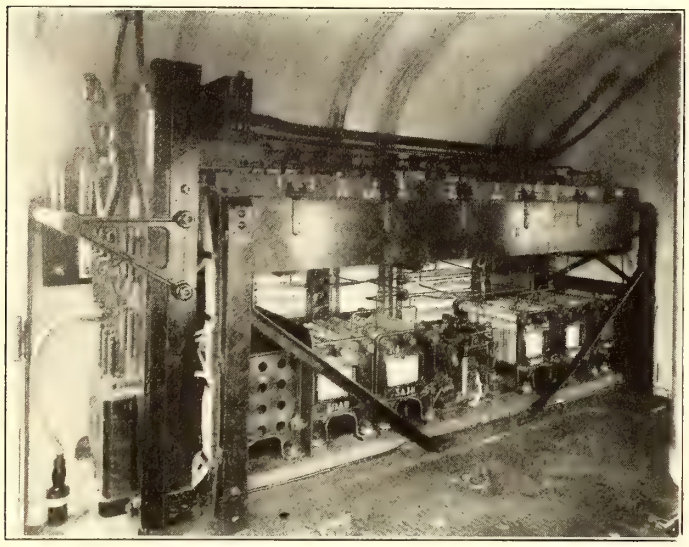
CONTROLLER AND BRAKE MECHANISM



PASSENGER COMPARTMENT

A special motorman's compartment has been designed over the motor trucks to accommodate the electrical equipment. The frame work of this compartment is bolted to the frame work of the car, and is a self-contained steel structure. The framing is made up of steel angles with a front screen of sheet

steel glazed in the upper part and provided with a double sliding steel door, also glazed. The sides of the cab are closed for a portion of their length by swing gates with outside handles. The remainder of the side is of sheet steel with louvres in the angle-steel sliding frame, which are suspended by rollers on steel rails. The rear portion of the cab is also



CONTROLLING MECHANISM ON DRIVING PLATFORM

sheet steel, and is provided with an opening to the passenger compartment. This entrance is normally kept closed by a sheet-steel door. This door is lagged with ⅛-in. uralite or asbestos on the side nearest the passenger compartment, and is covered with uralite panels veneered with sycamore and framed with teak on the passenger compartment side. The rear partition of the cab is 1 in. clear of the nearest part of the end panels, the space being filled in with fire-resisting material. A sheet of ⅛-in. uralite or asbestos is placed over the whole rear partition between it and the body framing. The floor of the cab is composed of chequer plates, except on the front platform, which is the same as the passenger compartments. These chequer plates are hinged to give access to the motors. The roof of the cab is also of sheet-steel.

Each motor weighs 4375 lbs., including gears. Of this weight 2040 lbs. is borne by springs. With 200 amps. at 500 volts, each motor gives a tractive effort of 3150 lbs. at a speed of 14½ m. p. h., measured at the tread of the wheel, which, as stated, is of 34 ins. diameter. The temperature rise after a day's service of sixteen hours is about 30 degs. C. above atmosphere.

The collector shoe is of chilled iron, suspended from the truck by four links. The truck supporting the passenger end of the carriage is, to all intents and purposes, the same as that of the trailer carriage, save that it has a wider wheel and carries a collector shoe like that on the motor truck.

The master controllers, contactors, reversing switches, resistances and the various other apparatus, are carried on the driving platforms of the motor cars. The contactors are carried on an angle-steel frame inside the cab, and below them are located the reversing switch and rheostats. A slate panel behind the driver carries the switches and fuses for the main motor circuit, control circuit, lighting and air compressor circuit. The motor circuit connections on the switchboard are of bare copper rod, while those of the control circuit are of asbestos-covered wire.

The air compressor, main reservoir, tool chest and sand box are situated on the opposite side of the cab to the switchboard. A series motor directly drives the compressor, which compresses 20 cu. ft. of free air per minute, and is provided with an automatic governor which cuts off the current when the reservoir pressure reaches 90 lbs. per square inch, and switches it on when the pressure falls to 80 lbs.

The master controller, as mentioned before, is situated on the driving platform, together with the apparatus for operating the air brake, as are also the ammeter, voltmeter, air-pressure gage and hand-brake wheels.

Each motor car, with the full complement of passengers, weighs 23 tons, 16½ tons of which are supported by the motor truck, and 6½ tons by the truck at the passenger end of the car. The trailer cars have a seating capacity for forty-eight passengers, the motor cars for forty-two.

The weight of one of these seven-car multiple-unit trains is 132.5 tons, while a seven-car train with gearless locomotive weighs 159.6 tons.

NEW SUB-STATION ON THE PORTSMOUTH, KITTERY & YORK STREET RAILWAY

A new sub-station has recently been placed in operation by the Portsmouth, Kittery & York Street Railway, at York Corner, Me., a junction of three roads leading to York Village, Dover, N. H., and Kittery Point. It is designed to furnish power to cars operating between Kittery, York Beach and Dover, and helps out the existing station at Kittery Point. It is also operated in conjunction with the company's storage battery at Long Beach.

Power is supplied to the sub-station at 10,000 volts over a three-phase transmission line of No. 6 B. & S. bare copper, running from the Dover station of the United Gas & Electric Company. The building is of dark wooden shingle construction, one story in height, and presents an unusually neat appearance. The roof is of the usual pitched variety, painted a tasteful green. The location of the station is on the edge of a meadow, and light and fresh air are present in abundance for the comfort of the attendants.

The interior of the building is 30 ft. long by 20 ft. wide, and is divided into two rooms, one for the machinery, switchboard and transformers, and the other for a passenger waiting room. The waiting room is neatly finished, has comfortable benches on three sides, and is well lighted from two large windows of



PORTSMOUTH SUB-STATION

north and west exposure. Mounted on the wall of the waiting room is a telephone for the use of car conductors in reporting their arrivals to the despatcher at the Kittery Point car station. When the cars are late this duty is performed by the sub-station operator. The waiting room is 12 ft. long by 8 ft. wide.

The machine room contains a 200-kw, twelve-pole, 550-volt, 60-cycle three-phase Westinghouse railway rotary converter, running 720 r. p. m., three 76-kw Westinghouse stationary transformers, a two-panel switchboard, and the usual complement of lightning arresters. The rotary has horizontally-split fields, compound wound, and is brought up to synchronism in starting by a special induction motor, mounted on the armature

shaft. The end play attachment of the rotary shaft is operated by springs. The induction motor is overhung, and is run from the low-tension side of the transformers, which are conected in delta. The designated primary voltage is 11,000, and the secondary 391. The transformers are oil-cooled, and are operated without oil switches. They are insulated from the concrete floor, and in working upon them the attendant stands upon a varnished platform supported above the floor by triple petticoated glass insulators. Rubber floor mats protect the operator when adjusting the brushes of the rotary. The high-tension wiring passes from the transmission-pole insulators to porcelain insulators on a horizontal wooden beam, supported near the roof on the west side of the building. The conductors spread in descending to a width of about 36 ins. between centers, and pass into the building through porcelain bushings set in the wall. These bushings are given an outward and downward inclination for the purpose of carrying the drip water of drainage away from the machine room. The conductors pass through three choke coils, one for each phase, after entering the station, and then go to three single-throw, spring-break pole switches, fitted with fuse attachment. The lightning arrester leads top off before the station switches are reached. No oil switches are in use in the station. The high-tension insulators are all porcelain, and are supported on stout oak pins. From the pole switches the 10,000-volt current passes to the transformer primaries. The secondary leads are carried below the sub-station floor in pipes to the switchboard, and from thence to the alternating side of the rotary through series transformers for instrument purposes. The direct-currrent and induction motor wiring also passes beneath the floor. The outgoing feeders pass up the wall and through bushings to the outside of the building, back of the switchboard.

The switchboard consists of two blue Vermont marble panels, supported by angle-irons. The distance between the wall and the nearest angle-iron is 30 ins., and the clearance between the wall and the nearest switchboard projection about 20 ins. One panel is for direct-current control, and contains an automatic circuit breaker in series with the 550-volt supply to the trolley; a direct-current ammeter for the rotary output, a field rheostat, double pole positive and negative switch, a voltmeter plug for reading both sub-station and Kittery Point station voltage, and a bracket lamp.

The other panel contains three alternating-current ammeters, one in each phase of the rotary leads, two synchronizing lamps for throwing the rotary into connection with the Dover power supply, two synchronizing buttons, a triple pole, double-throw horizontal knife switch for the induction motor, and a triple pole, single-throw low-tension knife switch for connecting the rotary with the transformer secondaries. The instruments are all round pattern, Westinghouse make. There are also two voltmeters on brackets, direct and alternating current respectively, and two bracketed lamps for the instruments on the alternating panel.

The machine room is lighted by a cluster of five-series incandescent lamps, set overhead in the middle of the room, and has ample windows. A large double sliding door permits the ingress or egress of supplies, and the room is fenced off to prevent the entrance of the too curious public. A water supply from the town mains is brought to the sub-station in a vertical pipe just outside. On top of the waiting room and in the north corner of the machine room is ample storage space.

ELECTRICAL EQUIPMENT OF THE DUNEDIN TRAMWAYS, NEW ZEALAND

The work in connection with the installation of the Dunedin electric tramway system, at Dunedin, New Zealand, is proceeding rapidly. Messrs. Noyes Brothers, the engineers, have already laid about 5 miles of track and erected most of the poles for the overhead work. The car house is completed, and ten of the cars are assembled. The cars are of Brill manufacture with 21-E trucks, fitted with Westinghouse magnetic brakes, and are equipped with Westinghouse motors and controllers with brake notches. It is proposed eventually to operate the generating plant by water power, but until the hydraulic work is completed a temporary steam plant is installed for the time being. The steam plant consists of three 200-kw Westinghouse generators coupled directly to Belliss Morcom engines, the boilers being of Babcock & Wilcox type. The steam plant is well under way, and it is anticipated that some of the cars will be operating in December. W. G. T. Goodman is the engineer in charge of the designing and construction, on behalf of Messrs. Noyes Brothers, his principal assistants being J. H. D. Brearley and F. R. Shepherd.



OPERATING TROLLEY CAR THROUGH FLOODED STREET IN LOS ANGELES

TROLLEY OPERATION UNDER DIFFICULTIES

The accompanying illustration shows a car of the Pacific Electric Railway Company, of Los Angeles, passing through Grand Avenue on its way to Redondo Beach. This photograph is one of particular interest, as it was taken during the rainy season on the coast, and it illustrates very strikingly the peculiar difficulties the street cars have to encounter in several streets of Los Angeles during the rainy season.

In the recent vote by the people of San Francisco on the question of authorizing the city to issue bonds to take over the Geary Street, Park & Ocean Railroad, the returns showed that in the lodging-house districts the vote was largely in favor of municipal control; that in the residence districts the vote was almost evenly divided, and that in the wealthier sections the sentiment was against the issue.

CENTER GRAB HANDLES

A novel feature in grab-handle construction in use on a number of European tramways is illustrated in Figs. 1 and 2. It consists of a post supported from the center of the step and extending to the hood. Of course, one use for this post is as a support to the upper deck of a double-deck car, but the post has other advantages which might make it of value on single-deck cars when a broad platform is used. In the first place, it divides, to a certain extent, the incoming and outgoing passengers, the latter leaving through the space nearest the car body, while the incoming passengers enter between the post and the dash, and then it furnishes something to grasp firmly with both hands, which is convenient for many people, especially elderly passengers, and often prevents accidents. In the two illustrations shown, the step is on the left-hand side of the car, as they are of cars on the Liverpool Tramways, and the practice in England is for the cars on a double-track road to use the left-hand track. Fig. 1 shows the post mounted on a wooden step and Fig. 2 on a Stanwood step.

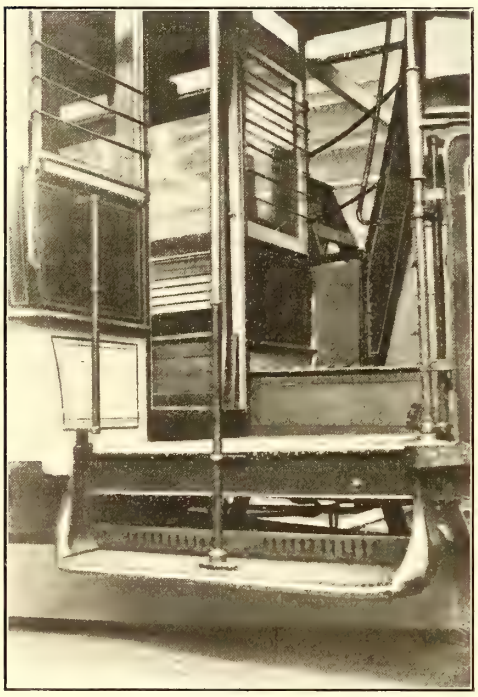


FIG. 1.—GRAB-HANDLES AND CENTER-POST

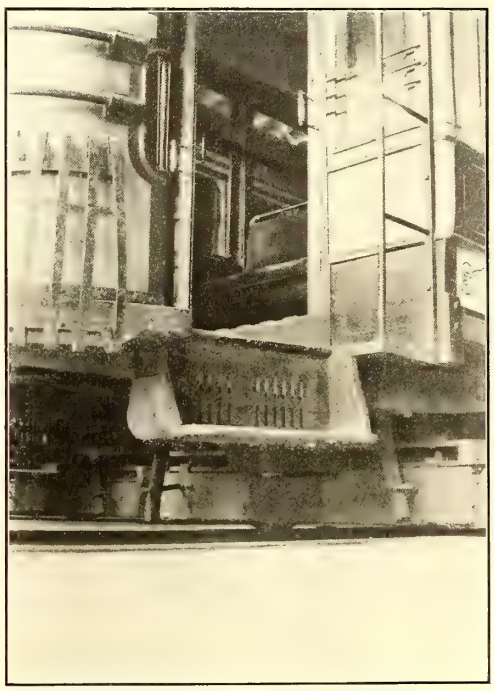


FIG. 3.—GRAB-POST AND LADDER

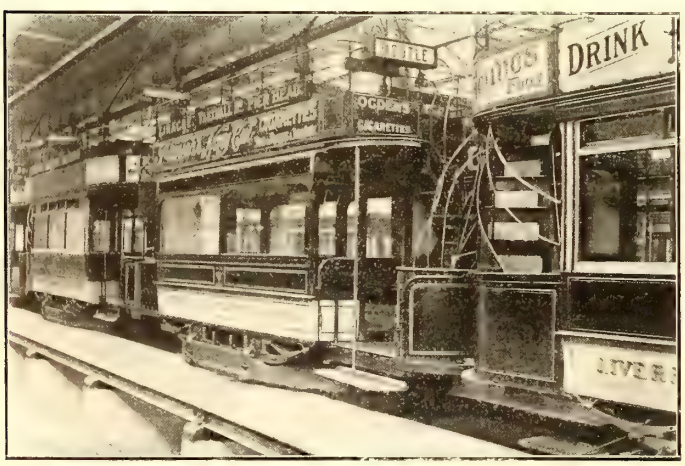


FIG. 2.—POST MOUNTED ON LIVERPOOL CAR

In these Liverpool cars the distance between the center post and the dash post is 22½ ins., and the distance between the center post and the end panel of the gate post is 21½ ins. The post is of iron covered in the center with a brass pipe.

Fig. 3 illustrates a combination grab post and roof ladder used on some of the cars of the Grosse Berliner Strassenbahn, of Berlin, Germany. These are single-deck cars, and the ladder is used only by repair men who have to mount the roof. The construction is neat in appearance, gives assistance to the boarding passenger and affords a certain amount of protection at the end of the platform near the car door.

CAR HOUSE TESTING ROOM

COLORADO SPRINGS & INTERURBAN RAILWAY COMPANY
Colorado Springs, Oct. 12, 1903.

EDITORS STREET RAILWAY JOURNAL:

A description of the "testing room" located in our new car house may be of interest to some of your readers. This is a small room equipped with a small switchboard, carrying a standard Weston voltmeter and ammeter. The switchboard is also equipped with two General Electric magnetic blow-out hand switches, from which two motors can be tested, one against the other or singly, as desired. The switchboard is protected by a General Electric automatic circuit breaker, with a range of from 100 amps. to 300 amps. capacity. The board has binding posts, so that any switch desired can be used to open or close the circuit under test.

From one of these binding posts is a wire leading to a trolley wire run alongside the main trolley wire, on which the trolley on any car can be placed and readings taken from the meters in the testing room without running wires to or from the car under test. If desired, a standard resistance can be connected across the binding posts at the switchboard and in series with this false trolley wire. By taking readings from volt and ampere meters the total resistance of the circuit under test can be readily determined, and by subtracting the standard resistance from total resistance the resistance in car circuit may be obtained. By this method one can readily observe how cars work on different notches of the controllers, thus enabling one to adjust the resistances under the car satisfactorily.

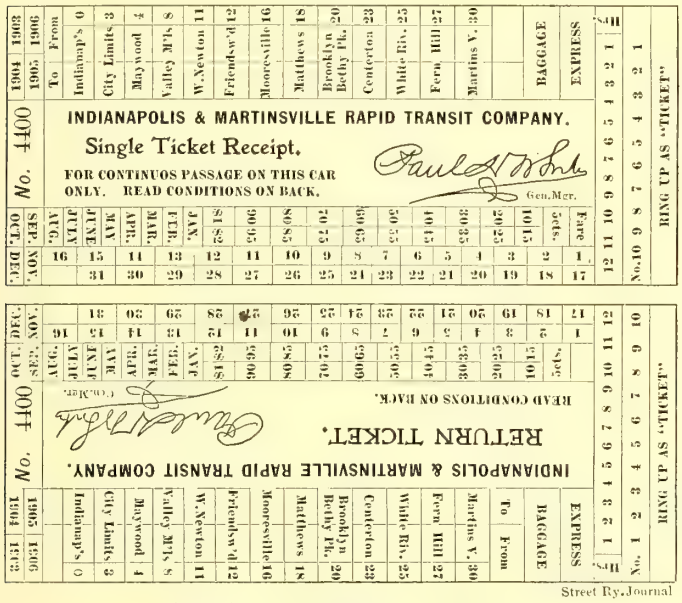
There is a small window on one side of this room, directly in the center of the testing track, from which the man making the test can see the operator of the car under test. Directly under the eyes of the man making the test are the meters, and to the right and within easy access is the switchboard. In connection with this switchboard are the switches, plugs, resistances, etc., for testing arc lights, headlights, incandescent lights, etc.

This room is equipped with a standard direct-reading ohmmeter, a Conant coil-tester, a Whitney bond-tester, a magneto bell and small tools, etc., for making tests. On the wall of the room is an air gauge and coupling for testing and setting air governors for air-brake cars. After the governor has been repaired and tested electrically it is then put under the final air test, after which it is ready for use. On two sides of the room is a small bench used for making light repairs. In one of the corners is a desk used for keeping all records of tests, car records, etc. We have found that this little room with its conveniences is a very indispensible feature in an electrical street car shed or barn.

D. L. MACAFFREE, General Manager.

TICKETS ON THE INDIANAPOLIS & MARTINSVILLE LINE

The accompanying illustrations are reproductions of the form of ticket used on the Indianapolis & Martinsville Rapid Transit Company's line, as designed by Paul H. White, general manager. One peculiarity of this ticket is that when half of it is used it constitutes a single ticket receipt for the passenger,



Street Ry. Journal

SPECIAL INTERURBAN TICKET

and the return ticket part is turned in by the conductor as the stub of this receipt. If a return ticket is issued to the passenger the whole ticket is torn out, including both the single ticket receipt and the return ticket. Either ticket must be punched or torn from the book in the presence of the passenger and rung up as a ticket on the fare register. The same ticket is used for transportation of baggage or express when so punched.

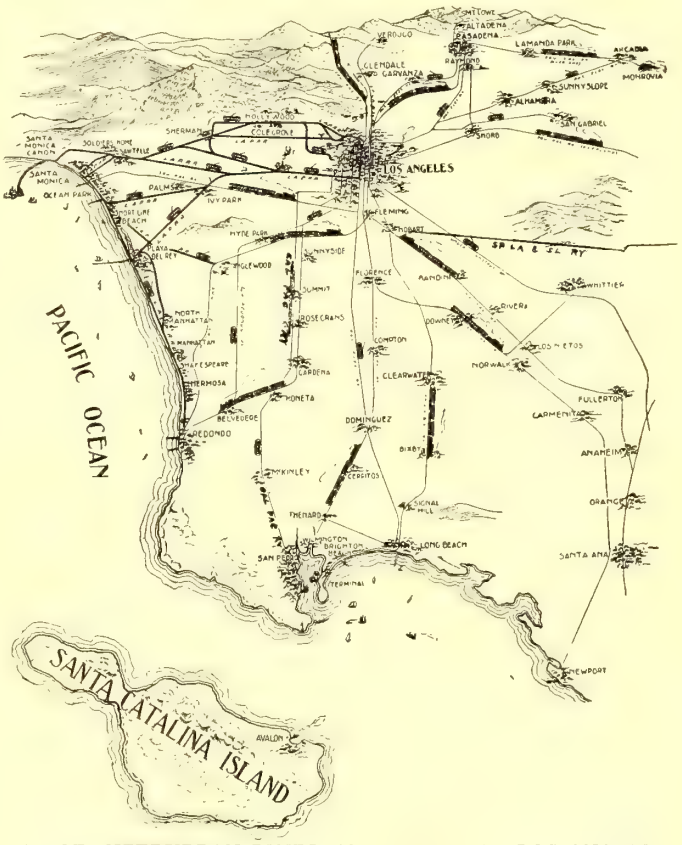
PROPOSED ELECTRIC RAILWAY BETWEEN HOUSTON AND SOUR LAKE, TEX.

The announcement is made that the Houston, Liberty & Sour Lake Interurban Railway has been financed. The plan of the company is to build an interurban electric railway between Houston and Sour Lake, covering a distance of 57 miles, or 8 miles less than the distance on the Southern Pacific Railroad, which it will parallel between those points. Houston, the main terminal, has a population of 100,000, and for the first 10 miles east of that city the line runs through one of the finest truck farming countries in the world and a region that is developing very rapidly. For the next 10 miles the road runs through forest land that has not yet been developed; then for 10 miles it runs through what is known as "the rice belt." It then touches Liberty, a town with a population of 3000. Between Liberty and Houston there are scattered along the line small towns with populations ranging from 500 to 1000. The first city of importance after leaving Liberty is Big Hill, which is about 10 miles out. The country between Liberty and Big Hill is principally devoted to agriculture. At Big Hill oil development is being carried on that promises to be almost as extensive as that at Sour Lake or Spindle Top. Ten miles east of Big Hill is Sour Lake, a city of 7000 inhabitants. At the latter place connections will be made with the Beaumont & Sour Lake Electric Railway, and connections will also be made with the line projected to Saratoga. The Beaumont & Sour Lake road is already under construction, and while interests identified with the Houston, Liberty & Sour Lake Railway are connected with it, it is denied that there is any connection between the two companies. Practically all of the right of way has been obtained for the Houston, Liberty & Sour Lake Railway. It is planned to build the line up to the standard of recent interurban practice. Seventy-two-pound T-rail will be used and the track will be thoroughly ballasted. Timber sufficient for bridging, piling and other work is at hand. It is planned to handle passengers, freight and express traffic. Edward Kennedy, of Beaumont, is in active charge of the affairs of the company.

INTERURBAN ELECTRIC ROADS OUT OF LOS ANGELES

The Los Angeles-Pacific Railroad Company has just issued a map showing the city and suburban lines, steam and electric, in and about Los Angeles, Cal., and connections with surrounding towns. The map is drawn to scale and the relative positions of the various localities are correct, except for Santa Catalina Island, which should be much farther from the mainland. Proposed lines do not appear on the map. One from Los Angeles to Glendale, a distance of 10 miles, is about to be built by the Los Angeles & Glendale Electric Railway Company, while the Pacific Electric Railway Company has completed surveys for an extension from Monrovia to Azusa, Covina, Lordsburg, Pomona and Ontario, a distance of about 20 miles. The latter company will also extend its proposed line from Whittier to Santa Ana on to Newport, and a branch is also building from Dominguéz to Wilmington.

The map shows, furthermore, how the electric road has paralleled the steam roads to almost every point, and this practically all within two years, except to Santa Monica and Pasadena. Managers of both the Southern Pacific and the Santa Fe now admit that their passenger traffic to seaside resorts is almost nil.



MAP OF INTERURBAN LINES IN VICINITY OF LOS ANGELES

While the Los Angeles & Redondo Railway Company has an electric line into Redondo it is agreed that all territory north of that point is for the exploitation of the Los Angeles-Pacific Railroad Company, while the great Huntington-Hellman interests are spreading out in every other direction, touching many places around Pasadena, Whittier, Long Beach and San Pedro.

Their future plans will also take them north, but they have no designs on the fertile country that lies west of Los Angeles down to the sea.

Mr. Huntington has said that his original plan for Southern California in the way of electric railways will mean the expenditure of $30,000,000. The work thus far done represents $10,000,000. To spend another $10,000,000 he recently organized the Los Angeles Interurban Railway Company.

AIR SAND BOX

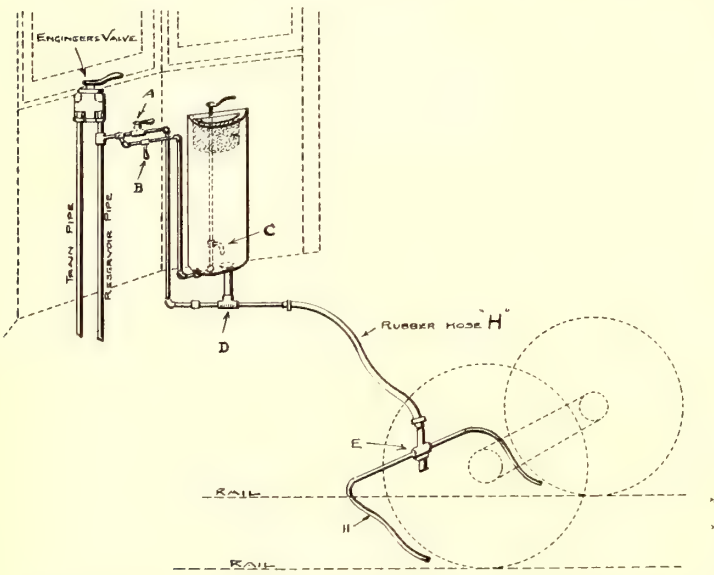
The accompanying illustrations refer to a sanding device manufactured by the Newark Air Sand Box Company, of Newark, Ohio, for all cars equipped with air brakes.

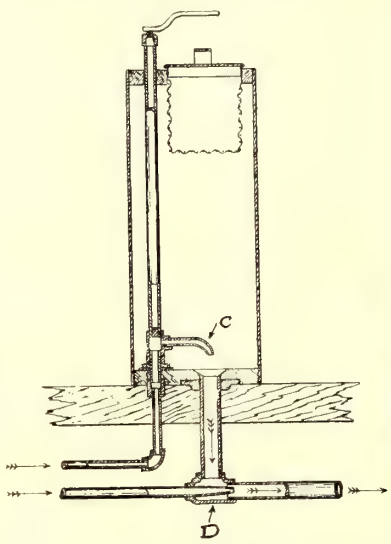
Fig. 1 gives a general outline of one equipment. The sand box proper has a screen or basket at the top, made of 3-16-in. wire mesh, which prevents stones or gravel passing through the pipes, and thus avoids clogging. This basket is removable and can be emptied at any time. The box is provided with a mixer, "C," as shown in Fig. 2. By applying the air at valve "B" the compressed air passes through this mixer, and by moving the handle on top of the box, blasts loose any sand which might be clogged. One of the advantages of the mixer is that it will dry damp sand almost immediately. By applying the air at valve "A" it passes through the T "D," which has a combining cone, as shown in Fig. 2, which forces the sand through pipes, is divided at "E," and delivers the sand in front of both wheels simultaneously.

Pipe 11, as shown in Fig. 1, is fastened to the truck, and a rubber hose, "H," allows it to swing with the truck so as to always throw the sand directly in front of the wheels, even on the shortest curves, while other boxes deliver the sand from 20 ins. to 24 ins. from the wheel.

All pipes are air tight, and, therefore, exclude all water, which naturally collects in the spiral pipes.

This sanding device has been on the market a very short time, but it is already in extensive use on some prominent electric railways, among them being the following: Indianapolis & Northwestern Traction Company, Cleveland, Painesville & Ashtabula Railway Company, Columbus, Buckeye Lake & Newark Traction Company, Columbus, Newark & Zanesville Electric Railway, Canton & Akron Railway, Newark & Granville Street Railway Company, Columbus, Delaware & Marion Electric Railroad Company, and Indianapolis, Columbus & Southern Traction Company.





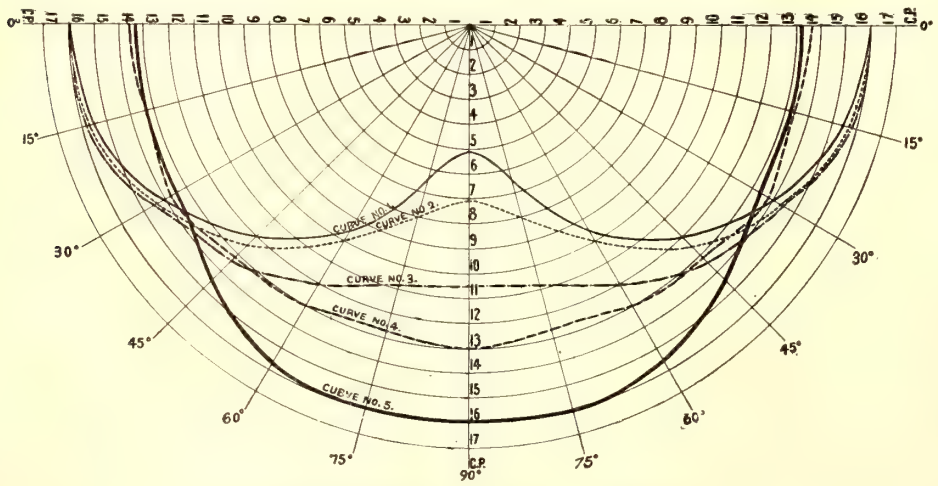
FIGS. 1 AND 2.—GENERAL OUTLINE OF AIR SAND-BOX EQUIPMENT AND DETAILS OF BOX



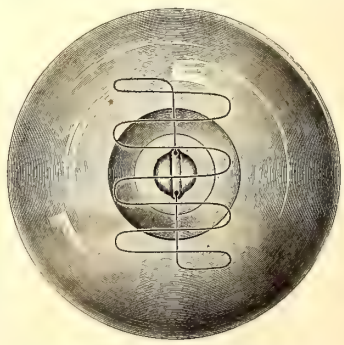
TIPLESS INCANDESCENT LAMP

DOWNWARD LIGHT TIPLESS INCANDESCENT LAMP

The accompanying cuts illustrate a novel incandescent lamp which has been placed on the market by the Downward Light Electric Company, of New York. The two features which radically distinguish this type from all other incandescent lamps are the arrangement of the filament and the abolishing of tips.



CURVES SHOWING DOWNWARD ILLUMINATION



VIEW, SHOWING ARRANGEMENT OF FILAMENT

By referring to the illustrations it will be observed that the filament has been designed to permit of a maximum downward light distribution, as this lamp is particularly intended for use in places where illumination of that character is preferable to

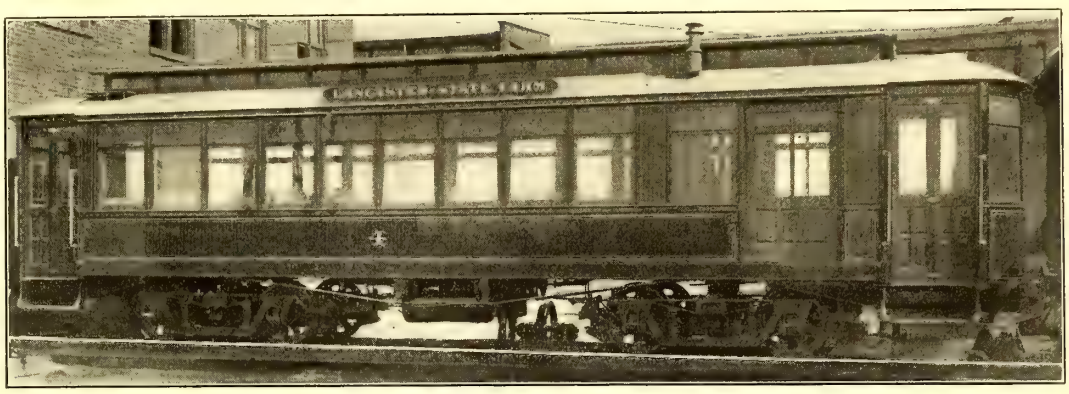
the usual method of light radiation. That the manufacturer has succeeded in developing this type will be evident from an examination of the light curves shown herewith. The curves as numbered represent the following types, which were tested by the Lamp Testing Bureau, of New York, and show total candle-power at 90 degs.

Curve No. 1 is for a 16-cp double-carbon lamp (5.1 cp); curve No. 2, 16-cp oval anchored lamp (7.1 cp); curve No. 3, 16-cp double round-coil lamp (10.5 cp); curve No. 4, 16-cp flattened double-coil lamp (13 cp), and curve No. 5, 16-cp "downward light lamp" (16 cp).

The tipless bulb avoids a great deal of breakage and helps to make the lamp especially serviceable when necessary to examine machinery details or seek for objects in obscure corners.

COMBINATION CAR FOR COLUMBUS, OHIO

The car shown in the accompanying illustrations is one which the American Car Company, of St. Louis, recently sent to the Fairfield County Traction Company, of Columbus, Ohio. It is mounted on the American Car Company's No. 14 M. C. B. type of trucks, and intended for high-speed service. Single platform steps are used at either end of the car, and platforms dropped low to bring these steps about 18 ins. from the rail-heads. Substantial vestibules have folding doors and sashes that drop into pockets. The side windows have two sashes, the upper being stationary and the lower arranged to drop into pockets which extend to the bottom of the double sills, the sills being spaced apart for this purpose. The sills are 2¾ ins. x 7¾ ins. each, with sill plates ⅝ in. x 8 ins. The center sills are composed of 7-in. I-beams. The vestibules, as well as the car sides, are sheathed with tongued and grooved poplar boards. Heavy under-trusses are anchored at the bolsters; platform knees are reinforced with angle-iron, and angle-iron bumpers protect and strengthen the platform. The seats are of spring cane with reversible backs, nine to each side, giving a seating capacity of thirty-six. The seats are 34 ins. long, leaving the aisle 25 ins. wide. The baggage compartment is 8 ft. 7 ins. long, and has sliding doors at both sides.



EXTERIOR OF COMBINATION CAR



INTERIOR OF COMBINATION CAR, SHOWING SEATING COMPARTMENT

The general dimensions are as follows: Length over end panels, 34 ft.; over crown pieces, 44 ft.; from panel over crown piece, 5 ft.; width over sills, including sheathing, 8 ft. 3 ins.; from center to center of posts, 2 ft. 8 ins.; end sills, 4¾ ins. x 7¾ ins.; thickness of corner posts, 3¾ ins., and of side posts, 3¼ ins. The interior is finished in cherry natural color with similar ceilings. The wheel base of the trucks is 6 ft., and 33-in. wheels are used. The car has a four-motor equipment of 38 hp.

TROLLEY SWITCH

A simple and durable trolley switch which, it is claimed, will not cause the trolley wheel to leave the wire, has been developed by the Cornell-Easton Company, of Syracuse, N. Y. The manufacturer says that many severe tests have demonstrated that this contrivance works with the same reliability under any weather and speed conditions. The device is shown in the accompanying illustration, and consists of but two main parts, a top plate and a movable switch section, both of bronze.

The top plate, or support, the stationary rails at the end of the top plate and the flanges on either side of the top plate, are in one piece. The tops of the stationary rails from the top plate are grooved diagonally to their ends to receive the trolley wire. These stationary rails are also provided with one set of ears, used to fasten the trolley wire. The main trolley wire is placed in the single stationary rail and passed over the top of the top plate and out of one of the two stationary rails. The stub, or short wire, which is used over one side of the ground track, is placed into the groove of the other stationary rail. After this wire has been firmly secured the small piece may be left on top of the top plate. As the top plate is made solid and the flanges on either side extend 1⅝ ins., no rain or sleet can get into the movable switch section to freeze it up or otherwise impair its efficiency.

The movable switch section is composed of two rails placed between the stationary rails and fastened to the top plate at one end by one pivot bolt and to a small movable plate at the other end. This small movable plate is provided with a tongue working in a groove in the top of the single stationary rail, thus making it impossible for the movable switch section at this end to drop



TROLLEY SWITCH

down. All rails are made 3-16 of an inch wide, being narrower than the average trolley wire, and will therefore stand more of a cramp from the trolley wheel than the wire without causing the trolley wheel to jump off. In fact, after a trolley wheel has entered the switch there is nothing for it to do but go right through.

The spring used to retain the movable switch section in one position is made of bronze spring wire, is reversible, and is used to retain the movable switch section either to the right or left, as may be necessary. It is fastened to the bottom of the top plate by a spring cotter pin and to the small movable plate by being placed in a hole in said plate.

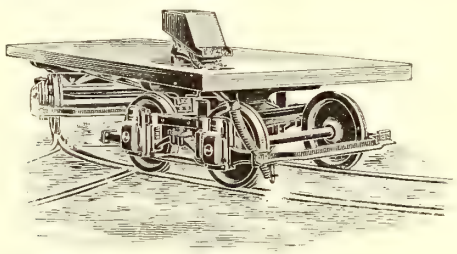
When the switch is hanging on the trolley wire the right-hand rail of the movable switch section is in alignment with the single stationary rail. Thus it will be seen that a trolley wheel entering the switch takes the right-hand rail and proceeds through the switch and out onto the wire toward the opposite switch. Assuming that the trolley wheel has reached the switch, has entered on the stationary rail on the left side of the switch and is proceeding on its way out on the main trolley wire, it will be observed, by reference to the cut, that the trolley wheel has come in contact with the left flange, crowded the left rail of the movable section into alignment with the single stationary rail and at the same time has also crowded the right rail of the movable switch section against the right-hand flange, thus giving the trolley wheel an uninterrupted passage through the switch on to the main wire. Immediately after the trolley wheel passes the connection of the rails the small bronze spring pushes the left rail back and draws the right rail into alignment with the single stationary rail, thus leaving the switch in its original position.

This switch is now in use under very severe conditions on the Syracuse, Lakeside & Baldwinsville Railway, of Syracuse, N. Y., and the manager of that company speaks very highly of its efficiency.

POSITIVE TRACK SANDER

The accompanying cut is an illustration of a railway track sander which has been placed in service on a large number of street railways after numerous practical tests by the makers—the Positive Railway Sander Company, of Lancaster, Pa.

The arrangement of the parts is such that with every stroke



POSITIVE TRACK SANDER ON FLAT CAR

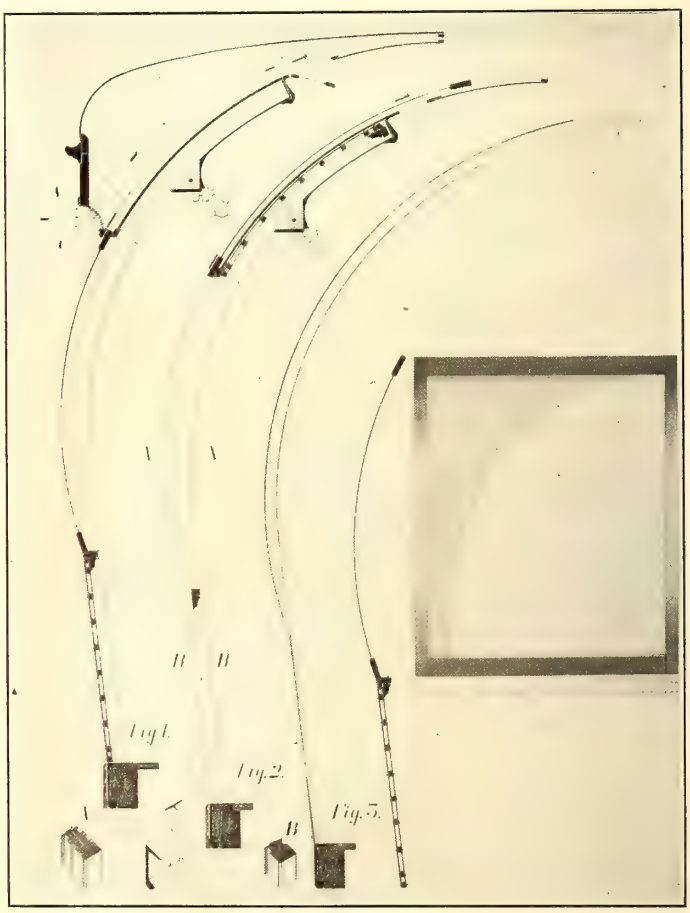
of the lever, or foot pressure, the sand will leave the box and pass down the pipe. The end of this pipe is attached to the car truck and is kept central with the wheel, so that the sanding can go on irrespective of the track radius. Owing to the connection of the sanding pipe with the car truck it conveys the truck vibration to the sand box, thereby keeping the sand in constant motion and preventing freezing or hardening.

The sand box is made of durable galvanized iron, and is placed under a car seat to prevent freezing. It is stated that the sand can be thrown wet or dry, and that there is no necessity for screening or drying.

If the device is operated with a hand lever it is only necessary to move the latter back and forth; if with the foot, press it up and down like a gong. The brush under the lower part of the sand box is stationary, but the corrugated parts coming in contact with it give it a vibratory motion, throwing the sand against a check or dam, located about 1 in. back in the forward part of the box. The loosened sand flows out on an inclined spring lip in the front and passes down the pipe. At no time is any sand lost through the motion of the car, because the sanding depends entirely upon the operation of either the hand lever or foot pressure. One car requires two boxes—one at each end. A sheet-iron fender, about 14 ins. long by 12 ins. wide, is fastened beneath the car floor to prevent any refuse from getting into the upper part of the pipe. This fender does not form an integral part of the sander but is recommended by the maker as a valuable though inexpensive auxiliary.

NOVEL CONVERTIBLE CAR

A new convertible car which embodies some radical departures from present practice has been designed by Hermann Romünder, of Bloomsbury, N. J. The characteristic features of construction of this car are side sections, each consisting of two parts, a large curved window and a flexible panel with window sill underneath it, movable between vertical side posts or ribs; the posts being made of a T-shaped steel rib covered with wood containing the necessary grooves in which the side



DETAILS OF CONVERTIBLE CAR

sections slide. These posts are reversible and interchangeable, and the car, owing to the steel frame construction, can, therefore, be made of any desired width.

The lower part of these side posts up to the line of the windows is straight, the upper portion being bent in a circular arc to accommodate the curved windows, both open and closed. By means of this construction sufficient floor area is obtained for seats and aisles as well as abundant space in the upper part of the car.

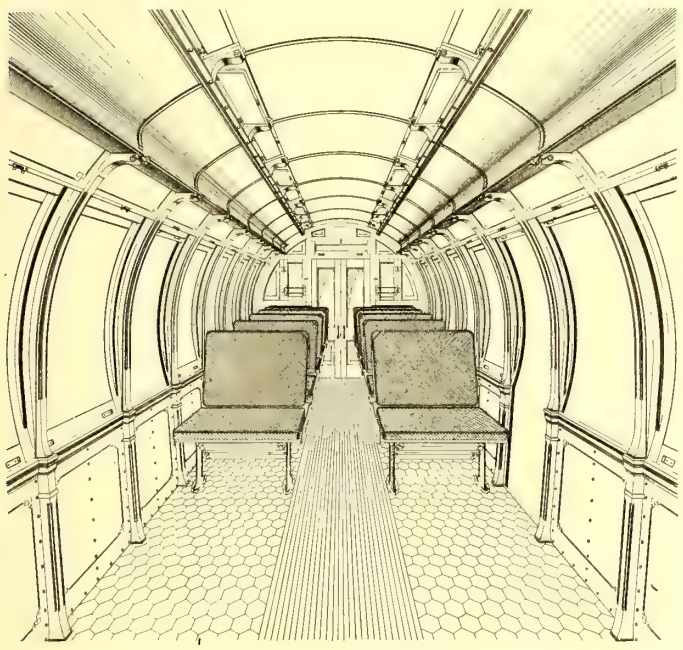
The large windows are of one sheet of curved glass, each held in a steel frame, providing an absolutely rigid curved

window sash, and are stated to be larger than those of any other car now in use. On this account alone it is an ideal observation car.

The flexible panels below the windows are composed of two plates of veneered wood, each consisting of three or more ply veneer, with reversed grain and united by a waterproof cementing composition; both plates being held together by lateral slats. The air space provided between the veneer plates serves to keep out cold, wet and draft. The panel is light in weight and of the usual thickness, also, owing to the reversed grain of the adjoining veneer layers in the veneer plates, of great strength and durability and lateral stiffness, but sufficiently elastic and flexible longitudinally, so that panels made of this construction can be easily raised and lowered in the lower straight and upper curved grooves between the side posts. At its upper end the flexible panel is provided with a regular window stool or sill which serves as an arm-rest.

When the windows and flexible panels of all side sections are closed down the car is completely tight on all sides. Any or all of the windows may be raised without disturbing the flexible panels, whereby the car is converted into an ordinary closed car with open windows. When the flexible panels are also raised into the roof the car offers every advantage of the open type during warm and dry weather.

The roof is constructed of the same material as the flexible panels, wood veneers with layers of reversed grain, united by

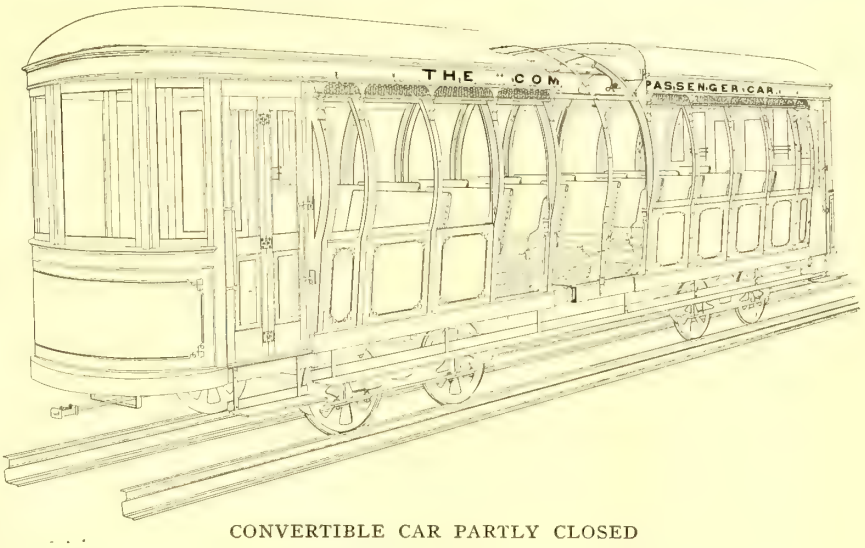


INTERIOR OF CONVERTIBLE CAR

a waterproof cementing composition, making it considerably lighter in weight than the present roof construction, of greater strength and durability and impervious to moisture and atmospheric influences. This roof extends over the entire upper portion of the car from side to side and end to end, overhanging the body of the car, so as to furnish one continuous strong and permanently closed outer cover for the car.

Another striking feature of this car which distinguishes it from all other cars now in use is the system of ventilation, whereby the monitor roof is entirely dispensed with and all the space otherwise occupied by the same is utilized to make the interior of the car higher and roomier; thus the car, while being 6 ins. higher inside than the ordinary trolley car, is 3 ins. lower outside.

The ventilation is accomplished by an air space formed between the overhanging outer roof, supported by the curved rafters and side posts and the inner veneered ceiling of the car. Perforated curved metal sheets or screens, placed in openings between the side posts above the window line, under the eaves of the overhanging roof, admit the outside air to this air space,



CONVERTIBLE CAR PARTLY CLOSED

after which it enters the interior of the car through openings in the ceiling of the car, which, when required, can be closed partly or entirely by panel sashes. By reason of this arrangement the outside air on entering the air space must rise up to these openings in the car ceiling and through same into the interior of the car. Consequently, it has been tempered somewhat in cold weather before reaching the interior of the car, affording a maximum of ventilation while at the same time all impurities, dust, soot, cinders, etc., are deposited during the upward course of the air, and only pure air can enter the car.

The details of the car are shown in the accompanying cuts. Fig. 1 shows a side post complete, with window and panel in closed position, the lamps being directly over the middle of the seat; also cut through the roof, the arrows indicating the travel of the air, rising upward from the outside and passing down into the car through the panel sashes in the ceiling of the car.

Fig. 2 shows the post with window and flexible panel in the upper part of the post when the car is open.

Fig. 3 shows the steel skeleton frame of the post covered with wood, and the grooves in which the window and flexible panel slide.

"A" shows cut through the post at A-A, with both grooves, one for the window the other for the flexible panel. "B" shows cut through the posts at B-B, with the groove for the flexible panel. Between both is a cut showing how the T-bar of the side post is riveted to the bulb angle-iron of the underframing, extending the entire length of the car body on both sides.

The other views show the window with lower flexible panel, from the inside of the car, as well as a cut through same.

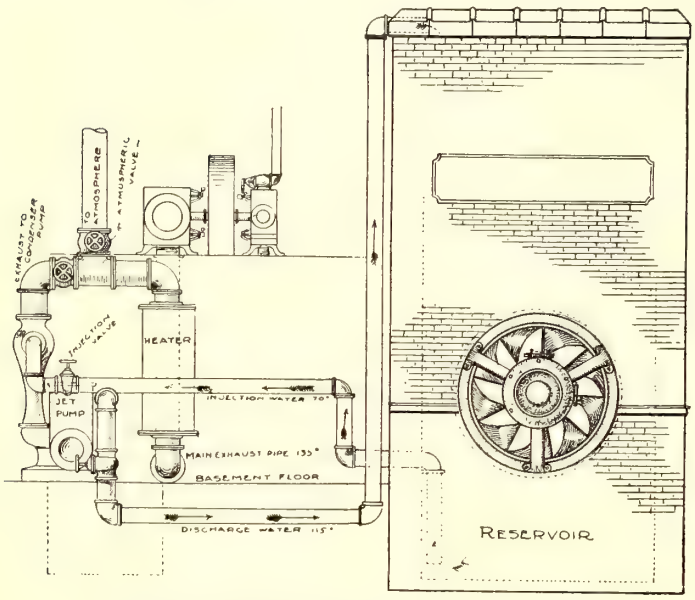
The inventor believes that this design and construction cover better than other types all the requirements sought for in a first-class convertible car as regards durability, comfort and attractiveness. This car can be built with or without baggage, smoking, toilet or other compartments, as may be required by the character of the service.

A high-speed suspended railway, to operate under the Romanoff system, is to be constructed in the grounds of the St. Louis Exposition. Mr. Romanoff, the inventor of the system, is a well-known Russian electrical engineer, and is expected to arrive in the United States within a few days.

COOLING TOWER AND FEED WATER SYSTEM

The accompanying illustration shows the piping arrangement used in connection with the Jennison water-cooler tower, manufactured by the International Steam Engineering Company, of Atlanta, Ga. This cooling tower is intended for use in places where it is impossible to easily secure enough water for condensation. It allows the same water to be used again and again, thus eliminating the necessity for a continuous volume of water.

A novel cooling method is employed in this tower, for in-



PIPING ARRANGEMENT FOR COOLING TOWER

stead of using tilings or boards arranged like checker work, the water enters the top of the tower through the discharge pipe into a steel trough, from which lateral pipes extend. These pipes are bored to throw the water upward at an angle of 30 degs. As soon as the water loses its pressure it falls, its gravity being greater than the surrounding air currents. Disintegration takes place and the water falls in separate drops similar to lead in a shot-tower. Thus every drop of liquid becomes enveloped by a cooling air current instead of the water being evaporated in mass. After passing through the first trough the water percolates through an indefinite number of troughs until the desired reduction in temperature is attained.

By this method and the erection of a cupola a great quantity of water is retained which would otherwise pass off to the surrounding atmosphere.

The tower is built of brick, wood or steel, as may be desired, brick being preferable on account of its durability. The brick towers are made water-tight through the employment of cement. The use of this construction will keep the tower and cupola absolutely clean and dry. The interior construction is chiefly of steel-channel and I-beams. The fans, which are also built of steel, are motor driven and of the propelled type. The use of this type is said to remove the danger of freezing in cold weather, thus avoiding the wreckage of fans, which has heretofore been a serious difficulty in connection with other types. This also eliminates the question of moisture thrown out by the back lash from straight flat disc fans.

The manufacturer believes that further economies may be obtained when this tower is used in connection with a modern feed-water system. It has long been the practice in many power stations to send the feed-water to boilers in a compound-condensing system at about 140 degs. F. This can be greatly improved upon in modern installations of primary and secondary heaters, using the exhaust steam from the auxiliary condenser and boiler feed pumps and heating the water to a temperature of over 200 degs. F.

LIMITED SERVICE ON THE CLEVELAND & SOUTHWESTERN

Following the example of other interurban roads running into Cleveland, the Cleveland & Southwestern Traction Company has announced limited service over its Wellington and Norwalk divisions. A limited car will leave Wellington at 7 a. m., and reach Cleveland at 9 a. m., cutting thirty minutes off the regular schedule. The Norwalk limited will leave at 7:30 a. m., and reach Cleveland at 10:00 a. m., cutting forty-five minutes off the regular schedule. The outgoing limited cars will leave Cleveland for Norwalk at 3:40 p. m. and for Wellington at 4:40 p. m. The half-hourly cars on all lines will be dispensed with for the winter, and there will be two extra cars each way to Berea and return.

SEMI-CONVERTIBLE CARS FOR BUFFALO

The J. G. Brill Company lately furnished several of its patented semi-convertible cars to the Buffalo & Williamsville Electric Railway Company. Buffalo was one of the first cities to use this type, the wide streets permitting the use of cars of suburban character. Williamsville is about 5 miles from the center of Buffalo, and the line between is almost a straight one.

As will be seen from the illustration the cars have steam car roofs and completely enclosed vestibules. The sashes in the vestibules are composed of single lights; the vestibules are wainscoted and have pockets for the windows in the sashes. As the side windows are arranged to be raised into roof pockets in the usual method of the Brill semi-convertible car, and there are, therefore, no wall pockets, several inches of transverse space are gained.

The outside width of the car is 8 ft. 2 ins.; deducting 2 ins.

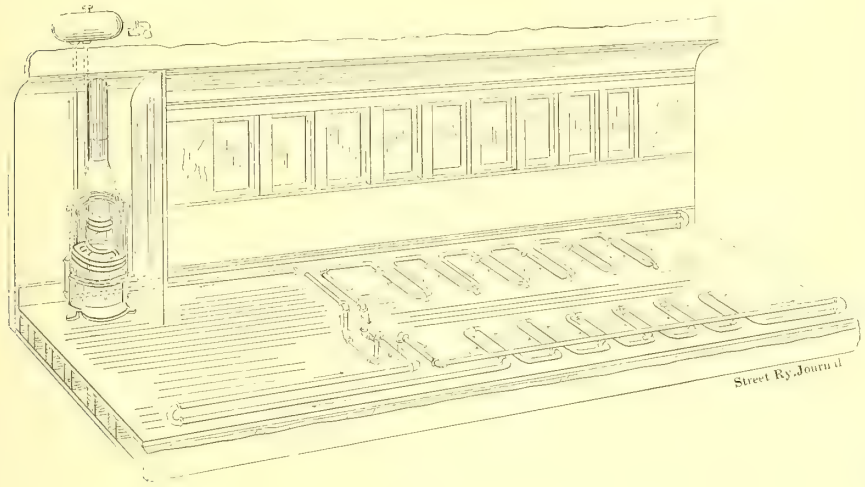


SEMI-CONVERTIBLE CAR FOR BUFFALO

on each side for the walls the interior width is 7 ft. 10 ins., allowing 36-in. seats to be used, leaving aisle 22 ins. wide. The interiors are handsomely finished in cherry with ceilings of three-ply veneer birch. The cars are 25 ft. 4 ins. long over the end panels and 34 ft. 9 ins. over vestibules; width over sides, 8 ft. 2 ins.; center of posts, 2 ft. 8 ins. The side sills are 4 ins. x 6¾ ins., plated on the inside with ⅜-in. x 12-in. steel, which plates extend well up the posts to which they are secured. Corner posts are 3¾ ins. thick, and side posts 3¼ ins. The trucks are Brill 27-F, with 4-ft. wheel base, 33-in. wheels and 4¼-in. axles, and are equipped with two 38-hp motors per car.

HOT WATER HEATING

The approach of cold weather again brings up the subject of satisfactory heating apparatus for both urban and interurban cars. Of the different systems in use hot-water heating in connection with independent heaters has found great favor,



CAR-PIPING PLAN IN CONNECTION WITH HOT-WATER HEATER

because it is simple, economical and reliable, and with proper piping makes possible any desirable heat radiation.

A piping plan, which is sometimes used in connection with hot-water heating, is shown herewith in connection with the "Mighty Midget" heater made by William C. Baker, of New York. The piping may be arranged as considered desirable, although straight-line piping is most commonly used. The receptacle shown above the heater contains the water supply. It is protected by a thick coating of an asbestos compound which also prevents the radiation of heat.

This heater is especially suitable for railway cars, as it may be placed in any convenient position. If placed in the vestibule of the motorman it can be easily cared for by him, there will be no ashes or cinders to annoy the passengers, and the vestibule will be kept well heated, thus preventing the frosting of the vestibule windows and giving the motorman a clear view of the track ahead.

The hot-water pipes leading from the heater are laid out to radiate the proper amount of heat to each portion of the car. As the operation of the system only depends upon a good supply of fuel there is little danger that the passengers will be obliged to suffer from cold in stalled cars during a power breakdown.

It is interesting to note that these heaters are in successful service, using soft coal for fuel, on the White Pass & Yukon Railroad, in the Klondike gold fields, where, in winter, the temperature sometimes falls as low as 50 degs. below zero. It is said that they have never failed to comfortably warm the cars even at this low temperature. A prominent interurban railway in the Middle West is using over 1000 of these heaters, and many others are in use on steam and electric railways.

By arrangement with the Boston Elevated Railway the Boston & Worcester Street Railway Company is now operating cars from Worcester through to Park Square, in Boston. Heretofore the Worcester cars have run only as far as the terminus of the Elevated line at Chestnut Hill, Brookline, where it has been necessary for passengers to change cars.

CARS FOR THE ATLANTIC CITY & SUBURBAN RAILWAY

The J. G. Brill Company has completed eight fifteen-bench "Narragansetts" and seven semi-convertible cars for the Atlantic City & Suburban Railway. In the issue of the Street Railway Journal of Oct. 10, the destruction of the Pleasantville car house and power house of the railway, by a severe wind storm, was described. It was mentioned in that article that a number of the new cars were standing in the car house at the time of its demolition by the hurricane. Pleasantville is situated several miles inland from Atlantic City, and there is considerable travel between the two communities. The line has lately been opened and would now be in good running order had not the catastrophe occurred. A limited number of cars are being run for the present until the cars, which were only slightly injured, are repaired.

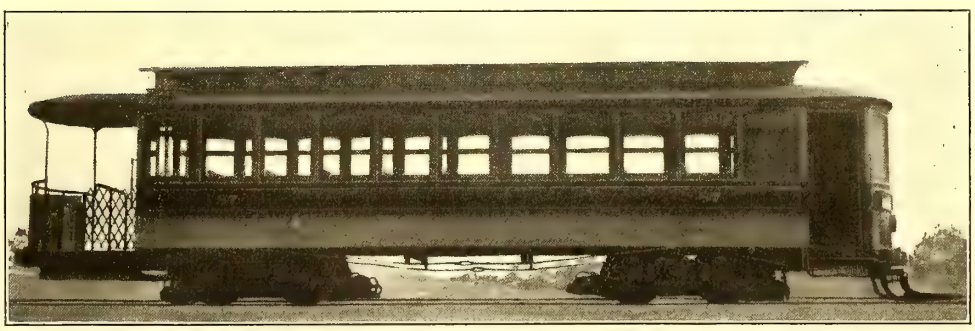
The semi-convertibles are 30 ft. 8 ins. over end panels, and 40 ft. 1 in. over vestibules; from panel over vestibules, 4 ft. 8½ ins.; width over sills, 7 ft. 10½ ins., and over posts at belt, 8 ft. 2 ins.; sweep of posts, 1¼ ins. The side sills are 4 ins. x 7¾ ins., plated on inside with ⅜-in. x 12-in. steel; the end sills are 5¼ ins. x 6⅞ ins.; corner posts, 3¾ ins. thick, and side posts, 3¼ ins. Interiors are finished in natural color cherry, and ceilings are of birch.

The "Narragansett" type of cars are 40 ft. 4⅜ ins. over crown pieces, and from center of corner posts over crown pieces, 4ft.; width over sills, 8 ft. 1 in., and over posts at belt, 8 ft. 2½ ins.; sweep of posts, 2¾ ins.

Cars are mounted on Brill 27-G trucks, with 4-ft. wheel base, 33-in. wheels and 4-ft. axles. Four 30-hp motors per car are used.

SEMI-CONVERTIBLE CARS FOR TEXAS

The accompanying illustration shows one of a lot of semi-convertible cars built by the G. C. Kuhlman Car Company, of Collinwood, Ohio, for the Northern Texas Traction Company. This car is 42 ft. long over all, finished in cherry, with bird's-eye maple ceiling, and has highly finished bronze trimmings. The windows are in two sections, and by lowering them in the sides, the car is made an open one. The windows are completely concealed in the side of the car by a window stool to give it the effect of an open car. The car has swinging gates on both ends, so as to be run on double track, and can be equipped with side or Hale & Kilburn walk-over seats. The construction throughout is the Kuhlman standard.



SEMI-CONVERTIBLE CAR FOR TEXAS

A company is being organized by Dayton (Ohio) interurban interests to erect a terminal station there. Dr. J. E. Lowes, of Dayton, is the principal promoter.

LEGAL DEPARTMENT

CONDUCTED BY WILBUR LARREMORE OF THE NEW YORK BAR.

CONTRACTUAL POWERS OF CITIES AND STREET RAILWAYS

The celebrated Rapid Transit case in the courts of New York (Sun Pub. Assn. vs. Mayor, 152 N. Y., 257) went to very considerable lengths in upholding the authority of a city to undertake, and pledge its credit for, elaborate improvements for the benefit of the public. A clause of the New York constitution forbids cities from giving money or property, or loaning municipal money or credit to or in aid of any individual, association or corporation, or from becoming directly or indirectly the owner of stock in, or bonds of, any association or corporation, and from incurring any indebtedness except for city purposes. The object of this provision was to suppress the notorious abuses that had grown up through the issue of municipal bonds and the use of municipal credit and funds to promote the construction of railroads. The majority of the Court of Appeals, however, in view of the peculiar geographical situation and topographical condition of the city of New York, were able to say that an underground rapid transit railroad was so clearly a matter of municipal necessity as, under a liberal construction of the constitutional clause, to constitute a city purpose. Accordingly, the Rapid Transit Act, providing, as it did, for the issue of bonds by the city for the construction of a railroad within its limits and for a lease of the same for a period of years to a private corporation upon such terms as the Legislature might prescribe, was held constitutional.

This was a case of peculiar, almost unique, municipal conditions, and the power exercised by the city was under a special statute. A similar liberal view of "city purposes" and of the discretionary authority of cities to make reasonable contracts in furtherance of such purposes is coming more and more to be taken by the courts, even in cases where cities enter into obligations under their inherent powers and without relying upon special legislative permission. One of the most recent and significant illustrations of municipal freedom of contract is furnished by City of Detroit vs. Detroit United Rys., decided by the Supreme Court of Michigan in June, 1903 (95 N. W., 736). It appeared that a street railway company taking over certain franchises granted to another company consented to a low fare as a consideration for an agreement with the city, that all paving, repaving, or repairing of pavements on streets used by the company should be at the expense of the city, except in certain instances, and that there should be no charge whatever, in any form or manner, against the company for repaving and repairing of pavements and streets on which the company operated its cars. It was held that by this agreement the city bound itself to repair the foundation necessary for the support of the company's tracks; that the city had authority to so bind itself, though the foundation must be heavier and stronger than that required by the ordinary traffic on the streets; and that such agreement did not contemplate the engaging by the city in a work of "internal improvement." The following language from the opinion of the Michigan court is well worthy of quotation:

"It is claimed, however, that the city had not the authority to bind itself by such a contract, for the reason that the construction and use of a street railway requires a heavier and stronger foundation than is required in the other portions of the highway used by lighter vehicles. A street railway is a public utility, it is an appropriate and necessary method of using the highway, and the municipalities may permit them to occupy and use portions of the streets. Such occupancy is in common with that of the general public, all persons being at liberty to drive upon and over them where they are laid in the traveled portion of the street. The street railway law does not in any way relieve the municipalities from the responsibility of maintaining the highways in a reasonably safe condition for public travel, and, as it cannot shift its liability to a railway company by contracting with it for the maintenance of the way, it would seem that it should be authorized, if it is not under a legal obligation, to repair the way when out of repair, whatever the cause. The right to assess the cost of pavement upon adjacent landowners is settled, and a wide discretion as to kind, solidity and cost is left to the authorities. There can be no doubt that they may specify such a pavement as the present or prospective traffic of the street may require, and provide varying foundations according to circumstances. In all ordinary cases the same are made adequate to sustain the vehicles that will traverse the streets. If street cars could be run without a fixed way of special construction, so that they could run upon any portion of the highway, the foundations of the entire roadway would need to be heavier and stronger, and in such case there would be no impediment to the construction of the same in the ordinary routine of building and repairing highways, unless it be the fact that the running of such cars might be a monopoly. Street railways are adapted to aid travel in the public highways, and, while the laws providing for their use impose upon private corporations the burden of constructing and operating them, all such laws contemplate that they will be constructed upon the highway. They presuppose a highway maintained by the public, and we are of the opinion that it is not beyond the authority of the public officers to build a highway that will support such traffic, even though it need a heavier pavement than ordinary traffic requires. We are also of the opinion that it cannot be said that the city engages in a work of internal improvement by making a contract whereby it shall construct and repair its highways and pavements, instead of allowing the railroad company to interfere with them."

In the legal department of this journal for Sept. 26, 1903, under the title, "Police Power and Roadbeds," there was discussed the right of cities to require street railways to perform such special acts in and about their tracks and roadbeds as are rendered necessary by the existence of the roads. The doctrine of the Michigan case is supplementary to that laid down in the previous article in that it upholds a city's power expressly to contract to perform the special acts—to furnish and keep in repair special kinds of pavement or foundations or other accessories of the roadbed—and recognizes the city's liability under a contract of that class. The policy of both the cases referred to is progressive, and in accordance with common sense and justice. The general judicial tendency at present is to presume in favor of liberty of contract between municipalities and street railway companies, and not to condemn agreements as beyond the power of either party, merely because they are of unusual and special character. Perhaps the very latest example is afforded by the decision of the U. S. Circuit Court, N. D. N. Y., in Thompson vs. Schenectady Ry. Co. (July, 1903, 124 Fed., 274). It was held that a grant to a street railway company of the right to maintain a line of road on a certain street has no relation to its corporate franchise, and is not a franchise in such sense that it cannot be abandoned by the company by agreement with the city and the property owners without the consent of the State.

Note—Communications relating to this department should be addressed to Mr. Larremore, 32 Nassau Street, New York.

LIABILITY FOR NEGLIGENCE

ALABAMA.—Street Railways—Injury to Passenger—Evidence—Trial—Cross-examination—Instruction.

1. On the cross-examination of plaintiff in a personal injury case, the witness complaining that counsel was trying to cross her so she would tell something that was not so, and asking for time to answer, the court said, "Give her time to answer it." Counsel said, "I have given her plenty of time," to which the court replied, "Sometimes you don't." Held, not error.

2. On cross-examination of a physician called by plaintiff in a personal injury case, defendant sought to show that, if she had been injured as claimed, she could not have walked as she afterward did. On redirect, the physician was asked whether, supposing she had limped and hobbled along, stopping frequently to rest, "couldn't she still have received the injury she complains of now, and done that?" Held, that the question was not

objectionable as calling for "a conclusion from the facts stated that the jury should draw, and not the witness, as an expert."

3. Where, in an action for personal injury, defendant had introduced testimony tending to show that plaintiff's physical condition was as bad before as since the injury, it was not error to permit her to be recalled and examined as to her condition before the accident.

4. Where plaintiff claimed to have been injured by the sudden jerking and stopping of a street car as she got on, a question to another passenger, "Did you see anything happen there that would have a tendency to hurt anybody?" was properly excluded as not calling for facts, but for the witness' opinion.

5. Where witnesses who have been put under the rule have violated the instructions of the court not to talk to any one about the case, it is not error to permit them to be questioned about such violations when called as witnesses.

6. A witness who had testified that, before the accident, plaintiff was weak and delicate, was properly asked on cross-examination if during such time plaintiff had not sat up at witness' house at night, when her baby died.

7. Where, in an action for personal injury, a physician called by defendant had testified that plaintiff was hysterical, and as to the symptoms and effects of such condition, it was proper cross-examination to ask him, "Is a patient any more responsible for a hysterical condition than for any other condition?" to test his knowledge as an expert on hysteria.

8. The physician having testified that it was taught that people who have lawsuits pending, and who are claiming to have been injured by accidents, and claiming money for them, imagined they were hurt, etc., and having further stated that he did not say such persons were necessarily hysterical, plaintiff was entitled to ask him on cross-examination, "Are they hysterical?"

9. The question was not objectionable as calling for a matter of common knowledge.

10. In an action for personal injury, to permit a physician to be asked whether another physician who has testified in the case is a skilled physician, and how he stands, is error.

11. Where, in an action for personal injury, a physician testified that he treated plaintiff several years before the accident, detailing her complaints, and that he examined her the day before, and stated her complaints then, refusal to permit him to testify whether they were not the same complaints she made when he treated her before was error.

12. Where, in an action against a street railway company, the negligence alleged was in starting the car with a jerk as plaintiff was getting on, and then suddenly stopping, it was error to permit the conductor to be asked on cross-examination how fast they ran when approaching the crossing.

13. Where the conductor had testified as to how he started the car, it was proper cross-examination to ask him how he usually started his car from the station.

14. Where a witness for the defendant was asked on cross-examination if he had not served a term in the penitentiary, or been convicted, and answered "No," it was not competent for defendant to afterwards call a witness to testify to his general character in the community.

15. Defendant objected to a certain clause in the charge, but said that if a certain word was inserted he would withdraw the objection. The court said that he did not think it necessary, but, to oblige counsel, he would insert the word. Held, that the remark of the court was not error.

16. Where, in an action against a street railway company, negligence was charged in one count in starting the car with a jerk, and in another with suddenly stopping, an instruction that if the jury "believe from the evidence that by the starting of the car the plaintiff was not jerked, slung, or thrown one way, and by the stopping of the car she was not jerked, slung, or thrown the other way, the verdict must be for the defendant," was properly refused.—(Birmingham Ry. & Electric Co. vs. Ellard, 33 Southern Rep., 276.)

ALABAMA.—Carriers — Assault by Servant — Liability — Complaint—Sufficiency—Witnesses.

1. An allegation of the complaint, in an action against a street railway company for an assault, that it was committed "while plaintiff was engaged in or about becoming a passenger on said car," did not show that plaintiff was a passenger.

2. A carrier is not liable for an assault committed by its servant or agent on a person not a passenger, and having no relation with the carrier, nor in any way encroaching on its rights, unless committed by its authority and under its direction.

3. A count in the complaint in an action against a carrier for an assault committed by one of its servants having alleged that plaintiff was at the time a passenger on defendant's car, it was not necessary to aver that it was committed within the scope of the servant's duty.

4. A Jew was asked on his cross-examination if he considered an oath binding when he took it with his hat off. A general objection to the question was interposed and overruled. He answered that under the Jewish law an oath is not considered binding unless one is sworn with his hat on, and that, if he had been in the old country, he would not have considered himself bound to tell the truth unless his hat were on. Held, that there was no error in overruling the objection.—(Birmingham Ry. & Electric Co, vs. Mason, 34 Southern Rep., 207.)

ALABAMA.—Street Railways—Killing Dog—Sufficiency of Complaint—Residence of Defendant—Plea in Abatement—Judicial Notice—Jurisdiction of Notary—Instructions.

1. A complaint in an action against a street railway for the killing of a dog, which averred that defendant, while operating its railway, through its agents, "did carelessly and negligently run over and kill" plaintiff's dog, sufficiently alleged negligence on the part of defendant.

2. Where a complaint in an action against a street railway for the killing of a dog alleged in one count that defendant, while operating its railway, through one of its agents, "did recklessly, wantonly, and willfully run over and kill" plaintiff's dog, it was not necessary to allege in that count specific acts of negligence on the part of defendant.

3. The circuit court of a county will take judicial notice of what ward in a city located in the county a notary public has been appointed for.

4. Where an appeal to the circuit court from a justice in an action against a street railway for the killing of a dog was tried on a plea in abatement, in which defendant averred that it resided outside the justice's ward, and that the dog was killed outside that ward, and the evidence as to defendant's residence was conflicting, plaintiff was entitled to an instruction that the verdict should be for her, if defendant resided in such ward, even though the dog was not killed there, as the averment in regard to defendant's residence made it necessary to find the truth thereof in order to sustain the plea.

5. In an action appealed to the circuit court from a justice, defendant, a street railway, pleaded in abatement that it resided without the justice's ward. Held, that plaintiff was not entitled to an instruction that defendant could be sued in any ward in which it did business by agents, as the issue raised by the averment in the plea was merely whether defendant resided in such ward.—(Russell vs. Huntsville Ry., Light & Power Co., 34 Southern Rep., 855.)

ALABAMA.—Master and Servant—Injuries to Servant—Street Railroads — Defective Track — Switches — Loose Tongue—Pleading—Evidence—Notice of Defect—Question for Jury.

1. Where, in an action for injuries to a street railway conductor by the derailment of a car at a switch, the complaint charged that the want of a spring at the switch, or other appliance to hold the switch rail in position, was a defect in defendant's ways, and that such defect had not been remedied by reason of the negligence of defendant, and that such defect was the cause of plaintiff's injury, the complaint presented an issue of fact, as to whether the want of such appliance constituted a defect in the track or switch, and was therefore not demurrable.

2. In an action for injuries to a street railway conductor by reason of an alleged defective switch, a plea alleging that the line was constructed under a contract with the city, under supervision of the city engineer, and that the switch was approved by such city engineer, and was first-class in every respect, was demurrable, since, if the switch was defective, its approval by the city engineer was no defense, and, if it was not defective, the matter covered by the plea was included in the general issue.

3. Where plaintiff alleged that he was injured by derailment of a street car, caused by the fact that the track at the point of derailment was out of gage, evidence that defendant's employee intrusted with seeing that the track was in proper condition was notified that the track was out of gage, and his response thereto, showing that he understood the existence of the fact stated, was admissible.

4. In an action for injuries to a street car conductor, caused by derailment at a switch, evidence that, by reason of defendant's failure to have the switch tongue fitted with a spring, it would become loose, and on numerous occasions the jarring from the front trucks of a car would turn the switch so that the rear trucks would leave the main track, which occurred on the occasion in question, presented a question for the jury, as to whether the switch as constructed was not defective, and, if so, whether such defect was the proximate cause of plaintiff's injuries.

5. Where, in an action for injuries to a street car conductor by derailment of his car, there was evidence that the track at the point

of derailment was out of gage, and that such defect was the proximate cause of the injury, as alleged, defendant was not entitled to an affirmative charge on such issue.—(Alabama Traction Co. vs. Reville, 34 Southern Rep., 981.)

ALABAMA.—Conclusion of Witness—Irresponsive Answer—Street Railway Company—Crossing Accident—Wantonness—Harmless Error.

1. Plaintiff's testimony, in an action against a street car company for injuries at a street crossing, that he had to get on the electric car track, or right at it, in order to cross a railroad track that an engine was on, is objectionable as a conclusion.

2. The testimony of witness that he was not aware the car was moving toward him before it struck him is not the statement of a conclusion, but of a concrete fact.

3. The answer, "He was doing all he could to stop," is not responsive to the question, "Did you see him do anything to stop?" and therefore may be excluded, though no objection was made to the question.

4. Though a motorman is not aware of the peril of one on the track in time to avoid injuring him, yet the company is liable if the motorman was guilty of wantonness in running his car over the crossing at the time and under the circumstances.

5. In an action for injuries, admission of plaintiff's conclusion is harmless; it tending merely to show he was not negligent, and the case being tried on the theory, and the jury being charged, that he was negligent.—(Birmingham Electric Co. vs. Jackson, 34 Southern Rep., 994.)

CALIFORNIA.—Servant — Injury — Negligence—Appliances—Duty to Adjust—Question for Jury—Expert Evidence—Damages.

1. Intestate was engaged on a construction train in distributing ties along defendant's road, when by reason of a sudden slackening of speed some of the ties fell off, carrying him with them in front of the car, and he was killed. There was no defect in the car other than stakes were not placed in the loops or pockets on the sides and ends to keep the ties in place. Intestate and his fellow servants loaded the car, and failed to place the stakes in position, though defendant had furnished stakes for that purpose. There was evidence that it was their duty to adjust the stakes. Held, error to charge in effect that it was defendant's duty to adjust the stakes; that being a question for the jury.

2. Whether stakes or uprights were necessary to make the car reasonably suitable and safe was a question for the jury.

3. The question as to the proper height of stakes to be used at the ends of a car loaded with ties is not a matter for expert evidence.

4. In an action against a railroad for the death of plaintiff's husband, an employee, an instruction that the jury might consider the fact that deceased was the sole support of the plaintiff was improper, though not ground for reversal.—(Kerrigan vs. Market St. Ry. Co., 71 Pacific Rep., 621.)

CALIFORNIA.—New Trial—Appeal—Discretion—Review.

1. On appeal from an order granting plaintiff a new trial on the ground of insufficiency of the evidence to sustain a verdict for defendant, and for newly discovered evidence, the order will be affirmed, unless it clearly appears that the trial court abused its discretion in granting such new trial.—(Hausmann vs. Sutter St. Ry. Co., 72 Pacific Rep., 905.)

CALIFORNIA.—Street Railways—Injuries to Passengers—Evidence—Statements of Conductor—Res Gestæ—Prejudicial Error—Duty of Employees—Contributory Negligence—Proof.

1. In an action for injuries sustained by a street car passenger while attempting to alight, statements of the conductor after he had gone from where the car stopped to where plaintiff lay on the ground, almost half a block away, and back again to the car, formed no part of the res gestæ.

2. The admission of incompetent statements of a street car conductor that the passenger, injured while attempting to alight, blamed him, and thought it was his fault, was prejudicial error, in an action for injuries sustained.

3. Where, in an action for injuries sustained by a street car passenger while attempting to alight, there was evidence that after the passenger was thrown off her balance she held to a stanchion and was dragged some distance, the testimony that, in response to call by passengers to ring the bell, some one answered that it was no use to ring the bell, as the car would not stop unless the conductor rang it, was immaterial.

4. Where, in an action for injuries sustained by a street car passenger while attempting to alight, the evidence showed that before the car had entirely stopped it again started suddenly, and thus caused the passenger to be injured, and instruction that, when a car was stopped to allow a passenger to get off, it was the duty of the employees of the company to see that no passenger was in the act of alighting before again starting the car, was inapplicable to the evidence.

5. The duty of a street railway company to afford its passengers reasonable opportunity to get off its cars is no greater than that of the ordinary steam railroad company.

6. The proof of the injury to a passenger casts on defendant the burden of proving that it was occasioned by contributory negligence of the passenger, unless the evidence on his part tends to show that the injury was due to his negligence.—(Boone et ux. vs. Oakland Transit Co., 73 Pacific Rep., 243.)

CALIFORNIA.—New Trial—Review—Street Railways—Appliances for Stopping Cars.

1. An order granting a new trial will not be disturbed, being general in its terms, and one of the grounds of the motion being insufficiency of the evidence, and the testimony being substantially conflicting.

2. Ordinary prudence requires that a street railway company, for the safety of pedestrians, exercise great care to keep its appliances for stopping cars in good condition.—(Mock vs. Los Angeles Traction Co., 73 Pacific Rep., 455.)

COLORADO.—Street Railroads—Persons on Track—Killing Children—Safety Appliances—Duty to Furnish—Damages—Evidence—Instructions—Appeal—Waiver of Error—Harmless Error.

1. Errors not discussed on appeal, either in the brief or oral argument of appellant's counsel, will be deemed waived.

2. Where a motion for a new trial on the ground that the verdict is contrary to the evidence has been denied, the verdict will not be set aside on appeal, unless it appears from the record that serious legal error occurred in the admission or rejection of evidence or in the instructions given.

3. Where, in an action for the killing of plaintiff's child by defendant's street car, there was nothing tending to prove that the car was not properly equipped, or that other appliances than those in use were more safe, or that there was any law or ordinance requiring the use of a fender, it was not error to refuse to permit a witness to testify that the car was not equipped with a fender like those subsequently used by defendant.

4. Where there was no evidence that defendant's street car, at the time plaintiff's child was killed by its operation, was not properly equipped to avoid accidents, an instruction that if defendant had been negligent in not providing the car with suitable contrivances for avoiding accidents of the kind in question, plaintiff would be entitled to recover, was properly refused.

5. The liability of a street railway company for failure to equip its cars with safety appliances, by reason of which plaintiff's child was alleged to have been killed, must be determined by the character of appliances in use at the time of the accident.

6. An instruction in an action for the death of plaintiff's infant son, charging that the amount of plaintiff's recovery must be limited to the value of the services of the son from the time of his death until he would have attained the age of twenty-one years, less what it would be worth to feed, clothe, educate, and care for him in a manner proper to his station in life, was not objectionable on the ground that under it the jury could not have found a verdict for plaintiff in any sum whatever.

7. Where the jury found for the defendants on the merits of the case, error, if any, in an instruction on the subject of plaintiff's damages, was harmless.—(Zimmerman et al. vs. Denver Consol. Tramway Co., 72 Pacific Rep., 607.)

COLORADO.—Master and Servant—Injuries to Lineman—Defective Poles—Res Ipsa Loquitur—Appliances—Inspection—Safe Place to Work—Assumption of Risk.

1. Where defendant's electric railway company had furnished plaintiff with a repair car, on which were appliances for bracing and securing poles, and, just prior to plaintiff's injury by the breaking of a pole, which he had ascended, in the course of his duty, without bracing the same, or examining to ascertain whether or not it was safe, a pole which plaintiff had ascended had been braced and secured by these appliances, defendant was not guilty of negligence in not furnishing proper appliances.

2. Where plaintiff was employed as a lineman, and was frequently required to climb poles supporting electric wires, and to reset poles and wires, and remove decayed poles, defendant was not liable for his injuries sustained by the falling of a defective pole, which plaintiff had ascended to change certain wires thereon.

3. Where plaintiff had worked as a lineman on poles in the construction and repair of electric lines for many years when he was engaged to work for the defendant, and it was plaintiff's duty to go upon poles that might be decayed for the purpose of taking down and putting up wires, defendant did not owe plaintiff the duty to inspect its poles, and inform him whether or not any of them were so decayed that it was unsafe to work on them.

4. Where plaintiff, a lineman in defendant's employ, was in-

jured by the falling of a defective pole which he had ascended to change certain wires thereon, mere proof of the accident was insufficient to establish defendant's negligence.

5. Where plaintiff was employed as a lineman, and was required to climb poles in the course of his business, the risk that some of the poles might fall on account of weakness was a risk incident to plaintiff's business.—(Kellogg vs. Denver City Tramway Co., 72 Pacific Rep., 609.)

DELAWARE.—Injury to Employee—Defective Appliances—Pleading—Description of Defect.

1. Where a declaration charged that defendant negligently used a car with a defective air brake, on a street, and that, by reason of the premises,—that is, such defective air brake,—the car, while being so used, could not be stopped, and ran into another car, on which plaintiff was engaged in discharging his duties as a conductor, by reason of which he was injured, etc., it was not objectionable for failure to allege wherein the car was defective.—(Jones vs. People's Ry. Co., 53 Atlantic Rep., 1065.)

DELAWARE.—Injuries to Servant—Negligence—Burden of Proof—Contributory Negligence—Master's Duty—Dangerous Employment — Youth — Inexperience — Rules — Measure of Damages.

1. A master owes its servant the duty of providing a reasonably safe place to work in, and reasonably safe and proper tools.

2. It is a master's duty to a servant to keep its premises and tools in a reasonably safe condition.

3. Where a servant is young or inexperienced, it is the duty of the master to inform him of the dangers incident to his employment.

4. A servant must obey and follow the instructions of his master as to the work he is employed in.

5. It is the duty of both master and servant to exercise reasonable care and diligence to avoid accident, varying according to the dangerous nature of the employment.

6. Plaintiff in an action against a master for injuries has the burden of proving defendant's negligence.

7. Plaintiff in an action against a master for personal injuries cannot recover if guilty of contributory negligence.

8. In an action for personal injuries, plaintiff can recover for loss of time and wages, past and future pain and suffering, and for resulting impairment of ability to earn a living.—(Karczewski vs. Wilmington City Ry. Co., 54 Atlantic Rep., 746.)

DELAWARE.—Carriers—Street Railroads—Injuries to Passengers—Motive Power—Care Required—Negligence—Actions—Issues and Proof—Damages.

1. The degree of care required of a carrier to be exercised for the safety of passengers is the same whether the motive power is steam or electricity.

2. A carrier is required to use the highest degree of care and diligence reasonably practicable in securing their safety by keeping its cars and appliances in a safe condition and at all times under the control and management of skilled and competent servants.

3. Where, in an action for injuries alleged to have resulted from a collision on a street railway, the declaration averred that plaintiff was thrown from his seat to the ground by the force of the collision, proof that plaintiff jumped from the car on which he was riding, and was injured, in his endeavor to escape the danger of the collision, would not justify a recovery.

4. In an action for injuries by reason of a street car collision, evidence that the motorman lost control of the colliding car by reason of the fact that a snap switch on the rear of the car was closed when it should have been open, was inadmissible under the declaration charging that the car was improperly equipped with a defective air brake.

5. Where a snap switch on a street car was closed when it should have been open, and by reason of its being closed, the air brake thereon failed to act effectually, which resulted in a collosion, the failure of defendant's employees to discover that the switch was closed, and open the same, constituted negligence.

6. A passenger injured by a carrier's negligence is entitled to recover reasonable compensation for his injuries sustained, including pains and suffering, impaired capacity to labor since the accident, and his probable loss of time and labor in the future, resulting from his injuries; and, if the injuries are permanent in character, he is also entitled to recover for any impairment of earning capacity in the future.—(McAllister vs. People's Ry. Co., 54 Atlantic Rep., 743.)

DELAWARE.—Carriers—Injury to Passenger—Pleading—Demurrer—Certificate of Counsel.

1. 21 Laws Del. p. 269. c. 126, requiring a demurrer to be accompanied by certificate of counsel that he believes it good in law and not made for delay, is not repealed by 21 Laws Del. p. 582, c. 303, requiring judgment of respondent ouster to be entered on issues joined on demurrer in certain cases, and containing no requirement for a certificate.

2. In an action against a street railway for injuries to a passenger, a narr. averring generally that the company negligently used insufficient and defective brakes and other appliances, by reason of which its servants lost control of the car, and plaintiff was injured while endeavoring to escape, was demurrable for not specifying the particular appliances that caused the injury, and how the injury was received.—(Newton vs. People's Ry. Co., 55 Atlantic Rep., 2.)

DELAWARE.—Street Railroads—Collision with Vehicles—Injuries—CareRequired—Contributory Negligence—Damages.

1. The rights of a street railway and the public to use the streets of a city must be exercised in a reasonable and careful manner, so as not unreasonably to abridge or interfere with the rights of the other.

2. A street car company, in operating its cars in a street, must move them at a reasonable rate of speed, and reduce the speed or stop, if need be, when danger is imminent.

3. Persons using the streets of a city on which street cars are operated are required to use reasonable care to avoid collision by stopping, and, if need be, turning out and keeping off the tracks in the presence of danger.

4. A person attempting to cross a street railway track is bound to look for approaching cars in time, if possible, to avoid collision, and, if he does not look and does not see an approaching car until it is too late to avoid a collision, he is guilty of negligence.

5. Though the right of a street railway within its lines to use the street is superior to that of other users of the street, the public, in the exercise of due care, are entitled to cross the tracks as well within the blocks as at street crossings, in which case both the traveler and the railway company are required to use care, commensurate with the danger, to prevent a collision.

6. A person injured by reason of a collision with a street railway car is entitled to recover for pain and suffering, loss of power to labor, in the past and in the future, resulting from the injuries, loss of time and necessary expense in procuring labor which but for his injuries he would have performed himself, and expenses for medicine and medical attendance.—(Wilman vs. People's Ry. Co., 55 Atlantic Rep., 332.)

GEORGIA.—Street Railways—Collision—Evidence of Damages—Pleading.

1. The petition alleging that there was a collision between the plaintiff's vehicle and a car of the defendant, which threw him upon the ground, injured his back, left leg, and hip, caused concussion of the spine, and inflicted other bruises and injuries upon his body, it was permissible to introdue evidence showing injury to plaintiff's urinary organs.—(Central Railroad Company vs. Mitchell, 63 Ga., 173, 3.)

2. The evidence authorized the verdict, and there was no error requiring the granting of a new trial.—(Atlanta Ry. & Power Co. vs. Maddox, 43 S. E. Rep., 425.)

GEORGIA.—Street Railway—Injury to Passenger.

1. It is the duty of a street railway company to exercise extraordinary care for the safety of its passengers. As an incident to this obligation, where, in compliance with a city ordinance, street cars are brought to a full stop just before reaching a crossing of tracks, and it is customary on such occasions to stop long enough for passengers to get on and off without giving any signal therefor, it is the duty of the proper servant of the company to exercise extraordinary diligence, before signaling the car ahead, to ascertain if any passengers desire to alight from the car, and, if so, to give such passengers a reasonable opportunity to alight in safety.—(Atlanta Ry. Co. vs. Randall, 43 S. E. Rep.)

GEORGIA.—Street Railroads—Injury to Employee—Negligence of Fellow Servant.

1. A chartered street railroad is a railroad company within the meaning of sections 2297 and 2323 of the Civil Code of 1895, and therefore is liable to one servant for injuries inflicted by the negligence of a fellow servant.—(Savannah, T. & I. of H. Ry. vs. Williams, 43 S. E. Rep., 751.)

GEORGIA.—New Trial—Review—Street Railroads—Presumption of Negligence.

1. If the law and the facts do not require the verdict, this court will not disturb the first grant of a new trial, although it was put upon a single ground; nor will it determine whether the court below was right in granting the motion for such special reason.

2. A chartered street railroad company is a railroad company within the meaning of the Civil Code of 1895, section 2321, and the presumption is against such company where damage was done to person or property by the running of the cars or machinery thereof.—(Cordray vs. Savannah, T. & I. of H. Ry.; Savannah T. & I. of H. Ry. vs. Cordray, 43 S. E. Rep., 755.)

LONDON LETTER

(From Our Regular Correspondent.)

A successful trial run has been made of the electrical trains on the Tynemouth line of the North Eastern Railway Company, particulars of which have been printed from time to time in these columns. The whole work is in the hands of Charles H. Merz, consulting engineer for the company. Power is at present being taken from the Newcastle Electric Supply Company, at Wallsend, but will eventually be taken from the new power house which was illustrated in the STREET RAILWAY JOURNAL of June 20, and which is being erected at Carville. The electric trains have been equipped by the British Thomson-Houston Company with the multiple unit train control system. The car bodies were built by the Brush Electrical Engineering Company, and, as is usual on all of the existing electric railways, are long, open corridor type, supported on two four-wheel bogie trucks. The cars are divided into three divisions, having transverse seats in the center division, while in the end sections the seats are placed longitudinally. The system comprises about 37 miles between Newcastle and Tynemouth on two routes. Each train consists of two motor cars and one trailer, the whole train accommodating over 200 passengers. A successful trial took place on Sept. 27. It is a very interesting coincidence that it was on Sept. 27, 1825, that the first passenger railway line in England was opened between Stockton and Darlington. It is also interesting to note that the electrical equipment fulfilled all expectations and the motors had no trouble in attaining 30 miles an hour for the train within 30 seconds from starting.

The tide appears to have turned with the Mersey Railway Company, which was electrically equipped by the British Westinghouse Company early this summer. This is an old steam tunnel railway from Liverpool under the River Mersey to a number of points on the opposite shore. For some years this company has been working at a loss, all possible profits having been exhausted by its working expenses, large sums having been consumed for ventilation of the tunnel, with little hopes of a dividend ever being forthcoming. At a recent half-yearly meeting it was stated that the number of passengers during the last half year distinctly increased and that the receipts have been steadily going upward, while before the electrification the receipts had been steadily going downward. The results of the succeeding six months will be much more important and will be awaited with considerable interest.

One or two accidents on the Central London Railway have called forth some criticism as to equipping electric railways with a multiple unit system. The accidents have been in the nature of derailments, and have always occurred while the trains have been shunted at one or other ends of the line and on a curve. It has brought forth the criticism that it is dangerous both to pull and push trains, especially on curves. The Board of Trade long ago decided that on railways the practice of pulling and pushing was dangerous, and now insists on trains which require more than one locomotive that the two locomotives should be in front of the train. The present system of electric traction, however, is rather opposed to this practice, and as the above criticism brings up an interesting point, doubtless more will be heard of it in the future.

Belfast City Council has unanimously approved the scheme for the purchase and electrification of the tramway system of Belfast submitted by Charles H. Merz at a cost of close upon a million pounds, including the purchase price of the owning company. It has also been decided to promote a bill in Parliament for the purpose of acquiring the undertaking. Mr. Merz has recommended the overhead system, and as all the lines will have to be relaid, the cost of electrification would mount up to about £664,621. This amount does not cover, however, the cost of a generating station, nor of certain necessary street alterations, so that the total cost of £1,000,000 will doubtless be readily reached.

Aberdeen has decided to try the "Thermit" system of welding rails, and it has been resolved to weld a hundred joints of the present rails in Albyn Place as an experiment. The report of the burgh surveyor was to the effect that if these rails, which were originally laid for horse traction, were welded, they would last for another four years.

At a recent meeting of the Town Council of Wolverhampton, it was decided to make important extensions of the surface contact system in use in that city, and a contract has been awarded the Lorain Steel Company for the necessary apparatus. The total cost of the extensions will aggregate about £60,000.

The important experiment of running a motor car service on their line between the Chalford and Stonehouse stations has been started by the Great Western Railway Company. At present the number of ordinary trains calling at these places and intermediate stations is but limited. Under the new arrangement, however, the facilities for traveling between these two points will be greatly increased, as it is intended to run a motor car each way every hour for about twelve hours daily. Not only will the car take up passengers at intervening stations, but passengers will also be taken on board at the four level crossings between Chalford and Stonehouse. The car is driven by a steam motor, and can be worked from either end. Divided into three compartments, one of which contains the motor, the car, which can attain a speed of 45 miles an hour, will accommodate fifty-two passengers, sixteen in cross seats in the center, and thirty-six in longitudinal seats towards each end. Space is left for parcels traffic and small hand luggage. Electrical communication is provided for the convenience of the conductor and driver. The vestibule, forming the third compartment, at one end of the car is provided with steps, by means of which passengers can enter and alight at level crossings. Tickets will be issued to travelers on the train itself on the tramway principle. The journey between Chalford and Stonehouse is timed to occupy twenty-three minutes, including stoppages.

A scheme for stimulating and expanding British trade in foreign and colonial markets, and one which promises to have far-reaching results, has been initiated by Ben. H. Morgan, recently Trade Commissioner to South Africa. It is that lectures shall be prepared by eminent engineers and leading experts in various lines of manufacture, who will make a point of showing what progress has been made in Great Britain up to the present time in the manufacture of all classes of machinery and goods, emphasizing novel points of utility, design, etc. It will be a special feature that each lecture will be illustrated with lantern slide views of the machinery or other subject dealt with. Lectures having thus been prepared will be immediately printed, and copies forwarded by previous arrangement for reading before technical and trade societies, Chambers of Commerce, colleges, schools and other educational and trading bodies in the British Colonies and leading centers of trade in foreign countries. The Board of Trade and other Government departments are giving the scheme their assistance, and are working with the Agents-General for the Colonies, with a view to arranging for the reading of the lectures before suitable institutions in the Colonies, while the Foreign Office is instructing Consuls abroad in the principal markets to give the scheme their co-operation. Mr. Morgan is dealing first with the engineering industry, and in this connection has already arranged for the preparation of the following lectures:

British Progress in Electrical Work—Sir Wm. H. Preece, Past President of the Institute of Civil Engineers.

British Progress in Dynamo and Motor Construction—J. Swinburne, Past President Institute of Electrical Engineers.

British Progress in Mechanical Road Traction—Colonel R. E. Crompton, Mechanical Institute Civil Engineers, Past President Institute Civil Engineers.

British Progress in Steam Generation—Professor W. Ripper, University College, Sheffield.

British Progress in Steam Boiler Construction—F. J. Rowan, ex-Vice-President Institute Mechanical Engineers.

British Progress in Machine Tool Manufacture—John Ashford, manager, Robey & Co., Lincoln.

British Progress in Municipal Engineering—W. H. Maxwell, borough surveyor and engineer, Tunbridge Wells.

British Progress in Steam Engine Construction—J. H. Dales, consulting engineer.

British Progress in Gas Works Plant and Machinery—C. E. Brackenbury, civil engineer, London.

British Workshops and Their Equipment—B. H. Morgan, Engineering Trades' Commissioner.

Pneumatic Tools and Appliances—E. C. Amos, Queen Victoria Street.

The Selection of Boilers—C. E. Stromeyer, chief engineer, Manchester Steam Users' Association.

A. C. S.

ELECTRIC RAILWAYS FOR VALPARAISO, CHILE

The Valparaiso Electric Company, formed in Berlin, Germany, by a combination of several leading banks and German electrical companies, with a capital of £250,000, to finance and build a complete electric railway system in Valparaiso, Chile, has taken over the concession granted by the Valparaiso municipality to Saavreda, Benard & Company, for the construction and operation of about 17 miles of electric railways in that city, and for the supply of electric light and power.

THE MICHIGAN AND INDIANA COMPANY'S LINE

The system of the Michigan & Indiana Traction Company, now under construction between Battle Creek and Grand Ledge, Mich., is expected to be completed about February, 1904. In all 56 miles of standard gage, single track line, will be built through Battle Creek, Belleview, Olivet, Charlotte, Potterville, Willetts, Lansing and Grand Ledge. The contract for the work is held by the Peninsula Construction Company. It is to be a third-rail road, and for the most part will be built upon private right of way, 4 rods wide, secured with a view to double tracking the line in the future. All fills and cuts have been made with the provision for double tracks. In Battle Creek, Charlotte and Lansing a private right of way has been secured with the object of running through cars on a fast schedule in these cities. Battle Creek, which is the terminus of the lines of the Michigan Traction Company, gives facilities for transferring passengers to Gull Lake, an ideal summer resort. In addition to this there is a summer resort at Lake Cognac, situated about a mile and a half from Battle Creek. Ledys Park, about three miles from Lansing, is also a pleasure resort. Grand River, through which the road passes, is the headquarters of the Spiritualists Association, which holds annual camp meetings there two months each year. The Michigan & Indiana Traction Company is in no way identified with the Michigan Central Traction Company, with which it has often been confused. The Central Company plans to build a road from Battle Creek to Lansing by way of Grand Ledge. The officers of the Michigan & Indiana Company are: Edward F. Pangburn, president; William M. Dibble, secretary; Charles J. Austin, treasurer; John M. Comstock, chief engineer; Frederick G. Higby, assistant engineer; Nicholas & Durfee, counsel.

NO STRIKE ON THE NEW YORK ELEVATED

The threatened strike of the motormen and firemen of the Interborough Rapid Transit Company, which operates all the elevated lines in New York, was averted Wednesday, Oct. 28, when an agreement was signed which is to be formally ratified at meetings of the motormen and firemen on Saturday, Nov. 7. The agreement was reached as the result of a conference lasting three hours Wednesday afternoon between the officials of the company and the representatives of the men. It was signed on behalf of the company by Vice-President E. P. Bryan. On behalf of the men it was signed by T. S. Ingraham, first grand engineer of the Brotherhood of Locomotive Engineers; John J. Hannahan, grand master of the Brotherhood of Locomotive Firemen; W. L. Jencks, chief of division No. 105 of the Brotherhood of Locomotive Engineers, and Harry B. Pinney, chairman, Brotherhood of Locomotive Firemen Lodges 149 and 155. The following copy of the agreement was given out by the officials of the company after the settlement was reached'

It was agreed as regards the differences between the management and the respective organizations named concerning examination of engineers and firemen that Dr W. R. Townsend, former medical examiner for the Manhattan Railway Company, and Dr. Leonard F. Pitkin, present medical examiner for the Interborough Rapid Transit Company, shall jointly, acting for the organizations named, and the Interborough Rapid Transit Company, determine from the records of the examination made by Dr. Townsend of the engineers and firemen of the Manhattan Railway, which men, from the number of men who on former examination of Dr. Townsend did not show a normal condition, should in their judgment undergo an examination at the present time.

All the men who showed a normal condition at the examination made by Dr. Townsend shall not be re-examined for a period of two years and six months from the date of their former examination, unless any of the men may give indication of weakness in any of the essential points required for the proper discharge of their duties. Those of the men who appear upon the record as very considerably below normal and whose records would seem to indicate that their condition could be improved by treatment, will be given a reasonable opportunity to fit themselves for this examination before they shall be subjected to it.

In the event of the examination or re-examination of the men, if a man examined is not satisfied with the decision reached by the company's medical examiner, he will have the privilege of undergoing an examination by any reputable physician or specialist in New York City. Should the diagnosis of the second physician not agree with that of the company's medical examiner, a third physician or specialist, to be agreed on by the company's medical examiner and the second physician or specialist, shall be called in, and the decision of two out of the three physicians shall be final. The company will pay the cost of all examinations.

When the examination of motormen was ordered some time ago there was considerable opposition to the order, and the men voted "not to submit," but the company insisted, and a series of conferences was held which resulted in the adoption of the agreement on Oct. 28, which is a complete victory for the management.

One reason for ordering a general examination was that the company felt the necessity for having complete, exact and reliable records of the physical condition of its employees. The old method comprised simply in having applicants present a certificate signed by the company's physician saying that the applicant was not disqualified by his physical condition from entering the service. This, of course, gave the company's officers no idea of the man's actual condition, and they could not determine intelligently whether he was liable to maintain the standard set by them or deteriorate physically within six months, a year, or two years. It was therefore determined to complete the records by having each man's condition carefully noted. The present certificate is made out in the following form:

THE INTERBOROUGH RAPID TRANSIT COMPANY,
MANHATTAN RAILWAY DIVISION
Surgeon's Office
No. 195 Broadway

MR. FRANK HEDLEY, General Superintendent. New York City, N. Y., ...190...

Dear Sir—

In compliance with your instructions of the————I have this day made a physical examination of Mr. .....as to his fitness for the position of ..... and beg to report as follows:

Age.....years		Height .....Ft. .....inches	
Weight.....lbs.		Pulse	
Respiration.....		Heart	
Color Sense	Vision	Right Eye	
Hearing		Lett Eye	

In my opinion the applicant is ..... for the duties of .....

General Remarks .....

.....

.....

Applicant's Signature .....

.....
Surgeon.

This certificate contains two endorsements; the first being the order of the superintendent to the medical department authorizing the examination, and the other the examining surgeon's memorandum. Each form must be signed by the applicant in the presence of the superintendent or surgeon, and countersigned by that officer of the company, thus effectually preventing the substitution of dummies for applicants who were not in good physical condition.

INDIANA COAL ROAD

The recent absorption of the Indianapolis & Plainfield Electric Railway by the Indiana Coal Traction Company divulges an extensive scheme for the operation of a coal carrying electric railway extending from Indianapolis through Sullivan, Clay, Green, Vigo, Owen and Park Counties, Indiana. The present system now covers 14 miles of road in operation between Indianapolis and Plainfield, but the mortgage of $5,000,000 which has just been placed on the property insures the construction of more than 150 miles of additional road.

The Western terminals of the system will be Rockville, Terre Haute and Sullivan. The plan is to build a double-track line between Indianapolis and Terre Haute, and maps already prepared show that the Plainfield line is now almost completed into Cartersburg and Danville, the latter town being reached by a spur from Cartersburg. Beyond Cartersburg the road is to parallel the Vandalia Railroad through Amo, Coatsville and Clayton. From Greencastle the main line is to be carried by a short cut to Brazil, passing between the Vandalia and Big Four Railroads most of the distance. At Brazil it is to cross to the south of the Vandalia, run a mile or two south of that company's tracks and head for Terre Haute by direct route. Starting at Greencastle, a branch line is to run through Vivalia, Ferndale and Lakeland to Rockville. This will be a single-track road, constructed principally as a coal carrier. The other big branch will leave the main line at Plainfield and head southwest by Monrovia, Halls and Eminence, in Morgan County, and Clay City, in Clay County, to Sullivan. A short road will be run south from Asheville to Linton. This line will be single track, and will tap large coal leases including thousands of acres held by the McGowan-McCulloch syndicate, which is interested in the Indianapolis Traction & Terminal Company and the Indiana Union Traction Company. It is said that the rolling stock for handling freight will be especially constructed and that electric locomotives will be used. Detail plans for the construction of these lines will be worked out this winter, and it is expected that their construction will be begun early next year. The officers of the company are: Albert Lieber, president; Fred Francke, vice-president, and J. J. Appel, secretary. It is understood that the road really is an Indiana Union Traction interest, and that Hugh J. McGowan and Geo. F. McCulloch are heavily interested, though their names do not appear connected with the company.

AN AUSPICIOUS OPENING

The Humbolt Transit Company, of Eureka, Cal., has submitted a very interesting statement of the business done on its lines during the first month of operation. The road was opened for business on Sept. 15, having 2¾ miles of track finished at the time, and two cars were operated for seventeen and a half hours a day. The total number of cash fares collected was 50,376, and tickets were sold representing 8946 additional fares, making a total of 59,322, or $2,966.30. Under the terms of the franchise 3½ per cent of the gross receipts is paid to the city of Eureka. This amounted to $103.82; the operating expenses are reported at $1,500, leaving a net income of $1,362.48. The total receipts per day, therefore, amounted to $98.87. During this month, however, a fair was in progress which, of course, greatly increased the business above the normal, and making allowance for this it is estimated that the normal receipts per day were $74.33. The company is now completing 2¼ miles of additional track which will be in operation by the first of the year.

PENNSYLVANIA RAILROAD TO OPERATE TROLLEYS?

The report comes from Philadelphia that indications are growing that the Pennsylvania Railroad, either directly or through interests closely allied with it, proposes to go into the business of operating electric railways for the short haul traffic in and about Philadelphia. A short time ago a company made up of Fourth Vice-President Samuel Rea and several employees of the road took out a charter for an electric railway to run from Bristol to Trenton, and presumably to use the discarded bridge of the Pennsylvania Railroad over the Delaware. On Saturday, Oct. 24, it was announced from Harrisburg that a charter had been granted authorizing the Overbrook, Bryn Mawr & Paoli Street Railroad Company to build a line 23 miles long, from the intersection of City Line Avenue and Lancaster turnpike in Lower Merion township, Montgomery County, to various suburbs. This line is in the territory which for years the influence of Pennsylvania interests has been strong enough to keep sacred from the invasion of the electric railway. Incidentally, it taps the territory that is designed to be used by the mysterious Philadelphia & Western Railroad, which has been thought in some quarters to be an entering wedge for the Wabash into Philadelphia.

NEW CHICAGO TRACTION COMPANY

Application has been made to the Secretary of State at Springfield for articles of incorporation of the Chicago Railways Company, which, it is said, will furnish the solution of the problems confronting the Union Traction Company and its underlying corporations. The corporators are Nathan C. Johnson, W. E. Cooper and Archibald G. Thiselton. Alfred Skitt, of New York, is said to be the prospective president of the company, and Harry B. Hollins, now a director of the Union Traction Company, has tendered his resignation from that company, and will be associated with Mr. Skitt in the directory of the new corporation. The capitalization of the new concern is placed nominally at $10,000, but it is said to be the purpose of its promoters to increase it to $5,000,000, and later to a figure that will cover the amount required for the rehabilitation of the North Side and West Side systems. The new company is declared to be not organized for any purpose unfriendly to the receivership of the Union Traction Company, and any leases which may be made by it will be subject to the termination of the receivership.

NEGOTIATIONS BROKEN OFF BETWEEN CITY AND COMPANY IN CHICAGO

On Wednesday, Oct. 28, the negotiations between the city and the Union Traction Company were brought to a close, at least, temporarily. The deadlock came over Attorney John S. Miller's refusal to agree to a waiver of the ninety-nine-year rights, such as were framed by E. B. Smith, special attorney for the city, and incorporated in the tentative ordinance granting the Chicago City Railway Company a twenty-year franchise. The matter was finally referred to the city's lawyers, who were instructed to evolve some plan, if possible, whereby the negotiations might be continued. Attorney Miller, who represents the traction receivers, based his refusal upon the fact that the ninety-nine-year rights were assets of the bondholders of the underlying companies, which the receivers had no right to give away.

Attorney Miller told the local transportation committee that the Union Traction Company could not accept a franchise exension ordinance on the terms agreed upon with the Chicago City Railway Company, because the receivers could not waive the ninety-nine-year claims without the consent of the bondholders. He also declared he did not see how the company could agree to pay the city any compensation for the extension of its franchise. Mr. Miller was unable to satisfy the committee that he and the receivers had the authority to enter into negotiaions and make terms that would be binding on the stockholders of the underlying companies. The lawyers, therefore, were directed to make another attempt to agree on some method of procedure by which negotiations can be resumed.

MONTREAL COMPANY MAKES OFFER FOR FRANCHISE EXTENSION

The Montreal Street Railway Company has submitted to the Council of that city, in reply to that body's communication of July 6, in regard to the terms it would make to remove snow from the streets, sprinkle, sweep and pave the streets, and make special rates of fare, specifically set forth a counter proposition in which it is practically agreed to assume all of the conditions laid down by the city if an extension of the company's franchise for thirty years is granted. In order thoroughly to understand the conditions, the official communications follow:

WHAT PROPOSITIONS OF THE CITY WERE

1. To remove the snow from the streets in which the company's cars are in operation.
2. To water the said streets at least twice daily, the city to supply the water for street watering free of charge to the company.
3. To sweep the said streets during the night, as far as it is mechanically possible to do so, the area which the company's appliances fail to reach to be swept by the city, and the sweepings to be removed by the city.
4. To sell ten tickets, instead of eight, for 25 cents during working hours. Working hours shall mean from 5 a. m. to 8 a. m., and from 5 p. m. to 7 p. m., from April 30 to Nov. 1, and from 5 a. m. to 8 a. m. and from 4 p. m. to 7 p. m. from Nov. 1 to April 30.
5. To pave the said streets in permanent paving to be selected by the road committee, and maintain the said streets in good repair.

THE COMPANY'S ANSWER

J. H. Dillon, Esq., Secretary of the road committee, City Hall, Montreal:

Dear Sir—After considering the extract from the minutes of Council, held on July 6, 1903, I have to answer your questions as follows:

This company would be prepared to undertake the following:

1. To remove the snow from the streets in which the company's cars are in operation.
2. To water at least twice in twenty-four hours its track allowance, the city supplying water and making provision for obtaining the water, by permitting sidings where convenient.
3. The company would sweep during the night the streets on which it operates by mechanical sweepers with as wide a sweeper as can be conveniently operated on its cars—the city to sweep the balance of the street and remove the sweepings.
4. The company would sell ten tickets, instead of eight for (25) twenty-five cents, for use during certain hours, that is to say, 5 a. m. to 8 a. m., and 5 p. m. to 7 p. m., with an additional half hour in the afternoon in the winter months, so long as the new arrangement is in force.
5. The company would be prepared to consider certain expenditure in connection with crossings, but would not be prepared to assume the whole burden of paving and maintaining the streets. This is an item that would require further discussion.

As a consideration for the foregoing, the company would require, by way of concession from the city:

1. A further extension of the company's contract for thirty years from the time of expiry of the present contract, modifications coming into force at once.
2. An arrangement by which the company would be enabled to consider and deal with questions affecting the use of the streets by other companies by mutual arrangement with such other companies, provided the arrangement be subject to reasonable restrictions in favor of the city. Failing such mutual arrangement, the city to deal with such other company subject to the existing rights of the Montreal Street Railway.
3. At the expiration of the extended period, the city, in event of expropriation, to acquire the whole undertaking of the railway, and not only the part in Montreal, at a price to be fixed by arbitration.
4. The new obligations assumed by the company to be in lieu of taxes, except such general taxes as may be imposed upon all joint stock companies.
5. An arrangement to be made to submit to arbitration in event of dispute, matters involving changes in or additions to the company's system, in territory not now within the city limits, but which may hereafter be within the city limits during the currency of the contract.

I cannot do more than indicate in general terms the lines upon which the company would be prepared to take up the matters referred to in the extract of minutes. Yours truly, F. L. Wanklyn,
Vice-President and General Manager.

A NEW CAR PLANT

The T. H. Buckley Car Manufacturing Company, of Worcester, Mass., which was organized in the early part of the current year, is rapidly pushing to completion its new plant in Worcester, Mass. The plant is located on the corner of Fay Street and Grafton Street, running back to the Boston & Albany Railroad. Three acres of land have been bought in this location. Part of this land is at present occupied by a manufacturing business in which Mr. Buckley is largely interested.

As the land on which the plant is located borders on the railroad, arrangements have been made with the Boston & Albany Railroad to secure switch and sidetrack privileges extending into the works. A track will be built through the main building of the plant, so that lumber and building material of all kinds for car construction can be unloaded inside ready for immediate use. Cars to be shipped from the works can be loaded on to freight cars within the main building. This method of handling material for construction and shipping the finished product will save considerable money to the company in hauling and cartage.

The main building will be 66 ft. wide by 225 ft. long, and is being rapidly completed so that it will be ready to receive the machinery before Dec. 1. The floor of this building will be of concrete. It will be equipped with the best modern machinery for street car construction. Two tracks will be run the entire length of this building and there will be room, at one time, inside, for setting up and finishing for shipment thirty-two standard electric cars. The full manufacturing capacity of the plant will be 300 electric cars a year.

Adjoining the main building is another building covering 15,309 sq. ft. of floor space. This contains the woodworking department, blacksmith shop, setting-up shop, painting and finishing department. It is already equipped with new and improved machinery and appliances for expeditious car construction. On the north end of the main building are located the engine and boiler rooms.

The services of thoroughly competent and experienced draughtsmen and car builders are being secured and work on the first orders for cars will begin by Dec. 1. The capital stock of the company is $250,000, fully paid in. The officers are: T. H. Buckley, president and treasurer, John T. Flannigan, secretary.

DIAGRAM OF TRAFFIC IN AN ANNUAL REPORT

A feature of the second annual report of the Birkenhead Corporation Tramways, recently made public, is a series of diagrams of the fluctuations of weekly receipts, the passenger demands for different hours on week days during a typical summer week, and the number of passengers carried hour by hour on a summer Sunday and a winter Sunday.

The diagram illustrating the number of travelers at the various periods of the day in a typical summer week shows that, commencing at 5 a. m., the cars carried in the first hour from 650 to 700 passengers, the number increasing at a bound in the next hour to 1800, falling again to 1300 between 9 and 10 a. m., and jumping up to 1700 between 11 a. m. and noon, 2100 between noon and 1 p. m., and 4500 during the next two hours. Afterwards the number dropped to 1950 between 3 p. m. and 4 p. m., rising to 2150 before 5 o'clock. From 5 o'clock to 7 o'clock, the "rush hours," the number carried by the cars amounted to 6000. For the remainder of the evening the pressure slackened rapidly, the passengers between 7 p. m. and 8 p. m. averaging 2250; between 8 o'clock and 10 o'clock, 1875 per hour; between 10 p. m. and 11 p. m., 1375; and for the last hour to midnight dropping to 650 stragglers.

The diagram illustrating the average number of passengers carried during each hour on a summer Sunday and a winter Sunday is most interesting. On the Sabbath the service commences at 1 p. m., and in summer the cars on the seven routes during the first hour carry from 1000 to 1800 passengers, as compared with 1200 to 1700 in winter. Between 2 and 3 o'clock the travelers grow from 1800 to 2000 in summer, and from 1700 to 1900 in winter, the numbers increasing in summer to 2200 between 5 p. m. and 6 p. m., and dropping to 1600 and 1500 in winter during the same period. Between 6 o'clock and 7 o'clock in the summer the traffic falls to 1900, and in winter to 1500, rising again in summer to 2200 between 7 p. m. and 8 p. m., 3400 between 8 p. m. and 9 p. m., and the maximum number of 3700 between 9 and 10 o'clock at night. In winter, from 6 o'clock, the traffic grows to 1800 between 8 p. m. and 9 p. m., and reaches the maximum demand of 2600 between 9 p. m. and 10 p. m. For the last hour of the Sunday traffic, between 10 and 11 o'clock, the passengers in summer decrease rapidly to 1200, and in winter to the low-water mark of 700 passengers.

CHANGES IN CLEVELAND CITY ROUTES

The Cleveland Electric Railway Company is again making changes in its routes. Since the consolidation of the two city systems, the company has been combining routes in order to run as many cars as possible directly across the city, thus improving the service by relieving the congestion on Superior Street, around the loop and at the Public Square. Among the routes combined were the following: Cedar and Jennings, Detroit and Wade Park, and Broadway and St. Clair. This took the Cedar, Jennings, Broadway and St. Clair cars off lower Superior Street, and also away from the loop which brought passengers to the point nearest the Union Railway station. The merchants of lower Superior Street immediately made complaint, claiming their trade was being diverted by the removal of cars. The Euclid Avenue line, the only line that had been running to the Union station, was recently tied up by a parade, and demand was made from certain quarters that more cars should be run to the station. Now it is proposed to run all Payne Avenue, Cedar Avenue and half the Euclid Avenue cars to the Union station. The other half of the Euclid Avenue cars will be coupled with the Jennings Avenue cars into a new crosstown line, which, of course, means the abandoning of the Cedar and Jennings combination. The combination of routes has been a good thing for the company, as it has decreased the mileage of cars on loops and has enabled the company to dispense with a number of runs. Besides, it is improving the running time across the city, and is facilitating the handling of crowds during rush hours.

NEW PUBLICATIONS

The Standard Dictionary, Decennial edition (July, 1903). Published by the Funk & Wagnalls Company, New York.

This dictionary has been before the public for a sufficient length of time so that its advantages have become recognized. The fact that a new and enlarged edition has become imperative is sufficient evidence that it meets the wants of a large number of dictionary users. Although containing 317,000 vocabulary terms, the single volume is not unwieldy, as the definitions are remarkable for their conciseness as well as for their accuracy. Several of the valuable features of the work, outside of its dictionary of words, proper names and phrases, are dictionaries of common Spanish-American, Austral-English and Anglo-African terms, an atlas of principal countries, descriptive and statistical cyclopedia, and glossary of abbreviations and contractions.

PERSONAL MENTION

MR. ALBERT H. FLINT, of Flint, Eddy & Company, of New York, has been elected president of the Chesapeake Transit Company, which operates an electric railway between Norfolk and Cape Henry, Va.

MR. A. T. LONG, formerly in the auditor's department of the Aurora, Elgin & Chicago Railway, has been appointed auditor of the Ohio Central Traction Company, with offices at Galion, Ohio, succeeding Mr. Frank R. Green, resigned.

MR. GEORGE W. COLLES, member American Society Mechanical Engineers, has resigned his position as chief engineer of Marion & Marion, Montreal, and opened an office as consulting mechanical and electrical engineer in Milwaukee, Wis.

MR. C. C. SROUFFE, who recently resigned as superintendent of the Yuma & Tucson division of the Southern Pacific Railroad, has been appointed chief engineer of the Los Angeles & Glendale Electric Railway Company, of Los Angeles, Cal.

MR. C. O. WHYSOLL has succeeded Mr. H. A. Fisher as general manager of the Columbus, Delaware & Marion Railway. Both Mr. Fisher and his son, Mr. L. D. Fisher, formerly chief engineer of the Columbus, Delaware & Marion Railway, are devoting their entire attention to the construction of the Elgin, Plainfield & Joliet Railway, which is being constructed between the towns mentioned in the title, which are in Illinois.

MR. ELMER M. WHITE, cashier of the Hartford Street Railway Company, was in New York last week. At the last convention of the Street Railway Accountants Association of America Mr. White was appointed a committee of one to take charge of the association's collection of blanks and forms. Mr. White is planning to bring this up to date and make certain rearrangements which will make the collection of greater value to members of the association.

TABLE OF OPERATING STATISTICS

Notice.—These statistics will be carefully revised from month to month, upon information received from the companies direct, or from official sources. The table should be used in connection with our Financial Supplement "American Street Railway Investments," which contains the annual operating reports to the ends of the various financial years. Similar statistics in regard to roads not reporting are solicited by the editors. * Including taxes. † Deficit. *a* Including all lines operated.

Company	Period	Total Gross Earnings	Operating Expenses	Net Earnings	Deductions From Income	Net Income, Amount Available for Dividends
AKRON, O.						
Northern Ohio Tr. & Light Co	1 m., Sept. '03	84,015	43,918	40,097	22,707	17,390
	1 " " '02	67,492	35,997	31,495	17,073	14,422
	9 " " '03	666,302	361,950	304,352	199,665	104,687
	9 " " '02	551,899	304,138	247,761	153,298	94,463
AURORA, ILL.						
Elgin, Aurora & Southern Traction Co.	1 m., Sept. '03	40,446	22,056	18,390	9,172	9,218
	1 " " '02	37,866	20,814	16,992	9,049	7,943
	9 " " '03	346,170	196,577	149,593	75,838	73,755
	9 " " '02	308,240	175,739	132,501	75,715	56,785
BEAVER FALLS, PA.						
Beaver Valley Trac. Co.	12 m., Sept. '03	227,409	126,207	101,203	70,414	30,788
	12 " " '02	177,214	96,399	80,815	62,374	18,241
BINGHAMTON, N. Y.						
Binghamton St. Ry. Co.	1 m., Sept. '03	21,932	10,657	11,275	------	------
	1 " " '02	18,432	10,460	7,972	------	------
	3 " " '03	73,507	33,998	39,509	19,108	20,401
	3 " " '02	65,253	33,983	31,270	15,449	15,821
BUFFALO, N. Y.						
International Tr. Co.	1 m., Sept. '03	377,922	201,041	176,881	127,445	49,435
	1 " " '02	321,355	161,525	159,831	125,887	33,944
	3 " " '03	1,198,316	592,926	605,390	398,971	206,419
	3 " " '02	1,019,518	506,664	512,854	381,198	131,656
CHICAGO, ILL.						
Aurora, Elgin & Chicago Ry. Co	1 m., Sept. '03	44,394	20,145	24,249	------	------
	3 " " '03	157,436	67,080	90,356	------	------
Chicago & Milwaukee Elec. Ry. Co.	1 m., Sept. '03	40,921	9,820	31,101	------	------
	1 " " '02	19,347	6,988	12,359	------	------
	9 " " '03	194,636	66,936	127,700	------	------
	9 " " '02	147,407	59,847	87,560	------	------
Metropolitan Elevated Ry. Co	12 m., June '03	2,104,470	1,037,181	1,067,289	901,643	165,646
	12 " " '02	1,833,631	781,210	1,052,421	837,817	214,604
South Side Elevated Ry Co	12 m., June '03	1,555,043	856,127	698,916	151,271	547,645
	12 " " '02	1,412,709	760,212	652,497	177,918	474,579
CINCINNATI, O.						
Cincinnati, Newport & Covington Light & Traction Co	1 m., Aug. '03	112,576	*61,827	50,749	21,351	29,399
	1 " " '02	96,217	*54,395	41,823	21,113	20,710
	8 " " '03	794,968	*460,490	334,478	168,534	165,943
	8 " " '02	707,436	*401,794	305,642	168,749	136,892
CLEVELAND, O.						
Cleveland & Southwestern Traction Co	1 m., Sept. '03	43,159	25,330	17,829	------	------
	1 " " '02	30,464	14,996	15,468	------	------
	9 " " '03	330,232	194,739	135,493	------	------
	9 " " '02	219,968	121,120	98,848	------	------
Cleveland, Painesville & Eastern R. R. Co	1 m., Sept. '03	23,023	12,973	10,050	6,568	3,482
	1 " " '02	19 396	10,933	8,464	6,193	2,271
	9 " " '03	164,886	94,008	70,878	58,302	12,576
	9 " " '02	151,895	84,396	67,499	55,775	11,724
Eastern Ohio Traction Co	1 m., Sept. '03	21,677	12,899	8,778	------	------
	9 " " '03	153,215	97,130	56,084	------	------
DETROIT, MICH.						
Detroit United Ry *a*	1 m., Sept. '03	413,639	*233,596	180,043	84,208	95,835
	1 " " '02	373,097	*204,262	168,835	81,258	87,577
	9 " " '03	3,333,622	*1947478	1,386,144	743,762	642,382
	9 " " '02	2,986,119	*1668017	1,318,102	703,219	614,883
DULUTH, MINN.						
Duluth Superior Traction Co	1 m., Sept. '03	51,577	28,094	23,483	10,832	12,651
	1 " " '02	46,763	23,091	23,672	9,619	14,053
	9 " " '03	465,261	257,041	208,220	94,085	114,135
	9 " " 02	396,258	206,994	189,264	86,819	102,445
FORT WORTH, TEX.						
Northern Texas Traction Co	1 m., Sept. '03	41,949	22,033	19,916	9,673	10,243
	9 " " '03	335,297	178,168	157,129	82,490	74,639
HAMILTON, O.						
The Cincinnati, Dayton & Toledo Trac. Co.	1 m., Sept. '03	49,983	23,401	26,582	15,999	10,583
	1 " " '02	44,090	23,050	21,040	16,251	4,788
	4 " " '03	204,661	99,586	105,075	64,291	40,784
	4 " " '02	184,502	91,206	93,296	65,241	28,055
HANCOCK, MICH.						
The Houghton County St. Ry. Co	1 m., Aug. '03	20,871	10,256	10,614	2,929	7,685
	1 " " '02	17,305	9,814	7,491	2,604	4,887
	12 " " '03	182,103	120,595	61,508	33,850	27,658
	12 " " '02	170,802	101,955	68,847	30,525	38,323
HARRISBURG, PA.						
Central Pennsylvania Traction Co	1 m., Sept. '03	45,753	36,714	9,039	------	------
	1 " " '02	38,391	22,515	15,876	------	------
	9 " " '03	391,143	274,133	117,010	------	------
	9 " " '02	344,539	205,930	138,609	------	------
HAZLETON, PA.						
Lehigh Traction Co.	1 m., Sept. '03	13,291	6,154	7,137	------	------
	1 " " '02	6,379	3,525	2 854	------	------
	9 " " '03	105,522	58,811	46,711	------	------
	9 " " '02	74,717	46 578	28,139	------	------
HOUSTON, TEX.						
Houston Electric Co.	1 m., Aug. '03	40,824	21,809	19,015	7,538	11,477
	1 " " '02	33,639	17,578	16,061	6,250	9,811
	3 " " '03	118,193	66,455	51,739	21,024	30,715
	3 " " '02	96,374	51,590	44,783	18,750	26,033
JACKSONVILLE, FLA.						
Jacksonville Electric Co	1 m., Aug. '03	21,790	14,138	7,652	3,115	4,536
	1 " " '02	17,832	13,730	4,102	2,875	1,227
	12 " " '03	231.785	155,328	76,457	35,138	41,320
LONDON, ONT.						
London St. Ry. Co	1 m., Sept. '03	19,536	10,308	9,228	2,432	6,796
	1 " " '02	18,158	8,648	9,509	2,110	7,399
	9 " " '03	132,517	83,756	48,761	19,873	28,889
	9 " " '02	115,611	70,812	44,849	20,284	24,565
MILWAUKEE, WIS.						
Milwaukee El. Ry. & Lt. Co.	1 m., Sept. '03	272,346	135,460	136,887	75,286	61,601
	1 " " '02	259,591	110,736	148,854	70,591	78,263
	9 " " '03	2,245,436	1,128,481	1,116,956	649,555	467,400
	9 " " '02	2,014,941	946,508	1,068,432	596,811	471,621
MINNEAPOLIS, MINN.						
Twin City R. T. Co	1 m., Sept. '03	372,252	156,924	215,329	60,937	154,391
	1 " " '02	339,669	130,611	209,058	60,233	148,825
	9 " " '03	3,020,843	1,398,887	1,621,955	548,130	1,073,825
	9 " " '02	2,667,095	1,191,320	1,475,775	530,733	945,041
NEW YORK, N. Y.						
Interurban Street Ry. Co. *a*	12 m. June '03	22,122,953	11389 109	10733 844	7,366,190	3,367,654
OAKLAND, CAL.						
Oakland Transit Consolidated Co	1 m., Sept. '03	100,252	49,122	51,130	24,246	26,883
	1 " " '02	83 326	44,592	38,734	21,865	16,869
	9 " " '03	837,911	428,951	408,960	------	------
	9 " " '02	695,717	414,811	280,906	------	------
PHILADELPHIA, PA.						
American Railways	1 m. Sept. '03	132,004	------	------	------	------
	1 " " '02	107,614	------	------	------	------
	3 " " '03	421.861	------	------	------	------
	3 " " '02	353,193	------	------	------	------
RICHMOND, VA.						
Virginia Passenger & Power Co	12 m. June '03	1,368,410	825 672	542,738	770,295	†227,556
Pueblo Suburban Traction & Lighting Co	1 m., Sept. '03	47,191	------	------	------	------
	9 " " '03	368,707	------	------	------	------
SAO PAULO, BRAZIL.						
Sao Paulo Tramway, Light & Power Co., Ltd	1 m., Sept. '03	126,000	32,000	94,000	------	------
	1 " " '02	102,960	32,873	70,088	------	------
	9 " " '03	962,300	295,100	667,200	------	------
	9 " " '02	822,020	314,937	507,083	------	------
SAVANNAH, GA.						
Savannah Electric Co	1 m., Aug. '03	50,756	26,859	23,897	9,804	14,093
	1 " " '02	46,196	24.183	22,013	9,583	12,429
	2 " " '03	101,068	54,053	47,015	19,636	27,379
	2 " " '02	92,747	48,632	44,114	19,166	24,947
Scranton Ry. Co	1 m., Sept. '03	78,622	40,561	38,061	19,786	18,275
	1 " " '02	55,647	34,379	21,268	19,086	2,182
	9 " " '03	619,577	348,735	270,842	178,072	92,770
	9 " " '02	378,932	287,333	91,599	171.772	†80,173
SEATTLE, WASH.						
Seattle Electric Co	1 m., Aug. '03	188,541	123,829	64,712	22,257	42,455
	1 " " '02	179.116	112,450	66,667	21,158	45,508
	2 " " '03	373.472	247,610	125,862	45,321	80,541
	2 " " '02	336,954	220,695	116,260	40,857	75,402
SYRACUSE, N. Y.						
Syracuse Rapid Transit Co	1 m., Sept. '03	72,079	39 966	32,113	20,329	11,784
	1 " " '02	61,164	33,545	27,619	19,025	8,594
	3 " " '03	212,593	117,459	95,134	60,883	34,251
	3 " " '02	184,314	101,224	83.090	57,075	26,015
TERRE HAUTE, IND.						
Terre Haute Elec. Co.	1 m., Aug. '03	46,255	26,818	19,438	6,665	12,773
	1 " " '02	34,456	21,800	12,656	6,461	6,195
	2 " " '03	88,299	57,075	36,225	13,203	23,021
	2 " " '02	62,258	43,068	19,190	12,891	6,300
TOLEDO, O.						
Toledo Rys. & Lt. Co.	1 m., Sept. '03	150,011	*78,237	71,774	41,418	30,356
	1 " " '02	127,639	*62,001	65,638	38 921	26,717
	9 " " '03	1,225,929	*631,174	594,755	366,850	227,905
	9 " " '02	1,069,058	*546,588	522,470	342,708	179,762
Toledo, Bowling Green & Southern Trac. Co.	1 m., Sept. '03	28,915	15,949	12,966	------	------
	1 " " '02	21,974	12,959	9,015	------	------
	9 " " '03	217,393	133,149	84,244	------	------
Lake Shore Electric Ry. Co	1 m., Sept. '03	63,498	36,639	26,859	20,370	6,489
	1 " " '02	46,052	29,796	16,256	------	------
	9 " " '03	467,912	296,136	176,776	179,632	†2,856
	9 " " '02	342,574	215,029	127,545	------	------
YOUNGSTOWN, O.						
Youngstown - Sharon Railway & Light Co	1 m., Sept. '03	43,781	*24,919	18,862	------	------
	9 " " '03	383,220	*226,313	156,907	------	------
ZANESVILLE, O.						
Zanesville Ry., Light & Power Co	6 m., Aug. '03	74,706	36,733	37,973	19,625	18,348

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EDITORIAL NOTICE

Street railway news, and all information regarding changes of officers, new equipments, extensions, financial changes and new enterprises will be greatly appreciated for use in these columns.

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Chicago Franchise Extension Ordinance

The Chicago City Railway Company has signified its acceptance in the main of the franchise extension ordinance prepared by the Council sub-committee on franchises, and outlined on another page in this issue. This ordinance will be submitted to the local transportation committee, and later to the whole City Council. The clause specifying the compensation to be paid the city has been left blank, and this feature will be a question for further negotiation. Under the terms of the proposed ordinance the company waives whatever rights it may have under the ninety-nine-year act in exchange for a blanket franchise covering all of its lines for twenty years. This is a very important decision in view of the attitude of the other companies, and the ratification of the agreement containing this provision, it is needless to say, might have an important bearing upon the general question, as it has been assumed all along that the terms of the several grants would be practically identical. Judge Grosscup, it is needless to say, places considerable weight upon the rights of the companies under the ninety-nine-year act, and the question naturally arises whether he will be influenced in effecting a settlement for the North Side and West Side systems by the action of the South Side Company. Whatever may be the final solution, therefore, the first franchise granted will undoubtedly be looked upon by the public as the model upon which the others will be formed.

It is unnecessary and impracticable to review the details of the proposed ordinance here. The subject has been carefully discussed in all its bearings in these columns during the progress of the controversy, and there is little to be added at this time. We must confess a feeling of disappointment over the form of the proposed measure. It is far from satisfactory, and, if adopted, will, we fear, require constant tinkering and interpretation. To begin with it is not a general measure, but is complicated and involved in details which should have no place in such a document. For instance, it specifies in a vague way many things regarding the operation and equipment, which should have been left entirely to the management to deal with according to the advancement in the art; most of the provisions the company would carry out in any event, whether specified in the ordinance or not. At any rate, a franchise ordinance is not the place where such matters should be discussed.

Provision is made for the operation of cars through a subway in the down-town district, if such subway shall be built, and specifies the way in which compensation for the use of subways shall be determined in case there is a disagreement between the city or any company building the subway and the railway company. It is stipulated that at the end of twenty years the city may purchase all the property of the company at its physical value, leaving out of account any values attached to the franchise, or may extend the franchise under a new ordinance, or the city may make the grant to another company, which shall pay to the Chicago City Railway Company the same price that would be paid if the city were purchasing the property. It is the purpose of the city administration to frame matters so that the entire transportation problem may be considered advantageously to the municipality at the expiration of the present term, and pave the way for municipal ownership and operation if such a step should be considered desirable at that time. There are other features of this ordinance which we will reserve for consideration at more opportune times.

St. Louis Transit Shops

The new shops of the St. Louis Transit Company, completed this fall and described in this issue, are in many ways the most important electric railway repair shops ever put in operation. It is common, in discussing work of this kind, to compare it with other recent work of similar character, but it would be difficult to make such a reference in this instance, because in many respects the St. Louis shops are designed to meet operating conditions which are quite different from those on many roads. For example, it is the plan to use them for practically all of the repair and renewal work of the entire system, leaving nothing to be done at the several car houses but the renewals of small parts, which can be accomplished by hand without the aid of machinery for heavy lifting. For this reason a great deal of space has been given to repair tracks, and the facilities for handling parts to and from these tracks are unusually complete. The very multiplicity of repair tracks and the great number of places at which heavy lifting must be

carried on at one time led the management to abandon the favorite modern method of installing large traveling cranes, and to use instead a system of overhead travelers running on I-beams and equipped with air and chain-block hoists. The large traveling crane has become so indispensible in large factories and is finding such increasing use in electric railway repair shops, especially where cars, trucks and motors are very heavy, that its absence in this installation seems strange at first thought, but not at all remarkable after the operating conditions are taken into account. It must be remembered that it is a vastly different proposition to handle motors and trucks on half a dozen tracks from doing the same work on twenty-seven tracks.

It would be hard to conceive of two large repair shops more radically unlike in design than those of the St. Louis Transit Company and the Chicago City Railway Company described several months ago. These two are are the best equipped large shops recently completed. When we say this we do not mean to cast any reflection on the excellence of many small shops recently described, which are equally well adapted for the class of work which they do. In the Chicago shops we find the machine shop, coil winding department and several minor departments in a large, high, two-story building, served with a traveling crane in a bay through the middle, by which the heavier material is delivered directly to the large machine tools. The number of repair tracks are comparatively few. The blacksmith shop is in another building. Car building and painting may be left out of the present comparison, as the new St. Louis shops do not include these departments. In the St. Louis shops we have a one-story building with low saw-tooth roof. The heavy material is handled entirely by an overhead traveler system of 6000 lbs. capacity, and this, with the car and pit hoist, is sufficient to do all the lifting and carrying. What makes possible such radical differences in shop design is the difference in the operating methods. At St. Louis everything goes to the repair shop for repairs and renewal of heavy parts, and numerous tracks have to be provided for the occupancy of the many cars that must be taken care of at one time. At Chicago many repairs and renewals are carried on at the several car houses. We will not now discuss the relative merits of these two operating methods, but they explain the necessity for changes in the design of these two shops. A shop like that in Chicago partakes largely of the nature of a manufacturing enterprise, while that in St. Louis is both a car repair house and a manufacturing concern.

Special attention should be called to some of the excellent features to be found in the St. Louis shops, notably the car hoists with which the repair tracks are equipped. These hoists seem to be as absolutely safe as any car hoists yet devised, and have many strong points, including the ability to stay at any point at which they may be left without special precautions for holding them there, combined with quickness and simplicity of operation. The transformer test for short-circuited armature and field coils has been referred to on numerous occasions within the last year in these columns, but on account of its simplicity of operation and consequent great commercial value, we cannot refrain from again calling attention to it. Another practice just being introduced by the St. Louis Transit Company, to which we have called attention before, is that of abandoning pit work as far as possible, and requiring all new motors and trucks to be adapted to repair work without the use of pits, or, in other words, to be handled from above rather than below.

Elevated Platforms in Chicago

The Union Elevated Loop in Chicago recently, after much delay, secured permits to lengthen its platforms at the various stations along the loop. The one thing needed at the present time to relieve the congestion during the rush hours on the Union Loop is the lengthening of the platforms so that two trains can be loaded at once at each station. This was clearly explained in the report on the Chicago transportation problem made last year by Bion J. Arnold, assisted by an eminent staff of transportation engineers. The findings of this report, which were the result of a long, intimate knowledge of Union Loop conditions, were that the ultimate capacity of the loop would be determined by the number of trains which could be passed into and out of the loop at the junction points, but that the present capacity of the loop was limited by the fact that only one train at a time could load at a platform. The lengthening of the platforms was thus shown to be the method which should be at once adopted to relieve the congestion on the loop.

Now, however, that the work has already begun on the extension of these platforms, certain property holders around the loop have joined together to throw obstacles in the way of these extensions. It certainly seems as if these gentlemen were acting from very selfish and short-sighted motives, if they thoroughly understand the situation. Probably many of them do not. At any rate, it is difficult to see why all the elevated transportation facilities of a great city should be crippled during the rush-hour periods by the objections raised by comparatively few property holders against the extension of existing platforms a few feet. It seems to be the opinion of the gentlemen forming this association that they alone are to be consulted in this matter, which, however, affects the happiness, convenience and comfort of the entire community.

English Railroads to Meet Electric Competition

The steam railways of England have awakened to the danger of competition for suburban patronage which is threatened by the extension of the electric street railway systems of the cities into the surrounding country, and of the advantage that would accrue to the older systems if they succeed in pre-empting the field by establishing feeder lines radiating from the principal centers of traffic along their routes. American railroads failed to recognize the importance of the trolley, and made no attempt to control the suburban feeder lines in their respective districts until it was too late, and in many cases this short-sightedness cost the steam lines a profitable business which a great deal of time and money had been spent in developing. The English managers do not propose to be caught napping in this manner, and they have already taken steps to meet the threatened competition. The Great Western Railway, for instance, which already suffers from competition of electric lines, has announced, through its chairman, that steps have been taken to forestall and prevent the building of other electric lines by establishing self-propelled individual passenger cars, running at more frequent intervals than trains were formerly operated, and also by establishing railroad stations and automobile service through country districts as feeders to the steam lines. It was further announced that these cars would run on the company's lines, and that arrangements had been made for stopping not only at existing stations, but at intermediate points, for picking up and setting down passengers. In this way a fairly quick local service would be provided. The management had had under consideration light railways, but it was doubtful as to whether there was sufficient traffic to justify the

construction of such lines. Another plan that was favorably considered was a proposal to feed their railway by running motor cars, and instructions have been given to purchase five, capable of carrying twenty-two persons each. The automobiles would travel at a moderate speed, and would show how much traffic there was in a district. One advantage of motor cars was that if the traffic proved insufficient they could be moved elsewhere, and the outlay involved was not heavy. The result of this experiment will be awaited with considerable interest in this country as well as in England, and if the plan prove feasible it will doubtless be very generally followed by the big steam roads throughout the British isles.

Interurban Information

We have called attention before to the unaccountable lack of information for prospective passengers on some interurban roads, and judging from conditions which have recently come to our attention, there still exists a necessity for several more sermons on the same text. There are, indeed, some notable and commendable examples of how to do it as well as those complained of, and in some of the interurban centers in the Middle West adequate provision has been made for the convenience and information of passengers. At all hotels time-tables are to be found, giving information about the interurban lines radiating from the city; the hotel clerks are as well posted about the arrival and departure of interurban cars as they are about the movements of steam railroad trains, and central waiting rooms are provided where passengers may receive information or wait for cars with the assurance that they will not miss the car they want. This is as it should be, but we regret that such complete arrangements are so unusual as to make them remarkable. At one of the most prominent interurban centers in the Middle West, there appears to be an absolute disregard on the part of the majority of the interurban companies of the fact that there are always many visitors who are unfamiliar with the community and its methods of doing business and who are not posted as to the movements of interurban cars and the routes over which they operate. Nine out of every ten citizens of a town may know that the interurban cars for Blankville leave at 6:05 a. m., and hourly thereafter, and that it takes 1 hour 25 minutes to make the run, but that fact doesn't secure the patronage of a traveling man or tourist who finds himself in the place for the first time. When arriving at one of these centers recently the writer sought information at the leading hotel regarding interurban lines, and found that not only was there not one single interurban time-table of any kind to be found on the premises, although there were about a half dozen interurban roads entering the city, but the clerks seemed woefully deficient in correct information about the arrival and departure of interurban cars, and in one case gave directions that proved to be entirely incorrect and nearly resulted in the missing of one of the hourly cars on a certain line. Some of the daily papers had time-tables showing departures of cars on some of the interurban lines, but these time-tables were not complete, and nowhere were printed time-tables to be found showing how long it would take to make a trip to any neighboring town and what kind of connections could be made. In other words, most of these companies were operating their roads in an excellent manner and adopting many of the features found useful in steam railroad service, but had evidently given no more attention to the information of prospective passengers than if they were operating a street railway.

Now, people do not start on an interurban journey of several hours with cars, perhaps, on 1-hour headway, in the same way that they will start on a street railway trip of a few minutes with cars on 1 to 10 minutes headway. The interurban trip is a more expensive and time-consuming proposition, and the stranger wants to know more about it before he starts. Nothing will reassure him like a plain statement in printer's ink as to when and where he can go and how long it will take him.

As most people are not mind readers they need something definite and tangible in the way of information as to the movements of interurban cars before they will patronize them. This is especially true of traveling men who furnish a steady volume of business to all railroads. They are eager to learn any new means of transportation, but they are apt to be discouraged in patronizing interurban lines if no information can be obtained around their hotels, as to when and where interurban cars run from a given center.

The time is coming when comprehensive interurban guides will be published. In fact such a movement was begun in Detroit some time ago, and is well carried out there, but, unfortunately, it has not been adopted elsewhere. People who want to make a trip to-day do not care what the time-table is going to be in the future; they want to know what it is now, and they are accustomed to change of time on steam railroads, so that they will not be seriously put out by a change later on.

T-Rail in Paved Streets

One might easily understand how an unthinking person could be considerably misled or confused by the rather conflicting reports which have been reported in these columns recently in the discussions of convention papers and elsewhere on the results of laying T-rail in paved streets. A few words analyzing the situation more closely may not be out of place. On one hand, we have the fact that the T-rail has been used successfully for years in down-town paved streets in such cities as Minneapolis, Denver, Los Angeles, Milwaukee and a score of smaller places. On the other hand, comes the testimony from cities where T-rail has been used in streets on which the team traffic was heavy, that the paving was soon worn into ruts just inside of each rail.

How to account for these discrepancies might seem difficult at first, but the explanation is easy. Where the T-rail has been successfully used it will be found that the streets are sufficiently wide and well paved to afford ample roadbed without tempting teams, as a regular thing, to drive on the tracks, and, moreover, the trucking in these cities is not as heavy and constant as in cities of the first class. Of course, the fact that there is a T-rail instead of a girder rail, which offers a smooth track for vehicles tends to keep the teams off the track as long as there is any other good place to drive in the street. Where the T-rail has been laid and its use abandoned because of the difficulty in maintaining paving, it will be found almost invariably that the streets are comparatively narrow, so as to compel teams to drive along the car tracks, or the street paving is so abominable outside of the car tracks that teamsters have every inducement to keep on the tracks; or, owing to the fact that girder rail has been used exclusively on other construction in the city, it has become a custom to drive along the car tracks, and the habit cannot be put aside when but a small mileage of T-rail is laid, and the girder rail, which invites driving on the tracks, is used everywhere else in the city. Where any of these conditions exist it would seem that T-rail would involve very heavy expense in paving maintenance, while in the class of cities first mentioned T-rail is undoubtedly the most desirable rail from every standpoint.

THE REPAIR SHOPS OF THE ST. LOUIS TRANSIT COMPANY

The new shops of the St. Louis Transit Company, which have recently been completed, contain an unusual number of new features in the way of labor-saving machinery, which are of interest both to large and small electric railway companies.



FIG. 1.—GENERAL VIEW OF FRONT OF SHOP AND TRANSFER TABLES, FROM THE SOUTHEAST

The features of most interest to small electric railway companies are the methods of hoisting car bodies and handling trucks and motors, which are applicable to both large and small shops and car houses. The St. Louis Transit Company is also engaged extensively at present in the manufacture of its own trucks, and has introduced labor-saving methods to such an extent that the cost of labor for truck manufacture is a very small proportion of the total cost. These manufacturing methods, however, will be of interest mainly to very large companies only.

These new shops are located at Park Avenue and Vandeventer Avenue, near the company's general offices and central power station. Ever since the consolidation of the numerous St. Louis street railway companies into the St. Louis Transit Company, the management has been constantly at work centralizing its various departments. It was not until the present shops were completed, however, that it was able to centralize its repair work at one point. The completion of these shops has resulted in the shutting down of nine shops widely scattered over the city, where repair work of various kinds was carried on. In the new shops all the repair work on the rolling stock of the entire system will be done, with the exception of the replacing of small parts, which can be accomplished in the several car houses. Any work calling for the removal of trucks or motors from car bodies is performed at the central repair shop. Formerly the principal machine shop was in one place and the armature-winding department in another. Altogether, as said before, nine shops were maintained, each giving special attention to one particular branch of work for which it was best equipped.

GENERAL ARRANGEMENT

Most of the new shop building is a one-story structure, with saw-tooth roof, having skylights facing north. Fig. 1 is a general view looking down on the front of the building. Two transfer tables afford the means of getting cars into and out of the building. The general floor plan of the shops is

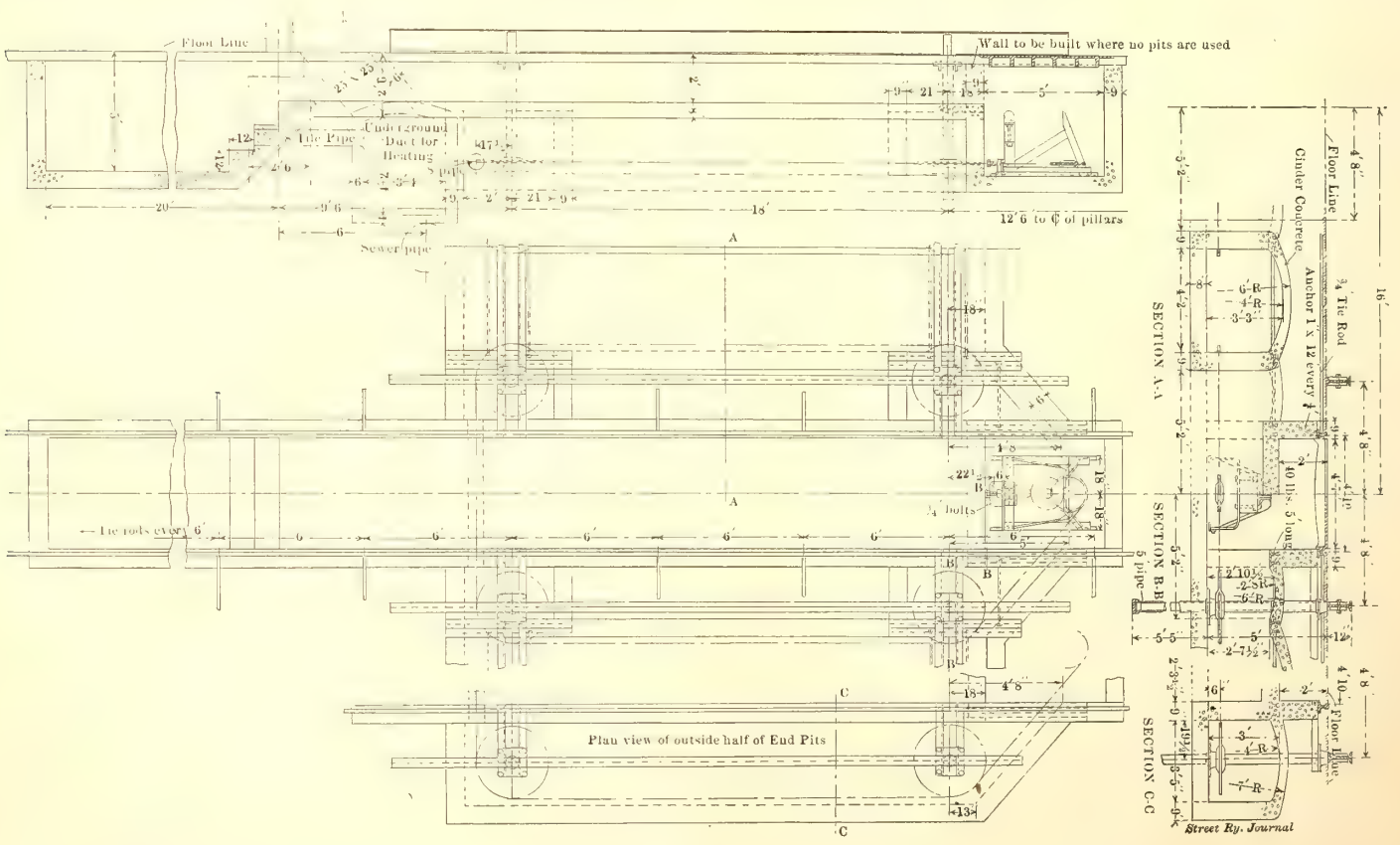


FIG. 3.—ASSEMBLY AND PIT FOR ELECTRIC CAR HOIST

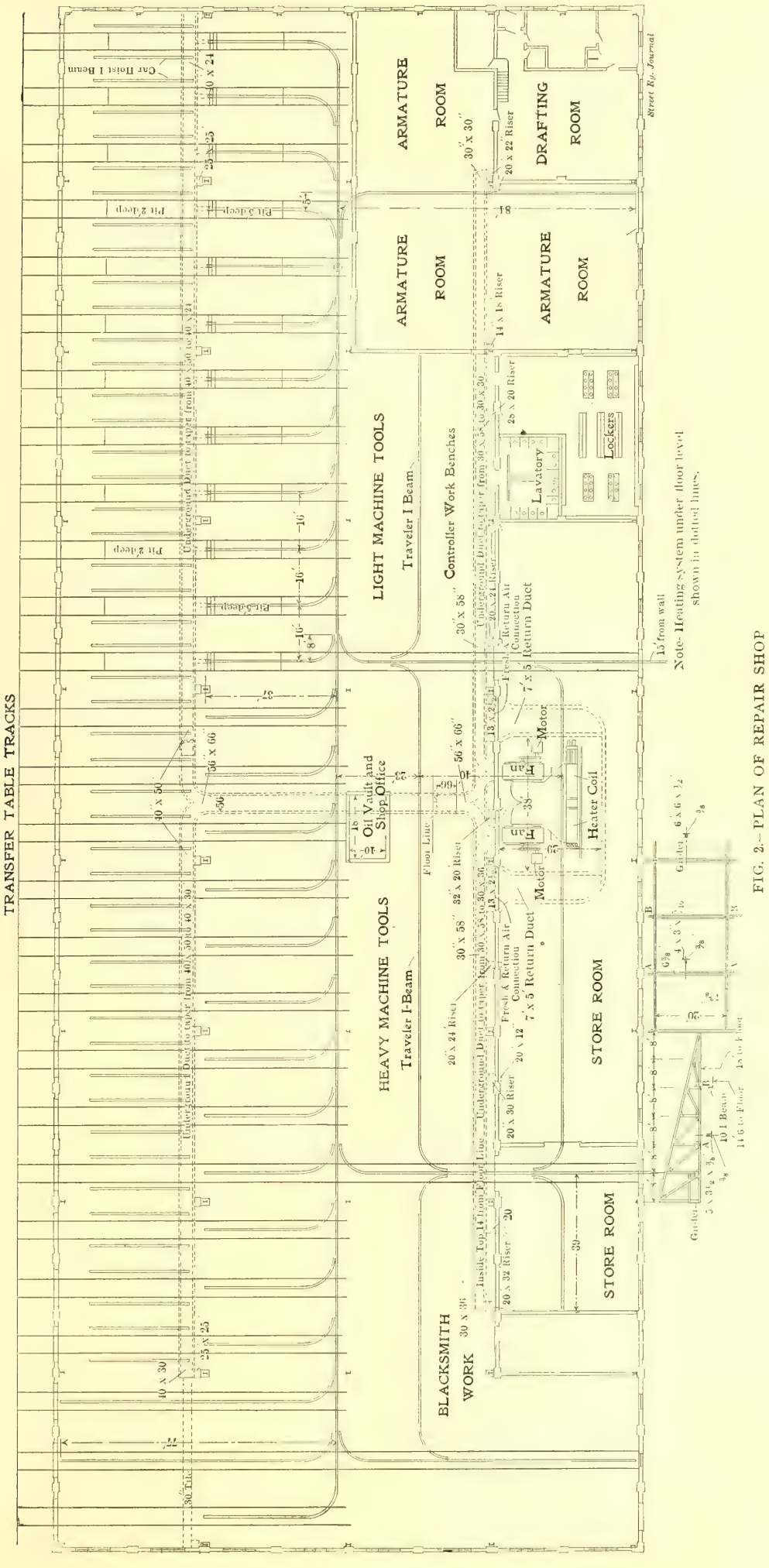


FIG. 2.—PLAN OF REPAIR SHOP

shown in Fig. 2. The eastern half of the building is occupied by twenty-seven repair tracks. The western half of the building has the blacksmith and machine shops, the store room, the armature room, the drafting room, general offices and toilet rooms. The blacksmith and machine shops are not partitioned off from the main part of the building containing the repair tracks. The armature room, store room, toilet rooms and offices, however, are divided from the balance of the building, as can be seen from the plan, Fig. 2. All of the floors are concrete. The total length of the building is 432 ft. The distance between track centers of the repair tracks is 16 ft. The repair tracks are 80 ft. long inside of the building, and the portion of the building now occupied by tracks is 80 ft. wide.

Adjoining the repair shop building on both sides are storage yards. In the rear, or west of the shops, are tracks which afford connection not only with the street railway lines but also with the steam railroads. As the street railway lines are not standard gage, a separate pair of steam tracks, parallel with the street railway tracks, are laid. These tracks are arranged so that unloading from the cars can be done onto platforms that connect with the store room and the shops adjoining. East of the shops, beyond the space occupied by the transfer table, is a storage yard for miscellaneous track material and also a sand drying plant.

CAR HOISTS AND TRAVELER SYSTEM

The feature that probably attracts the most attention on the part of the average street railway man is the new form of car hoist employed. It is similar in its general principles to a number of hoists installed in the Louisville Railway shops in 1896 by the gentlemen who now have charge of the St. Louis Transit Company's shops. While it is, therefore, not entirely new it has several improvements as compared with the Louisville hoists. This form of hoist is certainly worthy of greater prominence than has heretofore been given it.

The hoisting is done by means of four screw jacks, operated simultaneously by a sprocket chain driven by an electric motor. Fig. 3 shows a plan, end and side view of the arrangement. Figs. 4, 5 and 6 are views of the repair tracks,

both with and without pits, showing the application of this car-hoisting apparatus. On each side of the track, referring to the foregoing illustrations, is a 12-in. I-beam resting on

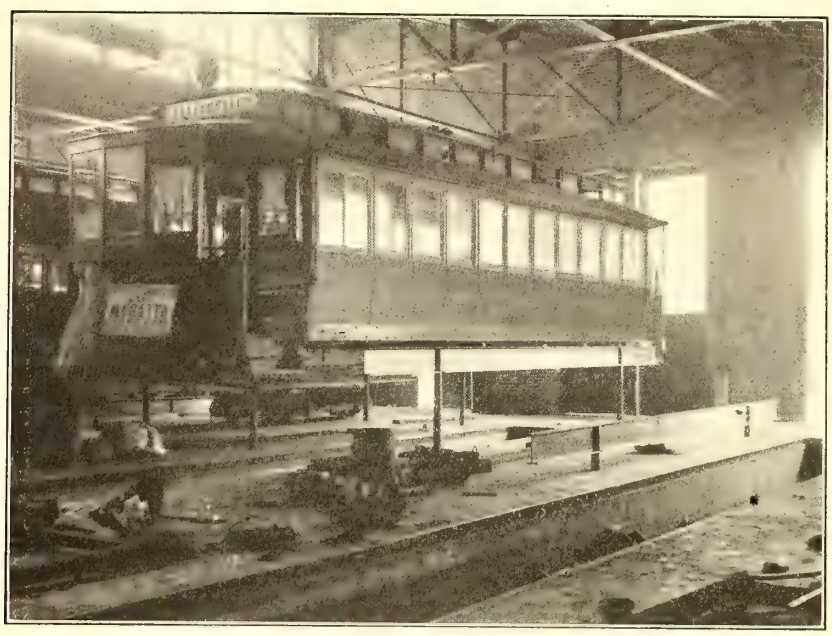


FIG. 4.—CAR ON HOIST OVER PIT TRACK

two pillars of 5-in. solid round steel. The lower end of these pillars is threaded to form the screw of the jack. The nut of the jack, which, when revolved, raises and lowers these pillars, is in the form of a sprocket wheel on which the sprocket chain runs, as shown in Fig. 3. To take the downward thrust of this nut a ball bearing is provided, since the four nuts of the hoist, when lifting the car body, must together support and turn under the full weight of the car body. The 5-in. bars or columns slide up and down in 5-in. pipe. They are slotted at the top, and the 12-in. I-beams rest in these slots, as seen in the cuts, Figs. 3, 4 and 6. The bottom flange of the I-beam is cut away for 5 ins., so that the web of the I-beam slides directly into the slot in the end of the bar. As the sprocket chain drives all four of the nuts simultaneously the I-beams on both of the tracks rise together. After hoisting a car it is necessary only to place an old rail or I-beam under each end of the car, resting upon the I-beams of the hoist, and to start the motor driving the hoist.

The motor used is an old Sprague railway motor with the double reduction gears just as they were used under the cars. It is placed with its shaft vertical, as shown in Fig. 7. It is in use very little, and it was not thought necessary to provide any special thrust bearing on the armature shaft, as the usual collar on the armature shaft was sufficient to sustain its thrust. The motor is mounted upon a frame, which can be slid along to tighten up the sprocket chain.

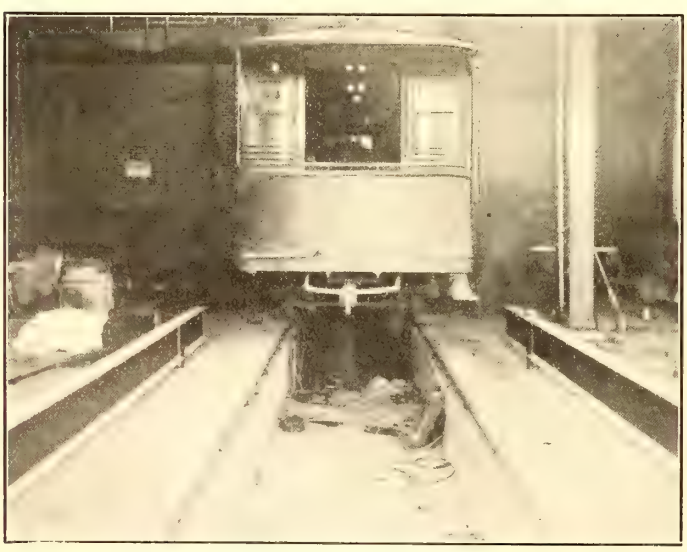


FIG. 6.—REPAIR TRACK, SHOWING HOIST AND DEEP AND SHALLOW PITS

As shown in the general plan of the shops, Fig. 1, twenty-four of the repair tracks have car hoists and twelve have pits. The remaining fifteen tracks have no pits. The motors, sprocket chains and jacks are entirely below the level of the concrete floor. The motor in each case is placed between the tracks in a pit, which is covered over with plank, as shown at the far end of the pit, Fig. 8. Between tracks is a narrow tunnel, which accommodates the sprocket chains of the hoists of the two adjoining tracks. The dimensions and details of construction are all fully given on the drawings, Fig. 3, so that further explanation of them is not necessary.

One of the first questions which would naturally be asked in connection with this new form of hoist is as to its cost as compared with hydraulic jacks for performing the same work. In selecting this type of hoist, however, the management of the St. Louis Transit Company did not consider this feature a controlling one, because it believed this

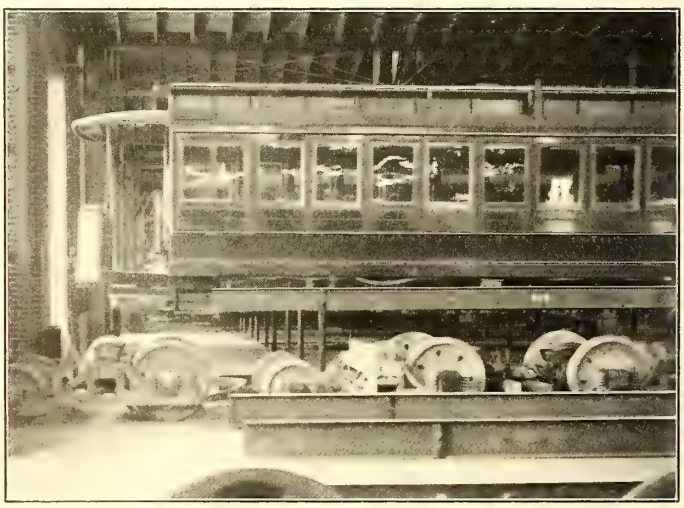
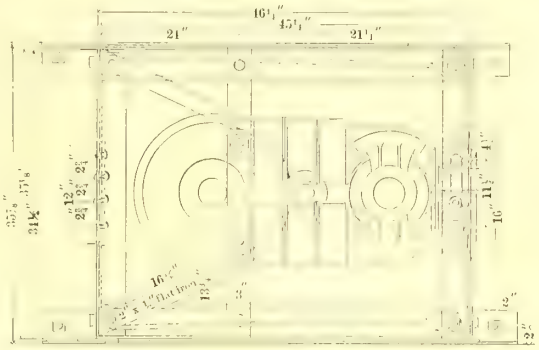


FIG. 5.—CAR ON HOIST, SHOWING LOCATION OF HOIST CONTROLLERS

form of hoist to be so much superior to hydraulic jacks or chain-block hoists in point of safety as to make the latter out of the question. Some personal experience with the breaking of chain blocks when used as hoists for car bodies led the management to give very earnest consideration to the question of safety. It is believed that this screw-jack hoist is as nearly absolutely safe as any hoist can be made. In fact, the liability of accident with it is practically nil. The car body when hoisted is supported on four solid columns of 5-in. round steel. These columns are supported at the floor surface and at the nut 5 ft. below the floor when the car is hoisted. The car body could not fall without bending at least two of these 5-in. columns. Another strong point in connection with this hoist is that while it is fully as rapid as the hydraulic or pneumatic hoist, there is no possibility that the car body will be wrenched through the hoisting of one corner higher than another, as the four jacks must necessarily act in unison, as they are driven from the same sprocket chain. Each hoisting motor is controlled by a type-K controller, located between the entrance doors adjoining the repair track under which the motor is located. The location of these controllers can be seen in Fig. 5.

Hoists of this nature could be installed in shops of small companies at a reasonable cost.

As mentioned before, part of the repair shop tracks have pits and part have not. All of the company's new equipment, including 450 cars recently ordered to take care of World's Fair traffic, is to be arranged so that no pit work is necessary. The motors will be designed to open from above, so that it will only be necessary to run the trucks out from under the cars to open and inspect the motors or to take the motors out of the trucks. As far as these new equipments are concerned, pits would be useless, but the company has many old equipments, the motors on which open from below, and for this reason it was necessary to provide some



any traveler can be switched from a branch to the main line, and vice versa. When the switch is thrown off the main line it is impossible for a man to run his traveler off the end of the I-beam at the switch, because of a catch which has been provided. As will be seen from the general plan, Fig. 2, and in the view, Fig. 13, there is a traveler track extending over half the length of each repair track. There is a main line traveler track extending the full length of the shop, with switches connecting to all the repair track travelers tracks, and also branches running to the machine and blacksmith shops. Practically the entire shop, where material is to be handled, is covered

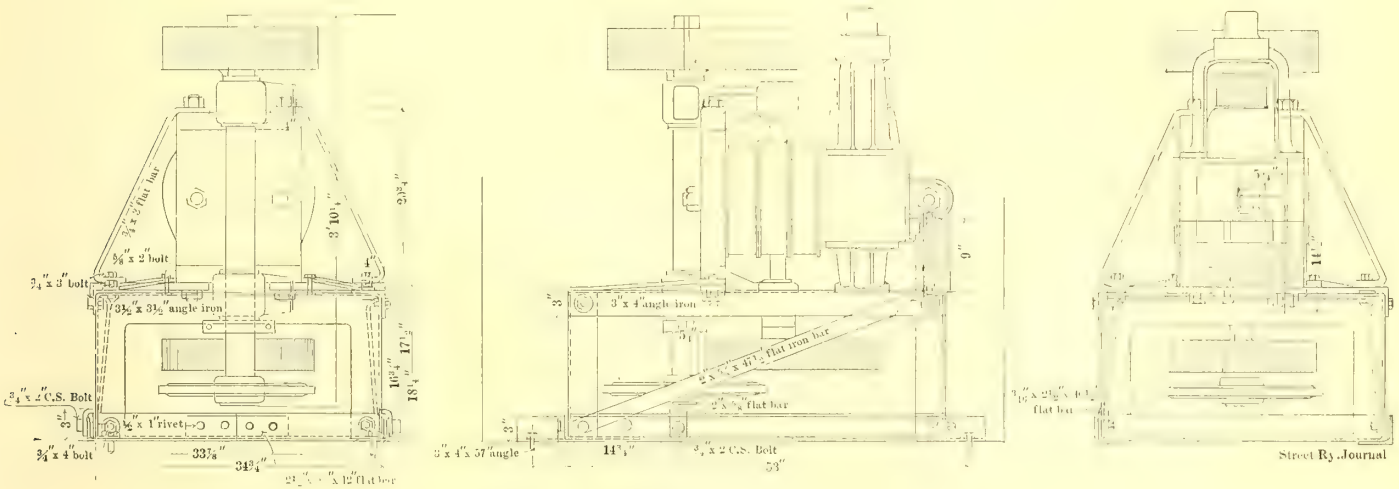


FIG. 7.—MOTOR SUSPENSION FOR ELECTRIC CAR HOIST

of the repair tracks with pits. The repair tracks so provided have a pit 2 ft. deep under that part of the track equipped with the car hoists, and a pit 5 ft. deep under another portion of the track, as indicated in the general plan, Fig. 1, and as shown in Figs. 6 and 8.

In the deep pits a pneumatic armature and motor hoist is to be installed, after the plans shown in Fig. 9. This pneumatic pit hoist is mounted on a truck which runs on a track in the bottom of the pit. In order to allow the pneumatic hoist to be moved to the right or to the left under a truck it will be placed on a second truck, mounted on the first truck spoken of, which will give the hoist a movement at right angles with the movement afforded by the pit tracks.

TRAVELERS AND CONVEYING SYSTEM

Suppose, now, that the car body has been hoisted from off the trucks, that the trucks are run out from under the car, and that the motors or armatures are ready to be taken to another part of the shop for repairs. At this point a very complete overhead traveler system comes into use. These overhead travelers, or trucks, run on the bottom flanges of 10-in. I-beams; these I-beams are suspended from the roof, and their location is shown by the general plan in Fig. 2. Fig. 10 to Fig. 15, inclusive, also show the general arrangement and appearance of the traveler system. At each junction point is a switch operated by chains within reach of the workmen, so that with the traveler system. Besides this there is a Curtis traveling crane of 2000 lbs. capacity, which spans that part of the armature room which is devoted to armature winding and testing. In some parts of the machine shop, especially around the large machine tools, light pivoted derricks are provided for getting heavy material into and out of these machine tools as an adjunct to the traveler system. About $10,000 has been spent in the overhead traveler system alone. It will be seen from the numerous engravings accompanying this article that the



FIG. 8.—SHOWING PITS FOR INSPECTION AND HOIST MOTOR PIT

shop has a comparatively low roof, as it was unnecessary to provide a great deal of head room.

It is interesting to compare the method of conveying material which has been adopted in this shop with that used in some

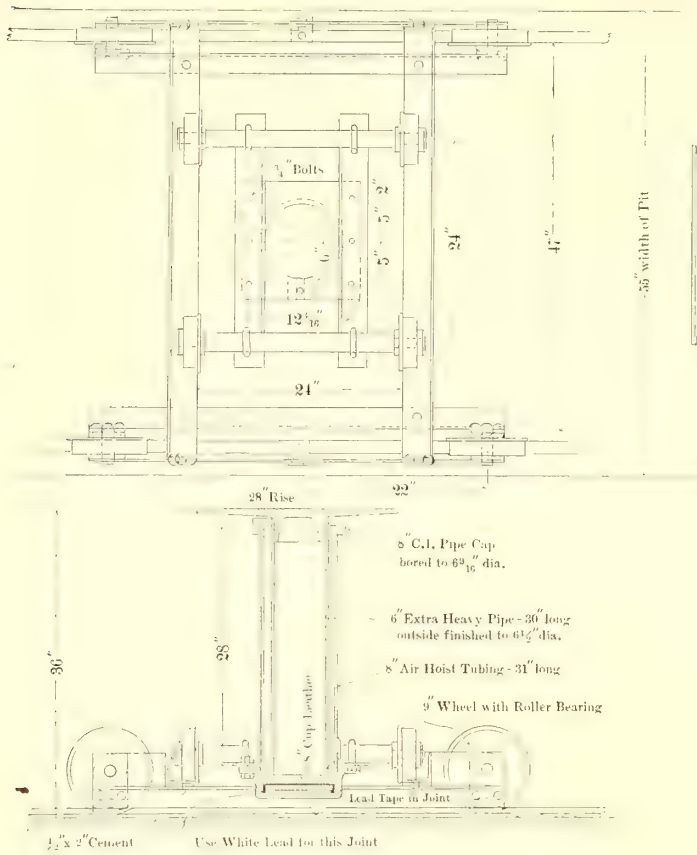
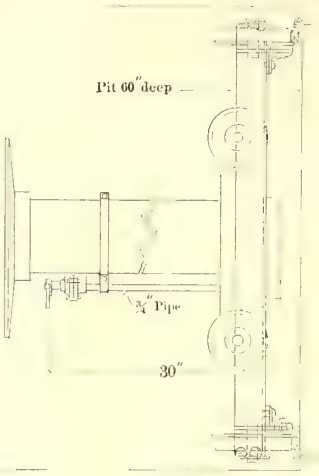


FIG. 9.—ASSEMBLY OF AIR-PIT HOIST

others, of having a large overhead traveling crane spanning that portion of the shop in which the heavy material is to be handled. If a system of overhead traveling cranes had been installed in this shop it would, of course, have called for an entirely different plan of building. Such a system was not considered, however, because the management did not think it would be feasible with it to handle as many pieces of heavy apparatus at one time as is sometimes necessary in such a large shop having so many repair tracks. With the traveler system which has been installed men can be handling and hoisting motors, wheels and armatures in many different places at one time without waiting for the services of one or two large traveling cranes. All the overhead travelers located on the sidings which serve the repair tracks are equipped with pneumatic hoists, as can be seen from Figs. 10, 11 and 12, and the same is true of the travelers in the vicinity of the machine tools. Of course, these pneumatic travelers cannot be taken any great distance from their home track, because of their air-hose connection with the compressed air system. For conveying material any considerable distance on the main line track, chain block hoists are used; but it is not necessary in most cases to do any hoisting with these chain blocks, as the load can be transferred to or from them by a pneumatic hoist, so that all the raising and lowering can be done by the pneumatic hoist on the siding at which the material is to be handled. The overhead traveler system is designed to carry a load of 6000 lbs. at any point.



TRANSFER TABLES

Next after the interior arrangements for hoisting and conveying, the transfer tables which operate along the tracks in front of the building are of interest. These transfer tables are shown in Figs. 1 and 15. Instead of having the trolley wire which furnishes power to operate the transfer table underneath the table, as has frequently been done, the table derives its power from an overhead trolley wire which runs parallel with the front of the building. This wire is supported on the ends of channel-irons, Fig. 16. These channel-irons are used instead of trolley wires for supplying current for the cars as they are run into the building. The channel-irons are of sufficient width to serve as a trough for the trolley wheels. The trolley wires which serve the transfer table are supported on the ends of these channel-iron troughs. Two trolley wheels, mounted on the overhead framework of the transfer table, ride on top of this trolley wire, as seen in Fig. 15. These trolley wheels supply current not only for the operation of the transfer table but for moving the cars when they are on the transfer table. By having the channel-iron troughs instead of trolley wire, where the cars leave the transfer table, there is but little danger from trolleys leaving the conductor, as they are guided by a frog into the end of the channel-iron trough. The channel-

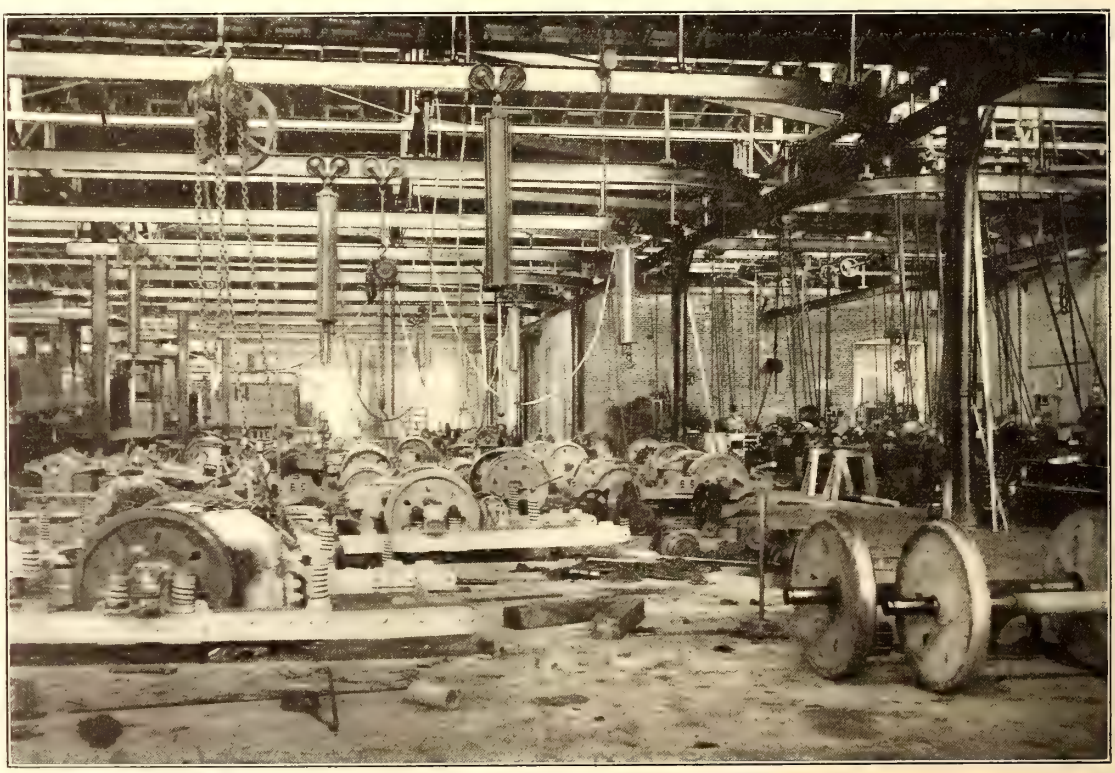


FIG. 10.—OVERHEAD TRAVELER SYSTEM, SHOWING GENERAL ARRANGEMENT OF SHOP

iron trough extends a short distance inside of the building, and is there connected to the regular trolley wire, which extends part of the length of the repair tracks. Two transfer tables are used to serve the twenty-seven repair tracks. The cars can be run onto the transfer tables from entrance yards at either end of the repair shop.

ARMATURE WINDING AND TESTING

The St. Louis Transit Company has for several years maintained an unusually well-equipped winding department. Special machinery and forms for winding were developed several years ago. This machinery was fully described and illustrated in the STREET RAILWAY JOURNAL of July 6, 1901. The principal change in coil winding introduced since that article has been the placing of some of the armature coil forms in a machine more easily manipulated. Some of these machines are illustrated in Fig. 17. The forms are mounted on a spindle, about the level of the operator's shoulders, and are revolved by power from a line shaft which is controlled by a foot lever. After coils are wound they are hung in rows on long sticks to dry, and after a time are taken to drying ovens located along one side of the armature room, where they are hung on racks, as in Fig. 18. These ovens are heated by electricity. They are adapted to receive either racks containing individual coils or completed armatures. The hooks in the top of the oven from which coils or armatures are hung are mounted on rollers, so that they can be pulled out from the oven, as shown in Fig. 18. As mentioned before, a crane of 2000 lbs. capacity spans that part of the armature room devoted to armature winding and testing. For moving the armatures about the shop two kinds of armature trucks are used. One is a derrick mounted upon a four-wheel truck, seen in Fig. 19, and the other is a smaller truck upon which the armature rests in bearings, and

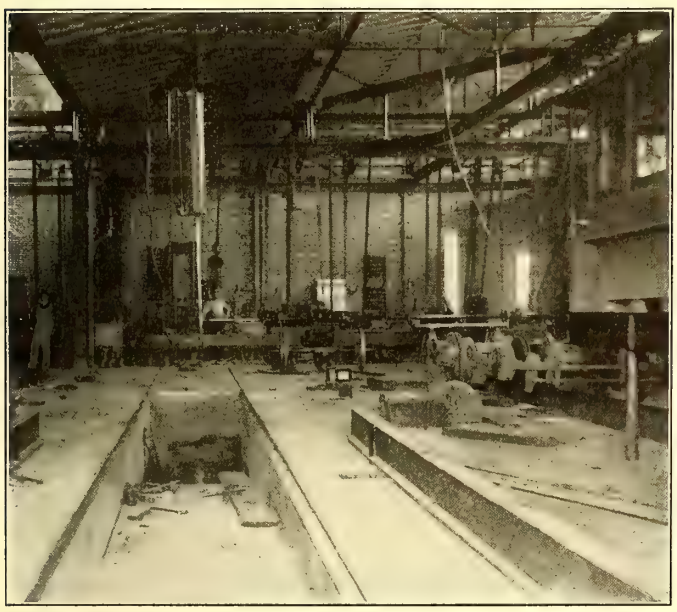


FIG. 11.—AIR HOIST ON TRAVELER OVER REPAIR TRACK

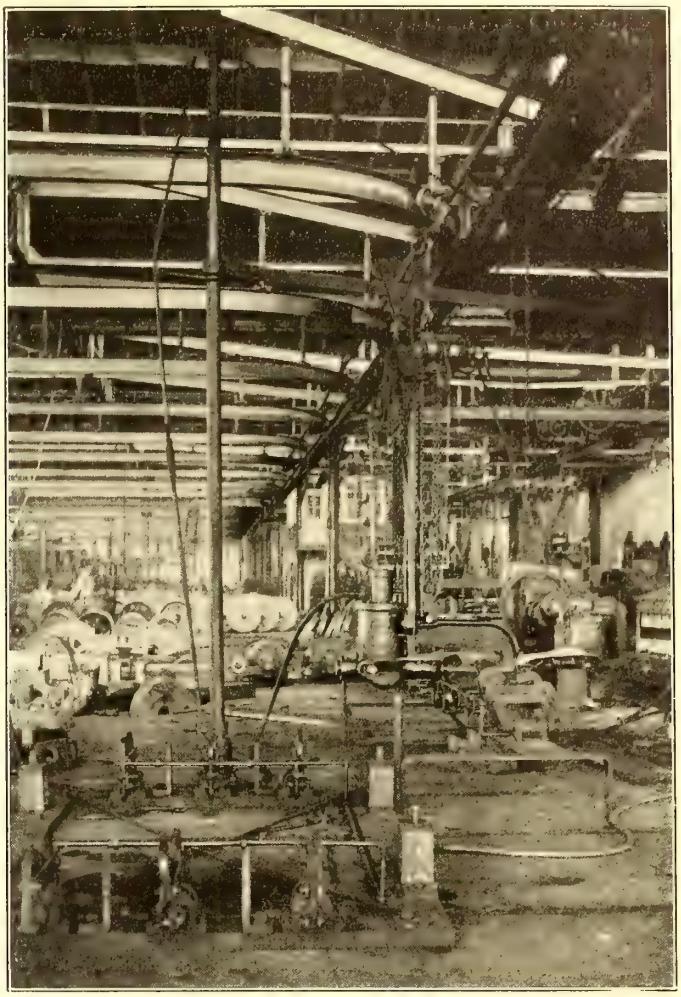


FIG. 13.—TRAVELER SYSTEM, PNEUMATIC RIVETER AND ASSEMBLER

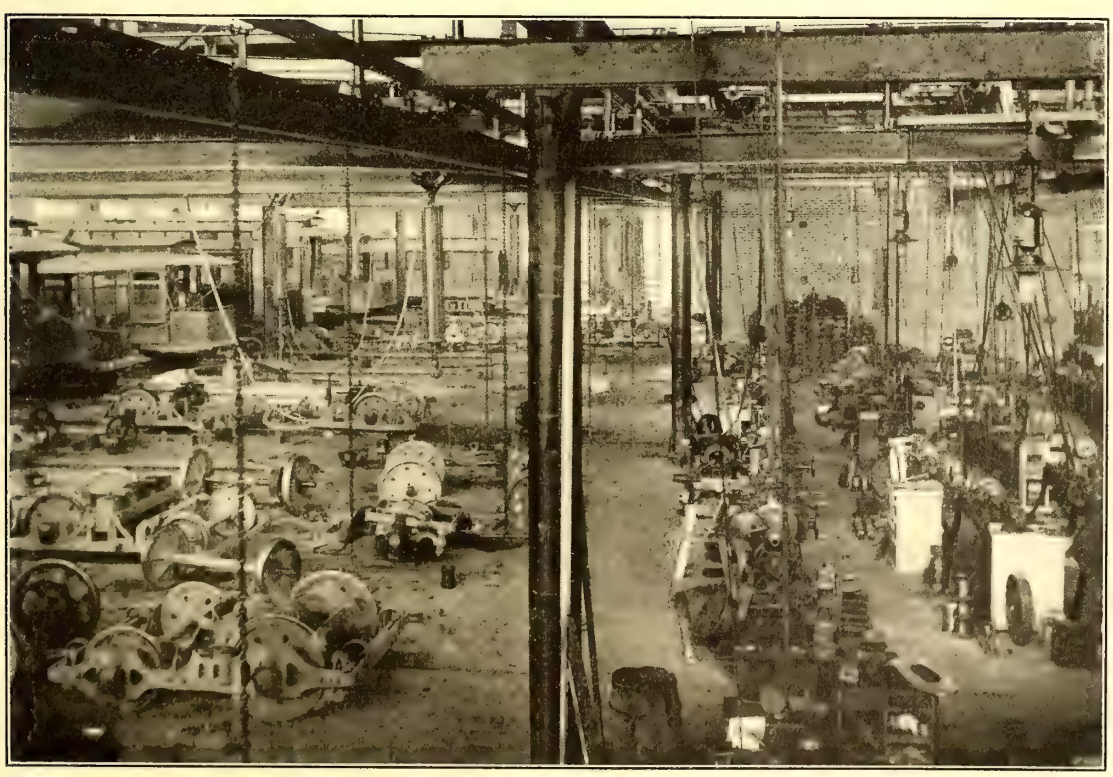


FIG. 12.—GENERAL VIEW OF MACHINE SHOP AND REPAIR TRACKS

illustrated in Fig. 20. There is a large number of these smaller trucks. As an armature is free to turn on the bearings when carried on such a truck, the transformer test can be easily applied to it without removing it from this truck, and, in fact, the armature can be turned over for any kind of inspection



FIG. 14.—BLACKSMITH SHOP

The transformer test is used for locating short-circuited armature and field coils. In Fig. 20 is shown an armature undergoing the transformer test for defective coils. This armature is mounted on one of the small shop trucks previously mentioned. The small transformer coil and core which is used in making the tests can be raised or lowered at will. When a test is to be made the armature is run under the transformer, and the transformer, which is hung on a pulley, is lowered so that its poles bear directly on the surface of the armature. The switch controlling the alternating-current supply to the transformer coil is within easy reach of the tester. When alternating current is turned into the transformer coil and there is a short-circuited coil on that portion of the armature enclosed between the pole pieces of the transformer, its presence will be made known by the vibration which it will cause in a piece of light sheet-iron held in the hand of the tester 90 degs. from that portion of the short-circuited coil which is between the poles of the testing transformer. The tester turns on current and "feels" for short circuits with his piece of sheet-iron, as shown in Fig. 20. After he has "felt" of the coils which come under the pole pieces with one setting of the transformer, current is turned off and another section of the armature brought under the transformer for test. The short-circuited coils, of course, act as closed circuit secondaries of the transformer, and in time their presence would be made known by their heating under test, but the vibration test with the piece of sheet-iron has been found sufficiently reliable, and is, of course, much quicker. The principles upon which this transformer test depends, and another form of testing transformers, were described on page 743 of the Street Railway Journal of Nov. 1, 1902. The present method of coil testing, as used at the Baltimore shops, was described briefly in the Street Railway Journal of April 4, 1903, and later in the paper by H. H. Adams, of Baltimore, read before the American Railway Mechanical and Electrical Association, printed in the Sept. 5 issue of this paper.

Alternating current is derived from a small motor generator set which supplies 125-cycle, 360-volt alternating current to a static transformer, which reduces the voltage to one that is safe to handle for general testing purposes.

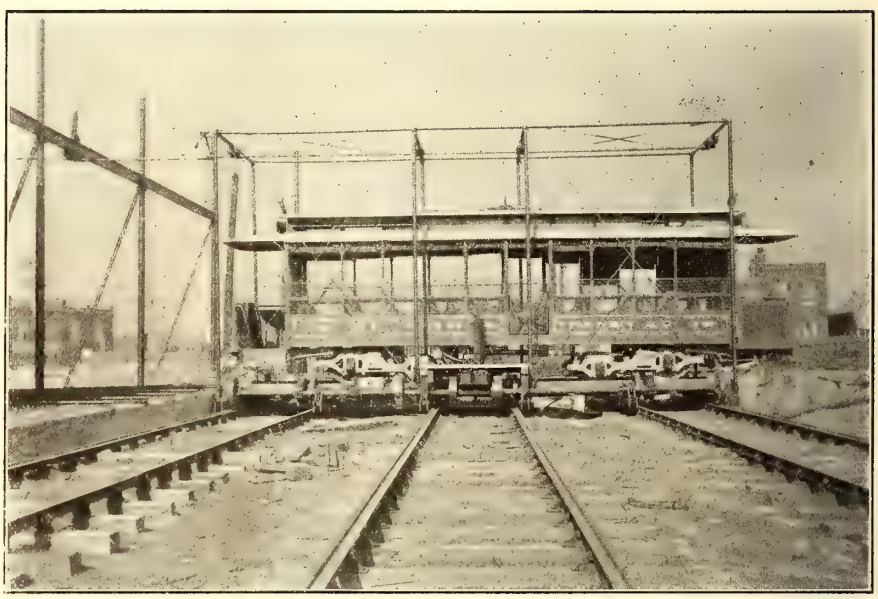


FIG. 15.—TRANSFER TABLE, WITH OVERHEAD TROLLEY

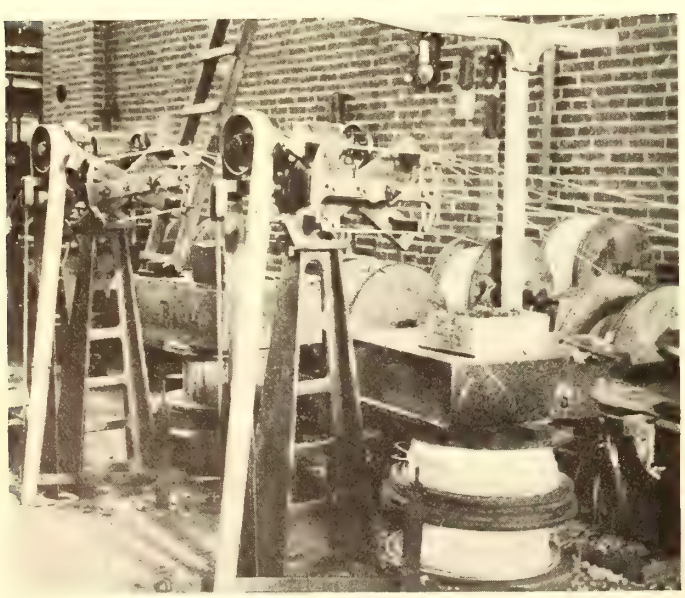


FIG. 17.—ARMATURE-COIL WINDING MACHINES

The transformer for testing field coils is shown in Fig. 21. By this transformer even a single convolution on a short-circuited coil is instantly made known, not only by the sound the transformer makes, which is considerably deadened, but by the reduced voltage across the terminals of the coil that is being tested. In practice this variation is indicated by the lighting of an incandescent lamp. It is intended, however, to put an ammeter near the transformer in the transformer circuit, so that the presence of short-circuited coils or of higher resistance, short circuits will be detected by the ammeter.

After armatures are wound they are tested by actually running in motor frames with a load imposed by a Prony brake. Testing frames are shown in Fig. 19. There is one frame with motor case and fields for each of the principal motors used by the company. Extensive use has been made of a plan of reinsulating the field coils of Westinghouse No. 56 motors, as described in the article on the Baltimore shops in the Street Railway Journal of April 4, 1903, and also in the paper by H. H. Adams, of the United Railways & Electric Company, of

Baltimore, which was read before the last convention of the American Railway, Mechanical and Electrical Association. This method was adopted by the St. Louis Transit Company



FIG. 16.—TROLLEY WIRE AND CHANNEL-IRON CONDUCTORS AT FRONT OF SHOP

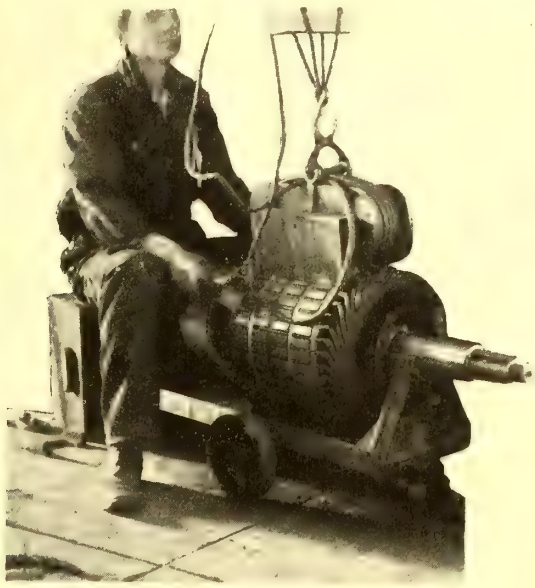


FIG. 20.—TESTING FOR SHORT-CIRCUITED COILS WITH TRANSFORMER

immediately after its appearance in the STREET RAILWAY JOURNAL, and it has been in use ever since. The field coils of this motor are of very heavy wire, and are curved in a form, so that it would be very difficult to repair them by any of the well-known processes of reinsulating and rewinding wire. The Baltimore plan is to separate slightly the convolutions of the

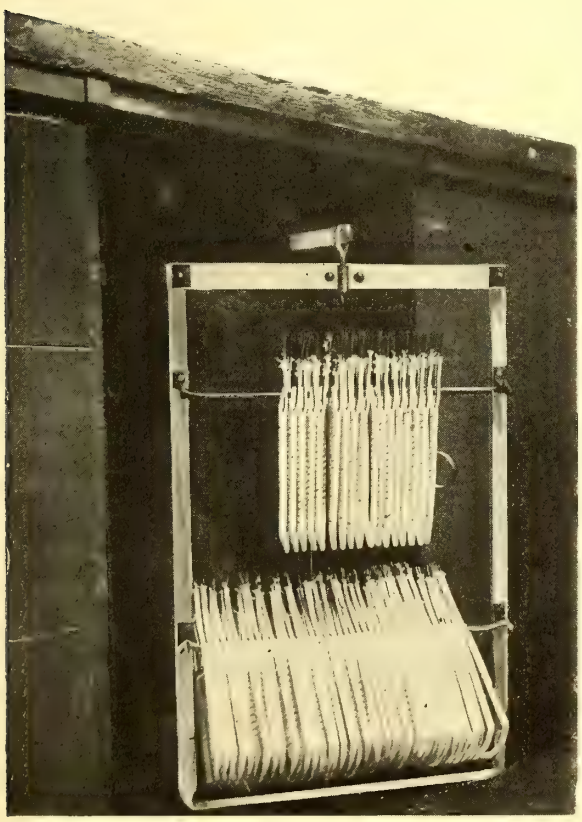


FIG. 18.—COILS ON RACK IN FRONT OF OVEN

coil, keeping them hung on a long rack. Cheap labor is employed to scrape off the burned insulation, and tape is wrapped on by hand without disturbing the general form of the convolutions, which are later bunched together in their original shape.

TRUCK MANUFACTURE

The company is now making 900 swivel trucks of the Dupont type, to go under 450 new cars. The shop methods in the manufacture of this truck have been carried to a high degree of perfection. As many trucks of one kind were to be made, the shop management could afford to give a great deal of study to labor-saving methods. The Dupont truck is a comparatively simple one to manufacture, as can be seen from Fig. 22, which shows a sample of the Dupont trucks the company is now able to turn out at the rate of ten a day. The frame of this truck consists of four pieces of bar steel, bent to the proper shape, and riveted together at the ends. These bars composing the truck frame are first cut to the proper length, and the rivet holes are then punched according to a templet. The templet used was described on page 843 of the STREET RAILWAY JOURNAL of June 6, 1903. Its peculiarity consists in having beveled holes for the punch to enter. That is, the top of the

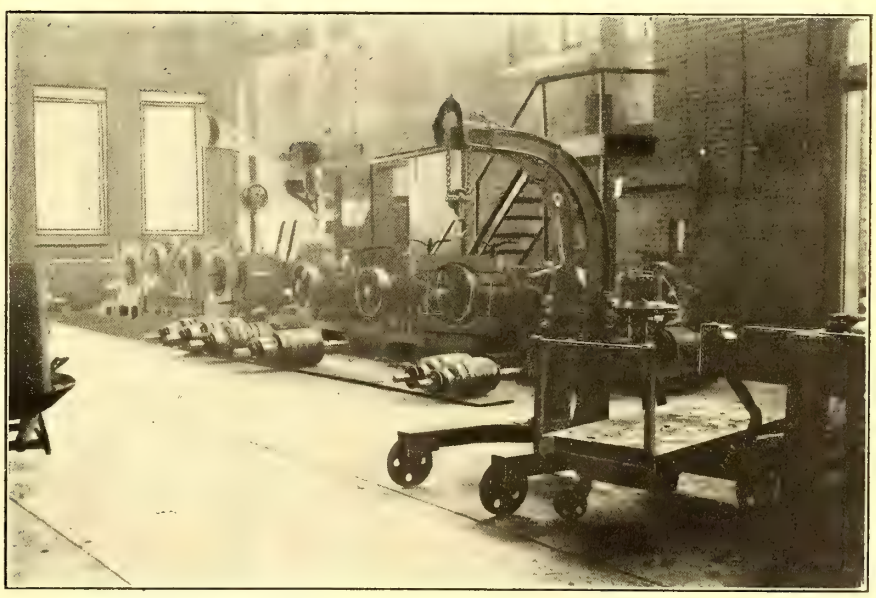


FIG. 19.—MOTOR-TESTING RACKS AND ARMATURE DERRICK TRUCK

hole in the templet where the punch enters is considerably larger than the bottom, so that the punch of itself finds the proper position. It would, of course, be next to impossible to do rapid punching with a templet having holes the same size as the punch, the entire thickness of the templet, as it would

be necessary to get the templet exactly under the punch before making a stroke. As it is, the punching can be done very rapidly and accurately, and is much cheaper than drilling.

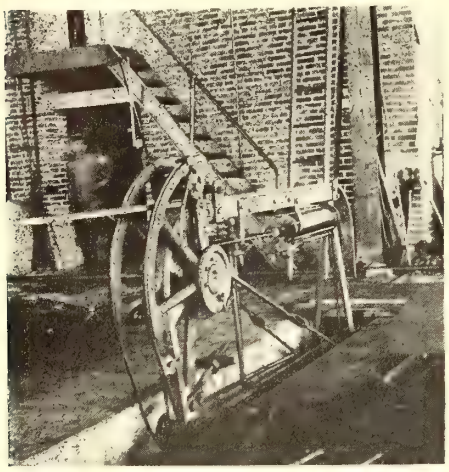


FIG. 23.—PNEUMATIC BENDING MACHINE FOR TRUCK FRAMES

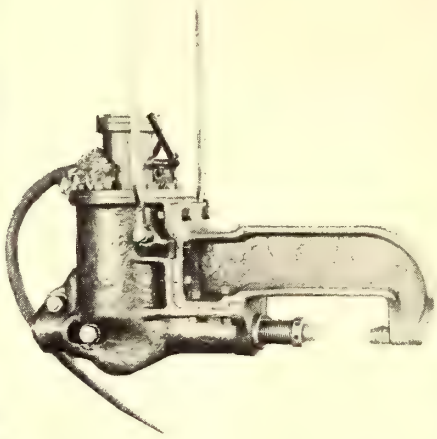


FIG. 24.—PNEUMATIC RIVETER

After these bars for the frame are punched they are bent to the proper shape. This bending is done cold, in a special pneumatic bending machine, shown in Fig. 23, where one of the bars is shown in the machine ready to be bent. An air cylinder in the base of the machine, operating through wire cables, draws a roller down over the proper segment of a circle to accomplish the proper bending of the bar. As there is a slight difference in the elasticity of different bars the exact amount of deflection of the end of the bar can be adjusted by a screw, and if the bar does not bend to the proper angle at first trial, the angle can be increased at a second or third trial. The cylinder seen in Fig. 23 is for making the return stroke after bending. The bending proper takes only one or two seconds, as the compressed air cylinder draws the bar down very promptly. The principal time is taken in putting bars in and out of the machine.

Before being bent these bars are straightened, and the fins taken off from the punch holes by a large steam hammer driven by compressed air. This straightening and general truing up of the bars is an operation which probably consumes more time in proportion to the visible results accomplished than any other in connection with truck manufacture as this company carries it on. Most of the small parts, fillers and other fittings of the truck, are of cast-steel. There are a few parts, however, such as motor suspension rods and bolster fastenings, which are made up from bar-steel on a bulldozer. Every piece bent on the bulldozer which goes into the truck is, however, bent in one operation. Some very ingenious templets have been devised to do this. In connection with cast-steel fittings it is to be noted that cast-steel brake beams are being used on these new trucks, and it is stated that cast-steel beams weighing 71 lbs. are stronger than 115-lb. wrought-iron beams previously used, and, everything considered, cheaper. After all the truck parts are ready for assembly the truck is riveted together with hot rivets by means of a pneumatic riveter, as shown in Figs. 13, 24 and 25. This pneumatic riveter is not a hammer, as many would suppose from its name, but is simply a pneumatic press capable of exerting sufficient pressure on a hot rivet to upset the end of the rivet and compress the whole rivet so that there is no possible chance for a loose fit. This riveter is swung on a small derrick with a vertical shaft, as seen in Fig. 13, so that it can be placed anywhere desired within the radius of the derrick.

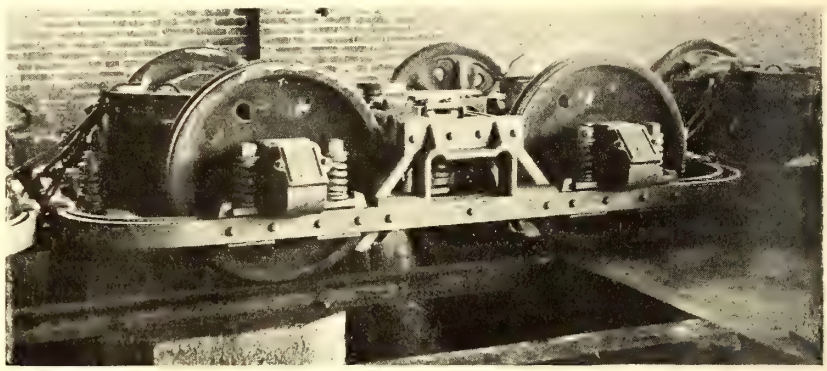


FIG. 22.—DUPONT TRUCK

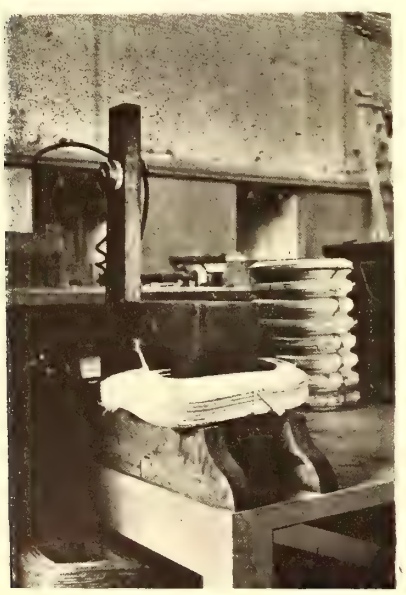


FIG. 21.—TRANSFORMER FOR TESTING FIELD COILS

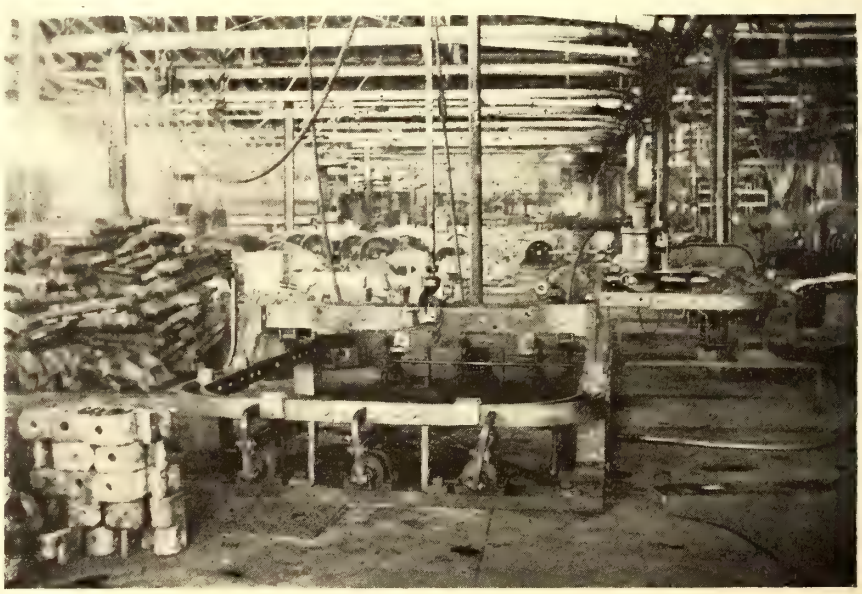


FIG. 25.—PNEUMATIC ASSEMBLERS AND RIVETER

In assembling the truck frames a pneumatic assembler is used to hold together the parts of the truck frame during riveting. This assembler is shown in Figs. 13 and 25, and it con-

sists of a number of pneumatic cylinders operating clamps, which can be quickly set to clamp the truck frame at a number of points while it is being riveted. The advantage of the pneumatic clamp is, of course, the rapidity of operation, as it would require many times as long to tighten up the screw clamps as it does to set the pneumatic clamps. Two sets of clamps or assemblers are used in riveting together a truck frame. Figs. 22 and 25 are views of truck frames and parts in various stages of construction. The extensive scale on which this company has gone into truck manufacture and the number of special templets and machines required to do this work cheaply might seem at first to call for rather large investment; but it was considered that if this special apparatus for making various parts was not built this year it would have to be built later to supply and repair parts, and that it would be amply justified now, not only on account of the reduction that it would effect in the first cost of trucks, but because of its use in later years. The bulldozers, punches, shears, cutters, milling machine and steam hammer would be necessary for a complete shop equipment in any event. The principal special investment has been in the way of templets and the pneumatic machine for the cold bending of truck frames, so that, after all, it is not high considering the saving.

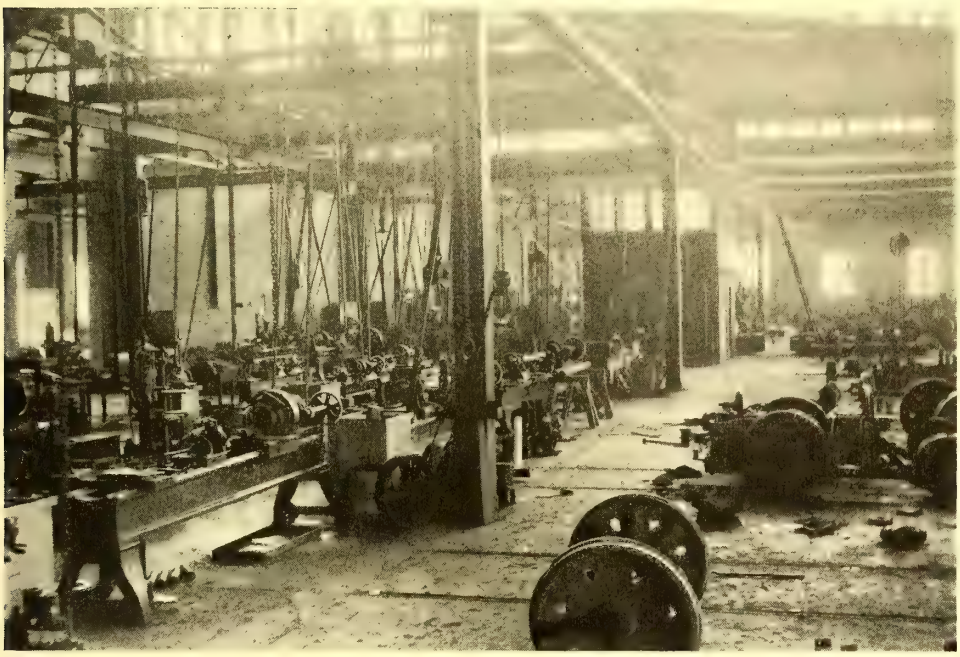


FIG. 26.—MACHINE SHOP, OIL VAULT AND SHOP OFFICE

GENERAL SHOP METHODS

The company makes its own bolts and nuts from the bar stock, as it figures that it can make them cheaper than it can buy them.

No brass foundry is maintained, as a very satisfactory contract has been made with a local brass foundry, whereby the brass foundry supplies the company with all of its brass castings, taking payment in scrap brass and copper. The price of the new brass castings and the price of the scrap brass and copper are fixed by contract, and it is, therefore, immaterial to both parties to the contract what the market fluctuations in the metals may be, and the foundry can figure on a definite margin for its work. In this way, probably a more advantageous contract is obtained than could be obtained from a brass foundry which must figure on fluctuations in the price of metals. The street railway company, of course, always has sufficient scrap copper and brass to pay for what new brass it requires.

Most of the smaller machine tools are driven from line shafting. A few of the larger machines are driven by individual motors, through the medium of silent chain. Both the Renold and the Morse silent chains have been used with satisfaction.

In the main it has been found most satisfactory to teach new men how to perform certain operations and keep them steadily at that work, than to hire general machinists, who know a little of everything and not much of any one thing.

HEATING SYSTEM

In a vault underneath the store room is a large bank of steam coils supplied from the power house across the street. The air is forced from these steam coils to the various parts of the shop by motor-driven fans. The hot-air ducts are all in tunnels under the concrete floor, indicated in the plan, Fig. 2, as it was desirable to leave the room overhead clear of hot-air pipes, because of light and the presence of the traveler system in all parts of the shop. The hot-air tunnels come to surface near pillars, and galvanized iron piping alongside of the pillars carry hot-air up a short distance and discharge it downward at an angle of about 45 degs.

TOILET ROOMS

In the toilet rooms enameled wash bowls on light iron supports, with open plumbing, are located in the center of the room, and expanded metal lockers for the workmen are ranged around the walls.

OIL VAULT AND SHOP OFFICE

In the center of the shop, as seen in Fig. 26, is a vault for the storage of oil. On top of this vault is an office overlooking the entire shop.

THE SUBWAY HABIT

Even the staid "New York Times" occasionally wanders into the realms of contemplation so aptly described by Prior. And when it does, no matter what the theme, some pert remarks are always sure to be made. Peering into the future the "Times" seems to see looming up what it terms "the subway habit." It says that within a few weeks, when the first section of New York's great underground system is opened for traffic, the habit will be contracted of regularly using the subway to the exclusion of other means of transportation. Commenting on the possibilities of the habit becoming chronic, the "Times" expresses the belief that the daily flight of the citizen from his office in the extreme southern end of the city to his home in Harlem or the Bronx, will eventually result in an unfamiliarity with the intervening territory as gross as the ignorance of "the most typical Reuben, who come to town at infrequent intervals to see the sights and give substantial encouragement to the gold-brick industry." As a corrective of this tendency the suggestion is offered that the citizen occasionally deny himself the privilege of rapid transit underground between walls of concrete, and take the time needed to traverse the city by elevated and surface lines. It is also suggested to the citizen that when there is a holiday the time be employed in familiarizing himself with the city, instead of rushing to the country.

The first report of the Underground Electric Railways Company shows that the company received up to June 30 cash £6,519,672, spent £5,600,222, leaving a balance of £919,450 cash in the bank and in call loans. The company has sold £6,999,931 of profit-sharing notes. Chairman Yerkes says that the total amount of capital required to complete the work is assured.

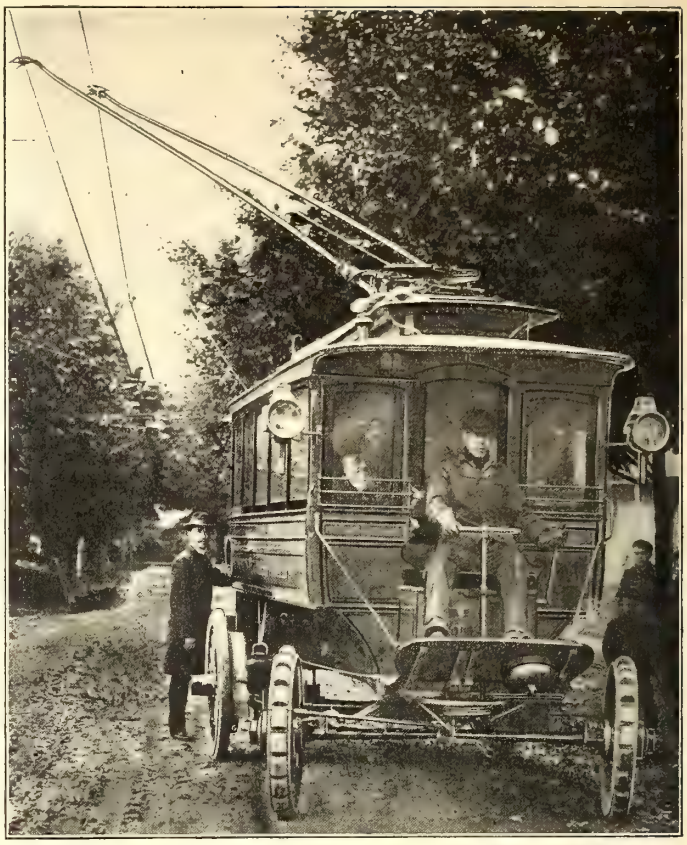
TRACKLESS TROLLEY IN SCRANTON

Active interest in trackless trolleys has been revived by the demonstrations on an experimental line recently constructed at Scranton, Pa., where a large number of interested spectators witnessed the operation of the road on Monday, Nov. 2.

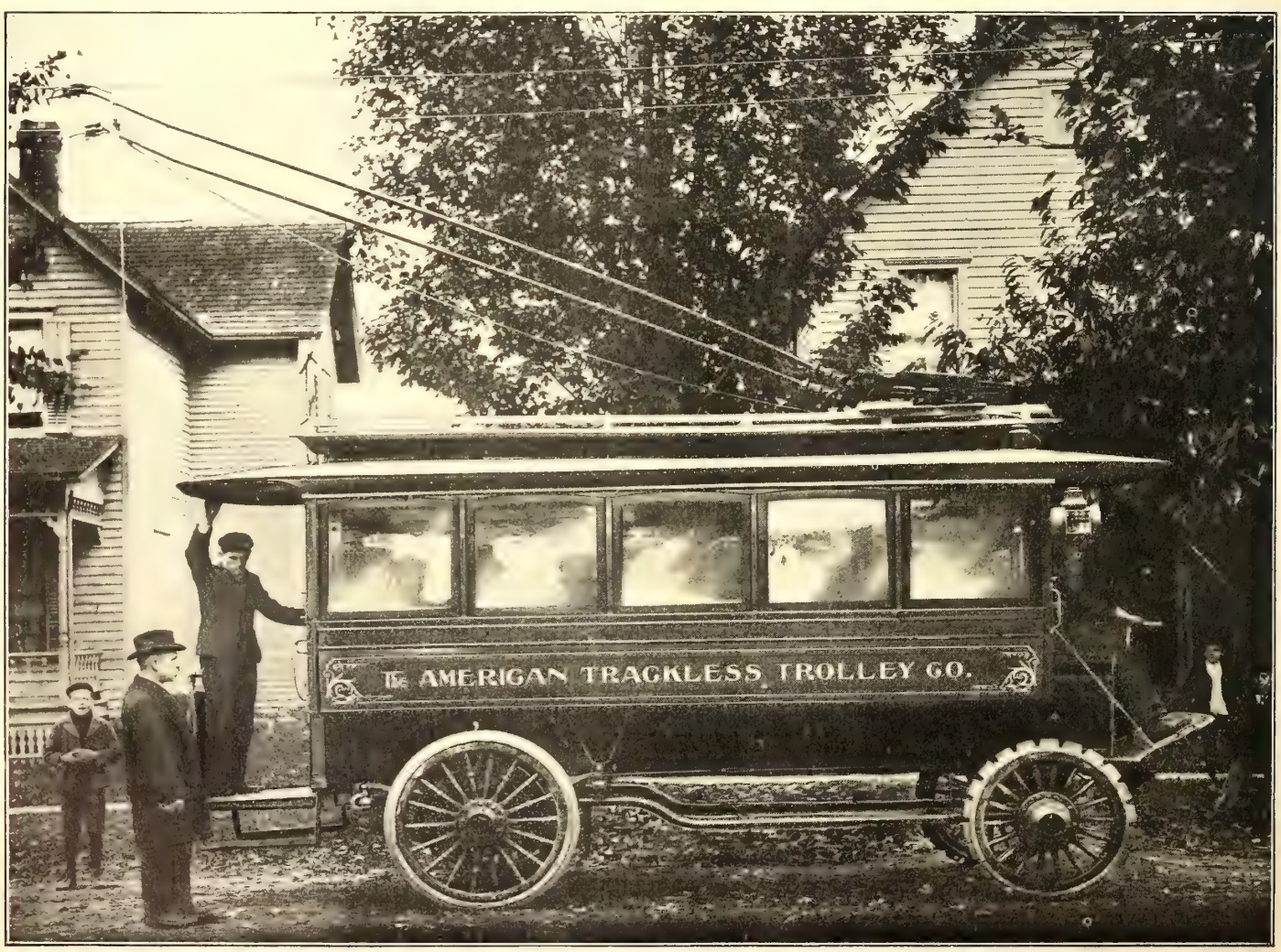
The line, 800 ft. in length, was run over private property, and the ground traversed by the coach was neither smooth nor hard, but exhibited conditions such as would be met with on many country roads. Nevertheless, the progress of the coach, ease of manipulation and comfort in riding were all that could be desired.

In outward appearance, as indicated by the engravings on this page, which are reproductions of photographs of the present equipment, the trolley coach resembles an omnibus, having a trolley-car platform, with step on either side, at the rear, and a seat for the motorman in the front. The steering gear, current controller, brake mechanism, motors and driving gear with which the coach is at present equipped, are similar to those in use on automobiles, but inasmuch as they are to be replaced by electrical railway apparatus of standard make they will not be described here.

Briefly stated, the object sought is to provide means whereby passenger coaches might be propelled through the streets, without the use of tracks, by means of electric current furnished from a main generating station, and continuously supplied to the motors on the coach truck through feed and return wires run above the coach. The trolley is designed to permit the coach to turn out a distance of 15 ft. to either side of the road, and thus to avoid interfering with either light or heavy traffic. At the same time it will enable the motorman to thread



FRONT VIEW OF TRACKLESS TROLLEY 'BUS, SHOWING STEERING GEAR



TRACKLESS TROLLEY OMNIBUS

his way through congested thoroughfares crowded with all kinds of vehicles as readily as could be done with any other type of ordinary conveyance.

The mechanical design and construction features of the system are illustrated in detail in the accompanying drawings. The essential feature of the system lies in the use of a double trolley having two horizontally disposed trolley wheels (a a), as shown diagrammatically in Figs. 1 and 2, that are held in contact with the feed and return trolley wires (b c) by the lateral separating pull exerted by the insulated spring (e) attached to the trolley pole bases. The trolley poles are pivotally mounted to permit the coach to move freely from one side of the street to the other, and they also have a vertical swing of from 18 ins. to 24 ins., to provide for any unevenness in the contour of the road.

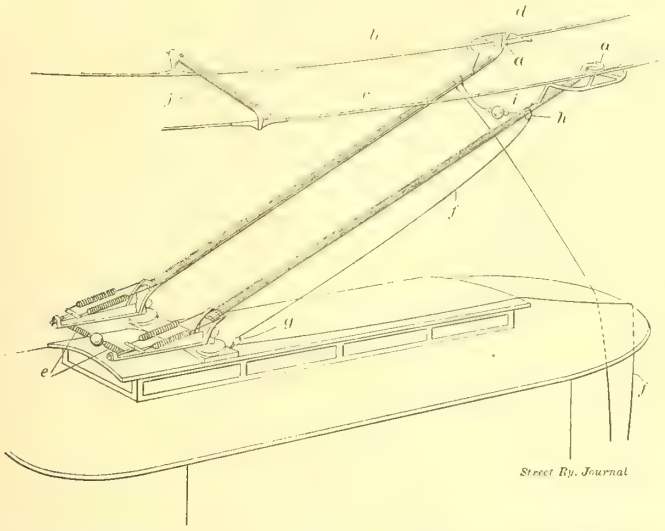


FIG. 1.—PERSPECTIVE OF TROLLEY POLES, SHOWING ARRANGEMENTS FOR HOLDING WHEELS IN CONTACT WITH FEED WIRES, SPREADING THE LATTER, AND TROLLEY-WHEEL DISENGAGING DEVICE

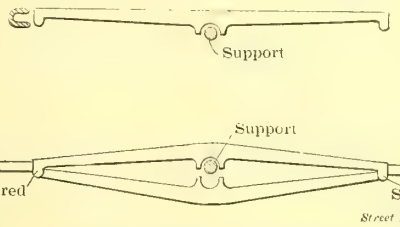


FIG. 5.—HANGER SUPPORT

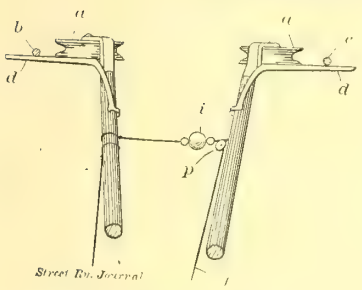


FIG. 2.—PERSPECTIVE ELEVATION OF TROLLEY WHEELS AND ATTACHED GUIDES

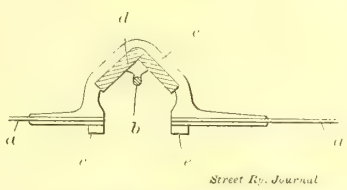


FIG. 6.—ELEVATION OF CROSS OVER BRACKET

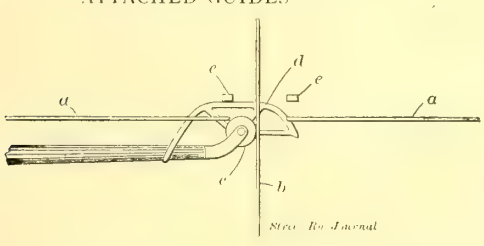


FIG. 7.—BRIDGING GAPS AT CROSS-OVERS FOR UNDER-RUNNING TROLLEY LINES

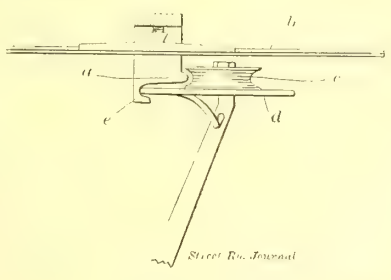


FIG. 8.—GUIDING TROLLEY WHEEL ACROSS GAPS

The trolley wheels are prevented from slipping off the wires while the coach is in motion by the guides or guards (d), whose shape is clearly indicated by Fig. 3, which also illustrates how the guards serve to guide the trolley wheel of the coach traveling in an opposite direction. One of the guards in such a contingency, it will be noticed, serves as a curved track over which the wheel of the other trolley passes to the wire without jumping off. Both guides are beneath the wire, even though both trolley wheels might not be in contact with the wire at the moment of passing.

Engagement of the trolley wheels with the feed wires, or withdrawal therefrom, is effected by means of the rope (f), Fig. 1, by which the trolley poles may be drawn toward each other. The rope is passed through two pulley blocks (g and h) to a ball insulator (i), and thence to the other trolley pole.

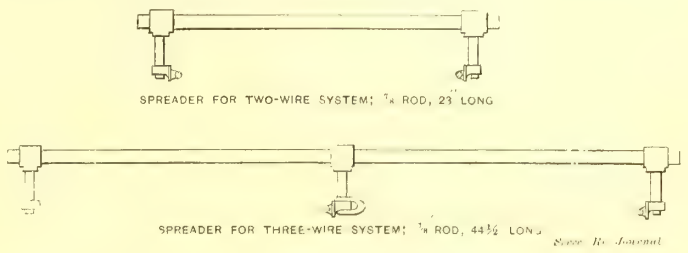
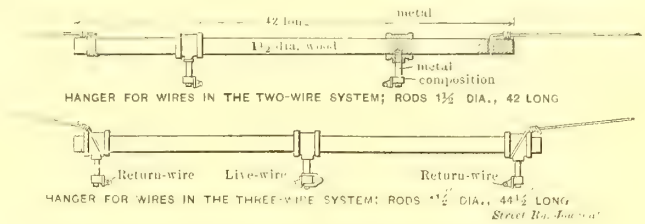
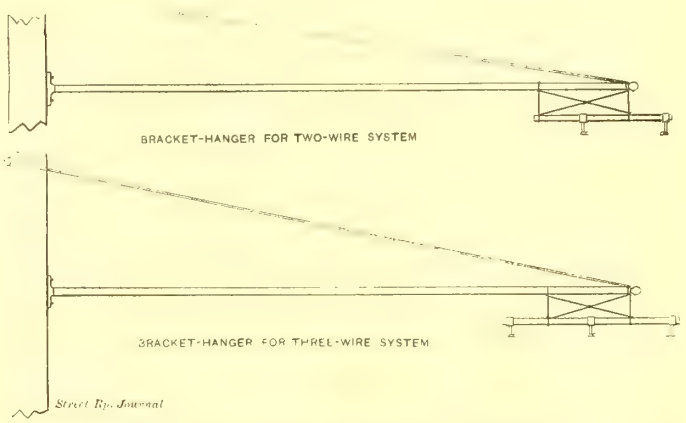


FIG. 4.—OVERHEAD FIXTURES



FIGS. 4-a AND 4-b.—TWO STYLES OF HANGERS



FIGS. 4-c AND 4-d. BRACKET HANGERS

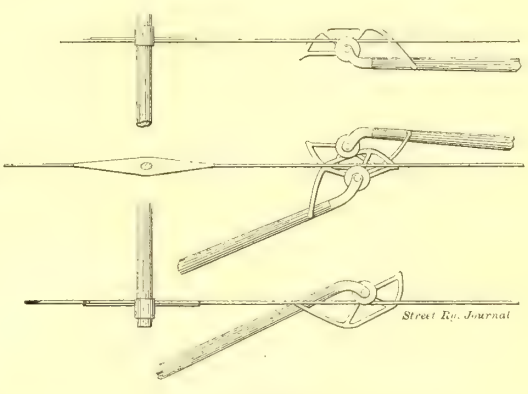


FIG. 3.—PLAN OF THREE-WIRE SYSTEM

The ball insulator serves the double purpose of preventing a short circuit and of limiting the distance between the trolley wheels when drawn toward each other by the rope. The degree of limitation is relatively shown in Fig. 2. The trolley wheels take a position only a short distance away from the wheel flanges, with the guards under the wires. By drawing the trolley poles toward each other and then swinging them by means of the rope to the proper position beneath the trolley wires, and allowing them to rise until the guards come in

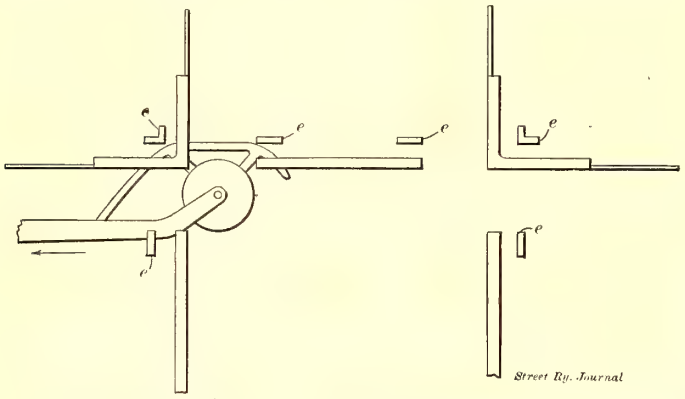


FIG. 9.—ARRANGEMENT OF GAPS FOR WIRES OF TWO SIDE-RUNNING TROLLEYS

contact with the wires, as in Fig. 2, the wheels, on releasing the rope, instantly spring apart into contact with the feed wires.

For the purpose of keeping the two trolley wires the same distance apart throughout their length, side engagement spreaders (j), Fig. 1, are used. These consist of composition metal side hangers insulated by the circular paraffined wooden bars or rods, to which they are attached.

Coaches traveling in opposite directions may pass each other without removing the trolleys when the three-wire system, illustrated by Fig. 3, is used. In this arrangement the central or third wire serves as a common feed wire, the two outer wires being for the return current.

The spreader and hanger used with the three-wire system are shown in Fig. 4a and Fig. 4b, respectively. The hangers for the outer wires are of the side engagement type, as with the two-wire system illustrated by Fig. 4b, but the hanger for the center wire is made somewhat like a dart, as indicated in Fig. 3, in order to prevent the trolley wheel flange from coming in contact with the hanger support. As indicated by Fig. 5, the trolley wire lies in a groove along the inner side of the hanger, which is made up of two composition metal elements, bent in the manner shown, the strip along the inner side of which the wire runs is made somewhat straighter than the other, so as to lessen the tension and thereby obviate danger of the wire pulling away from the hanger at the ends.

Bracket hangers for both systems may be of any desirable pattern, those illustrated in Fig. 4c and Fig. 4d being considered satisfactory types for this service.

Provision for passing an under-running trolley line at right angles is made by placing the wires for the trackless system slightly below the wire of the other system, as shown in Fig. 6. Then by running the former within 2 ins. of the other wire at either side, a gap will be provided for the passage of the under-running trolley wheel. The trackless trolley wires (a) are

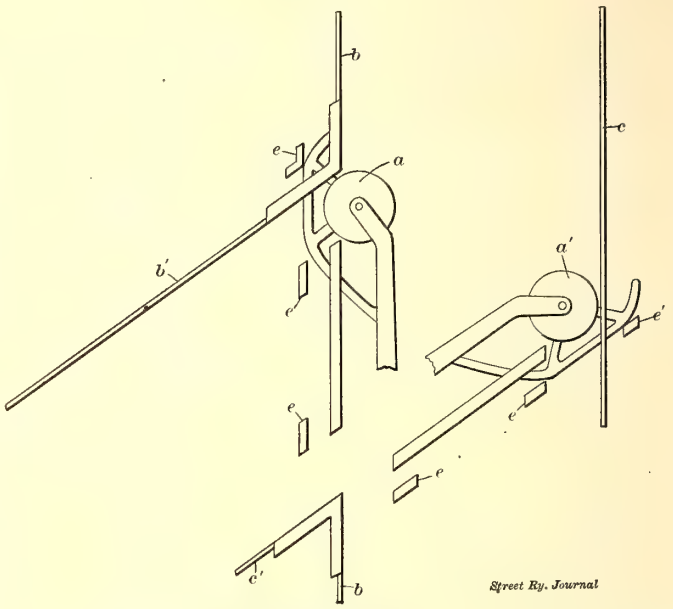


FIG. 10.—SWITCHING SIDE-RUNNING TROLLEY FROM ONE WIRE TO ANOTHER

held in position at the gap by a rigid metallic arch that also serves to hold in place the under-running trolley wire (b), which is supported by and insulated from the arch. An insulating trough protects the latter in case the under-running trolley wheel should slip off its wire. To prevent the side-running trolley wheels from being pressed into the gaps in passing them, a grooved track or guide for the trolley wheel guard (d), Fig. 7, is formed in the lower portion of the arch at the points (e), Fig. 6, so that the guard, being of greater radius than the trolley wheel, bridges the gap and delivers the wheel to the wire on the other side smoothly and with certainty. Fig. 7 is a plan view, showing the method of bridging the gaps at the cross-overs, while Fig. 8 is an elevation showing the relation of grooved guide or track to the guard, trolley wheel and wire of the under-running trolley line.

Where two side-running trolley wires pass each other at right angles, all the wires being in the same horizontal plane, the gaps in the wires are arranged as indicated in Fig. 9, permitting the proper wheels to slip through, while the track blocks (e) prevent the wheels from flying through the wrong gap to the cross wires.

The same arrangement permits the side-running trolley to be switched from one line to another, as shown in Fig. 10, wherein the trolley wheel (a) is shown passing the gap opposite

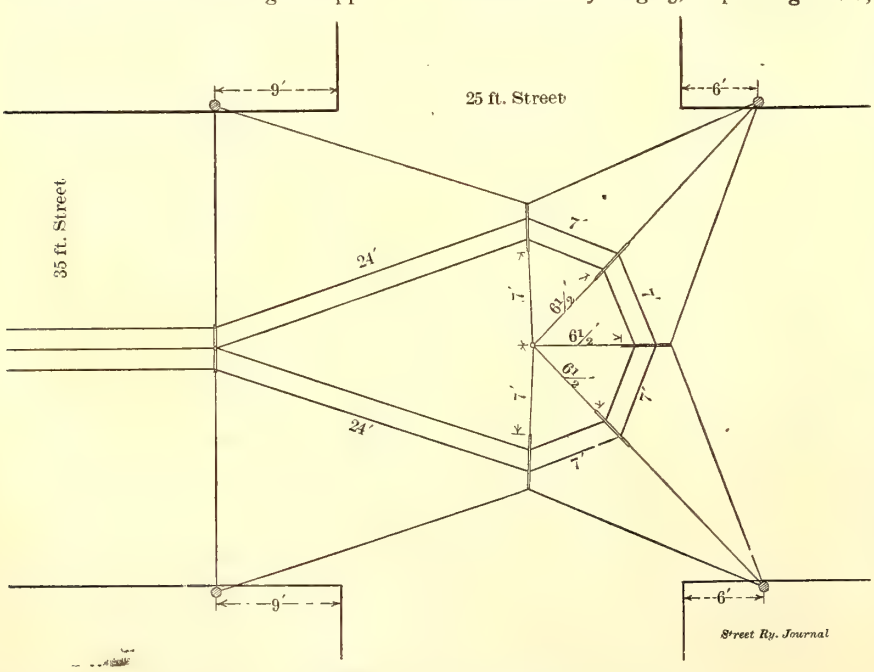


FIG. 11.—OVERHEAD LINE AT TERMINAL LOOP

the wire (b′). In order that the trolley wheel may leave one wire (b) and pass to another (b′) the motorman turns the coach to one side in the direction of the latter wire (b′) before the trolley wheels reach the switch. Therefore, when the wheels actually reach the latter they will be lying in the direction of the switch line and will pass through the gaps to the proper wires (b′ and c′).

With the three-wire system no switches are necessary at the line terminals, where loops are arranged, as indicated in Fig. 11; but with the two-wire system a switch, such as is shown in Fig. 12, is arranged at the entrance of the loop at each end of the line. The feed wire is carried around the loop to the point (c), where a wooden track serves to insulate it from the return wire (b). When the trolley wheels reach the wooden switch piece (d) it is thrown over to the wire (a), returning to its original position under the influence of the spring (e).

Since the trackless trolley system obviates the use of running rails it is especially adapted for asphalt pavements in residential localities where permission to tear up the streets could not possibly be obtained; also, in small cities and large towns and villages, whose residents refuse a franchise for laying tracks, and for temporary service to summer resorts and other places of amusement. Another field of usefulness is in joining villages whose traffic is not sufficient to warrant the expense of the installation of track lines or for meeting the requirements

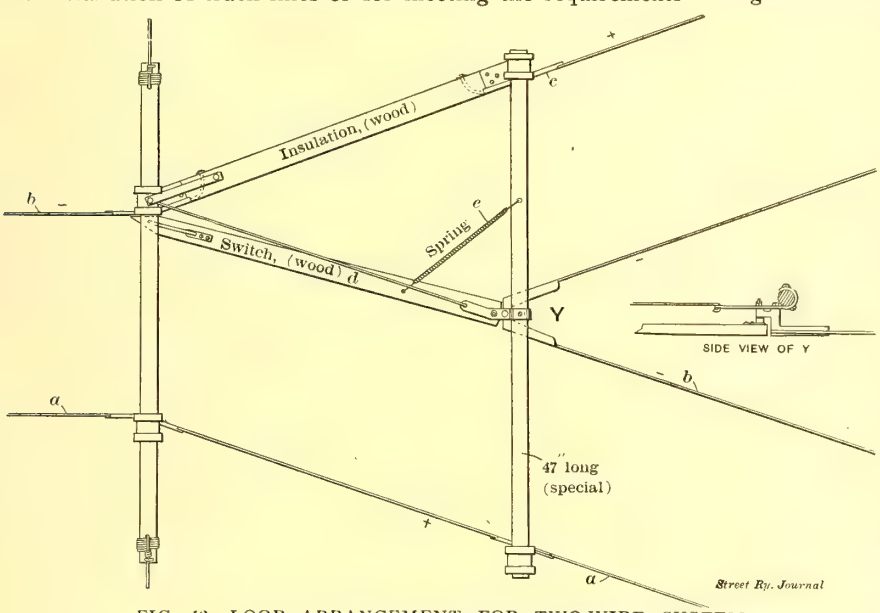


FIG. 12.—LOOP ARRANGEMENT FOR TWO-WIRE SYSTEM

of outlying districts where feeders to main-track lines would be desirable. Moreover, the system permits the operation of combination passenger and freight lines, the trolleys of the slow freight cars merely being pulled off the wires at any point to allow the faster passenger coaches to pass. Furthermore, by means of a removable line extension the freight cars may be run off 100 ft. or more from the trolley line to distant stores or warehouses.

When operated in localities where there is a considerable fall of snow in winter, it is suggested that instead of piling up the snow on the sides of the road, a snow roller may be used for packing down the snow, and thus insuring good sleighing.

No data as to the cost of operation in comparison with street car lines can as yet be given. The cost of installation of the trolley wires and supports is about $1,600 per mile, while the cost of coaches, having a capacity of twenty passengers seated and fifteen standing, with motors and trolleys complete, is about $2,600 each.

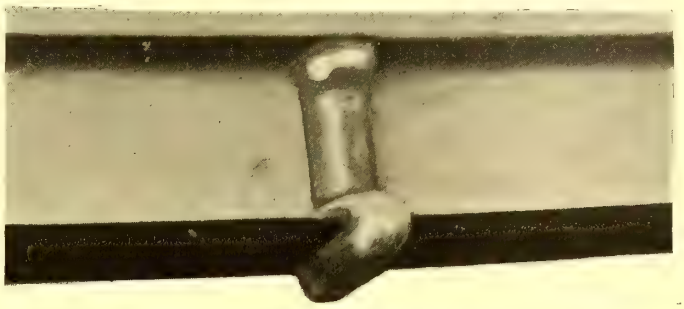
The inventor of the system here described is A. B. Upham, president of the American Trackless Trolley Company, of Boston. The installation at Scranton was made under the personal supervision of Fred. G. Tilton, of that company.

ALUMINO-THERMICS AND RAIL WELDING*

BY DR. HANS GOLDSCHMIDT

The large field of welding processes with the aid of thermit—which is at present the most important application of alumino-thermics—has been considerably broadened in recent years.

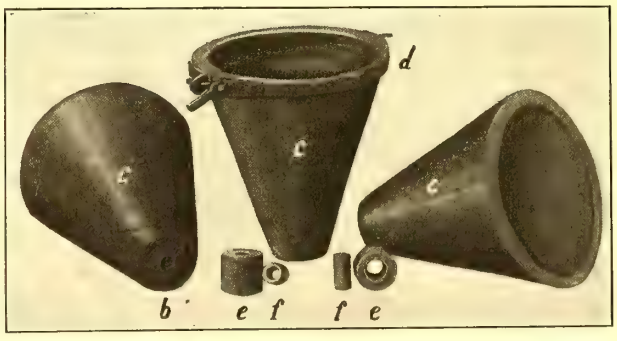
The most important of these welding processes is the one by which a continuous rail—a necessity of modern trolley road



SIDE OF RAIL, SHOWING WELD

construction—is simply, cheaply and effectively obtained. Engineers in this country, in which no less than 25,000 miles of single track are in existence, are watching the good results obtained in Europe with this system.

The city of Leeds, in England, after careful investigation by a commission of experts, is using this process over the whole of its track, and an American expert, who had occasion to see it employed there, recommended it for a very important contract at Singapore, where, in consequence, it is now being used over a track of 27 miles. Last year 3000 joints were welded, and this year no less than 20,000 joints have been delivered. A marked advantage enjoyed by this system is the absence of any bulky equipment. All that is required is a crucible, a mould box, and, in some instances, where a complete butt-weld of the head of the rail is desired, a rail clamp. All these materials, including the necessary quantity of thermit, can easily be moved on a hand truck. Each weld, according to section, requires from 15 lbs. to 20 lbs. of thermit. Even where a rail clamp is used the time employed is less than that necessary for fixing fish-plates and copper bonds.



CONICAL CRUCIBLES LINED WITH MAGNESIA

The mould is made according to a model designed especially for each section. Its two parts, one on each side, firmly enclose and exactly fit the rail. Certain channels are provided in the

* Abstract of lecture before the Columbia University Chemical Society, Nov. 13, 1903.

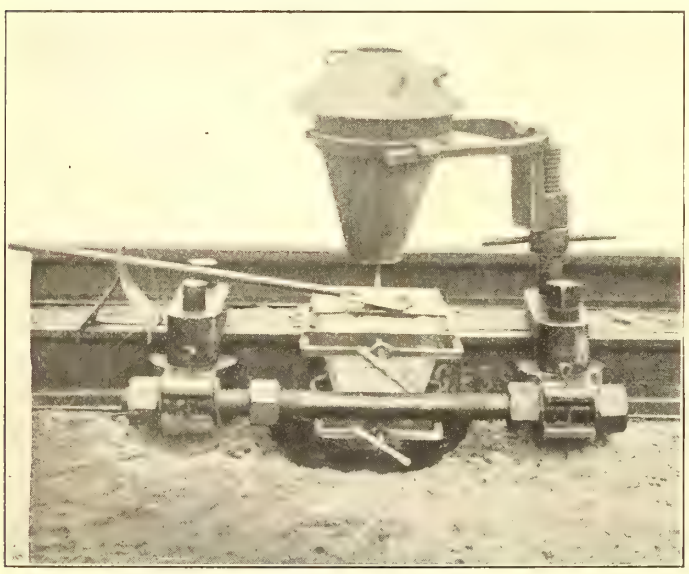
mould parts for the thermit iron to run through. The size of these channels, which are open towards the rail, has been accurately determined by experiments. It varies according to whether slag or iron is to fill the mould and also in accordance with the requirements of each section. The thermit iron running out of the crucible flows round the web and foot of the rail, and, melting them, forms one mass with them. The



MOULD READY FOR CASTING

liquid slag which follows the metal is diverted to the top of the rail and brings the latter to welding heat. The whole section is thus heated equally and the rail ends will not buckle.

The weld can be made with or without rail clamps. In the former case the rail ends are butted together by tightening the screw two minutes or three minutes after the run. A slight and very short upset will be produced at the joint, which can easily

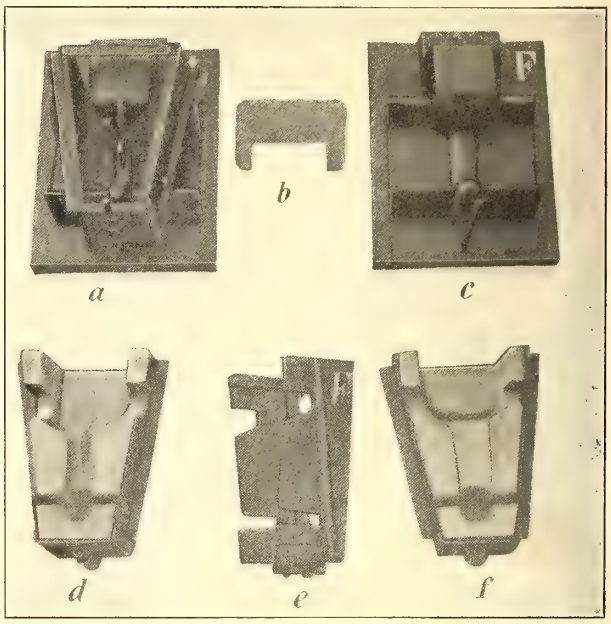


COMPLETE OUTFIT

be removed. The simplest way has been found to chisel it off, as a grinder will not answer the purpose as well. One man can take care of twenty-five joints a day in this manner. By using the rail clamps a perfect butt-weld, without even the smallest gap between the ends, is obtained. The rigidity of the joint is particularly great, and when tested under hydraulic pressure the break occurs outside the welded zone, for with the iron shoe welded onto the section the joint is really stronger than the rail.

The use of the rail clamps is, however, by no means obligatory. Without them the work is still further simplified, as the time necessary for adjusting the heavy clamps and for chiselling off the up-set is saved. By practical experience it has been found that the weld without clamps is quite sufficient. Of late the clamps are being used less and less.

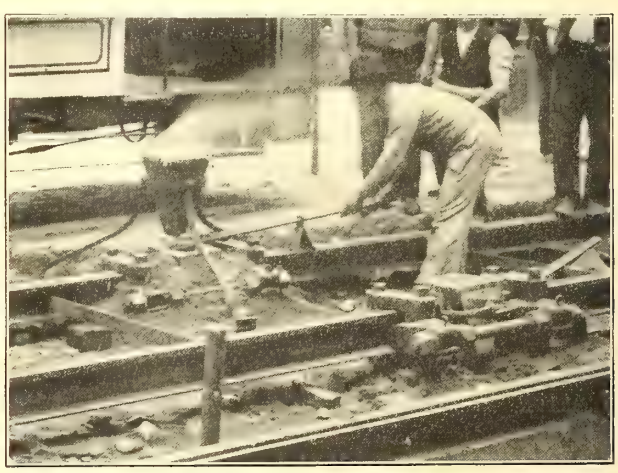
The first to weld without clamps was the town of Brunswick,



FORMS AND MOULDS

a Model for the lip side with mould shell. *b* Appliance used when ramming the sand in. *c* Model for tread side. *d* Finished half of mould for lip side. *e* Half of mould shell for tread side. *f* Finished half of mould for tread side.

Germany, more than two years ago; it has continued to follow this plan ever since. Nearly all the work done in France, such as at Rouen, Havre and Paris was without clamps, and the joints have now been in the ground for more than a year. Italy also, particularly the cities of Genoa and Milan, preferred to work without clamps. Altogether this modification has been tried in several thousand joints and given entire satisfaction.



WELDING TRACK AT DRESDEN

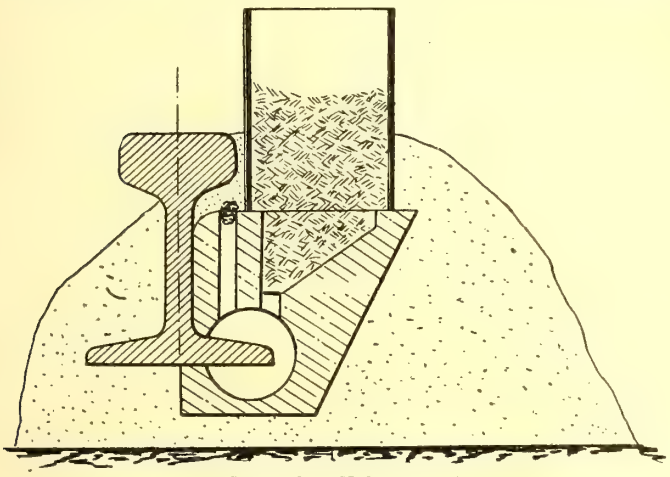
The use of clamps is based chiefly on theoretical considerations. Even a butt weld can be obtained without clamps, particularly with rails already embedded. At Barmen, Germany, this was done very successfully about a year and a half ago. The old fish-plates were taken off, the ends of the rails were raised slightly by means of a crowbar, and a shim was firmly wedged in between; in this case the shim is welded into the head of the rail.

When welding new rails not yet embedded the use of rail

clamps can be obviated by firmly wedging up the rail from the next succeeding joint.

When working without clamps the time consumed per joint equals three-quarters of an hour for one man; trained squads of four men, including foremen, did not use nearly so much time. At $1.50 per day the wages item of cost is 10 cents per joint. The use of the clamps doubles this amount. All other labor connected with welding remains the same whether clamps are used or not.

As stated the moulds are in two parts. They can either be made on a large scale by manuafcturers of refractory earthenware, or, according to the requirements of the trolley lines, in the repair shops. In the latter case they are made by ramming a simple mixture of sand and loam into a sheet-iron case, which



WELDING THIRD RAIL

afterward has to be dried during a couple of hours at a temperature of some 100 C. The cost is, therefore, only a few cents.

The mould is dry and porous, and is screwed onto the rail, and the rims are carefully smeared with clay where they touch the rail. Prior to this, however, the rail ends are cleaned of dirt and rust with a wire brush, and are slightly warmed. A sand blast is superfluous.

In case the tops of the rails are to be butt-welded the section has to be filed. This is all that is required in the way of preparatory work. A true alignment of the rail is, of course, an indispensable precaution. The rails require no bolt holes, as no provisional fish-plates are necessary. In wet weather the protection of a few planks is desirable to prevent the mould and thermit getting wet. None of this work demands special training, and can easily be done by inexperienced labor.

The next and only appliance remaining necessary for thermit welding is the crucible. This consists of a sheet-iron mantle lined with magnesia. It is of simple construction, the lining being introduced by ramming it round a cone which is suspended in the middle of the mantle. The bottom is formed by a hard magnesia stone provided with an exchangeable outlet, which will stand from nine runs to 10 runs. The crucible, with the cone in it, is placed in a furnace for two hours until it is brought to a glow heat, when it is ready for use. Crucibles will stand about twenty-five reactions, and the wear and tear will, therefore, amount to only a few cents per joint. Every section, according to its weight and according to its different dimensions, requires different quantities of thermit, the composition of which has also to be regulated for each separate case. Although sections generally in use in this country are higher than the average European standard, the less width counterbalances in a certain degree the increased height, and the quantity of thermit required will average about the same in both countries. Thermit is supplied in small bags, containing the exact weight which is needed to effect the weld. These are called welding portions. The trolley companies may make their own crucibles and moulds, and they will, therefore, have to pay freight only on the welding portions. As these weigh about 20 lbs. gross the freight is, of course, considerably less than that on fish plates and bolts. The Essen Works have a plant to supply over 500 welding portions daily. The illustrations which accompany this article show clearly the methods and apparatus employed, both in track welding and for contact rails.

The strength of the weld is about 80 per cent of the strength of the original material. The shoe welded onto the foot of the rail not only makes up for the remaining 20 per cent but materially strengthens the rail at the joint. The head does not get softer although it is brought to welding heat, the reason being that the operation takes place without the air having access to it. Test rods, cut out of rails, brought to welding heat with thermit, have proved this contention. Tensile strength and elasticity have not suffered. Three years practical experience in over forty towns in Europe confirms these conclusions.

TABLE OF TESTS

From tests made June 23, 1903, by F. S. MacGregor, permanent way engineer of the Leeds City Tramways, on the strength of thermit joint, the following figures are taken:

Rail supported 5 ft. center to center, test made with 10-in. ram, 2-in. bearing on head of rail.
Up to 28 tons, no deflection and no set, and then 1-64 in
Up to 30 tons, 1-32 in.
Up to 40 tons, 1-32 in.
Up to 45 tons, 1-64 in.
Up to 50 tons, 3-32 in.
Up to 55 tons, 3-32 in.
Up to 60 tons, ⅛ in.
Test was then stopped, and it was found that there was no permanent set whatever.
Pressure brought on again to 65 tons, still only ⅛ in. deflection; at 68 tons, rail still sound, and at 70 tons, rail broke, but not through the weld.
Hydraulic test, July 7, 1903. Dead load, 5-ft. bearings, 10-in. ram, 2-in. bar on head of rail:
Eighty-five tons, 3-16 in. set.
Ninety tons, ¼ in. set.
Ninety-five tons, ½ in. and slight fracture.
Thermit welded joint tested to dead load as above:
Up to 60 tons no permanent deflection.
Safe dead load at 68 tons.
Seventy tons fractured at side of the weld, the welded portion remaining intact.
Fish and sole-plate joint. Fish-plates, 62 lbs. per pair, 2 ft. long, six 1-in. bolts; sole-plate, 46 lbs., 2 ft. x 8 ins. x ¾ in., 12⅞-in. bolts.
Permanent set at 85 tons, ¾ in.
Permanent set at 90 tons, ⅞ in.
Fractured at 102 tons.

The so-called third rail is also welded by this means. The skin resistance of copper bonds increases with time, and frequent repairs are necessitated thereby, but welding obviates these repairs. It can be done in two ways. The first is identical with the one described before (but without the use of clamps), and is now in operation on 20 miles of road at Paris, France, where a short track gave satisfaction after a year's trial. The second consists in welding a small bridge of thermit iron between the feet on one side of the rail. Both are in use on a large scale. On the Suburban Road from Berlin to Grosslichterfelde, the Union Elektricitäts-Gesellschaft of Berlin has welded 13½ miles of track. In this case the crucible is superfluous. The welding portion, of about 3 lbs., is placed directly into the upper part of the mold, which is prolonged by a piece of gas pipe.

The accompanying cut shows the third rail and the mould at the right hand. A tube is placed above the mould and filled with thermit iron. At the bottom the thermit iron mixture rests on a thin iron plate. When the thermit mixture is ignited this plate melts, and the molten mass flows into the mould and the weld is made. The ignition is made by placing about a thimbleful of ignition power in the crucible and setting fire to it with an ordinary match.

"L" ROAD PATRONAGE AFFECTED BY ESCALATOR SERVICE

The charts published herewith, although compiled primarily to show graphically the falling off of revenue at the Twenty-Third Street station of the Sixth Avenue Elevated Railroad, New York, while the escalator was shut down, are also interesting because of their presentation of other phases of the fluctuations of traffic.

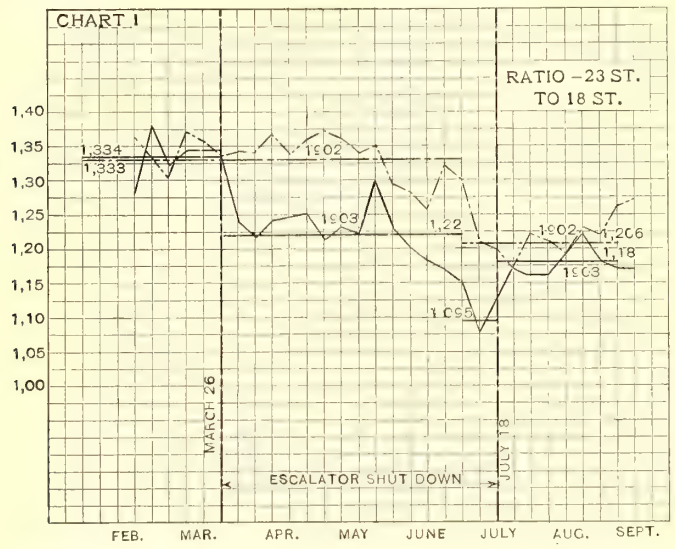


FIG. 1.—RATIO BETWEEN TRAFFIC AT TWENTY-THIRD STREET AND EIGHTEENTH STREET STATIONS

In Fig. 1 the upper curve shows the ratio between the traffic at the Twenty-Third Street and the Eighteenth Street uptown stations in 1902, when the escalator was operating. It is of interest to note, in passing, that the curve begins to fall about the middle of May, when the spring shopping terminates, indicating that the Twenty-Third Street receipts fall off at a greater rate in summer than the Eighteenth Street receipts, as indeed might be expected from the difference in the character of these shopping districts.

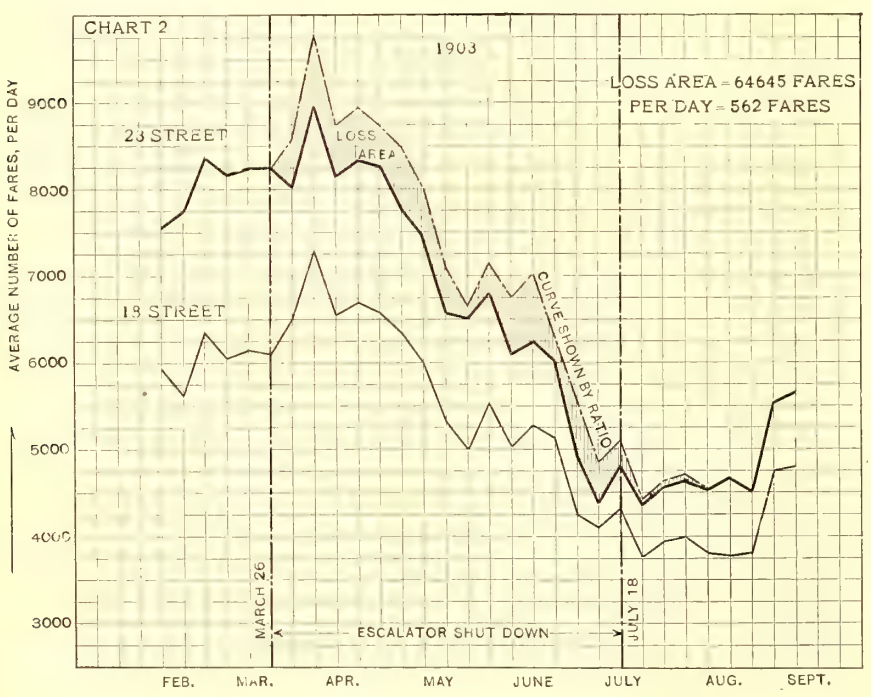


FIG. 2.—DAILY RECEIPTS

The lower curve in the same chart shows the ratio between the receipts at Twenty-Third Street and Eighteenth Street for 1903, and here it will be noted that the ratio between the two is practically the same as in 1902 up to March 26 of this year, when the escalator was stopped. It was necessary to keep it out of commission while a number of electrical changes were being made to secure better speed regulation of the driving motor. From the date on which the escalator was stopped the ratio curve took a sudden drop and the ratio of the receipts at the two stations, from March 26 to July 18, averaged 1.22, as compared with 1.33 for 1902. On July 18 of this year the escalator again resumed regular operation, and the chart shows that from that time on the ratio again began to rise until it became practically the same as in 1902. From these facts it is assumed that, had the escalator remained in operation, the ratio of receipts of the two stations would have remained practically the same in 1903 as in 1902.

In Fig. 2 are plotted curves showing the actual number of fares per day during the season of 1903, as compiled from the books of the Interborough Company. The lower curve represents the actual number of fares at the Eighteenth Street station. The solid curve above it represents the actual receipts at the Twenty-Third Street station. If the same ratio between the receipts at the two stations which obtained in 1902 had held during 1903, it is computed, the receipts at Twenty-Third Street would have been those shown by the upper dotted curve. From the foregoing analysis it is concluded that the only reason for a reduction of the ratio was the fact that the same facilities were not offered the public at Twenty-Third Street as in 1902; that is, the escalator was shut down during the period under discussion, and in support of this line of reasoning is cited the fact that within less than four weeks after the escalator had resumed operation (a period which necessarily elapsed before the traveling public became fully aware that the service had been resumed) the corrected curve of receipts merged with the curve of the actual receipts. As is obvious, the area between the corrected curve and the actual curve represents the fares which were lost during the shut down. A calculation of this area shows that the loss was 64,645 fares, or $3,232. The loss would have been much greater had the shut-down not been, for the most part, during the summer months, when traffic is the lightest.

WORLD'S FAIR EXTENSIONS PLANNED BY THE SUBURBAN COMPANY

Extensions for handling World's Fair traffic have been planned by the St. Louis & Suburban Railroad Company which will give it terminals near the two principal entrances to the Exposition. The improvements include two loops, one at a point just east of the main entrance at De Baliviere Avenue and Lindell Boulevard, and the other at Skinker Road and the Colorado tracks at the northwest corner of the Pike.

The plan is to run through cars during the World's Fair out over the main road to Union Avenue and thence south to a point south of De Giverville Avenue. The line will then run westward over a right of way through Catlin tract to a point about 200 ft. east of De Baliviere Avenue and Lindell Boulevard, terminating there in a loop. The Suburban tracks crossing those of the Wabash and the Colorado will be either depressed or elevated. A station will probably be erected at the loop.

The route of the western branch of the line to the Fair Grounds will be as at present until the curve on the Brentwood division, 600 ft. south of Delmar Avenue, is reached. At this

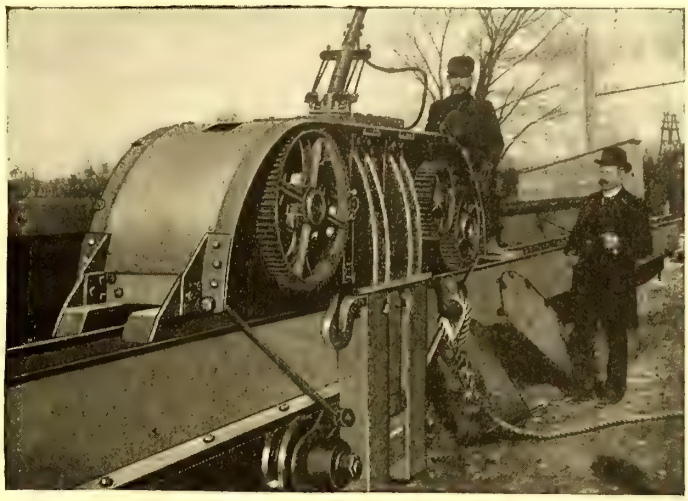
point the extension tracks will run eastward over a right of way leased from the Parkview Realty Company. These tracks will terminate in a loop at Skinker Road and the Colorado tracks, west of the road and north of the tracks. A station will also probably be erected here. All of the extension lines will be double tracked. While negotiations have been almost completed for the lease on the necessary land the leases have not yet been closed.

"ELECTRIC MULE" ON ERIE CANAL

Recent tests were made on the Erie Canal, at Schenectady, for the purpose of determining the practicability of an electric towing system designed by Stephen W. Wood. The experimental track is about 2700 ft. in length, with a sharp curve, and furnishing a good average section of the 7-ft. prism. Along the bank are erected every 25 ft. short posts set in concrete and supporting, on each side of the post, about 3 ft. apart, continuous plate 18-in. girder, the girder farthest away from the canal being raised above the inner one, as in a tier of seats. The girders are cross braced so as to stiffen the structure, and of a most substantial character. The edges of each girder are faced with light 3-in. rail for track. Over the two girder tracks extend a series of ordinary trolley brackets carried on poles set at the outer edge of the canal bank and carrying a trolley wire readily accessible to a trolley reaching up from either track.

The "electric mule" is a vehicle closely resembling a "hog-back" mule locomotive, and is 10 ft. long by 2 ft. wide, and 3 ft. high from the rail. It is iron-clad for better protection from the weather, but all the parts are accessible. At each end is a 40-hp motor of street car, narrow-gage type; but, owing to the low speed required, geared down by double reduction in the ratio of about 40 to 1. Both sets of gear are shown in one of the views, on the exposed side, the first reduction from the motor armature axle to the first gear being seen in front, while the second reduction set of the rear motor is seen at the rear. Each motor drives a grooved wheel about 22 ins. diameter, which travels upon the upper rail; and, by reversing, the motor runs promptly backward and forward. At the rear end is a series-parallel controller and a resistance box. The mule has two large hooks for the tow-ropes, and has also a running board and guard hand rail, so that the driver can go around the machine without dismounting. Reaching upward from the center of the top shell of the motor is a stout, short mine trolley, which can be pulled down so as to let another mule pass on the upper or lower track. Obviously, two wires, one for each track, could be strung if desired.

From the body of the motor mule extends downward a heavy arm, which carries springs pulling upwards two grooved wheels so as to exert a gripping effect on the under rail. This tension spring can be loosened or tightened at will, and the arrangement serves to keep the tractor steady, besides affording additional adhesion. The amount of power consumed varies, of course, with the speed, the weight hauled, the condition of the track and other factors. Direct current is furnished from the General Electric plant to the motors at 475-500 volts.



"ELECTRIC MULE," SHOWING GEARING ON EXPOSED SIDE



CONSTRUCTION OF TRACK AND POLE LINE

As to the tests themselves, they included the hauling of two boats each loaded with over 200 tons, at a speed up to 4¼ m. p. h., as recorded by tachometer in the observation car keeping abreast over the run. These two boats would represent a total weight of probably 600 tons. Other tests included the haulage of four loaded barges at varying speeds up to the same figure. In every instance the slight wave motion in the canal, or absence of wash, was most noticeable, the disturbance dying out in a mere ripple as it reached either bank. This would appear due to the steadiness of the breast pull and the abolition of the churning action consequent upon the use of a screw propeller. Some of the tests were conducted in a heavy snowstorm, but little, if any, difference was observed in the results.

During the tests one or two mule tows passed in the opposite direction, making barely a mile an hour on the wet towpath. The contrast between the two systems was most striking, while it was not to be forgotten that both the old and the new methods were operating at the same time without interference.

The cost of equipping the Erie Canal, 352 miles, with the Wood system, is estimated by the International Towing & Power Company, of New York, at $7,040,000, provision being made for 300 equipments, of 80-hp capacity each.

The gross earnings from the operation of the system, estimated at 50 cents a ton for 10,800,000 tons, which is the capacity of a barge canal, would be $5,400,000. The operating expenses would be: Four per cent on equipment, $281,600; cost of 24,000 hp, seven months' use at $35 per hp per annum, $490,000; wages, motormen for 300 motors (three men each) 8-hour shifts, $378,000; trackmen, $11,340; repairs, salaries, etc., $150,000; total, $1,310,940, making the net earnings $4,089,060.

The General Electric Company, while in no way associated with the enterprise, built the motors and furnished current for operation in order to encourage the effort. Carl W. Larsen, of the mining department, and W. B. Potter and A. P. Jenks, of the railway department, have devoted considerable attention to this experimental work.

PROPOSED SUSPENDED RAILWAY FOR HAMBURG, GERMANY

The following is an abstract of a paper read by Richard Petersen, chief engineer of the Continentale Gesellschaft for Elektrische Unternehmungén, Nürnberg, before the Architects & Engineers Verein of Hamburg, concerning the plans for the proposed suspended railway which his company has prepared for the consideration of the Hamburg municipal authorities. The system offered is based on that now in service at Barmen-Vohwinkel, to which reference was made in the Street Railway Journal of June 7, 1902.

In planning the system the company's engineers were chiefly guided by the present need for rapid transit between Hamburg and its suburbs, but they have also provided for taking care of the probable traffic increase for several decades to come. The present plans call for one main line through the middle of Hamburg, with numerous branches to the outlying towns.

The main line will begin in the eastern portion of Hamburg, known as the Deichtor, pass through the center of the city to a point near the Rathshaus, thence southerly to Baumwall and along the River Elbe to St. Paul's Landing Bridges. After running along the boundary between St. Paul and Altona, it will turn to the north, cross above the Hamburg-Altona State Railroad, run northeast to Schlump and then northwest to Schlankreye, which will be the western terminus. One track is to be used for express service between Deichtor and Schlankreye. Total length of main line about 5 miles (6.5 km).

Of the four branches contemplated, that between Deichtor, St. George, Borgfelde, Hohenfelde, Uhlenhort and Barmbeck will be the longest (about 5 miles), running northeasterly to the northern limit of Barmbeck. At Uhlenhorst provision is to be made for future extensions to Mühlenkamp and Winterhude.

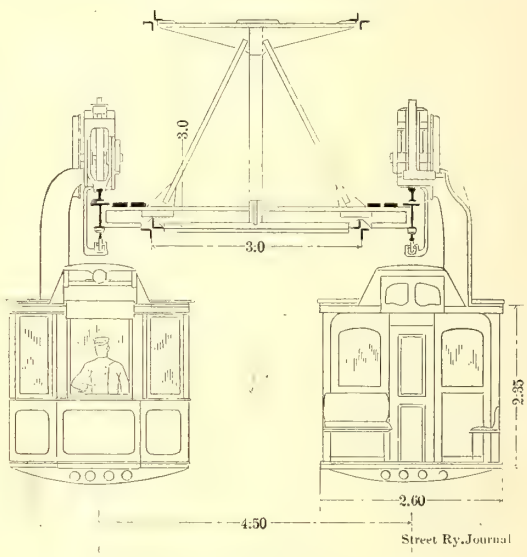
The second eastern branch is to run to St. George-South and Billwärder-Ausschlag, crossing several canals. The present plans contemplate building about 2 miles, terminating at the Billhorn Canal. It is intended, however, to extend this line to Hammerbrook later.

Two branch lines are planned to begin at the Schlankreye terminus of the main line—one running north to Eppendorf-Winterhude, and the other west to Langenfelde, via Eimsbüttel. The Eppendorf-Winterhude line is to be connected later with the Uhlenhorst-Winterhude branch, thus forming a belt line around the Alster Basin.

The construction of the railway will not be of uniform character but varied to suit the conditions, the supports being designed, wherever possible, in harmony with the surroundings. Along promenades and narrow streets they will form inverted capital U's. Where there is ample room, however, the supporting posts will be placed in the center of the road with cross-beams attached. Owing to the poor quality of the soil it is planned to imbed the supports in cement to a depth of 10 m, and have them rest on granite foundations.

The rails and adjacent longitudinal sections of the upper structure are to be inflexibly combined in solid sections, varying from 200 m to 400 m in length, by screws. It is expected that this method will prevent the serious disturbance formerly caused by the rails becoming loosened from the rest of the structure. A cross section of the upper portion of the proposed line is shown in the accompanying illustration.

Each car is to have double trucks, two motors and complete air brake equipment. It is expected to run the cars singly at first and in trains of two or three later on, each car seating



CROSS-SECTION OF SUSPENDED RAILWAY
All dimensions shown are in meters.

eighty-five passengers. All station and switching plans are, however, based on the ultimate use of six-car trains. Every car will have a double center door on each side for entering and leaving, and end doors for use in extraordinary cases only. Elaborate plans have been drawn up covering the switching and signaling arrangements.

If the system is adopted the company intends to run single cars on a five-minute headway on the main line and ten-minute headway on the branch line, but cutting these headways in half during the rush hours. It is estimated that with three-car trains on a two-minute headway the hourly capacity of the system would be 15,000 passengers.

Mr. Petersen's paper has been published in book form, with many fine maps and other illustrations. Whether the suspended railway is adopted or not there is no doubt that the Continentale Gesellschaft, of Nürnberg, has made an earnest effort to solve Hamburg's traction problem.

A company is being organized by Dayton (Ohio) interurban interests for the purpose of erecting a terminal station for the electric roads centering in that city. The plan is to erect a fine station between Main Street and Ludlow Street, near the steam railroad station. Dr. J. E. Lowes, V. J. A. Obenauer, W. J. Ferguson, Stanley Krohn and C. H. Bosler are the promoters. The company will be capitalized at $120.000.

FIRST "WORLD'S FAIR" CARS RECEIVED BY THE ST. LOUIS TRANSIT COMPANY

The St. Louis Transit Company has received the first of 450 new cars which are being built for it by the St. Louis Car Company. The new cars are about the same size as those now in use on the Olive Street line, 33 ft. 4¾ ins. long, 9 ft. wide and 8 ins. over all, but severely plain in general appearance, being entirely devoid of ornamentation. The body of the car is shaped like a railroad coach, and the car is constructed throughout with a view to economy of space. While the length of the car is about the same as the present ones, the seating capacity is increased to fifty persons. The maximum carrying capacity is about 120 persons. A portion of the space heretofore given to platforms is given to the body of the new car, and space saved by straightening the sides of the car is added to the aisle, which is 12 ins. wider than in the old cars.

The front platform is reduced to a narrow cab, with barely room enough for the motorman, and the rear platform, which is of the double type, is not so large as the platform now in use on the long cars. The front door of the car is to the right of the center, and is smaller than the rear door, which opens in the center. The interior finish is done in mahogany, with white wood ceiling. The seats are of the latest pattern and upholstered in split cane.

The cars are mounted upon solid steel trucks and equipped with four 75-hp motors, improved air brakes and controllers, and are to be heated by electricity. The lighting arrangement will be the same as that now in vogue. The cost of each car is approximately $5,000.

By the middle of November the Transit Company is to receive an additional assignment of fifty cars, which will be at once placed in service on the Laclede Avenue division. All of the entire 450 cars are to be completed before the opening of the World's Fair.

The plan for running observation cars during the period of the Fair has not yet been decided upon. Superintendent Grant says that if the crowds are not as large as expected the company may decide to run observation coaches.

CONDENSING WATER FROM A BIG SEWER

The South Side Elevated Railroad Company, of Chicago, has secured the permission of the Drainage Board of Chicago to use water from the Thirty-Ninth Street intercepting sewer or conduit for condensing purposes in its new power house. The company is to pay the sanitary district $1 per rated horse-power per year as compensation. This sewer is one of the intercepting sewers or conduits which the sanitary district of Chicago has been constructing as a part of the plan to divert all sewage from the lake into the new drainage canal. It takes water from the lake and discharges into the south branch of the Chicago River near the Stock Yards. The South Side Elevated Railroad Company has heretofore used cooling towers for artificially cooling its condensing water, but as the plant grew, land on which to locate these cooling towers has become scarce, and it has been necessary to operate part of the plant non-condensing at times.

In order to avoid confusion, due to similarity of the names of the Interurban and Interborough Railway Companies, the Interurban Street Railway Company, of New York, will change its name to the New York City Street Railway Company.

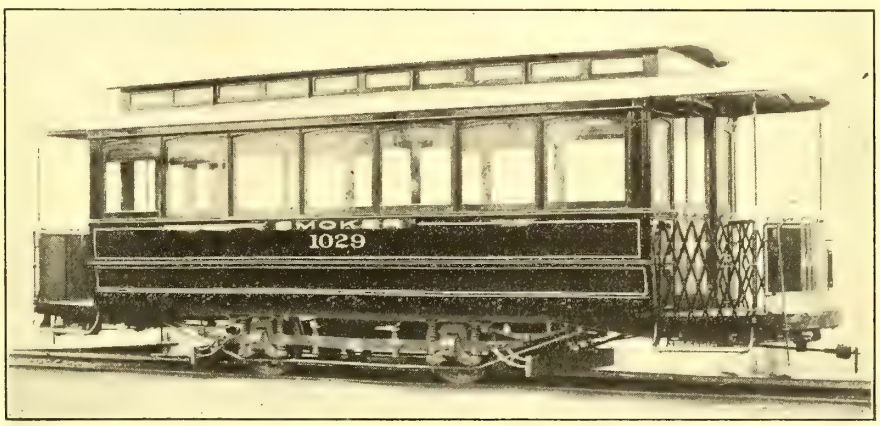
NEW BUFFALO CARS

Fifty closed cars, embodying several deviations from common city practice, have been recently built for the International Railway Company, of Buffalo, N. Y., by the J. G. Brill Company. One of these cars, as it appears when used as a trailer, is shown in the accompanying illustration. All are arranged, however, to be readily converted into motor cars, as trap-doors are provided in the floors and the trucks prepared to take motors at any time.

To prevent passengers from indulging in the dangerous habit of standing on the car bumpers, the latter are roofed with sheet metal covers placed at such an angle as to make it impossible to get a footing. It will also be noticed that the car shown is marked "Smoker," indicating that it is for the special convenience of tobacco users, who will no doubt appreciate the railway company's courtesy. When used for regular passenger service this sign is changed.

The car is equipped with Brill folding gates, which are attached to the dash posts and provided with a cover in the form of a clasp when folded. The windows are arranged to drop into pockets. The seats are longitudinal, are upholstered in spring cane, and accommodate about twenty-six passengers. The car interior is finished in plain cherry.

The construction throughout is extra strong; besides the



NEW CAR FOR BUFFALO

½-in. x 6-in. sill plates on the outside of 5-in. x 7-in. sills, high trusses of ⅜-in. x 2½-in. iron are supported on the posts 4 ins. below the sash rails by iron struts. The end sills are 5 ins. x 7¾ ins.; platform timbers, 5 ins. x 5¾ ins., plated with ⅜-in. x 5-in. steel; platform knees are 2¾ ins. x 7½ ins., plated with ⅜-in. x 3-in. x 4-in. angle-iron. Two cross-sills, 3¾ ins. x 5 ins., are faced with ¼-in. x 5-in. steel. The intermediate sills are 4¾ ins. x 5 ins.; corner posts are 3¾ ins. x 7¼ ins.; side posts are 2¼ ins. thick. Each car has four steel rafters sandwiched between the wooden rafters.

The general dimensions of the cars are as follows: Length of body, 22 ft. 10¾ ins.; length over crown pieces, 30 ft. 10¾ ins.; length over bumpers, 31 ft. 10¾ ins.; width over sill plates, 7 ft. 2 ins.; over posts, 7 ft. 9 ins., and over all 8 ft. The cars are mounted on 21-E trucks, which have an unusual feature, in that the ears at either sides of the journal boxes are extended to bring the coil springs immediately under the coil springs which are seated on the frames. This, the builder believes, is a correct principle of construction, inasmuch as the load upon the frame is brought directly over the points where the frames themselves are supported—it also extends the base of the coil springs and increases the stability of the truck. The trucks have a wheel base of 8 ft., diameter of axle, 4½ ins., and of wheels 33 ins. They are arranged for 50-hp motors.

FINANCIAL INTELLIGENCE

Wall Street, Nov. 11, 1903.

The Money Market

Two very striking changes have occurred in the money situation during the last fortnight. Responding at length to the extremely heavy drain of currency to the West and South, money rates have advanced sharply, so that call loans are quoted now between 4½ and 6 per cent, and time money is not obtainable for any period below 6 per cent. The contraction in local bank reserves which has produced this advance, has been one of the most violent ever witnessed in Wall Street. Although nothing more than the usual interior money requirements have been present, it seems to be a fact that the movement westward was delayed altogether too long, and that interior bank correspondents, if they had read the situation correctly, would not have had to make such hasty withdrawals from their New York balances. The other and even more striking incident of the fortnight has been the heavy drop in sterling exchange, which is partly due to the rise in money rates here, but more largely is the result of the enormous outrush of cotton from the seaports, and the purchases of some very large blocks of our railway bonds by European investors. It has been the extraordinarily heavy cotton exports which have chiefly demoralized the exchange market. When it is pointed out that the cotton movement has increased five or six times over, as compared with September, and when the high prices at which the staple is being sold are also taken into consideration, some idea may be formed of the rapid making of exchange, which has lately been in progress. Foreign subscriptions to some of our new bond issues have also contributed to increase the supply of exchange bills pressing for sale. We have dwelt on these conditions at some length, because the foreign exchange position is evidently the key to the whole domestic money market for the immediate future. Surplus bank reserves are down to nearly $5,000,000. The crop-moving demands for money are likely to continue for several weeks longer. We should clearly enough reach the position very soon where, in order to replenish or protect the surplus reserve, it would be necessary to call loans from home borrowers. But as it is, this disagreeable means of relief will probably not be necessary now. Europe is placing impediments in the way of our drawing gold; we have been able to import so far less than $2,000,000, although sterling rates are down well below the usual import point. But the natural factors in the exchange situation, as they have just been described, are so exceedingly strong that there can be no doubt of our getting what gold we need this autumn, providing our money rates are maintained.

The Stock Market

Discussion of the stock market of the last two weeks should be devoted about three parts to the United States Steel stocks and one part to other issues. The Steel stocks have held the center of the stage from first to last, and their decline has been a greater influence than anything else that the market has had to encounter. Two conclusions can safely be drawn from the recent dealings. One is that the market is in a very much stronger position than it has been at any time previous this season, else it would have never been able to withstand, with so little decline, such an enormous weight of selling as that which has forced down the prices of the Steel shares. Second, it is clear that whatever reasons investment capital has had for fighting shy of the Steel stocks have not affected the investment attitude toward other securities. It is still a question whether the break in the Steel group has not exaggerated the importance of the unfavorable trade conditions which seem to have produced it. The theory generally entertained among Wall Street speculators is that not only will the remaining dividend on the common stock be passed altogether at the next meeting, but that there is some probability of a reduction being made in the preferred stock dividend also. This apprehension is founded entirely on the idea that the recent cut in prices of steel products will enormously reduce the profits of the Steel Corporation. There will be some decrease in earnings without any question, but analysis of the earnings of the past year shows that profits might be cut to a third of what they were and still leave enough margin for the payment of the full 7 per cent on the preferred stock. Nobody conversant with the iron trade, we imagine, is prepared to believe that any such slump as this is now in prospect. The general market has stood up well under the tremendous strain of the Steel liquidation. The adverse money conditions have, of course, greatly aggravated the test. Only one inference is possible from this, and that is that liquidation in the standard securities has for the time being run its course. Whether it will break out again later on seems to depend very largely upon the effect which a general decline in business will have upon railroad earnings during the next few months.

The local traction stocks have been the strongest features of the past week in the general market movement. Manhattan Elevated has been the leader of the group in point of advance, but the rise in Metropolitan and Brooklyn Rapid Transit has been scarcely less noteworthy. All three stocks show the effect of some very heavy accumulation which has been going on quietly and unobtrusively at the recent low prices, and which has made it possible for a strong clique of professional operators to mark them up with comparative ease. The fact is appreciated that properties situated as these are, depending for their earnings upon the growing traffic of a great city, are not likely to be seriously affected by whatever depression may be in store for the business of the country at large. This is the simple explanation why the traction shares should be selected above others for bull operations at this time.

Philadelphia

Prices have moved with considerable irregularity on a small volume of trading in the market for Philadelphia traction stocks. The speculative issues have been inclined toward weakness, while the securities which have a positive investment merit have been disposed to show considerable strength. This differentiation between the two groups is the natural result of investment capital having reentered the market to a moderate extent, but keeping close to the safest opportunities. Thus, shares of the Philadelphia Company have been rather depressed, the common stock selling down from 37 to 35¾, and the preferred from 43¾ to 42, while at the same time Philadelphia Traction has advanced from 94 to 95½ and Union Traction has held firm around 44, which is its recent high figure. Dealings in all these stocks have at times been quite active, but in other directions the trading has been generally light and unimportant. American Railways is up a point to 43, and scattering sales have occurred in Philadelphia Rapid Transit at 12, Pittsburg Traction preferred at 49, and Consolidated Traction of New Jersey at 60. As a further evidence of the increasing investment activity in the market, a much better inquiry is reported for such standard bond issues as Philadelphia Company 5s, Electric People's Traction 4s and People's Passenger 4s.

Chicago

Something of a flurry was occasioned in Chicago street railway circles by the announcement ten days ago of the incorporation of a new company, called the Chicago Railways Company. It is said that the new concern aims to absorb eventually every street railroad and elevated railroad in Chicago or Cook County, together with any desirable line in the neighboring counties. According to the gossip the new company stands ready to appropriate $5,000,000 to assume the indebtedness of the North and West Chicago lines and to guarantee a dividend of 4 per cent on Union Traction preferred, together with something possibly on the common. The scheme will not be unfolded in all its details until the franchise controversy is settled, but the fact that J. Pierpont Morgan and other prominent financiers are behind it, is sufficient assurance that the project will be worked out to a satisfactory conclusion. Strange to say, the market for the various traction specialties has shown no enthusiasm over this new and startling development. On the contrary Union Traction preferred is down from 32 to 30, North Chicago is selling at 100, and West Chicago has broken from 56¼ to 50, which is a new low record for the stock. City Railway, after selling at 170, fell to 166, on fears of a strike among the employees of the road. The elevated securities have fared no better. Metropolitan common has sold as low as 18, which is pretty close to the poorest figure of the season. South Side dropped from 94 to 92, while 4 is the highest price recorded for Lake Street. The reorganization plan of the latter company has at length been given out. The underwriting syndicate will pledge itself to raise $1,400,000 cash, in return for which it will receive $2,000,000 preferred stock, $2,000,000 common stock, and $500,000 first mortgage bonds. The cash raised in this way will suffice to clear off the floating debt and put the company on its feet again.

Other Traction Securities

With the exception of Boston Elevated, which sold as high as 141 a week ago, all the Boston Traction specialties have been rather depressed in the recent dealings. Massachusetts Electric common dropped from 19½ to 18, and the preferred from 77½ to 76, both of these representing the low prices of the year. General market conditions, rather than any special considerations, are responsible for this decline. West End common has changed hands between 90 and 91, and the preferred between 109 and 109½. In Baltimore the trading, so far as the traction securities are concerned, has been rather more active with a particularly good demand for the standard bond issues. Sales are reported in Atlanta Consolidated 5s at 104 and 104¼, Lexington Street Railway 5s at 100, North Baltimore Traction 5s at 118, Knoxville Traction 5s at 101, and Anacostia 5s at 89¾. The United Railways' 4 per cent bonds have kept firm around 91, but the income bonds, and the stock have shown no rallying power, the former, after rising to 59⅛, falling back to 58¾, while the latter has continued heavy at 8¾. Transactions for the last ten days on the New York curb include the following sales of traction issues: Interborough Rapid Transit from 87½ up to 90, Brooklyn City Railroad at 232, Brooklyn Union Elevated at 16, St. Louis Transit at 14, and Brooklyn Rapid Transit 4s at 77½ and 75.

Cincinnati Street Railway lead in the selling at Cincinnati last week, but sales numbered only about 450 shares at the steady price of 127½ to 128. Detroit United sold to the extent of 327 shares, with a range of from 66 to 67½, which is several points higher than the stock has been selling during the past few weeks. Toledo Railways & Light also showed improvement, and about 300 shares sold at from 21½ to 23½, the latter an advance of four points over recent sales. A block of Cincinnati, Dayton & Toledo 5s sold at 80, a drop of 2½ points from recent sales.

The sweeping victory of Mark Hanna and the Republican party in Cleveland had a tendency to strengthen the demand for Cleveland Electric, which is controlled by Hanna and his friends, and after several sales the price advanced to 66⅜, but after unfavorable reports from New York markets, it dropped back to the old price of 65. Aurora, Elgin & Chicago common became quite active during the week, after an inactivity of several weeks. Two lots sold at 16 and then it fell to 15 for another 100 shares. Northern Ohio Traction & Light declined to the lowest figure it has yet reached, 13⅞, with other sales at 14 and 14½. A small lot of Northern Texas Traction sold at 30; the stock is in good demand at that figure, but offerings are few. A block of Northern Ohio Consolidated 5s sold at 95⅛, a decline of two points from last sale.

Security Quotations.

The following table shows the present bid quotations for the leading traction stock, and the active bonds, as compared with two weeks ago:

	Closing Bid Oct. 27	Nov. 10
American Railways	41¾	42
Aurora, Elgin & Chicago	12	—
Boston Elevated	140	140
Brooklyn Rapid Transit	34⅞	37
Chicago City	169	165
Chicago Union Traction (common)	7¼	5½
Chicago Union Traction (preferred)	32	28
Cleveland Electric	64	65
Consolidated Traction of New Jersey	60	60
Consolidated Traction of New Jersey 5s	104½	105
Detroit United	60¼	64
Elgin, Aurora & Southern	a56	a56
Lake Shore Electric	—	—
Lake Street Elevated	3½	3
Manhattan Railway	134¾	138¾
Massachusetts Electric Cos. (common)	19	18
Massachusetts Electric Cos. (preferred)	77½	76
Metropolitan Elevated, Chicago (common)	17	17
Metropolitan Elevated, Chicago (preferred)	55	55
Metropolitan Street	110	111½
New Orleans Railways (common)	7¼	7⅛
New Orleans Railways (preferred)	a28½	28
North American	75	70½
Northern Ohio Traction & Light	15	12½
Philadelphia Rapid Transit	12⅛	11½
Philadelphia Traction	94	95
St. Louis Transit (common)	14	13½
South Side Elevated (Chicago)	92	90¼
Third Avenue	105	108
Twin City, Minneapolis (common)	86	86½
Union Traction (Philadelphia)	44¼	43⅞
United Railways, St. Louis (preferred)	61	59

a Asked.

Iron and Steel

The principal incident in the iron market during the last two weeks has been the cut announced by the steel billet pool from $27 to $23 a ton. No action has yet been taken in the matter of lowering the quotation for steel rails, but it is expected that a cut cannot much longer be delayed in the price of this product, in view of the general decline in steel and iron schedules elsewhere. These reductions in prices conform to the knowledge which has been common property long before this, that business in the steel trade has been falling off very heavily during the last few months, and that whether the reaction goes further or not a readjustment of market quotations was necessary in order to meet the altered conditions. While the finished branches of the trade are thus preparing for a period of diminished consumption, the producers of pig iron have decided to continue their agreement to curtail output for another month at least. Probably when the new time-limit expires it will be found advisable to continue the agreement indefinitely. Quotations are as follows: Bessemer pig iron $15.85, steel billets $23, and steel rails $28.

Metals

Quotations for the leading metals are as follows: Copper 13½ cents, tin 25½ cents, lead 4½ cents, and spelter 6⅛ cents.

REORGANIZATION OF LAKE STREET ELEVATED RAILROAD, CHICAGO

A compromise has apparently been reached by several factions in the Lake Street Elevated Railroad Company, of Chicago, whereby a reorganization will be effected. Those agreeing upon this compromise are the directors of the company, the protective committees of the income bond and stockholders, the representatives of Blair & Company, bankers, of New York, and the Northwestern Elevated Railroad Company. The following plan was evolved in a series of conferences lasting over a week, the plan being in the form of a compromise. The plan provides for the incorporation of a new company which is to take over the assets of the Lake Street Elevated Railroad Company. This new company will have a lower capitalization than the present company, having $6,000,000 in common stock as against $10,000,000 of the present company; $3,200,000 of preferred stock as against none in the present company; $5,000,000 of first mortgage bonds as against $5,860,000 in the present company, and no income bonds as against $1,023,550. The present outstanding issue 5 per cent first mortgage bond issue is to be called in and stamped redeemable at 105 on any interest date and returned to the holders. Later, when there is an opportune market, this issue will be refunded and reissued in 4 per cent bonds. The $3,200,000 of new 5 per cent preferred stock is to be issued thus: $2,000,000 to the underwriting syndicate which will furnish new money; $800,000 to the holders of the present income bonds and $400,000 to the present holders of the common stock. The common stock is to be issued as follows: $4,000,000 to the present holders of common stock who will give in return for it their present $10,000,000 of common stock and $200,000 in new cash; $2,000,000 of the common stock to go to the underwriters syndicate. This will amount to an assessment of $2 per share on present common stock. Under this plan the first mortgage bondholders will receive dollar for dollar on their holdings in the shape of new securities. The holders of the income bond will receive $800,000 in preferred stock in exchange for $1,000,000 of income bonds, or 80 per cent of the face value of these bonds. The common stock holders will receive $2 preferred stock for each $1 assessment paid and will get two shares of new common stock for each five turned in. The underwriting syndicte, which, supposedly, will be headed by Blair & Company, will pledge itself to raise $1,400,000 of cash. It will receive for this $2,000,000 of preferred stock and $2,000,000 common stock and $5,000,000 of first mortgage bonds. The Northwestern Elevated has agreed to accept a note for $350,000 due in five years at 2 per cent interest as payment for its claims against the road, which amount to over $700,000. It is agreed by all parties that the receivership is to be dissolved.

CONTRACTS LET HERE FOR JAPANESE ROAD

Some important contracts have just been let in the American market for rails, bridge material, trucks, motors and power house equipment for the Hanshin Railway, which is to be a high-speed road operating between Kobe and Osaka, Japan. The system will be about 20 miles long. Japanese capital is exclusively interested in the undertaking. Four thousand tons of 60-lb. steel rails have been ordered from the Carnegie Steel Company's branch of the United States Steel Corporation. About 600 tons of bridge material have also been contracted for through the same source. Nineteen Brill trucks—double ones—have been requisitioned for. The motors will be of Westinghouse build, No. 68. There will be four 400-kw generators, direct-connected by McIntosh-Seymour horizontal cross-compound engines of 600-hp capacity each. The contract for the generators has been placed with the General Electric Company.

SAN FRANCISCO ARBITRATION BOARD DECIDES IN FAVOR OF EMPLOYEES

The terms of the decision reached on Tuesday, Nov. 3, by the arbitration committee which for several months has been hearing testimony in regard to the labor dispute between the Amalgamated Association of Street Railway Employees and the United Railroads, of San Francisco, have just been made public by Oscar S. Straus, the third commissioner, chosen by Col. Patrick Calhoun and W. D. Mahon, who represented respectively the street railway companies and the employees.

In the introductory passages of the announcement of its findings the committee considers standards of wages and of the cost of living on the Pacific Coast, as compared with other parts of the country. It points out that of 345 street railways from which statistics were obtainable, only four pay a higher rate than those of San Francisco, and finds that during the last year the rent of the rooms or apartments such as the employees in that city would live in has advanced about 10 per cent.

The four clauses of the actual award are as follows:

First—That the United Railroads of San Francisco pay to such of the members of Division No. 205, Amalgamated Association of Street Railway Employees of America, who are now and have been in their employ for a period under two years prior to April 1, 1903, an increase of 5 per cent above 25 cents an hour, and to such of said employees who are now and have been prior to April 1, 1903, in their employ two years and over, an increase of 10 per cent above 25 cents an hour, and that for overtime the like percentages of increase above the present rate be paid.

Second—That the United Railroads of San Francisco pay to such of its employees who are members of Division 205, Amalgamated Association of Street Railway Employees of America, who work by the day, and who are now and have been in their employ for a period of under two years prior to April 1, 1903, an increase of 5 per cent above the daily rate of wage they are now receiving, and to such of said employees who are now and have been prior to April 1, 1903, in their employ two years and over, an increase of 10 per cent above the rate of wage they are now receiving.

Third—That the same hours and schedules that now obtain be continued. It is always within the province of the railroad on the one side and the employees on the other to amend their schedules by mutual agreement. We therefore decline to disturb the present schedule.

Fourth—In accordance with the agreement under which this arbitration was entered upon, the wage rate adjudged and awarded shall be deemed to go into effect as of the 1st of May, 1903, and continue until the 1st of May, 1904.

The award is made by Messrs. Straus and Mahon, Col. Calhoun, representing the street railway company, declining to concur in it.

ANNUAL REPORT OF THE MONTREAL STREET RAILWAY COMPANY

The annual report of the Montreal Street Railway Company for the year ending Sept. 30, 1903, was submitted to the stockholders of the company at their forty-third annual meeting, held on Wednesday, Nov. 4. The report shows gross earnings for the year of $2,222,787 as compared with $2,046,208 for 1902. The operating expenses for 1903 were $1,316,848, as against $1,135,176 for 1902. The net earnings decreased, the amount for 1903 being $905,939, as against $911,032 for 1902. After providing for the percentage of earnings accrued to the city and the interest on bonds and loans, four quarterly dividends amounting to $600,000 were paid. During the year the company placed to the credit of the fire insurance fund an additional sum of $25,000, which increased the total amount to $239,377. As $50,000 was placed to the credit of the contingent account, a surplus of $9,907 was left. This was transferred to the general surplus account of the company. The increase in the percentage of operating expenses to gross earnings was due to the heavy increased rate of wages paid in all departments, the increased amount spent on the maintenance of the company's property and the increased percentage paid to the city on gross earnings. Several new and important extensions were made to the company's system, and such increases were made in the equipment as to meet the requirements of the traffic. During the year $1,000,000 of new stock was issued to provide for extensions of the company's lines and additions to its rolling stock and equipment. This stock was offered to and subscribed for at par by the stockholders on record on Oct. 14. In order to improve the condition of its employees, the company has assisted in the establishment of a mutual benefit association to provide life insurance, relief in case of sickness and accident, and to pension those who have served faithfully for a stated period. James Ross, vice-president, resigned during the year, and F. L. Wanklyn was elected in his place. During the year the company paid to the city $121,299, covering all taxes, and $47,168 on account of snow clearing, making a total sum of $168,467. The general statistical statement follows:

	1903	1902
Gross receipts	$2,222,787	$2,046,208
Increase 1903 over 1902 8.63%	176,579	.....
Operating expenses	1,316,848	1,135,176
Increase 1903 over 1902 16%	181,672	.....
Operating expenses—		
Per cent of car earnings	60.20	56.39
Net earnings	905,939	911,032
Decrease 1903 over 1902	5,093	.....
Net income per cent of capital	11.41	11.68
Passengers carried	54,592,014	49,947,467
Increase 1903 over 1902 9.30%	4,644,547	.....
Transfers	16,774,595	15,977,511

The profit and loss account shows:

	1903	1902
City percentage on earnings	$107,183	$95,115
Interest on bonds and loans	113,848	114,951
Dividends (payable quarterly)	600,000	600,000
Transferred to fire insurance fund	25,000	100,000
Transferred to contingent account	50,000	.....
Transferred to surplus	9,908	966
	$905,939	$911,032
Net earnings from operation	$905,939	$911,032

The balance sheets follow:

ASSETS

Year ending Sept. 30	1903	1902
Cost of road and equipment:		
Construction, etc	$3,650,222	$3,539,823
Equipment, etc	3,287,161	3,063,068
Real estate and buildings	1,627,009	1,616,925
M. P. & I. Ry. Co's. stock and bonds	1,160,105	1,159,297
Stores	159,531	76,086
Accounts receivable	113,596	57,277
M. P. & I. Ry. Co	169,166	122,501
Cash in bank and in hand	32,931	95,383
Cash on deposit with City of Montreal	.....	25,000
Fire insurance fund investments	206,000	100,000
	$10,405,721	$9,355,360

LIABILITIES

	1903	1902
Capital stock	$6,000,000	$6,000,000
Bonds:		
5 per cent payable March, 1908	292,000	292,000
4½ per cent payable August, 1922	681,333	681,333
4½ per cent payable November, 1922	1,500,000	1,500,000
Mortgages	6,035	6,034
Bank of Montreal loan	407,456	.....
Accounts and wages payable	109,020	100,808
Accrued interest on bonds	33,350	33,275
Accrued tax on earnings	114,035	101,748
Employees securities	10,302	8,490
Unclaimed dividends	1,957	1,957
Unredeemed tickets	22,966	20,401
Suspense account	139,511	62,490
Dividend payable Nov. 1, 1903	150,000	150,000
Fire insurance fund	239,377	204,222
Contingent account	179,636	183,766
Surplus	518,743	508,836
	$10,405,721	$9,855,360

CHICAGO CITY RAILWAY FRANCHISE EXTENSION ORDINANCE

The proposed franchise extension ordinance of the Chicago City Railway Company prepared by the franchise sub-committee of the local transportation committee of the Chicago City Council and representatives of the Chicago City Railway Company has been completed and is now before the transportation committee for consideration. The document goes into details of construction, equipment and operation to a much greater extent than is generally done in ordinances of this character. It is divided into thirty-two sections, contains several exhibits and tables, specifications for the improvements contemplated and statistics prepared by transportation experts supplementary to the principal document itself. It is expected that whatever ordinance may be passed for the Chicago City Railway Company will be taken as a model for similar grants to the North Side and West Side systems, so that they may permit of harmonious operation and the adoption of universal transfers. The only feature of the problem that still remains unsettled, as far as the city's representatives are concerned, is the question of compensation. This section of the ordinance has been prepared, but the amount of compensation and the percentage have been left blank.

During the discussion of the franchise problem the principal features of the proposed ordinance have been discussed in these columns, and it is only necessary at this time to enumerate the more important points covered.

Preliminary to the terms of the ordinance itself is presented a declaration on the part of the city denying the validity of the claims of the company under the "ninety-nine-year act" and requiring the company to waive all rights under this act in consideration of the granting of the present franchise extension. The several ordinances under which the company is now operating expire at different times, and it is contended by the city that in order to obtain the best results and to furnish the South Side with proper transportation service it will be necessary to reorganize the entire system and reconstruct a considerable portion of it, and that this can only be done properly if the franchise privileges of all the lines extend over a common period. But of even greater importance in the view of the city is the fact that this plan provides for the termination of all ordinances at the same time, thus enabling the city to deal with the transportation problem as a whole when the rights now conferred shall expire. In case the city shall decide to purchase the property of the company at the end of twenty years, or grant a franchise to another corporation which shall take over the plant of the present owners, the valuations shall be fixed by a board of appraisers, but it is distinctly specified that in fixing the price to be paid for the property the earning power or franchise valuations shall not be considered.

The privileges, powers and obligations covered by this ordinance may be concisely enumerated as follows:

Section 1 designates the term of the life of the franchise as twenty years.

Section 2 directs the immediate construction of a new power plant, the introduction of an underground conduit system in certain parts of the city, and the reconstruction of such portions of the overhead line, track and roadbed as may be deemed necessary to put the entire plant and equipment in first-class condition.

Section 3 provides for electric operation throughout. The company is directed to install on Clark Street, north of Twelfth Street, Wabash Avenue, and State Street, north of Eighteenth Street, and on all downtown loops, an underground conduit system.

Section 4 authorizes the use of the overhead trolley on all other lines excepting those designated in Section 3 for underground conduits.

Section 5 reserves to the city the right to use the poles of the company to carry signal, telephone, telegraph and electric light wires and lamps for city service.

Section 6 permits the company to lease its poles to other companies for carrying electric conductors.

Section 7 empowers the company to construct a system of conduits for carrying its transmission wires and feeders within that portion of the city lying east of Halstead Street, north of Sixty-Third Street and south of the Chicago River.

Section 8 directs the city electrician to supervise the construction of all lines, and makes his approval of such work necessary for its acceptance.

Section 9 relates to track construction and specifies the methods and materials to be employed. Trilby rail weighing not less than 100 lbs. per yard is named as the standard, but certain exceptions are made, where girder rails may be used, and the conditions governing such cases are specified.

Section 10 requires the company to fill, grade, pave, keep in repair, sweep, sprinkle and keep clean 8 ft. in width of all streets and public ways occupied by a single-track railway, and 16 ft. in width of all streets in which double tracks are laid. Provision for the removal of snow and ice are also made. Specifications for the repair of roadways are included in this section.

Section 11 and Section 12 relate to the operation of cars. Only passenger and mail cars can be operated under this ordinance, and each service is to be kept distinct and separate. Passenger cars shall not be used for any other purpose, and mail cars are to be devoted exclusively to the service of the United States Post Office Department. Many features of design, construction and equipment of the passenger cars are described, such, for instance, as the vestibuling of closed cars, provision for heating them in cold weather and the seating arrangement. Power brakes as well as hand brakes are required for all double-truck cars, and the present practice of running trains of two or more cars is forbidden, single cars being the rule hereafter.

Section 13 authorizes the city to make an arrangement with the company for the sprinkling of the entire roadway, wherever possible, and also for the removal of street sweepings, garbage, or other refuse at night wherever practicable, the rate of compensation to be agreed upon in advance of the performance of this service. The company shall also have the right to carry materials for its own use or for the use of the city over its lines during the night.

Section 14 gives cars the right of way over tracks, and requires all other vehicles to make way for them so as not to impede the movement of the cars.

Section 15 prohibits the issuing of passes or free tickets by the company, except to its own employees and city detectives presenting written requests for them signed by the chief of police of the city. Policemen and firemen in full uniform shall be permitted to ride free.

Section 16 requires the company to remove all tracks not in use.

Section 17 and Section 18 are devoted to the subject of fares and transfers and embody features already discussed.

Section 19 relates to the establishment of a surface loop system and also the common use of tracks by the North Side and West Side Companies as well as the South Side Company within the district specified.

Section 20 deals with the matter of compensation, but, as already mentioned, the rate is not specified.

Section 21 forbids the company removing its offices beyond the limits of the city during the term of the franchise, and also prohibits the sale or transfer of rights in the ordinance except by way of mortgage to secure funds for necessary improvements to its tangible property, and the company is further prohibited from entering into any consolidation or combination except after having first secured the approval and consent of the City Council. The company is specifically forbidden to mortgage its street railway property and such rights as it enjoys under this ordinance for indebtedness maturing later than the date of the expiration of the franchise, as such action might prevent it from conveying to the city or to any licensee of the city, all of its property clear of encumbrance at that time.

Section 22 contains provision for the indemnification of the city against damages.

Section 23 directs the company to make a detailed report not later than Jan. 15 each year covering its operations during the previous year, and authorizes the comptroller of the city to inspect the books of the company at any time.

Section 24 authorizes the city to declare the privileges conferred by this ordinance forfeited in case the company fails to observe the terms of the agreement.

Section 25 empowers the city to intervene in suits affecting the work here authorized where it is believed such actions might be instituted with the connivance of the company for the purpose of delaying these improvements or otherwise jeopardizing the interests of the community.

Section 26 enumerates the terms under which the company shall use the subways which it is proposed to build through the downtown business district, provided they are completed and ready for the operation of cars through them before the expiration of the franchise.

Section 27 vests authority in the Council to require the extension of lines in any street where the service is needed and the patronage will be sufficient to warrant the improvement.

Section 28 confers on the city the right to buy the railway property at the expiration of the grant, and outlines the method of procedure for determining the valuation and fixing the terms of the purchase.

Section 29 indicates the alternative in case the city is not prepared to buy the property at the expiration of the franchise. The city may grant a franchise to another company or make a new

grant to the present company upon new terms to be agreed upon.

Section 30 provides for the ninety-nine-year waiver.

Section 31 reserves to the city the right to make such additional regulations as may be necessary to secure the highest degree of efficiency in the service for the community.

Section 32 directs that the ordinance shall take effect upon its acceptance by the company, but, in case of failure to comply with the requirements, including the filing of the bond and the formal assent to the terms and conditions within sixty days, all rights and privileges are nullified.

Accompanying the ordinance and comprising a part of it are several exhibits. These include a list of the routes at present occupied by the company, and those over which it is proposed to extend the lines of the system, also an outline of the work to be done, including the establishment of a new power system and the construction of an underground conduit system in the down-town business district.

UNION LOOP CONTROVERSY

A movement has been started in Chicago by business men along the route of the Union Elevated Loop for the purpose of securing certain concessions from the management. The new organization will be known as the Loop Protective Association, and its object, as stated at the initial meeting, is to prevent any further encroachment over the streets, such as the extension of platforms, to secure the removal of all advertising signs on platforms and in cars, the removal of disused stairways along the route and the lessening of the noise along the loop. The association has retained an attorney to look after its interests. The members declare that the loop has injured their business by darkening the street and creating the nuisance of constant noise. They were from the first strenuous advocates of the removal of the signboards at the stations because of their darkening effect, and now the association is engaged in drawing up an ordinance compelling the loop company to take measures for abating the noise caused by the running of trains. The City Council will be asked to pass this ordinance.

CHICAGO UNION TRACTION CERTIFICATES OF DEPOSIT TO BE EXCHANGED

Announcement has been made to stockholders of the North Chicago Street Railroad Company, the West Chicago Street Railroad Company, and the Chicago Union Traction Company, the three transportation companies whose stock interests here have been in the hands of a protective committee for reorganization purposes, that certificates of deposit may now be exchanged again for the original stock certificates through the Guaranty Trust Company. The protective committee has secured relief of the Chicago Union Traction Company from the financial burdens it was under by reducing the lease rentals on the North Chicago Street Railroad Company and the West Chicago Street Railroad Company from 12 per cent to 6 per cent, and from 8 per cent to 4 per cent respectively, on an arrangement whereby the amounts withheld are made cumulative for five years. This will enable the reorganized company to devote a large part of its income to development of its property, and will, it is thought, make it possible to come out with a clean sheet when the five years are up.

JURISDICTION OVER CHICAGO UNION TRACTION MATTERS

Henry R. Platt and Horace K. Tenney, attorneys, in contempt of Judge Grosscup's injunction, filed bills in Judge Tuley's court Oct. 31, attacking the Union Traction reorganization plan, which was approved by Judge Grosscup last August. Judge Grosscup is of the Federal Court and has charge of the Union Traction receivership. The court in which the attack on the reorganization plan was filed is a State court. Judge Grosscup issued warrants Nov. 1, summoning the attorneys mentioned to appear before him for contempt of court Nov. 2. This involves a question as to the relative jurisdiction of the two courts.

The temporary restraining orders issued Sunday by Judge Grosscup caused Attorneys Henry R. Platt and Horace K. Tenney to abandon for a week their attempt to secure from Judge Tuley an injunction against the officers of the North and West Chicago Street Railroad Companies. These two attorneys were summoned by Judge Grosscup, of the Federal Court, to appear Nov. 9 and show cause why the restraining orders issued by Judge Grosscup should not be made permanent. The attorneys appeared before Judge Tuley Nov. 2 and stated that the move made by Judge Grosscup prevented for the present any prosecution of the case in the State Court of Judge Tuley. The attorneys, therefore, asked that the hearing of the motion for injunction presented at Judge Tuley's Court to prevent payment of interest under the reorganization plan be postponed until Nov. 10. Judge Tuley, believing that this was the proper course to pursue, entered an order for this postponement.

Judge Grosscup took up the defense of the jurisdiction of the United States Circuit Court and its exclusive and paramount rule over all questions affecting the Chicago Union Traction Company, the West Chicago and North Chicago Street Railway companies, and answered the arguments made before him by Henry R. Platt and Horace K. Tenney in the question of enjoining the suit brought in the Circuit Court of Cook County, Illinois, before Judge Tuley by them in behalf of Jacob Miller or Meller, a subject of Germany. In the arguments submitted, Attorney Platt took up the question of jurisdiction and insisted that his client had the right to go before Judge Tuley. Judge Grosscup defined his position very clearly in the following statement:

"The Federal Court, in my judgment, has charge of all the assets of the Chicago Union Traction Company, the West Chicago and North Chicago Street Railway companies, for the proper administration of their affairs. This includes the charge of all leases, contracts, franchises and extension of franchises. The modifying of the old leases were absolutely essential to the administration of the properties of these companies. It is a question of business judgment. The law is as elastic as business judgment to fit the necessities. The leases are an important factor, if not practically the entire assets of these companies.

"In the legal relations of these companies, the presence of the new leases as a substitute for the old ones was an absolute essential to prevent the companies from bleeding to death for the proper equipment of the properties in charge of this court and its dealings with the city. This court must be in a position to have power and control over the entire interests, and it must have exclusive control. Without this power and control the companies would not be in shape to negotiate with the city for a renewal of the franchises. This question of a renewal of the franchises is a valuable asset. The administration of the affairs of this company must not be passive, but must be actual.

"I think the law is clear on the point, that when a court, State or Federal, has taken possession of a thing to administer it, all controversies that affect the possession must be settled in the court having charge of the property.

"Interference now might have the result that after the administration of the property by this court had been adjusted and regulated and the receivership discharged the companies might be forced into another receivership by demands upon the old leases, based upon the judgments in the State courts now sought."

CHICAGO UNION TRACTION PROTECTIVE COMMITTEE DISBANDS

On Nov. 4 the protective committee of the Chicago Union Traction Company, formed last winter to prepare plans for reorganization and to conduct franchise negotiations, was formally abolished. This committee voted itself out of existence because conditions have changed, so that there is nothing for it to do. In an address to the stockholders, the committee says: "In view of the pending negotiations with the city by the receivers of the Chicago Union Traction Company and the formation of a new corporation to provide for the obligations of your company and lease its property, your committee deems it unwise for it to undertake independent action in the premises." The new corporation spoken of is the Chicago Railways Company, recently incorporated.

POSITIVE TRACK SANDER

In the description of the new sand-box of the Positive Railway Sander Company, of Lancaster, Pa., published in the last issue, the reader might infer that the vibrations of the truck were transmitted to the sand-box. This is not so, as the box is mounted on the car floor and is consequently spring supported. The vibratory motion of the truck is confined to the hose connection between the outlet of the box and the track, and the constant jar prevents any sand from collecting in this pipe during freezing or damp weather. The flow of sand from the hopper is regulated by the movement of a foot or hand lever which, by the movement of a corrugated plate gives a vibratory motion to the hopper, shaking out sand only when required.

MUNICIPAL OWNERSHIP IN CHICAGO

The Chicago "Record-Herald" recently editorialized very much to the point regarding the efforts of certain organizations in Chicago to secure immediate municipal ownership of the street railway lines. Under the head "The Council Acts Wisely," the "Herald" says:

"The jealous watch that is kept upon the local transportation committee of the Council is probably due to the best of motives, but we can think of no plea for open hearings at the preliminary traction negotiations which would be convincing. On the other hand, it is manifest that the so-called secret hearings are favorable not only to the expediting of business but to a thorough thrashing out of the various questions involved. The many irrelevant matters that would be brought up at a town meeting, and that would tend only to confusion, are eliminated, while the businesslike character of the conferences leads to a freedom in dickering that would be simply impossible in any large public gathering. Propositions and counter-propositions will follow each other rapidly, there will be changes of confidences, tentative concessions which may or may not be withdrawn, and ultimately a pretty clear exposition of the limits to which each party is prepared to go. The method is the common method of all business transactions, and experience shows that it is absolutely necessary to bring about effective and satisfactory results.

"If, however, the people's rights should be sacrificed, it must be remembered that all this work is merely an introduction to the more definite work of the Council, acting as a representative body in open session, and also that if a sufficient number of persons are dissatisfied with both committee and Council there is the possibility of a final resort to the referendum. Obviously the protection is ample if any wrong should be committed under the programme which has been adopted and affirmed.

"It is clear also that suggestions for immediate municipal ownership are not at all helpful at the present time, but utterly impractical. The people who make them are misinformed or have not reflected upon the situation as they should. What will they do with the numerous grants that are now running for varying terms? Can they stop them all instanter and so devise a municipalized system? What will they do with the ninety-nine-year act and its promise of interminable litigation? Have they absolute power over the law and the courts; can they waive aside suits and injunctions? Evidently they fail to recognize a series of complications of the most puzzling description. Yet these complications exist, and they cannot be undone at a single stroke of a magical wand labeled municipal ownership. The process will be a slow one by agreement and contract so made as to enable the city to venture upon municipal ownership when the times are propitious for the experiment.

"In view of all the facts in the case and of the reasoning that is suggested by them it is plain that the Council acted wisely when it decided to let the transportation committee proceed with its work in its own way."

FIRST MEETING OF THE COLORADO ELECTRIC RAILWAY LIGHT & POWER ASSOCIATION

The Colorado Electric Railway, Light & Power Association held its first meeting Oct. 28 and 29, in the demonstration hall of the Denver Gas & Electric Company, in Denver. The first session was called at 10 a. m. Oct. 28. J. F. Vail, general manager of the Pueblo & Suburban Traction & Light Company, was in the chair, and the room was well filled with delegates, over fifty being in attendance. President Vail recited among other things the fact that the association was organized Aug. 12, 1903, and that this was the initial meeting. There was no reading of papers in the forenoon, that part of the programme being skipped to take up general business and reports of the several committees which were appointed to get the new association under way. In the afternoon L. C. Stockton discussed "A Few Advertising Hints," and C. W. Humphrey presented a paper on "Meters." A question box was opened.

When the association met for the second day's session, W. A. Layman, of the Wagner Electric Manufacturing Company, of St. Louis, read a paper on "Single-Phase Motors as a Means of Increasing Central Station Earnings." Then L. L. Summers, one of the engineers of the Denver Gas & Electric Company, read a paper on "Steam Economics." The delegates then went into executive session to elect officers. The selections resulted as follows:

J. F. Vail, of Pueblo, re-elected president, which office he has held since the organization of the association; William Mayhu, of Greeley, re-elected vice-president; George B. Tripp, of Colorado Springs, re-elected secretary and treasurer. The members of the finance committee chosen were F. F. Webber, Charles Beeley and L. J. Kelin. The membership committee consisted of C. W. Badgley, C. E. Doolittle and C. H. Peters. Then J. E. Lundstrum and J. A. Beeler were added to the executive committee and the executive session was closed.

In the afternoon the members went on a trolley ride to the coal mines of the Denver & Northwestern Company, at Leyden. They rode in the private car of General Manager J. A. Beeler, of the Denver City Tramway Company.

Among the twenty-two active State corporations with representatives at the meeting were: Durango Light & Power Company, Larimer Light & Power Company, Las Animas Electric Light Company, Colorado Springs Electric Company, Leadville Gas & Electric Company, Boulder Electric Light & Power Company, Pueblo & Suburban Traction & Light Company, Las Animas Light, Power & Manufacturing Company, of Trinidad, Arkansas Valley Electric Company, Gilpin County Light, Heat & Power Company, of Black Hawk, Denver Gas & Electric Company, Denver City Tramway Company, La Junta Electric Company, Greeley Electric Light Company, Crested Butte Water & Power Company, Roaring Fork Electric Light & Power Company, of Aspen, Loveland Light, Heat & Power Company, Lamar Electric Company, La Belle Mill, Water & Power Company, of Goldfield, Colorado Electric Power Company, of Canon City, Colorado Springs & Interurban Railway Company, and Pagosa Springs Electric Light & Power Company.

Among the eighteen associate members represented were: Albert Sechrist Company, of Denver; E. C. Means, of Denver, agent Adams-Bagnall Company; Phelps Company, of Detroit; Western Electric Supply Company, of St. Louis; National Carbon Company, of Cleveland; Mutual Oil Tank Line, of Omaha; W. A. Layman, of the Wagner Electric Company, of St. Louis; Westinghouse Electric & Manufacturing Company, of Pittsburg; Gilbert W. Kes & Company, of Denver; Allis-Chalmers Company, of Chicago; American Steel Wire Company and B. K. Sweeney, of Denver; B. F. Vreeland, of Denver; W. L. Otis, of Denver, and George A. Woolet, of Denver.

ANNUAL REPORT OF THE MANHATTAN ELEVATED RAILWAY

The annual meeting of the Manhattan Elevated Railway Company, of New York, was held on Wednesday, Nov. 11. Attention was called by President Gould to the lease of the company on April 1, 1903, to the Interborough Rapid Transit Company, also to the fact that since the last annual meeting the electrical equipment of the lines has been completed. The official operating report gives separate figures of the Manhattan and Interborough companies, but compiled figures for the twelve months ended Sept. 30, 1903, show:

	1903	1902
Gross receipts	$12,651,977	$11,067,746
Operating expenses	5,429,474	5,545,395
Net earnings	$7,222,503	$5,522,351
Other income	345,859	515,800
Total increase	$7,568,362	$6,038,151
Interest and taxes	2,844,564	2,712,089
Surplus	$4,723,798	$3,326,062
Dividends	3,894,000	1,920,000
Surplus	$829,798	$1,406,062

The surplus after charges of $4,723,798 is equal to 8.55 per cent earned on the $55,200,000 capital stock.

The officers and directors were re-elected.

BRILL CARS AND TRUCKS FOR FOREIGN COUNTRIES

The J. G. Brill Company, of Philadelphia, has various British, Portuguese, South American and New Zealand contracts in hand. Sixteen center-pivotal trucks, 27-G type, and seventy trucks, 21-E type, for four-wheeled cars, are to be shipped to the Electric Tramway & Carriage Works, Ltd., Preston, which concern is largely controlled by the British engineering and contracting firm of Dick, Kerr & Company, Ltd. The Compania Carris de Ferro de Porto Lisboa, of Lisbon, Portugal, has ordered twelve trucks, 21-E type, for four-wheeled cars. Fifty cars have been requisitioned for shipment to Buenos Ayres tramways. A Brill convertible car is to be exported to New Zealand for experimental use on the electric traction system now under construction at

Wellington by the British electrical engineering and contracting firm of Macartney, McElroy & Company, Ltd. As previously mentioned in these columns the Brill Company is to build the trucks for the same road.

CONTRACTS PENDING FOR TOKIO STREET RAILWAY

The Tokio-Shigai Railway (Tokio Street Railway), which has at present in operation a short street railway system in the Japanese capital, and is building 20 odd miles of double track, has decided to erect a power plant for the purpose of operating the system. At present power is taken from the Tokio Electric Light Company's plant, the General Electric Company having received the contract for the converters—five machines of 120-kw capacity each. The capacity of the new plant will be about 5000-hp. The specifications call for four 800-kw alternating-current railway-type generators, direct-connected to 1200-hp horizontal compound-condensing engines. Last summer contracts were placed with European companies for 100 trucks and double motor equipments. Dick, Kerr & Company, of London, secured the contract for the trucks. Recently 100 trucks were ordered in Germany. The double motors for these will be manufactured by the General Electric Company.

REPORT OF RAILROAD COMMISSIONERS ON POWER SITUATION IN NEW YORK CITY

The Board of Railroad Commissioners of the State of New York, under date of Nov. 5, issued a report in regard to transportation conditions in Greater New York. The report gives by months the number of passengers, transfers, car mileage, greatest number of passengers carried per day, number of employees and cars in service during June, July and August for all of the street railway companies in the city.

Regarding the power situation, the commissioners state that the Brooklyn Heights, the Coney Island & Brooklyn, the New York & Queens County, the New York & North Shore, and the Manhattan Elevated Railway companies have not sufficient power of their own fully to supply and operate their lines, and recommend in the case of several of these companies an increase in power station capacity. The Interurban Street Railway Company and the Union Railway Company have ample power to operate more than the maximum number of cars now in use. Statistics are also given of the power station capacity of the different systems and the provisions being made for their increase.

MORE SOUTH AMERICAN RAILROAD PROJECTS

The construction of a number of electric railways is projected in the Argentine Republic and Brazil. Advices from Buenos Ayres state that a considerable portion of the Tramway Rural, which is a cable system owned by Frederick Lacroze è Hijo, in the Argentine Republic capital, is to be operated by electricity. The road is more than 22 miles in length.

The Public Works Department of the Buenos Ayres Municipal Council has reported favorably on a proposal made by Doll & Galazar for the construction and operation of an electric traction system to run between Plazo Constitucion and the Liniers slaughter houses, passing through Flores and Vélez Sarsfield. This line will be about 5 miles long.

Eugenio de Andrade has secured a concession to construct a road between Rio de Janeiro and Petropolis, not less than meter gage, passing by the parishes of Santa Anna, San Christovao, Inhauma and Iraja, of the Brazilian capital, and by those of Merity, Pilar and Estrella, located in the State of Rio de Janeiro. The length of the road will be about 60 miles. The franchise permits of the concessionaire carrying on the undertaking without subsidy for a period of seventy years, after which time the road is to revert to the Brazilian Government.

REPORT OF THE SARATOGA CONVENTION

The verbatim report of the twenty-second annual convention of the American Street Railway Association, held at Saratoga Springs last September, has just been published by the secretary. It is an attractive looking pamphlet, larger than usual on account of the extent of the papers, and contains an excellent steel-engraving of President Hutchins, a list of the members of the association, attendants at Saratoga, etc. In the power station discussion some diagrams of the new 50,000-kw station of the Philadelphia Rapid Transit Company, furnished by W. S. Twining, chief engineer of the company, have been included. This station will contain ten Westinghouse 5000-kw turbo-generators which will generate 25-cycle current at 13,200 volts. The value of the papers presented at Saratoga has already been referred to, and this year's report will prove a valuable addition to the Transactions.

CHICAGO RAILWAY STRIKE

The employees of the Chicago City Railway Company voted by a large majority at a ballot held on Nov. 5 and 6 to insist on the demands for higher wages, the employment of none but union men and many other minor demands, published in the Street Railway Journal of Oct. 17, 1903. These demands had been presented to the management twice and had been refused with full statement of the reasons for refusal. It was generally understood by the employees that the vote to stand by their demands meant to strike in case the management would not reconsider its action, unless a compromise could be effected in some way.

The "strike" order went into effect Thursday morning, but at this writing the outcome is uncertain. The company is prepared to operate its cars, and the mayor claims that provision has been made for protecting life and property; but the men have taken measures to cripple the service and a clash is feared. A special detail of police has been placed under an "assistant chief," an office created to meet the present emergency, and this would indicate that serious trouble is anticipated by the city government.

BRILLIUM AS FUEL

Since the demonstration made of the value of Brillium as fuel by Harold P. Brown under the boilers of the Grand Union Hotel during the Saratoga convention, Mr. Brown has received reports on a number of other tests of the fuel, which indicate a very marked reduction in the cost of coal when this material is used. Some figures from tests conducted at Station B, of the New York Steam Company, last month are presented below:

New York Steam Company. Boiler Tests, Station B

Oct. 15, 1903 With Brillium		Oct. 16, 1903 No Brillium
6	Hours duration	6 hours
93	Pressure	93
155	Temperature of water	155
5,625	Pounds of coal burned	6,575
1,875	Pounds of coke dust	None
1,364	Pounds of ash	668
.182	Per cent of ash	.10
55,302	Total water, lbs	50,062
9.85	Water per lb. of coal, actual	7.61
10.81	Water per lb. of coal 212°	8.35
7.37	Water per lb. of fuel, actual	7.61
8.09	Water per lb. of fuel 212°	8.35
307 to 333	Boiler H. P. (30")	278
Barley 75%	Kind of coal	Barley coal only
25% & Brillium	Coke breeze	None
344	Temperature of flue gases	348
7/8"	Average forced draft	7/8"

During the second hour and fifth hour of this test the boiler developed 333⅓ H. P.

Another concern which is using this material is the Marine Engine & Machine Company. F. A. Scheffler, general manager of the company and who is known in street railway work through his connection with the Walker, Stirling Boiler and other manufacturing companies, reports as a result of the week's run on all coal a reduction of 25 per cent from the cost of coal when Brillium is used. At the Saratoga Grand Union Hotel test the saving was considerably more.

A few words in regard to the theory and nature of the new material may be of interest in this connection. Brillium is supplied in the form of a powder, which is not itself combustible but will dissolve in five or more times its weight of water. Fifty pounds of the material are usually mixed with 250 lbs. of water and the mixture is then spread over a ton of coal and cinders. Where the cinders are high in carbon good results are obtained by using a large proportion of cinders, say 70 per cent, otherwise equal parts of coal and cinders are used. Where the coal is in large sizes, no particular advantage is gained from the use of the Brillium, as the material remains on the outside of the coal and does not mix thoroughly with the combustible; excellent results, however, have been obtained with smaller sizes and with coal dust. The effect of the heat of the fire is to decompose a portion of the water in the Brillium, the hydrogen burning and the oxygen uniting with the carbon in the cinders and the coal. Mr. Brown's attention was attracted to the material as the result of a study of the waste products from acetylene gas manufacture, consisting largely of slacked lime. His experiments with this mixture showed that there was a means of producing calcium from slaked lime by the use of several active reagents to give the results secured by the material now on the market.

MORE LOW FARE LINES IN CLEVELAND

A proposition to build and equip four street railways to be operated at straight two-cent fares was received by the city clerk of Cleveland last week, when proposals were opened for new low-fare lines. The proposition was made by Will Christy, a prominent electric railway operator, through his attorney, C. W. Collister, and was a great surprise to the members of the present city administration. Mr. Christy's proposal calls for a two-cent cash fare, thirteen tickets for 25 cents, twenty-six tickets for 50 cents and fifty-two tickets for $1. The streets on which he would like to build are: Denison Avenue, Rhodes Avenue, Summit Street and Doan Street. One other bid was received. This was from the Forest City Street Railway Company, organized a few weeks ago, it is understood, for the purpose of relieving the People's Street Railway Company of its franchises. The proposal of this company covered Summit Street, from Erie Street to Seneca Street, a distance of half a mile. The bid was for a three-cent fare, five tickets for 15 cents, seventeen tickets for 50 cents and thirty-four tickets for $1. Each bid was accompanied by a forfeit of $5,000, the total of $25,000 being handed to the city clerk in cash.

Mr. Christy's proposal created the biggest sensation that has occurred in Cleveland street railway circles in years. Mr. Christy is vice-president of the Northern Ohio Traction & Light Company. He has been prominently identified with many of the projects of both the Everett-Moore and the Pomeroy-Mandelbaum syndicates, and is regarded as one of the largest traction operators in Cleveland. He is president of the Cleveland Construction Company, of Akron, and has built a number of prominent roads. Neither Mr. Christy nor his attorneys will say anything regarding their plans.

By some people it is believed that the proposal is a starter for a city system formed for the purpose of bringing the interurban roads into the city over their own tracks. The present traffic arrangement with the city company gives the interurbans two cents per car mile for the use of their cars while on the city tracks, and the interurbans turn over the whole amount collected in city fares. Whether a two-cent fare would be a more profitable arrangement for the interurbans, in view of the investment and cost of power, is a question that is being debated by well-informed people. As opposed to this view of the situation is the fact that only two of the streets, Denison Avenue and Rhodes Avenue, would be available for bringing an interurban line into the city, and this line is the Cleveland & Southwestern Railway, whereas the supposition is that Mr. Christy would first be interested in assisting the Northern Ohio Traction & Light Company into the city, since this line is handicapped more than any of the others by the necessity of long city hauls and slow city schedules. Another confusing point is that Denison Avenue is already held by the People's Street Railway Company, which has constructed about two miles of track for its proposed three-cent fare line. However, this route is free territory, and another company could get into the center of the city by paying its share of the cost of building and operating the line.

Mayor Tom L. Johnson, the supposed backer of the three-cent fare lines, has voiced the opinion that Mr. Christy is backed by the Cleveland Electric Railway, and is endeavoring to work some sort of a scheme to block the three-cent fare company. The officials of the Cleveland Electric Railway affirm that the company is in no way connected with Mr. Christy's project.

STREET RAILWAY PATENTS

[This department is conducted by W. A. Rosenbaum, patent attorney, Room No. 1203-7 Nassau-Beekman Building, New York.]

UNITED STATES PATENTS ISSUED OCT. 27, 1903.

742,154. Car Replacer; Alexander Bouvier, Concord, Mass. App. filed March 10, 1903. Details.

742,157. Car Mover; Norman E. Bunting, Marion, Ia. App. filed June 29, 1903. A bar having a curled heel with a laterally level surface and a shoe adapted to slide forward on the rail to act as a fulcrum.

742,236. Grip for Aerial Wire Rope Tramways; Byron C. Riblet, Spokane, Wash. App. filed March 4, 1903. Details of a cable friction grip.

742,310. Electric Car Heater; Edward E. Gold, New York, N. Y. App. filed Feb. 26, 1903. A plate overlying the heaters and adapted to deflect the heat from under the car seat outwardly and laterally.

742,311. Trolley Finder; Fred A. Graham, Ferdinand F. Carmiencke and John R. Neely, Muncie, Ind. App. filed Jan. 30, 1903. The trolley wheel is provided on each side with rotary spiral tracks adapted to convey the displaced wire to the wheel.

742,331. Casing for Trolley Wheels; Thomas Kelch, Newport, Ky. App. filed Feb. 2, 1903. One side of the casing is hinged to allow the trolley wheel to be removed and replaced.

742,378. Trolley Contact Device; Wallace L. Baker, Painesville, Ohio. App. filed Dec. 29, 1902. Springs are arranged in the harp to hold the wheel in a normal position, but permit it to tilt when necessary.

742,786. Means for Lubricating the Rails of Street Cars; Elisha K. Green, Los Angeles, Cal. App. filed March 4, 1903. The depression of a lever on the car platform opens a valve in a pipe leading from an oil-supply tank to the rails.

UNITED STATES PATENTS ISSUED NOV. 3, 1903

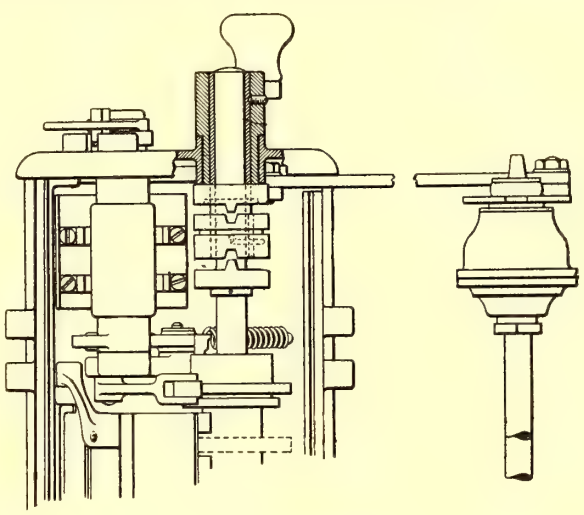
742,933. Electric Motor Controller; Walter N. Vance, Chicago, Ill. App. filed July 2, 1902. A railway controller in which the object is to insure safety in operation, the various parts being interconnected and interlocked to prevent a change of circuit unless the conditions for the change are first made right.

742,967. Combined Motor Controller and Engineer's Valve; Frederick W. Caldwell, Schenectady, N. Y. App. filed May 28, 1903. The motor controlling switch and air brake engineer's valve are so connected as to be operated by a single handle.

742,996. Apparatus for Opening or Closing Railroad Switches; Jonathan S. Jones, Westbend, and Arthur W. McFarland, Sioux City, Ia. App. filed Feb. 3, 1903. Details of automatic switch-throwing mechanism.

743,101. Railway Bond; Henry E. Procunier, Oakpark, Ill. App. filed Sept. 22, 1902. Relates to the formation of the terminal of the bond which is driven into a hole in the rail.

743,153. Trolley Mechanism; Charles I. Earll, New York, N. Y. App. filed Sept. 20, 1901. The trolley cord passes from a spring drum mounted at the base of the pole through the tubular pole and over a sheave at the upper end of the pole.



PATENT NO. 742,967

743,198. Convertible Car; Hermann Romunder, Newark, N. J. App. filed April 11, 1902. Details of the construction of this car were given in the STREET RAILWAY JOURNAL of Nov. 7, 1903.

743,210. Car Seat; Hubert Witte, St. Louis, Mo. App. filed April 6, 1903. The cushion overhangs the end castings, the brackets secured to the back being bent to pass around the ends of the cushion and having heads seated in recesses formed in the end castings to which they are bolted and having offset ears fitting in openings formed in the end castings.

743,272. Safety Trolley Alarm; William M. Gruner and William C. Fink, Springdale, Pa. App. filed Sept. 14, 1903. A second trolley wheel of wide tread mounted below and to the rear of the main trolley wheel on a sub-trolley arm branching from the main pole, is adapted to engage with the wire when the main wheel leaves it and sound an alarm.

743,291. Convertible Passenger Car; Andrew Kimble, Zanesville, Ohio. App. filed Aug. 14, 1903. Details.

743,331. Means for Removing Sleet, etc., from Electrical Conductors; Elias E. Ries, New York, N. Y. App. filed Sept. 4, 1903. The power rail is made a part of a second circuit carrying a current of large heating capacity.

743,378. Automatic Self-Dropping Trolley Pole; John Deland, Terra Haute, Ind. App. filed March 23, 1903. When the trolley pole rises above the wire a trip is actuated allowing the pole to fall to the roof of the car, the last part of the movement being retarded.

PERSONAL MENTION

MR. DON R. ALMY has resigned as assistant to the solicitor for the Interurban Street Railway Company, of New York, and has opened an office for the general practice of law at 76 William Street, New York. Mr. Almy will be associated in his legal practice with Mr. J. Arthur Hilton.

MR. THOMAS ELLIOTT, formerly general manager of the Pittsburg, McKeesport & Connellsville Railway Company, of Pittsburg, has been appointed chief engineer of the Cincinnati Traction Company, of Cincinnati. The office of chief engineer is a new one with this company, and Mr. Elliott will have charge of all power houses as well as all construction work.

MR. IRA A. McCORMACK, who was formerly connected with the Syracuse and Cleveland street railway properties, was on Nov. 1 appointed manager of the Grand Central Depot and of the Harlem line from Fifty-Second Street to the Mott Haven Yard of the New York Central & Hudson River Railroad Company.

MR. CHARLES T. YERKES arrived in New York on Tuesday, Nov. 10, on the Kaiser Wilhelm II. from London. This is Mr. Yerkes' annual visit to this country, and he had little to say. About the tunnel lines he is building in London he said they were well under way, and that the line from Baker Street to Waterloo will be finished in about a year. He expects to see the entire system completed in five years.

COL. MYRON T. HERRICK, of Cleveland, who overwhelmingly defeated Mayor Tom L. Johnson, of Cleveland, in the race for the Governorship of Ohio, is prominently identified with electric railway enterprises in addition to being president of the largest savings bank in Ohio. He is one of the chief owners of the Pennsylvania & Mahoning Valley Railway Company, of Youngstown, a large stockholder and director of the Cleveland Electric Railway Company, and was one of the members of the bankers' committee that took charge of the affairs of the Everett-Moore syndicate at the time of its embarrasment.

MR. THOMAS M. JENKINS has resigned as general manager of the St. Louis & Suburban Railway Company, of St. Louis, Mo. Mr. Jenkins has been manager of the company for five years, coming to St. Louis from Covington, Ky. Under his management many improvements in service and equipment have been introduced and the system is now regarded as one of the best in the country. Mr. Jenkins has not outlined his plans for the future, but it is understood that he will remain in St. Louis. At present he is a member of the State board of mediation and arbitration, to which he was appointed by Governor Dockery last year.

MR. JOHN C. DANIELS, president of the Garton-Daniels Company, of Keokuk, Ia., died Oct. 25, at his former home at Eau Claire, Wis., where he had gone in the hope of restoring his health. Mr. Daniels was born in New York State in 1840, and was therefore sixty-three years old at the time of his death. He was formerly the owner of a fleet of raft boats operating on the Mississippi River, but in 1892 engaged in the business of the Garton-Daniels Company. He was a man of sterling character, and while his acquaintance among the street railway fraternity was not large, there will be many that will be pained to learn of his death.

PRESIDENT H. S. PRITCHETT, of the Massachusetts Institute of Technology, on Oct. 31 rode in both the Siemens and the Allgemeine cars used in the high-speed experiments on the Berlin-Zossen road, in Germany. As weather conditions were unfavorable, a speed of 100 m. p. h. was not permitted to be exceeded. Mr. Pritchett is the first foreigner to ride in the cars. He expressed emphatically his belief in the commercial success of a speed of 100 m. p. h., and his opinion is that this speed on roads between cities like New York and Washington, with low grades, few curves and heavy ballast, would be exceedingly profitable.

MR. LEWIS R. McCLYMONDS, a director of the Syracuse Rapid Transit Company and largely interested in the Wheeling Traction Company, of Wheeling, W. Va., died at South Orange, N. J., Saturday, Nov. 7, from apoplexy. He was born in Ohio fifty-three years ago. He began business in Cleveland in the Ohio National Bank. Later he became interested in the manufacture of rubber goods, and was in control of the Cleveland Rubber Company, which, under his management, was enlarged until it became one of the leading industries of its class in the West. Mr. McClymonds organized and established the Chicago Rubber Works, and in 1892 identified himself with the New York Belting & Packing Company in the capacity of president and general manager. In 1902 he retired.

MR. JOHN MAHONEY has been appointed general superintendent of the St. Louis & Suburban Railway Company, of St. Louis, Mo. The announcement of his appointment was made after it had become known that General Manager Thomas M. Jenkins had resigned from the company. Mr. Mahoney is a practical street railway man of nearly thirty years' experience. Since last July he has been connected with the Suburban Company as auditor and purchasing agent. He came to St. Louis in 1874 from Hartford, Conn., and worked his way up from a subordinate place on the old Union Line to foreman of the People's Company, now the Fourth Street line. Later he became superintendent of the Citizen's Railway, now known as the Easton Avenue line, and when this road was sold in 1890 to the syndicate he went back to the People's Company. On the organization of the Transit Company in 1899, when all lines except the Suburban were taken in, he was made division superintendent for the Transit Company. At the instance of President Walsh he resigned from the Transit Company and became connected with the Suburban Railway. In his new duties, Mr. Mahoney will have complete charge of the operation of the lines and of the accounting, while the more important executive duties of former General Manager Jenkins will devolve upon Mr. Julius S. Walsh, Jr., son of President Walsh, who has been vice-president of the company since last January.

MR. MATTHEW C. BRUSH has accepted the position of assistant to Adams D. Claflin, president of the Boston Suburban Electric Companies, assuming the duties of his position on Nov. 1. The companies represented in the corporation include the Commonwealth Avenue Street Railway Company, Lexington & Boston Street Railway Company, Newton Street Railway Company, Newton & Boston Street Railway Company, Wellesley & Boston Street Railway Company, and the Waltham Gas Light Company. Mr. Brush, who will relieve President Claflin of the details of the management of the system, is but twenty-five years of age, and has had no special advantages that any man of pluck and determination to succeed may not command, yet he has attained a position many young men would consider a high degree of success at any period of life. At twenty he was clerk of the passenger steamer "Northwest," and at twenty-two was purser of the "North Land," of the Northern Steamship Company, sailing on the great lakes. For five years he was clerk or purser on one or the other of that company's steamers. After his graduation from the Massachusetts Institute of Technology, about two years ago, Mr. Brush became roundhouse foreman for the Union Pacific Railroad at Omaha, later was general foreman of shops and roundhouses of the Rock Island Railroad in western Kansas, resigning to accept his present position with the Boston Suburban Electric Companies, with offices at Newton.



MATTHEW C. BRUSH

MR. WILLIAM L. ELKINS, the traction magnate and financier, died at his summer home, at Ashbourne, near Philadelphia, Saturday, Nov. 7, from a complication of diseases. Mr. Elkins was born near Wheeling, W. Va., of Quaker parentage, on May 2, 1832. The family went to Philadelphia in 1840, where Mr. Elkins was educated in the public schools. At the age of fifteen he entered the business world, and engaged in different ventures with varying success until the discovery of petroleum in Pennsylvania, in 1862. He then made large investments in oil company shares, and, disposing of his other investments, went to western Pennsylvania and made a thorough investigation of the oil regions. He soon had control of the entire local industry of oil refining. He afterward became largely interested in the manufacture of gas. In 1875 he became a partner of the Standard Oil Company and six years later disposed of his interest to the company, retaining some of its stock, but giving up all active connection with the oil business. Mr. Elkins then turned his attention to street railways. With his associate, Mr. P. A. B. Widener, he was the principal owner of the Philadelphia Rapid Transit Company and was also interested in the Interurban Street Railway Company, of New York, the surface systems of Chicago, Pittsburg, Cincinnati and other cities. He was buried from Ashbourne on Tuesday, Nov. 10. At the moment when the funeral services were begun the entire street railway system throughout the city and suburbs suspended operation, and every car remained stationary for one minute as a tribute to his memory.

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EDITORIAL NOTICE

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Third Rail versus Trolley

The number of interurban third-rail roads is gradually increasing, and there are now in the neighborhood of a dozen having the third rail in operation or under construction. Interurban railway owners and builders are very much divided as to the desirability of the third rail for interurban service. The advocates of the third rail point to the fact that it really costs less per mile than an overhead trolley with overhead copper feeders of conductivity equal to the third rail. They also point to the freedom from danger of the trolley jumping at high speeds and the ability of the contact-shoe on the third rail to collect a much larger volume of current than the overhead trolley. Those who still adhere to the overhead trolley for high-speed interurban service would, no doubt, admit that the third rail would be necessary for very heavy trains; but they do not admit that its advantages outweigh its disadvantages for supplying current to interurban cars of the heaviest type now common. It can be used only on a private right of way, and the interruptions of the third rail at highway crossings are annoying at night when they put out the lights.

The advocates of the third rail point to the rapid wear of trolley wheels on heavy interurban cars. That this wear is often very rapid there is no doubt, and yet it is wonderful what mileage some well-operated interurban railway companies obtain from wheels running on fast, heavy cars. The roadbed and trolley wire alignment that permits of speeds as high as 60 m. p. h. without trouble from trolley wheels leaving the wire is certainly worthy of admiration. There are a number of such roads whose officers, apparently, have no use for the third rail, and there are also a number of third-rail roads whose officers have an ill-concealed scorn for the trolley. The truth of the matter lies between these extremes. There are many roads operating under conditions which make the third rail utterly impracticable, as they traverse village streets and highways at such frequent intervals that even if the third rail were used in the portion which is on private right of way the change from third rail to trolley would involve prohibitory delays. It would be of value to know just what loss occurs at the trolley contact, and also the loss under the same conditions at the contact-shoe on a third rail, although this is generally a minor consideration. It has been claimed by some that the loss at the trolley contact is very large. Where trolley wheels are rapidly worn out by the arc formed between wheel and wire, there is no doubt considerable loss; but where trolley wheels run from 5000 miles to 10,000 miles on a heavy interurban car, as they do on well-maintained roads, the loss at the trolley contact evidently does not make itself seriously known in the shape of trolley-wheel wear, and it is only safe to assume that loss at the trolley contact in such cases is not very large until the contrary is proved.

The Chicago Strike—and Others

As we go to press the strike on the Chicago City Railway is following the road trodden by strikers since Satan devised the Walking Delegate—from idleness to mischief, from mischief to rioting. From hurling abusive epithets the strikers and their sympathizers have advanced already to bricks, paving stones and pistol bullets, and the end is not yet. The cars have not stopped running, but carrying policemen cannot be considered a lucrative traffic, and the railway business is at a standstill. Sympathetic strikes are probable, and further violence may confidently be predicted.

In our issue of October 17 we outlined the situation which has led to the present strike. It embodies no novel features of any moment, but is the same old story of a demand for increased wages, unionization of the system and abolition of the company's control of its schedule and discipline. We hear much about requests for the recognition of the union and arbitration of differences. But the experience of the management of the Chicago City Railway Company in this controversy shows how little dependence can be placed upon unions to carry out their agreements. The firemen at the power houses, who walked out to show their sympathy for the motormen and conductors, had only two days before bound themselves, through their union, not to engage in any sympathetic strike for a year, the term of the contract with the company. The engineers were under a similar agreement, yet they, too, followed the firemen, deserting their posts without any warning whatever.

In the present instance the issues were conceded at the very outset. Mr. McCulloch and his colleagues had already dealt with their employees in a broad-minded way, and were entirely willing to deal with any organization its men might form, and to arbitrate everything that could be properly settled in that

amicable way. They have, in fact, pursued this policy in the past. But they are not willing to resign the management of the stockholders' property to an outside and irresponsible organization, to forget their duty to the public or to coerce their employees into joining the Amalgamated Association, the Concatenated Order of Hoo-Hoos, or Dowie's church.

What would be thought of a street railway manager who should order the entire working force of the system to join even a total abstinence society on pain of dismissal? He would be denounced right and left as a tyrant, and would probably have a strike on his hands within forty-eight hours, in spite of the fact that such a move might be decidedly for the benefit of the service. Americans pride themselves on maintaining personal liberty, and how they can reconcile liberty with an attempt to coerce individuals into membership in any social, religious or political body passes our understanding. Moreover, the one strong hold that street railway employees have on the sympathy and support of the public is that they are working with and for a public service corporation. How can they reasonably ask help in breaking down the responsibility of that corporation to the public? A company that would turn over its public service and its discipline to any association for any purpose ought to forfeit its franchise and go out of business. The Chicago strikers are asking a sheer impossibility, and they ought to be sane enough to recognize the fact. They may be assured, too, that violence in such a cause will meet its due reward. We deprecate the suggestion that the Federal forces must be called in to prevent interference with the mails, for such a subterfuge is of doubtful ultimate expediency and a humiliation to the community that is thereby self-confessed as unable or unwilling to defend its own rights against the aggression of the irresponsible body of hoodlums that always collects when a strike is on. We do not think that the Chicago police force has forgotten the proper use of the long night-stick, or the lesson of the Haymarket. The local authorities should be amply able to cope with any rioting that is likely to arise, and we do not see how the strikers on the issues raised can hope for any material sympathy that may give them a chance for ultimate success. Rioting will certainly alienate whatever sympathy might possibly be expected.

Strikes very generally lead to violence, for the reason that no single body of men can force a settlement merely by abstaining from work. To win, they must have the assistance of circumstances, as when impending contracts make it cheaper to settle than to fight; strong public sympathy that is able to force a compromise; passive strength which may win by arousing fear of a general sympathetic strike with its attendant disaster; or sufficient criminal aggressiveness to terrorize the community into surrender. Rioting is a pretty sure sign that the strikers have a cause so weak as to alienate legitimate support, and rioting is a thing that must be suppressed in the interest of the whole people. Of course, rioting involves many elements besides the strikers, and Chicago has very large riotous possibilities, but we think the present difficulty will be easily controlled. With a company that stands openly for the principle of arbitration, and is entirely willing to deal with the union, the strike can have no permanent motive power, and we earnestly hope that it may be amicably settled. But this much is certain—that no street railway company can so far forget its duty as a public servant as to give up its power of enforcing discipline, or of making such traffic arrangements as will accommodate its patrons. The question of wages is one which is always to the front, but as we sometime since remarked, the average motorman earns as much as the average minister of the Gospel, on a very much smaller equipment of special training, and with quite as much certainty of permanent employment. These are times, too, when wages are tending to fall rather than rise, and the man with a steady job may consider himself in luck. The coming winter will see a larger body of unemployed labor than for some years past, much of it skilled labor at that, and a strike, even were it founded on just claims, is just now singularly ill-timed.

Schedule Speeds

The schedule speeds prevailing in the several large cities of this country vary in the main between 7 m. p. h. and 12 m. p. h. In cities having broad streets, where the obstructions by team traffic are few, schedule speeds as high as 10 m. p. h. and 12 m. p. h. are frequently found prevailing over an entire system of city lines. On the other hand, there are cities where there is no inherent reason why equally high schedule speeds could not be made, but where, nevertheless, they are very low, and it is a very difficult matter to raise them. In general, it may be said that the schedule speed prevailing on any city system is dependent more upon the amount of obstruction from team traffic than upon anything else. To a certain extent such obstructions are beyond a company's control. They are certainly not beyond a city's control, and it is for the management in each city to conduct a vigorous and diplomatic a campaign of education in this respect as possible. At the Saratoga Convention Mr. Grant, of St. Louis, told of methods there pursued in eradicating the team obstruction evil. Schedule speeds at St. Louis have been undergoing a decided quickening the last three years, and this has been made possible only by freedom from team obstruction. In the same discussion Mr. Beggs outlined the different but no less effective methods he had used at Milwaukee in stopping delays of cars by teams. In any city much can be done by educating the public to realize the loss of time caused by team-traffic obstructions to street railway traffic. Once the public team owners and municipal authorities are fully awake to the importance of the matter, it becomes easy to secure and to enforce police regulations which will make a marked reduction in the amount of obstruction by teams.

Aside from the question of street obstructions there are a number of very complex engineering questions in connection with schedule speeds in city service. Some managers are strongly inclined to insist on schedule speeds which are close to the fastest attainable. The majority are more conservative, and leave a considerable margin between the schedule time and the fastest possible time that could be made over a given route. It has been accepted for some years as a general proposition that fast schedules are the most economical, both for the company and passengers. From the passenger's standpoint there can be no doubt that fast schedules are appreciated, provided they are not accompanied, as they are on some roads, by a jerking in stopping and starting, which counteracts all the satisfaction over making fast time. Leaving out of account the traffic-drawing qualities of a fast schedule, and considering schedules from a purely operating standpoint, it has been commonly considered that faster schedules, up to a certain limit, are more economical, because of the saving made in the various items of cost which depend upon time rather than upon mileage. The largest single item of operating expense per car mile is the item of trainmen's wages. Since conductors and motormen are paid by the hour an increase in schedule speed means a greater mileage per hour, and a consequent reduction in this item per

car mile. Most of the other operating expenses per car mile are not so directly dependent upon the schedule speed as are wages, though they are modified by it. The amount of power required per car mile, and consequently expense for power, increases as the schedule speed increases. Just what the relation between schedule speed and power consumption is depends on so many elements that it cannot be definitely figured. It has been generally considered that since the cost of power is considerably less than the wages of motormen and conductors a considerable increase in power cost, caused by the increase in schedule speed, would be more than offset by the reduction in cost of trainmen's wages per car mile. One point must be considered in this connection, and that is that as cars increase in length and weight the cost of power becomes a greater proportion of the total operating expense, while the conductors' and motormen's wages are a smaller per cent of the total. This means practically that the increase in power consumption, due to any increase in schedule speed will be greater in proportion to the saving in conductors' and motormen's wages than it would be with a shorter car. There are a number of other items which increase with the schedule speed, such as cost of motor maintenance, brake-shoe wear, and other things which it is extremely difficult to figure upon in advance. Last, but not least, there is the accident record to look after. The more a motorman is crowded to make a schedule the greater chances of accident he will take. It does not follow, however, that increased schedule speeds always means more accidents. There is, no doubt, a critical schedule, above which accidents, power expense and maintenance expense increase enormously. It is for the manager to determine about what this critical schedule is and keep below it.

Emergency Stops

At the present time the exigencies of interurban and other heavy electric railway work have compelled the adoption of air brakes on electric cars to a very large extent. That such brakes are vastly superior to even the best and most skillfully applied hand brakes has been demonstrated over and over in theory, in experimental runs and in the hard school of every-day service. Air brakes came slowly, it is true, on account of the small need which existed on the earlier roads for such extreme measures, and by reason of the additional expense of the equipment. The increasing speeds and the rapidly-growing weight of the equipment forced the issue, but even now the change to power brakes is not as complete as one might wish. Speed is still increasing, cars are growing still heavier, and the constant demand for more frequent service has brought still further need of improved stopping devices. Interurban lines are laid out with a freer hand than has been usual in ordinary railroad location, the grades are stiffer, the curves sharper and more numerous, and usually the roadbed rather lighter. The result is an increased need for powerful and efficient brakes. After making all allowances it must be admitted that the last season has had more than its share of accidents due to cars getting beyond control, and it is high time to overhaul the brake question, with a view of seeing whether better means of stopping cannot be devised. Accidents have sometimes happened through failure of the brakes to act properly, but we are inclined to the opinion that in most instances the brakes are in average good working order, are properly inspected and promptly applied. They require a certain space in which to stop the car, and this space is sometimes too long, considering the speed and weight of the car and the necessities of the case.

It, therefore, is pertinent to inquire whether some additional stopping power cannot be furnished, capable, in time of great need, of stopping the car much more quickly than air brakes of the ordinary sort worked under average conditions. There have been, and still are, track brakes intended to bear directly upon the head of the rail, but they have not yet been in sufficient use to show their real value. One very pretty brake of this kind has been introduced recently, but like the others it has not yet shown its practical value. On general principles a track brake, the effective pressure of which is not limited by danger of skidding the wheels, ought to be capable of producing retardation up to the limit imposed by the safety of the passengers. Of course, this would imply very great strains on the brake mechanism and on the track, but if the former stands the work the latter may be neglected, since the first consideration is the stop, and such desperate measures need rarely be resorted to. We wish some of the roads on which track brakes of any kind have been introduced would go to the trouble of having a careful test of their effectiveness made for various speeds, and would make public the results. Such tests are in themselves necessary to show whether the brakes can be trusted to do their work, and have a direct bearing on the responsibility of the road in case of accident. It would mean no small gain if by using track brakes the space required for a full stop could be reduced to one-half its present amount. It would imply a greatly lessened danger of collisions in fog and darkness, and would enable a car to be pulled up quickly enough to avert many minor accidents. It is of relatively small importance whether the track brake proves desirable for general service. If it can make an emergency stop promptly, it has claims sufficiently strong to ensure its popularity.

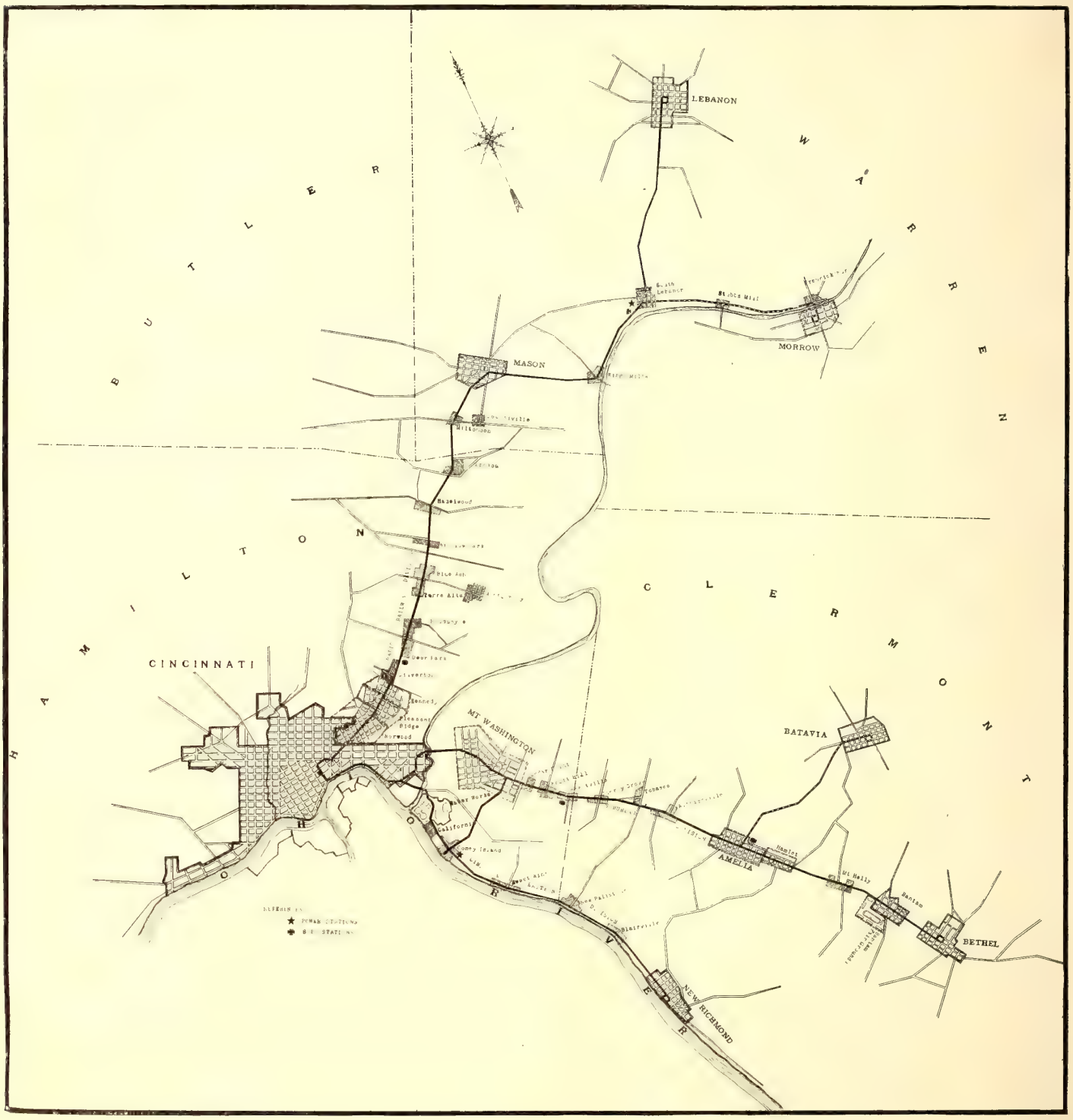
Still another question in this same line involves reversing the motors as an emergency measure. All our readers who have had a reasonably long experience will recall that on the early electric roads the motors were reversed without hesitation in a tight place, and that the controllers were so planned that reversal was the work of a moment. They will also probably recall divers gears and armatures that came to grief by too rash reversals. As time went on most roads, having suffered by hasty motormen, passed stringent rules against reversing the motors save in direst extremity, and at present not only are these rules generally in force but controllers are commonly so built that reversing is sufficiently inconvenient to prevent its employment under any ordinary circumstances, no matter how great the necessity. It has been often stated in print, and out, in defense of this condition, that reversal is really comparatively ineffective, and will not stop a car much, if at all, more quickly than power brakes. No one who has ever reversed one of the old Sprague cars in a really tight place is quite ready to swallow the proposition without proof, and we would like in addition to the track brake tests to suggest a really careful investigation of emergency stops by reversal. Under what conditions are these more effective, and under what conditions less effective than braking stops with the best brakes now obtainable? Everybody agrees that reversal is hard on the motors, but people do not make emergency stops with a view of coddling the car equipment. It is not a case of what means one would prefer to employ to avert an accident, but what means will certainly be effective. If reversal can stop a car in 100 ft. on a slippery track where brakes would require 110 ft., then reversal is wanted, and vice versa. Between the two, however, there is no compromise as emergency measures, since the brakes must be off if the reverse is put on.

CINCINNATI INTERURBAN DEVELOPMENT—I

Compared with other large cities in Ohio the development of interurbans radiating from Cincinnati has been unusually slow. For several years three electric railways have operated out of Cincinnati, but because of existing conditions they have been unable to penetrate into the heart of the city, and have been obliged to transfer their passengers to city cars at the city limits. Quite naturally this condition has proved a serious handicap to the development of the passenger business and a still greater one to the growth of the package freight business.

It is only within the last year that the people of Cincinnati have enjoyed the advantages of boarding a comfortable interurban car in the center of the city and riding without change to towns within a radius of 30 miles or 40 miles of that point. The territory covered by these lines is shown in the accompanying map.

Several unusual conditions contributed to the apparent lack of enterprise on the part of the interurban railways, but the chief retarding influence seemed to be the fact that the interests formerly controlling the Cincinnati street railways preferred to keep the interurbans outside the city limits so that the city lines could carry the passengers out to them, and retain the entire city fare. This policy was strengthened by the fact that the Cincinnati lines not only use a wide gage (5 ft. 2½ ins.) but employ the double trolley system, which was saddled on them years ago by the telephone interests. Added to these were the obstacles of numerous heavy grades and narrow streets, which caused small radius curves and very narrow devil strips, some of them only 3½ ft.



MAP OF INTERURBAN LINES CONTROLLED BY THE INTERURBAN RAILWAY AND TERMINAL COMPANY OF CINCINNATI

INITIAL MOVEMENT

In 1900 a syndicate was formed by George R. Scrugham, Lee H. Brooks, J. M. Kennedy, C. H. Davis, W. E. Hutton, E. G. Kinkhead and others of Cincinnati, with a view of giving Cincinnati its proper position among Ohio cities as

an interurban center. The system developed by this syndicate, embracing 101 miles of track, is now in complete operation. The property is controlled by the Interurban Railway & Terminal Company, of Cincinnati, and comprises the terminal station and other facilities, as well as the lines of the Cincinnati & Eastern Railway, the Suburban Railway and the Rapid Railway, each of which is now operated as a division of the completed system. The first company was organized as the Cincinnati & Eastern Railway Company, to build a line paralleling the Ohio River to New Richmond.

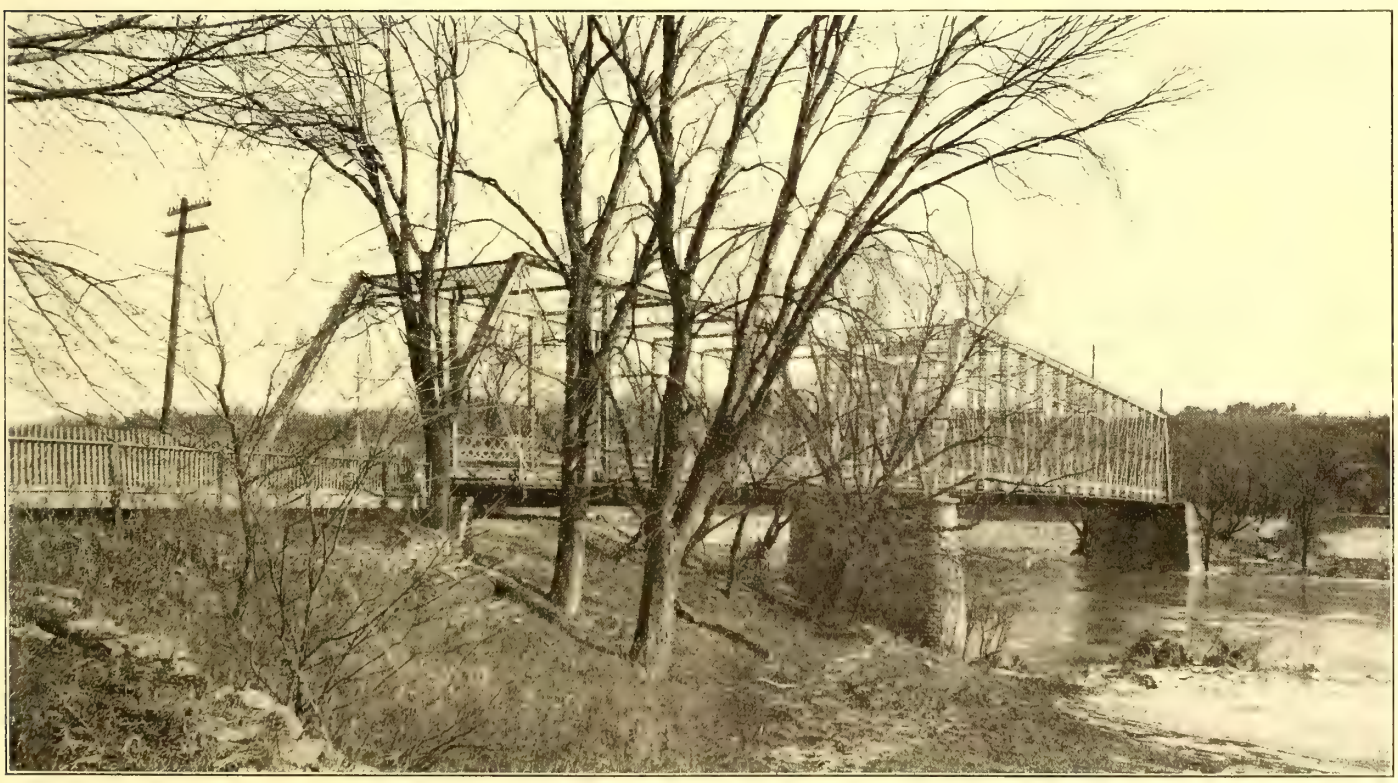
It was the fixed policy from the start that an essential factor in the development of interurban passenger and freight business was a suitable terminal station in the heart of the city, to which all interurban cars should be operated. Backed by the syndicate, a measure, known as the Roudebush bill, was proposed before the Ohio Legislature. It provided that interurbans operating outside a city might condemn right of way inside of municipalities, including city streets, for terminal purposes. Naturally, the measure met with strenuous opposition from all city companies in the State. While the fate of the bill was still undecided the Cincinnati lines were leased to the present Cincinnati Traction Company. Amicable overtures were made, the new management and the syndicate reached a satisfactory settlement, and the bill was allowed to die. A traffic arrangement was made whereby the interurban cars might operate to a terminal station, the division of city fares being on a basis of 2 cents to the interurban company and 3 cents to the city company. The interurban company agreed to make all changes in tracks and curves necessary to let its cars into the city. The proposition of laying a third rail was considered, but the interurban people decided that the advantages of standard gage were not commensurate with the added investment. They have gone ahead on the theory that the chief utility of the interurban is to develop business to and from towns within a radius of 30 miles to 40 miles of a large center, rather than to form



MIAMI RIVER BRIDGE (CINCINNATI & EASTERN DIVISION)



RIP RAP ON HEAVY FILL NEAR OHIO RIVER (CINCINNATI & EASTERN DIVISION)



MIAMI RIVER BRIDGE (CINCINNATI & EASTERN DIVISION)



RETAINING WALL (CINCINNATI & EASTERN DIVISION)

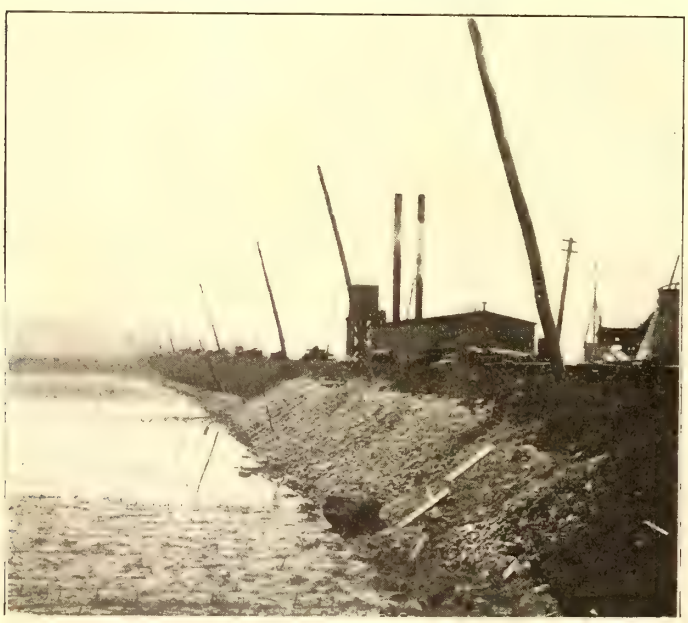
traffic arrangements with other lines and attempt to compete with steam roads for long-distance traffic.

CINCINNATI & EASTERN DIVISION

Work on the Cincinnati & Eastern was started Sept. 15, 1900, and the line was placed in operation to New Richmond, a distance of 24 miles, on Oct. 12, 1902. The road is at the side of the highway which parallels the Ohio River, and the cars are seldom out of sight of the great yellow stream, backed by a range of "Blue Grass" hills on the Kentucky side, making this an ideal scenic route. In building a portion of this road the company encountered some unusual and expensive engineering difficulties. In the district known as Turkey Bottoms the highway had traversed the lowlands that were frequently inundated, and the company not only had to raise the entire highway but provide means to prevent the embankment being washed away by high water. Fortunately, unusual facilities were at hand for accomplishing this. The city of Cincinnati is erecting, at California, near this point, an immense water works pumping station and filterage plant. The tunnel to the plant passes directly under the fill, and a great deal of solid rock was encountered. An opening was made adjoining the highway, and something over 117,000 yds. of rock and shale were delivered in dump cars from the tunnel. A view of the fill, together with the tunnel power house and hoist, is presented; also a view of another large fill protected by broken rock. This division has the largest bridge on the system. It has a 400-ft. span crossing the Little Miami River, and a 63-ft. approach, and is built for double track. Views of this bridge are shown Near the city limits there is an overhead crossing over the Pennsylvania Railway. This is provided with a gauntlet track, which dispenses with switches at the bases of the inclines, and also serves as guard rails. From the city limits to Coney Island the line is double track, to provide for the heavy summer traffic to this park, which is the most popular resort near Cincinnati. A



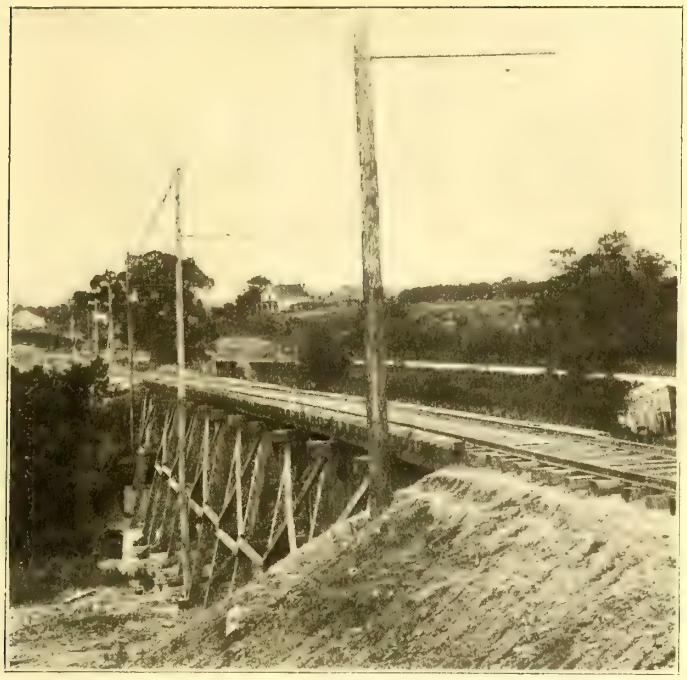
FILL, THROUGH APPROACH NEAR NEW WATERWORKS (CINCINNATI & EASTERN DIVISION)



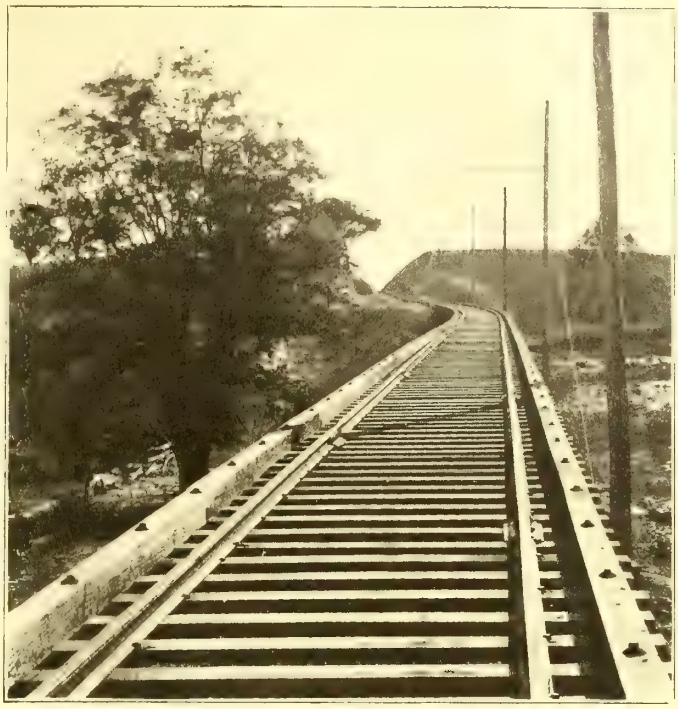
FILL, NEAR CINCINNATI, SHOWING RIP-RAP BEING PLACED ON IT



10-FT. BRICK, CONCRETE AND STONE ARCH CULVERT (SUBURBAN DIVISION)



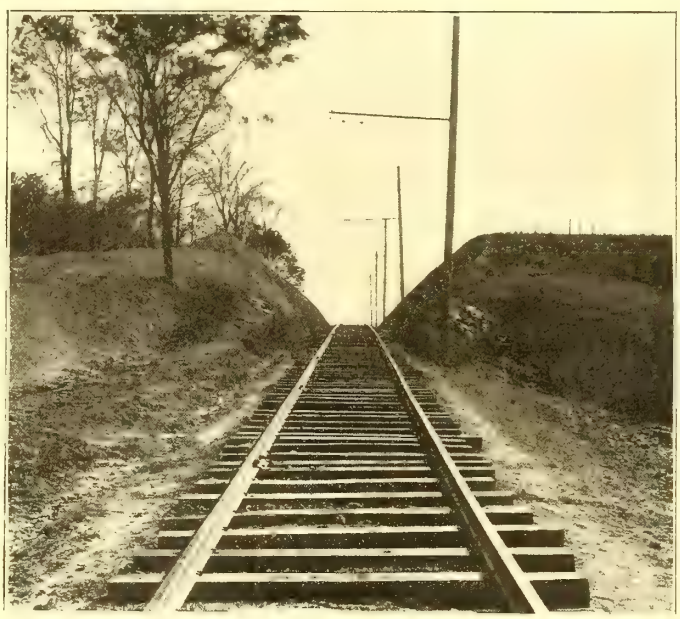
FRAME TRESTLE ON STONE FOUNDATIONS (SUBURBAN DIVISION)



TRESTLE AND CUT, APPROACH TO LEBANON (ON RAPID DIVISION)



SINGLE TRACK NEAR AMELIA (SUBURBAN DIVISION)



CUT 557 FT. LONG, 40 FT. DEEP, NEAR LEBANON (RAPID DIVISION)



CUT NEAR LEBANON (RAPID DIVISION)



TRESTLE ON CONCRETE PIERS CROSSING SMALL CREEK (RAPID DIVISION)

California	1,073
Coney Island	406
Intermediate population	2,752
Tributary population	5,000
Total	12,730



FRAMED TRESTLE 330 FT. LONG, CROSSING A RAVINE 60 FT. DEEP (RAPID DIVISION), NEAR KING'S MILLS

description of the park will be given in the second installment of this article. The city is preparing to build in connection with the waterworks system a fine park bordering the river, and this will prove a source of revenue to the company. There is practically no competition offered the Cincinnati & Eastern for a distance of about 20 miles, as there is no steam road on the Ohio side and only one line on the Kentucky side, running two local trains a day, so that the majority of the people now cross the river and take the electric line into the city. The population contributing to the Cincinnati & Eastern division, exclusive of Cincinnati, is shown in the accompanying table.

Sweet Wine	318
Eight Mile	276
Blairsville	516



CROSSING BALTIMORE & OHIO RAILROAD OVERHEAD (RAPID RAILWAY DIVISION)

New Palestine	473
New Richmond	1,916
	4,978

SUBURBAN DIVISION

The construction of the Suburban Railway was started April 15, 1901, and it was placed in operation June 1, 1903. This line extends



OVERHEAD CROSSING AT PLEASANT RIDGE, OF THE PENNSYLVANIA RAILROAD (RAPID DIVISION)

to the village of Bethel, in Clermont County, a distance of 32 miles from the city limits. From Mt. Washington to Bethel the track is built at the side of the old Ohio Turnpike, on right of way bought outright from the turnpike company,

and it is separated from the pike by a ditch and a pole line. At the present time the cars of this line go south from Mt. Washington to Coney Island, and enter the city over the tracks of the Cincinnati & Eastern, but a direct line from Mt. Washington into the city is being built, and will be placed in operation as soon as the city completes an extensive levee work at the crossing of the Miami River. This will improve the running time for the Suburban Railway, and the loop formed will be used for local business and excursions. The district traversed by the Suburban is one of the most fertile market gardening districts in the country. Fruit and vegetables of every description are raised in immense quantities, and the people are now sending their produce to market by the electric road instead of hauling it long distances. The population of the towns along the Suburban Railway follows:

Mt. Washington	781
Cedar Point	370
Fruit Hill	431
Forestville	730
Cherry Grove	311
Tobasco	560
Withamsville	517
Amelia	1,223
Hamlet	305
Mt. Holly	217
Bantam	470
Bethel	850
	6,765
Intermediate points	4,216
	10,971
Tributary population	5,200
Total	16,171

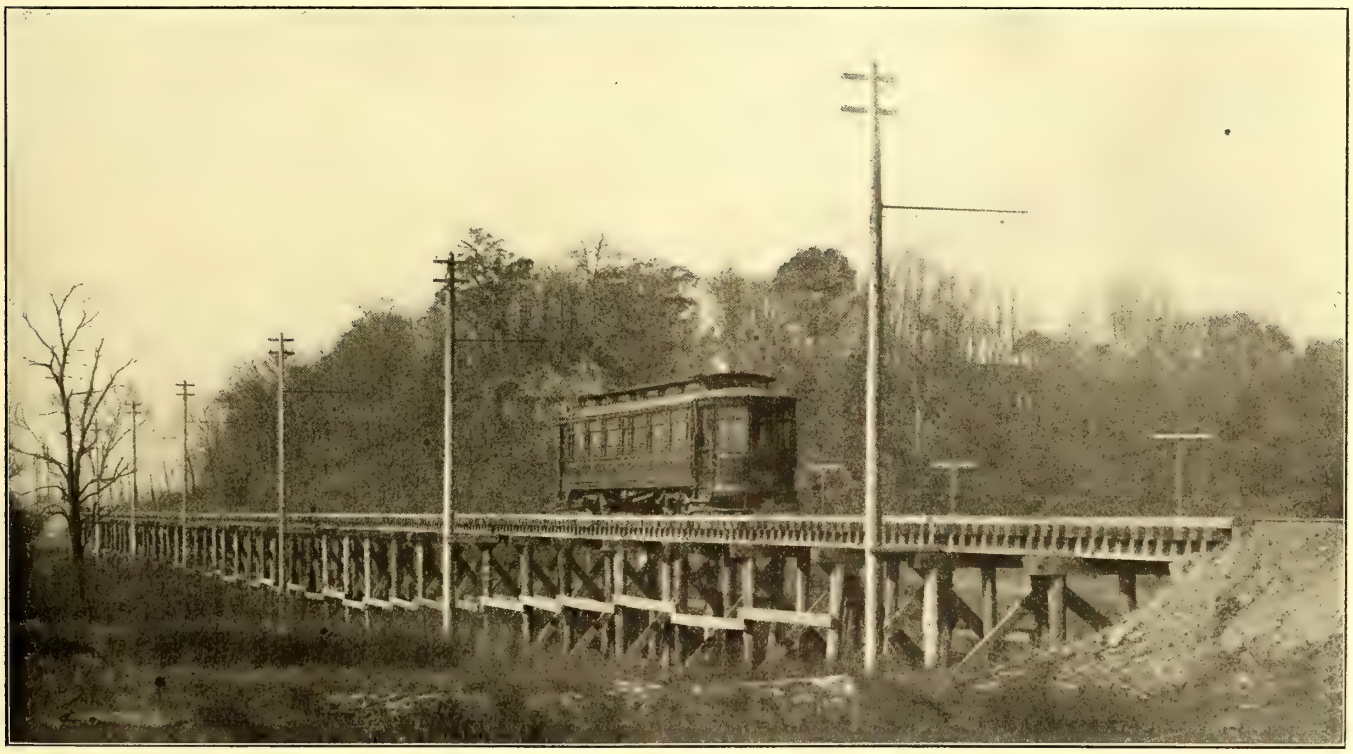
RAPID RAILWAY DIVISION

The Rapid Railway was placed in operation to Lebanon, 32 miles from Cincinnati, on Oct. 1 of this year. Electric roads almost without number have been projected to this point from Cincinnati, but the Rapid is the only one in sight or likely to be built. The country is rough in many places, and a number of instances of bold engineering marks the work. Approaching Lebanon a hill was cleft fairly through the center, the cut being 35 ft. deep. At Kings Mills there is a double-deck trestle



TYPE OF CONCRETE ARCH CULVERT MASONRY USED WHEREVER POSSIBLE IN CROSSING SMALL WATERWAYS

330 ft. long and 60 ft. above the water. Near this the hillside has been cut and a solid stone retaining wall erected. Passing through the villages of Kennedy and Silverton the company widened the entire turnpike to enable it to lay double track without going to the sides of the roadway. A large amount of money was spent to enable this road to enter the city. New routes had to be made for the city company in order to avoid severe grades and narrow streets, and a large amount of special work had to be laid to provide curves that would carry the long cars. The Rapid Railway is now handling almost exclusively the employees from a number of factories in the outlying towns. At Kings Mills are the plants of the King Powder Company and the Peters Cartridge Company, which give employment to over 1000 hands. Owing to the dangerous nature of these plants the buildings are scattered over a radius of several miles,



PILE-DRIVEN TRESTLE



SINGLE-TRACK CONSTRUCTION

and the companies insist that the employees shall live at a considerable distance from the works. This fact ensures a heavy commuter business for the road. Lebanon, seat of Warren County, is a beautiful town, and is noted for its wealth and famous men and women. Heretofore its only connection with Cincinnati has been a branch steam line affording infrequent service, and the recent formal opening of the electric road, which was witnessed by the writer, was the occasion of a sincere outburst of public favor. Lines building to the north and west from Lebanon promise to make the town an important interurban center, as they will form valuable feeders for the Rapid Railway. A line is under construction to Franklin, and will be completed in a few months. The Dayton, Lebanon & Cincinnati, a steam road, is now being equipped with electricity, while another road is projected to Dayton. A line is being projected from Lebanon to Xenia, which will connect with the Springfield & Xenia Railway, thus establishing through connection to Springfield and Columbus. The census of 1900, which is used as the basis of all calculations here, gives the population of the district tributary to the Rapid Railway as follows:

Norwood	6,480
Pleasant Ridge	953
Kennedy	209
Silverton	131
Deer Park	311
Rossmoyne	370
Terra Alta	102
Blue Ash	507
Winslow Park	193
Hazelwood	370
Brecon	441
Miltomson	210
Mason	629
King's Mills	1,653
South Lebanon	592
Lebanon	2,867
	16,018
Intermediate population	6,500
	22,518
Tributary population	5,000
Total	27,518

ROADBED AND TRACK

The construction work on all the lines follows a high standard, and all of the track through the country is laid with 70-lb. A. S. C. E. section in 30-ft. lengths. In several villages and towns a "shanghai" T-rail is used, while in towns where there is pavement a 7-in. "Trilby" has been adopted. The ties are 6 ins. x 8 ins. x 8 ft., of genuine white oak, purchased in West Virginia and Kentucky, and brought down the river in logs by the company itself. Rail-joints are of the 22-in. continuous type, and the National elastic nut track bolt is used. Bonds of the General Electric No. 0000 9-in. conceiled Wood type, with No. 0000 cross-bonds every 1000 ft., are employed. All sidings and turnouts to car houses, etc., are provided with the Lorain Steel Company's double-spring frog, which gives a continuous rail either way. The ballast on the



DOUBLE-TRACK SPAN CONSTRUCTION



SINGLE-TRACK, SIDE-POLE BRACKET CONSTRUCTION



DOUBLE-TRACK, CENTER-POLE BRACKET CONSTRUCTION (RAPID RAILWAY DIVISION)

Suburban and Rapid lines is napped blue lime stone, placed 8 ins. under the ties, filled up even with the rails and brought out beyond the ends of the ties. On the Cincinnati & Eastern



STANDARD PASSENGER CAR 46 FT. LONG

gravel ballast, 6 ins. under the ties, is used. Tracks are carefully trenched on both sides, and at all road crossings double-strength tile has been used, with dressed stone or concrete head-walls. There are a number of timber trestles, resting on concrete or stone piers, and there is one pile-driven trestle of

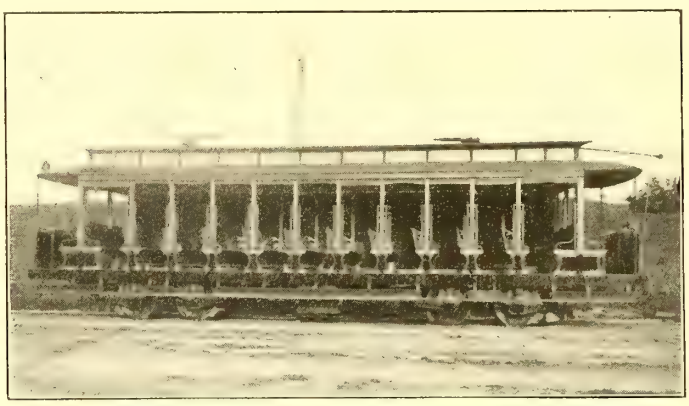


CLOSED CAR

considerable length, which is illustrated. There are a number of 8-ft. to 10-ft. brick, stone and concrete culverts, while the smaller arch culverts are all concrete. There are several girder bridges resting on blue lime stone abutments. The entire district is a rolling country cut up by streams, and some of the grades are very severe. On the Rapid Railway there is one grade of 5.83 for 650 ft. In the city there are a number of short 8 per cent and 9 per cent grades. There are a number of perfect tangents on the system; one on the Rapid Railway is 4 miles long. The private right of way, enclosed by American Steel & Wire fencing, ranges from 40 ft. to 100 ft.

OVERHEAD LINE

Several types of overhead construction have been employed, as shown in the accompanying illustrations. In the towns adjoining Cincinnati, where double track was advisable, a fancy malleable iron center pole bracket, furnished by the Craighead Engineering Company, adopted. A stretch of this type of line work is illustrated. On double-track through the country cross suspension was substituted, and an example of this class is also illustrated. The standard interurban work is all side-bracket construction, including 10-ft. 2-in. Craighead flexible brackets, cape and cone hangers and 15-in. soldered ears. The trolley wire is No. 00



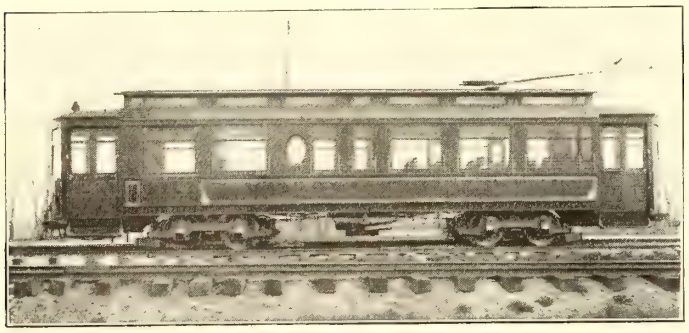
OPEN CAR



INTERIOR CLOSED CAR

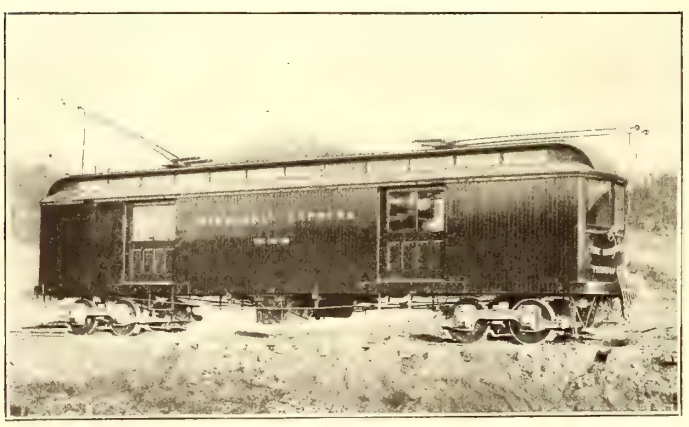
round, and to conform to the standard in Cincinnati two wires are placed 18 ins. apart. The right-hand wire is always used, as, of course, the overhead return system is not employed on the interurban roads.

The standard pole line carrying high-tension wires has three cross arms. The lowest is 18 ins. above the bracket, and has provision for telephone wires and direct-current feeders. Five feet above this is an 8-ft. cross-arm, carrying four pins for high-tension wires, two on each side of the pole. Two feet



COMBINATION CAR 46 FT. LONG

above the second arm is a 6-ft. arm carrying one high-tension pin near each end. The two arms provide for two three-phase circuits in equilateral triangular arrangement. The high-tension insulators are the Knowles 30,000-volt, glass type, which have been found very satisfactory. The high-tension wires are No. 4 hard-drawn copper for 10,000-volt transmission. The direct-current feeders are No. 0000, with the exception of 10 miles of aluminum. Poles are 35 ft. tall and spaced 100 ft. apart. On the Rapid Railway the poles are of Idaho cedar, all straight, with 8-in. tops, making a pole line that is hard to equal. All poles are being painted white with black butts. Westinghouse and Garton-Daniels lightning arresters are used on poles every half mile, being grounded to a 14-in. x 14-in. copper plate sunk 5 ft. in the ditch. All pole lines are anchored every half mile. Stromberg-Carlson iron box telephones are placed at



STANDARD FREIGHT AND EXPRESS CAR 46 FT. LONG

all turnouts for communication with the despatcher. The same company furnished the wall instruments for all stations.

SPECIAL TYPE OF CARS

The designing of cars for this system was a problem which gave the engineers no little trouble. At first glance it would seem that a road using 5-ft. 2½-in. gage could adopt a very wide car, but as a matter of fact it was necessary to go to the other extreme on account of devil strips 3½ ft. to 4 ft. wide. Curves of only 35-ft. radius necessitated unusually short trucks, and precluded the possibility of as long a car as is used by many interurban systems. The city public, which had never seen interurban cars on the streets, was considered, and it was deemed advisable to make the cars follow as closely as possible the lines and general appearance of the city cars; hence the monitor, rather than the steam, roof was adopted, and a peculiar arrangement of windows made the cars seem shorter than they really were. For the same reason the car was hung very low, thus necessitating only one step, 14 ins. above the rail. There are thirty-six cars in regular service, all furnished by the St. Louis Car Company. Twenty-six of these have smoking compartments and ten are combination passenger and express cars. They measure 46 ft. over all, 34-ft. body and 8 ft. extreme width. The framing is of the Robinson patent beam construction. The side sills are of steel, 8-in. x 2½-in. Carnegie section, weighing 18¾ lbs. to the foot. The ends of the side channels are bent with round corners, extending around to the center of end sills, joints being broken at opposite ends. All uprights, corner posts and side posts are seasoned ash. The uprights are riveted to steel channels. All longitudinal rails, top plates, ventilator rails, etc., are yellow pine without splices and faced with mahogany. The flooring is double, of ⅞-in. material, with two thicknesses of felt between, and fastened with screws. The window sashes are double, and both sections drop below the arm-rail, which is covered when not in use. Seats are of the St. Louis walk-over type with grab handles across the top. Those in the passenger compartment are finished in red plush, and those in the smoker in rattan. Pantasote curtains, Consolidated electric heaters, Stanwood steps, electric bells and brass trimmings throughout are among the accessories. The finish is dark mahogany with the customary decorations. The toilet room and water-cooler are located between the compartments. At each car house there is a filtration tank, and the coolers in the cars are filled each trip. The combination cars were made to resemble closely the passenger cars. The door takes the place of the first window, and has a glass in it the same size as the other windows; when open, the door slides back of the next window. The baggage compartments may be used as smokers if desired. There are longitudinal seats, divided in the centers and hinged at the ends, that may be swung up to the roof and hooked when not in use. The trucks are, of course, unusually wide to conform to the gage, but have only a 4-ft. wheel base. In principle they are a modication of the St. Louis No. 47. Four No. 56 Westinghouse motors are used, and these are outside hung. Cars are equipped with the Westinghouse air-brake system, Hunter fenders, and both arc and incandescent lamps of the St. Louis make. Three freight and express cars have recently been purchased, and these follow more closely the lines of interurban cars, as it was found that the anticipated public protest against large cars did not materialize. These cars have the steam type of roof and they stand rather high. They are 48 ft. over all and have no vestibules or partitions. They have two doors on each side, one 4 ft. 6 ins. and the other 6 ft. wide, and are provided with the same general equipment as the other cars, except that they are double-enders, whereas the others are all single-enders. All controllers are the K-14 type. In addition to these cars the rolling stock includes four fourteen-bench open cars for summer excursions, three work cars and a supply car. All cars are equipped for the double trolley system, one pole being positive and the other negative. Between the two poles there is a switch, so that in case the positive pole is broken while in the country the negative pole may be used as positive. There is also a switch operated by the motorman which cuts out the negative pole at the city limits and throws in the ground, after which the negative pole is hooked to the top of the car. Of course, in the country the active pole and wire are 9 ins. off center. Nuttall poles, bases, wheels and split gears are adopted as standard.

The second installment of this paper will describe the buildings erected for the operation of these lines, including terminal stations, car houses and power houses. The power system will also be described in detail.

THE HEATING OF RAILWAY MOTORS

BY S. T. DODD AND M. C. CANFIELD

An editorial in the STREET RAILWAY JOURNAL of Oct. 31, on the above subject, raises a question as to "the possible effect of specialized means of ventilation on the final temperature of railway motors and on their useful working capacity." The result of motor ventilation, as here suggested, is perhaps more important than is immediately appreciated, and it has seemed to us that it is worth while to discuss this subject somewhat at length, and state what has already been done in the way of ventilated motors, and, in this connection, indicate what the probable tendency of the development of street railway motors is apt to be.

The service capacity of a railway motor is subject to two limitations. In the first place, the maximum current and consequently the initial acceleration of the car is defined by the commutation limit of the motor. The railway motor having been originally developed almost entirely for city service, this limit has controlled its development and rating. It is due to this fact, probably, that we have adopted a standard rating of railway motors by which a motor is rated on its capacity for one-hour service, rather than on its capacity for continuous work, as is the method of rating usual with other types of electrical apparatus.

The second limitation by which we find ourselves confronted is the heating of motors due to their internal losses. This

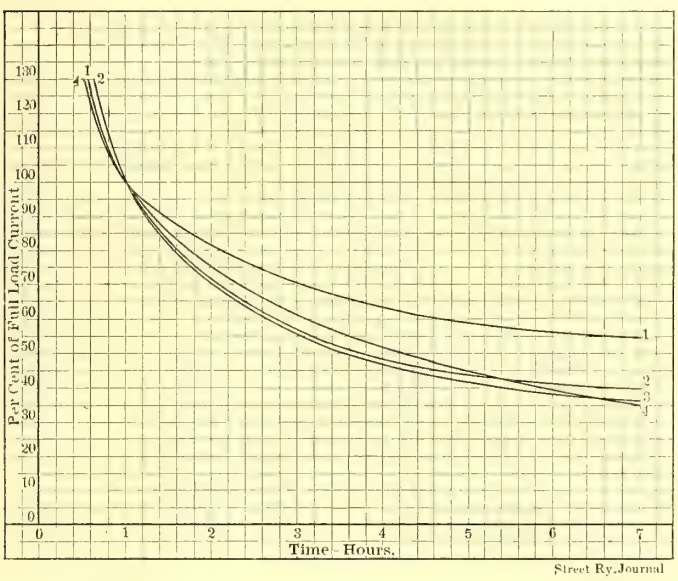


FIG. 1.—HEATING CHARACTERISTICS OF RAILWAY MOTORS

imposes a limit upon the capacity of motors which we meet with in interurban service more frequently than in city service. With stops occurring at intervals of from 1 mile to 5 miles, a little more or less initial acceleration does not have a very important effect upon the schedule, and a motor is demanded which can be called on to run for long periods of time, delivering an average amount of power, rather than one which can be called upon for abnormal efforts at intervals. As a consequence, there is a field to be covered by increasing the capacity of motors for long-time service, and we wish to indicate briefly the results which have been attained in this direction, and the development to which these results may lead.

Fig. 1 presents a set of curves which show the proportions of rated loads which various motors will carry for different periods with the same heating. There are four curves referring to four different motors, which have been put on the market by four different manufacturers. These motors are practically of the same size and commercial rating, and have been sold in competition with each other for the same service. Curves 2, 3 and 4 refer to the ordinary type of motor, with frame practically enclosed, and having more or less ventilation in the armature. Curve 1 refers to a motor built with special attention to the ventilation of the armature, the escape of heated air from the same, and the admission of cool air to the interior of the motor. The curves are based either on tests which we have made ourselves or on claims of the manufacturers published in trade circulars.

The temperature due to the full load of the motor for one hour is in each case taken as a standard, and points on the curves are determined by operating the motor at various loads for periods which will, in each case, develop the standard temperature. As a consequence, it is evident that the curves will cross at the point representing one hour at full load, and will diverge at longer periods as the different motors represented vary in their carrying capacity at these longer periods.

It will be noted on inspection that curves 2, 3 and 4 lie fairly close together, while for all times longer than one hour, Curve 1 lies uniformly above them. The percentage of difference between Curve 1 and the other curves gradually increases, until at the end of the seven-hour period Curve 1 is practically horizontal at 54 per cent, showing that the motor represented by it is capable of carrying for a long period 54 per cent of its rated current with the same rise of temperature as developed by its full load for one hour, and the relative position of the other curves shows that the motor represented by Curve 1 has attained a marked improvement in long-time capacity.

We have been accustomed so long to comparing railway motors on the basis of their heating on one-hour rating that the benefits are not immediately apparent which would be derived from increasing the long-time capacity of a railway motor, although maintaining the same hour rating, or even at the expense of decreasing the hour rating. As a consequence, it seems that it might be of interest to discuss the results which could be attained by two equipments, such as are here represented, one of which we will call the No. 1 equipment, having a long-time capacity of 54 per cent of its hour rating; the other, which we will call the No. 4 equipment, having a long-time capacity of 35 per cent of its hour rating. We will apply these equipments to one or two detailed cases.

Let us consider a 30-ton car, geared for a maximum speed of 45 m. p. h., and making one stop every 2 miles. Let us then calculate the size of equipment necessary to operate this car with motors of the No. 1 type, and also with motors of the No. 4 type. In order to arrive at a basis for calculation, we will refer to the data given in Mr. Armstrong's Institute paper, entitled "High-Speed Electric Railway Problems," presented at the meeting of June 30, 1903. Fig. 2 is a reproduction of Fig. 4 of that paper, and gives the speed and energy curves for a single car geared for various maximum speeds. Referring to the curves for 45 m. p. h., we derived the following data:

Schedule speed, two stops per mile..	33 m. p. h.
Average energy consumption per ton mile.....	85 watt-hours
Average energy consumption per ton, at 33 m. p. h.....	2.8 kw
Average energy consumption 30-ton car.....	84 kw

If we consider such a car taking an average energy of 84 kw and equipped with motors of the No. 4 type, with an average capacity of 35 per cent of their hour rating, the size of equipment for operating such a car would be 240 kw, or, making the necessary allowances for motor efficiency, approximately 258 hp. This would correspond to an equipment of four 64½-hp motors.

Let us now consider the same car equipped with four motors of the No. 1 type, which have a long-time capacity of 54 per cent of their hour rating. The rated capacity of such an equip-

ment would be 156 kw, or 168 hp, which would correspond to an equipment of four 42-hp motors.

In order to get an approximate idea of the saving effected by the use of the latter equipment, aside from the question of first cost, we can figure the weight of the equipments at 65 lbs. per horse-power. The weight of the two equipments would then be as follows:

	Pounds.
258-hp equipment	16,800
168-hp equipment	10,900
Difference in weight of equipments	5,900

This shows a saving in car weight of about 3 tons, which, if we wish to make the weight of the complete cars the same, could be devoted to greater seating capacity. When we consider that 5900 lbs. represents a weight equivalent to about forty passengers, it will be seen that the saving effected by using a motor of the No. 1 type is something which is by no means to be neglected.

Let us illustrate this point still further by comparing two

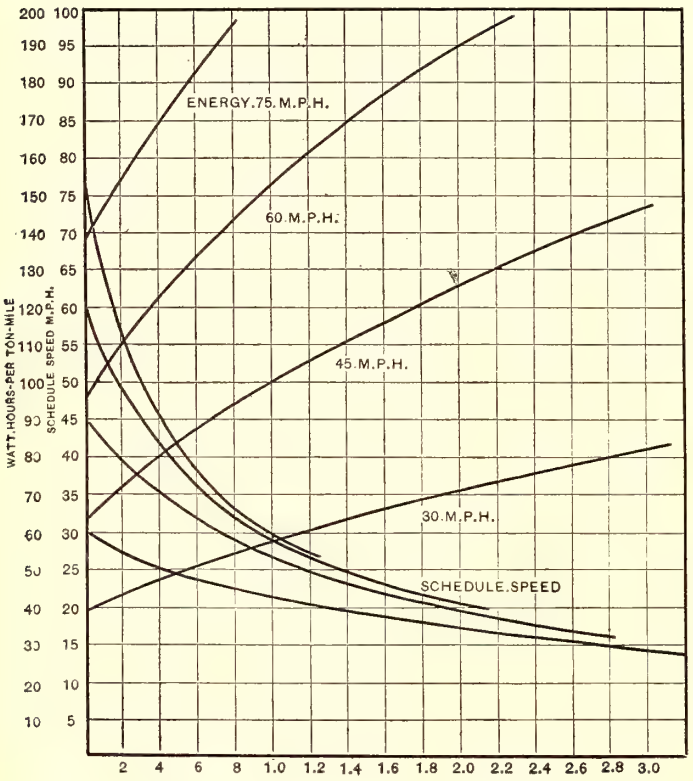


FIG. 2.—SPEED AND ENERGY CURVES

equipments of exactly the same one-hour rating. We will assume that the equipments are geared for a slow speed, such as would represent freight service, and will consider the difference in maximum load which the equipments could handle without exceeding their heating limits. Let us assume that we have two equipments, each rated at 200 hp, or 186 kw. One of these equipments is of the No. 4 type, and its average capacity is 65 kw. The other equipment is of the No. 1 type, and its average capacity is 100 kw.

Referring again to Fig. 2 we can obtain the energy consumption per ton under any particular condition by multiplying the energy per ton mile and the corresponding schedule speed as given on the energy and speed curves of this figure. With a gearing for a maximum speed of 30 m. p. h., the average consumption is about 1.2 kw per ton. Dividing the average capacities of the two equipments, as above given, by this factor, we have a maximum load capacity for the No. 4 equipment of 54 tons, and a maximum load capacity for the No. 1 equipment of 83½ tons. It appears, therefore, that under these conditions the No. 1 equipment would be capable of handling a load 50 per cent greater than the No. 4 equipment without exceeding its heating limits, provided that the two motors were of identically the same capacity upon their hour rating.

In addition to the above considerations it is evident that the No. 1 type of motor is worked nearer to its maximum efficiency than the No. 4 type. Fig. 3 represents a characteristic curve of efficiency of a railway motor. We have noted on this curve the points corresponding to 54 per cent and 35 per cent, respectively, of the maximum current input. It will be noted that the motor carrying an average of 54 per cent of its maximum load is working at a point of efficiency on the curve several per cent higher than the motor carrying 35 per cent of its maximum load. As a matter of fact, the difference is even greater than this, for when running at full speed on a level track, the current consumption is a good deal less than the average on which we have based our calculations, and, as a consequence, when running at full speed, the type No. 4 motor would be working low down upon the efficiency curve, while the No. 1 type would be working well up toward the knee. What the exact difference would be could be determined only in particular cases, but it is evident that a considerable economy will be effected by working an equipment at a high fraction of its full load.

The discussion above has purposely been made very general. We have not taken into account such detail questions as the reduced weight per horse-power of the ventilated motor, nor the difference in repair account, nor the increased life of arma-

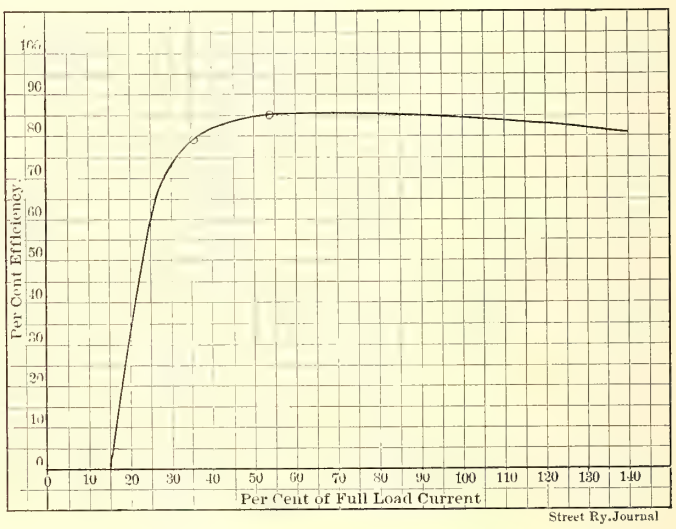


FIG. 3.—EFFICIENCY CURVE OF RAILWAY MOTOR

ture and field coils, which would be incident to the use of the cooler running type of motor; nor have we discussed the decreased acceleration incident upon heavier loads applied to a small motor. These are details which would have to be made the subject of a more particular discussion.

With regard to the further question of danger from dust or moisture, it is a fact that in all modern motors provision is made for the escape, outside of the motor casing, of grease and oil from the bearings. This very fact renders the motors liable to the admission of dust at their most sensitive point, viz., directly to the bearings, so that if any damage was to be anticipated from dust entering a ventilated motor, we are already liable to that danger in every type of modern motor. Modern insulation is to a great extent waterproof, and the danger to be anticipated from moisture on a ventilated motor of this type can be determined only from experience. We can say that we do know that motors here referred to as the No. 1 type have been in operation through the snow and slush of winter and through the dust and rain of summer, and no trouble has yet been experienced which could be attributed to this source.

The point to which we wish particularly to call attention in this article is that while the limits are rather narrow within

which improvements can be made, we do not believe that the street railway motor has yet reached the final phase of its development. If results, as sketched in this article, can be attained by merely opening up the interior of the motor and permitting some access of cool air to it, what are we going to be able to attain by careful attention to this point in the design and by proper porportioning of core losses and copper losses with a view to the increased ventilation? In particular, is it not going to pay to at least experiment with the forced ventilation of our motors? Nearly all our most efficient forms of motive apparatus use some sort of artificial cooling. Our most efficient steam engines are equipped with condensers, and are water-jacketed in guides and bearings. Our gasolene engines make use of water-jackets and cooling devices. Shall we not find that the final type of street railway equipment will include some method of artificial cooling of the interior of the motor, and that, thereby, we can lessen the weight and cost of electrical details, allowing more room for bearings, gears and other mechanical parts, while at the same time we can increase the ratio of paying tonnage to dead weight of our car equipments?

INTERVIEW WITH CHARLES T. YERKES ON HIS LONDON PLANS

Charles T. Yerkes, who is now here from Europe on his annual visit, consented, at the invitation of the STREET RAILWAY JOURNAL, to furnish this paper some interesting and exclusive details regarding his London plans. These will involve the control of some 140 miles of underground and surface track, and the expenditure of at least $85,000,000, about half of which will be American capital. Mr. Yerkes when interviewed at his office, 54 Wall Street, said: "The Underground Electric Railways Company, Ltd., of London, whose capital is £5,000,000, half of which is paid up, is converting the Metropolitan District Railway from steam to electric motive power. It is also building the Baker Street & Waterloo Railway, which is a double line operating from the Waterloo station of the London & South-Western Railway, thence under the River Thames to the Victoria Embankment, where it has an interchange station with the District Railway, thence to Trafalgar Square, then on to Piccadilly Circus, under Regent Street—the great shopping center—to Regent Park, terminating near the Baker Street station of the Metropolitan Railway Company. This system was purchased from the London & Globe Finance Corporation when the latter got into financial difficulties some eighteen months ago. It was bought for 25 per cent of the amount that had been expended on the part completed, which was about two-thirds of the road. We are going to extend the lines at both ends. From Waterloo we will construct the line on to the Elephant and Castle, and from Baker Street we will build on to Paddington, the London terminus of the Great Western Railway.

"The Great Northern, Piccadilly & Brompton Railway, which runs from Finsbury Park to Earl's Court, has also been acquired. This line goes through by way of Tottenham Court Road and Piccadilly. The Charing Cross, Euston & Hampstead Railway is another road which will be controlled by the company. It will be a double line, running from the Charing Cross station of the South-Eastern Railway to the Euston station of the London & North-Western Railway, thence to Camden Road, at which place it will divide, one line proceeding to Hampstead and Golders' Green, and the other line going to the Kentish Town station of the Midland Railway Company, and then on to Highgate. The underground company will include in its system the surface lines of the London United Tramways, which start from Shepherd's Bush and Hammersmith, and run to Hampton Court and Southall. A franchise, permitting of the building of a surface road between Golder's Green and Edgeware, is also the property of the underground company.

"For the purpose of operating the whole system a power station, which was illustrated in the STREET RAILWAY JOURNAL for July 18, 1903, is under construction at Chelsea Creek, London, Southwest, and will be the largest plant hitherto built in the world for the generation of current for electric railway use. The plant, which will cost upwards of $6,000,000, will occupy four acres. It will have a water front of 1100 ft. on the River Thames and Chelsea Creek. On Lots Road, Chelsea, 860 ft. will be the frontage. The power house itself will be 453 ft. long and 175 ft. wide. The office building will be 81 ft. in length and 25 ft. in width. German and Belgian steel is being used in its construction. The initial capacity of the plant will be 75,000 hp. The British-Westinghouse Electric & Manufacturing Company, Ltd., secured the contract for the steam and electrical equipment.

"There will be ten Westinghouse-Parsons turbines of 7500-hp capacity each. The generators, also of Westinghouse build, will be of three-phase type, wound for 11,000 volts, 33 1-3 cycles. The normal rating of each generator will be 5500 kw, but they will carry an overload of 50 per cent for two hours at practically the same steam consumption per kilowatt-hour. The plant is designed with a view to increasing the capacity by one-half. The boiler equipment, in the first instance, will consist of 84 units, of 520-hp capacity each.

"Within the building over the boilers storage has been provided for 15,000 tons of coal. Two unloading machines, worked from bridges which span a large tidal basin, will discharge the coal from the barges. The capacity of each of these machines will be 60 tons per hour. The contract has been undertaken by the John A. Mead Manufacturing Company, of New York. The chimneys for the power plant will be four in number, each 17 ft. internal diameter and 275 ft. high. The contract was awarded to the Alphons Custodis Chimney Construction Company. The District Railway will consume 50 per cent of the power generated in the Chelsea plant, while the Baker Street and Waterloo line will require 10 per cent. These two roads we anticipate having ready for active operation about the latter part of next year, at which time the necessary power will be ready to deliver.

"The Underground Company has an agreement with the District Company whereby securities and some cash—but mostly securities—have been accepted as payment for the changing of the system from steam to electricity. Since we have commenced work the value of these securities has increased from 40 per cent to 50 per cent. We are doing this work without profit, charging the District Company net cost, payable in securities at market price. Our whole profit lies in the increase in value of these securities. The District road will be entirely changed, and very little left except the tunnel itself. All the tunnel walls along the route will be whitened."

Regarding the rolling stock, Mr. Yerkes said: "The question of cars has been given a great deal of consideration. We have gone into the matter very fully for the last two years, and have conducted many experiments. Fourteen sample cars have been built, and are now running on our Ealing-Harrow line. This line, which is operated by power generated at a temporary station at Alperton, is 5 miles long, all double track. Two trains of seven cars are employed on the road. One of these trains is equipped with the British Thomson-Houston system of multiple control, and the other with the Westinghouse system. Each car has motors aggregating 500 hp. These trials have been going on for the last twelve months, and I expect to decide as to which system will be adopted before I return to Europe next month. We shall require 480 cars. Each will seat fifty-two passengers. The trucks will be made of iron and the body will be built of non-inflammable wood and aluminum. The part of the car containing the motor will be

steel cased. Nothing will be in the tunnels that is liable to catch fire.

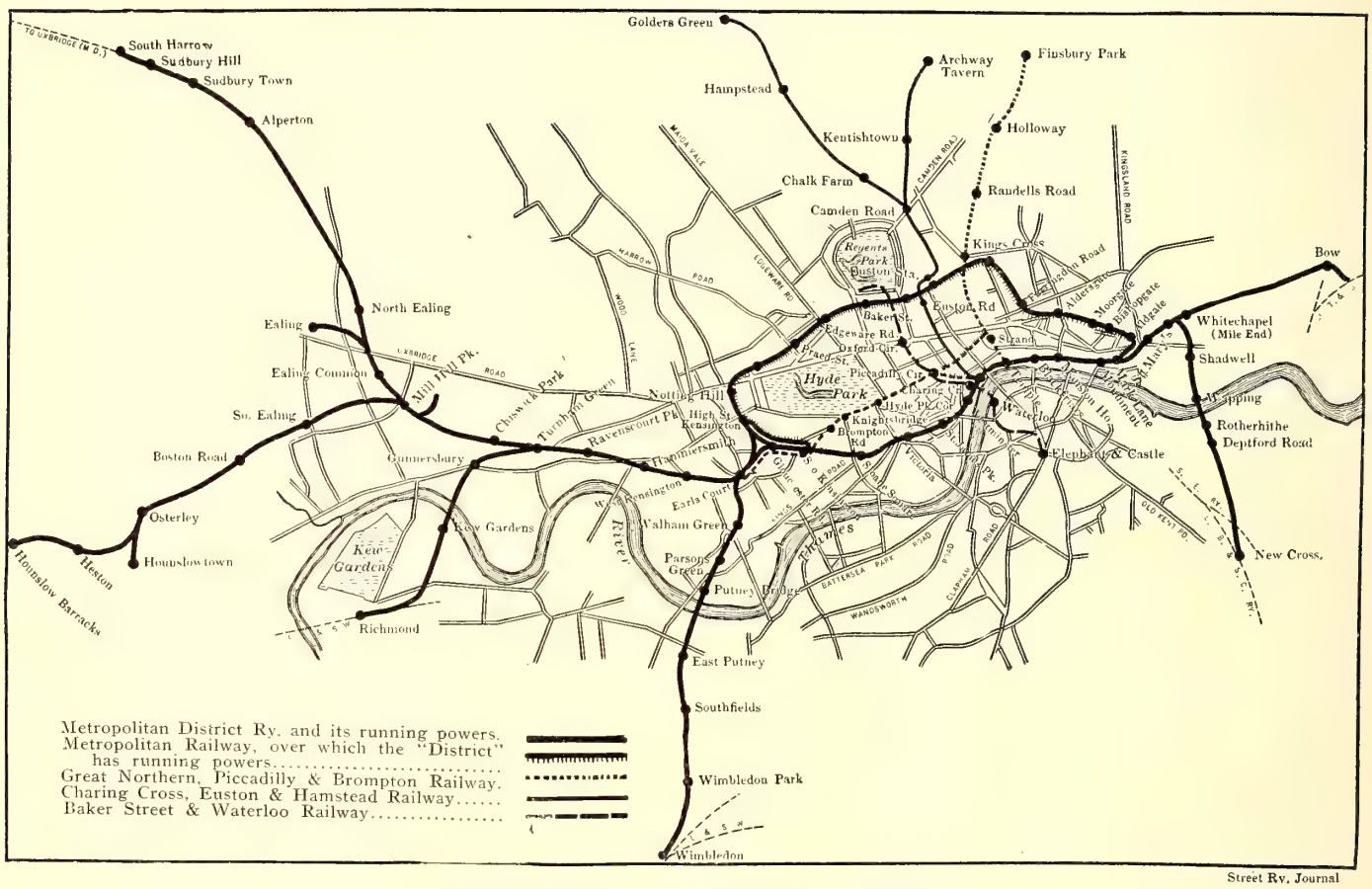
"We have found that the great danger of all electric operation is the creation of an arc. If an arc is once formed nothing can resist it. The only thing we can do is to have material in proximity to it that will not burn. Metals will take fire from an arc as quickly as wood. Therefore, the proper thing to do is to have your material of such a character that it will not smoke or continue to burn after the arc is destroyed. During our experiments with cars at our testing plant at Harrow, we did our best to burn up a car. We built fires beneath it and also inside of it, with the result that the car was not burned and very little damage done to it. Of course, we took the chance of losing a car, but while we were about it we preferred to make a practical test. The plan of the car which we have adopted is even an improvement over the ones just spoken of."

In reply to the question as to the prospects for financial success attending the operation of the various lines to be operated by the underground, Mr. Yerkes, said:

"We don't care to guess for the public what kind of business we are going to do. I know, however, that in and around London there are 8,000,000 people, with very meager facilities for transportation. When you know this, it is not worth while to surmise. In a business we always have to take chances, but I believe that this is the best chance I ever took.

"It is our intention to charge a single fare of 2 pence on the different tube lines from one end to the other. On the District line 2 pence will be the popular fare, but the line will be divided into 'zones,' the present rate of the District Railway being based upon the mileage the passenger travels. We believe the introduction of the American system of a one-fare rate will tend to build up the lines and make them much more popular."

Though the Underground Electric Railways Company, Ltd., is incorporated under the British Limited Liabilities Act, there are seven American directors on the board. Charles T. Yerkes is chairman of the company. The other American directors are: James A. Blair, of the New York banking house of Blair & Company; T. Jefferson Coolidge, Jr., president of the Old Colony Trust Company, of Boston; James H. Hyde, of the Equitable Life Assurance Society of New York; James Speyer, of the New York banking house of Speyer & Company; Robert H. McCurdy, of the Mutual Life Insurance Company, of New York, and L. F. Loree, president of the Baltimore & Ohio Railroad. The British members of the directorate are William Abbott, of London; Frank Dawes, of the law firm of Bircham & Company, of London; Lord Farrer, director of the Midland Railway Company; Charles Ainsworth Spofford, of London; Edgar Speyer, of the London banking house of Speyer Brothers, and Charles James Cater Scott, chairman of the London & India Docks Company. Jonkheer Henry Teixeira de Mattos, of Teixeira de Mattos, of Amsterdam, is also a director.



YERKES SYSTEM OF UNDERGROUND ROADS

CARS FOR THE SUBWAY

The mechanical department of the Interborough Rapid Transit Company of New York has been kept busily engaged during the last few weeks in testing the cars built for the subway, which are now being received from the manufacturers. At present more than 200 of these new cars are in the yards and shops of the Interborough Company, and between seventy and eighty are daily pressed into service on the East Side elevated lines, where they are in regular service. The company is taking this means of testing the equipments thoroughly and getting the stiffness out of them before the opening of the subway. It also affords an excellent opportunity to enable the motormen to become familiar with them. The Manhattan division has been short of cars, and the opportunity to try-out the subway equipments, pending the arrival of new coaches for the elevated, was welcomed by the management.

CHICAGO STREET RAILWAY STRIKE

As announced last week, the conductors, motormen and gripmen on the lines of the Chicago City Railway Company went on a strike, and since that time cars have been operated on the South Side system only under great difficulty, the union men and their sympathizers obstructing the movement of the cars as much as possible and preventing, by intimidation, all patronage of such cars as were operated. Mail cars were operated regularly through the week, the union offering to furnish men if necessary to do this, in order that no excuse might be afforded for an appeal to the Federal authorities for protection. Where the company endeavored to follow up the mail cars by regular passenger coaches, however, difficulties were met with at every step; the streets were obstructed by teamsters, and the police seemed powerless to keep the lines open. Piles of stone, timber and iron were placed on the car tracks at regular intervals, delaying the movement of the cars until these obstructions were removed. Crowds lined the streets on which the company attempted to operate its cars, and, as is usual in such cases, the lawless element asserted itself. In many instances, bricks and paving stones were hurled at the cars, and in two or three cases showers of missiles were thrown upon passing cars from the tops of tall buildings, in some cases crashing through the roof of the coach and often injuring the employees. On Thursday morning, Mayor Harrison published a strike proclamation, in which he warned the people not to congregate upon the



"WHO THREW THAT BRICK?"



A FAVORITE METHOD OF OBSTRUCTION



TYPICAL SCENE AT CLARK AND VAN BUREN STREETS

streets, especially along the railway. This, however, had no appreciable effect, and the entire day was marked by stormy scenes between the strike sympathizers and the employees in charge of cars. Toward the end of the week the company succeeded in maintaining regular service upon the Wentworth Avenue electric line, which runs down Clark Street from Twelfth Street. But this section soon became a storm center, as is clearly shown by the views herewith presented. At the corner of Van Buren Street and Clark Street a great deal of trouble was experienced, because of the peculiar physical conditions. The Union Traction Company operates a cross-town line on Van Buren Street which is one of the busiest down-town outlets for the West Side lines, and all the Wentworth Avenue cars pass this intersection. The union loop for the elevated service is also on this street, and the supports for the structure occupy considerable space in the roadway, so that there is always a great deal of confusion at this point. The strikers took advantage of this favorable opportunity for hampering the operation of the Chicago City Railway Company's cars on the lines running north and south, and they succeeded in keeping that portion of the system constantly in confusion.



SCENE AT MADISON AND CLARK STREETS

On Friday night the company had succeeded in operating regularly twenty-five cars over the electric lines turning into Clark Street, but a new complication arose at this time through a sympathetic strike being declared by the firemen. Their places were filled, however, after considerable difficulty, but on Saturday night the announcement was made that the engineers had followed the firemen, and that the teamsters, who had been relied upon for hauling the coal to the power plants, had announced that they would cut off the supply of fuel if it were to be handled at the stations by non-union labor.

Although the labor leaders had announced, with considerable flourish of trumpets, that the present controversy would be carried on without disturbance or violence of any kind, the actual conditions show a complete disregard for authority. Several cases were reported where members of the Union in the preliminary meetings on the day the strike was declared, opposed the policy of ordering an immediate walk-out, and they were denounced as spies and maltreated by their companions. Pickets were stationed at all of the car houses and power stations as well as at frequent points along the lines, and efforts made to prevent non-union men from accepting service from the company. In several instances, where the men persisted in staying at their posts they were assaulted, and in some cases very seriously injured.

At the beginning of the trouble the Mayor gave instructions that the police were not to assist in the operation of the cars in any way, but they were to be entirely neutral, merely maintaining order along the lines and in the vicinity of the company's property. It soon became apparent, however, that this was impracticable, and the indignation which was manifested on all sides resulted in a modification of this policy, so that by the end of the week the cars were operated under strong police protection. This, of course, greatly incensed the strikers, and lead to several demonstrations. At the Council meeting on Monday the Mayor was denounced bitterly by the union supporters because of the protection afforded the company by the police, but the legal department has since supported the position of the administration in placing policemen on the cars and taking such other steps as were deemed necessary for the safety of patrons of the company. It is significant that the City Council passed a resolution endorsing the action of the Mayor in taking such strenuous measures to prevent mob violence.

About twenty-five Wentworth Avenue electric cars were run



GUARDING THE MOTORMAN AND CONDUCTOR

on a five-minute schedule Monday despite the strikers. There was only one serious blockade, which lasted half an hour, and was caused chiefly by the peculiar operation of a Union Traction car at Van Buren Street. Teamsters took part in the blockade. Three thousand persons gathered and were dispersed. Several small attempts at wrecking were reported, and a few torpedoes snapped harmlessly under the wheels of the first car north at West Thirty-Ninth Street. One southbound car was turned into West Thirty-Ninth Street by a spiked switch. A heavy tile crashed to the sidewalk from the roof of the new post office while a car was passing. Policemen formed the majority of passengers on all the cars, and curious crowds watched the movement of cars down-town in silence.

One hundred and fifty men, including repair men, linemen and dynamo men, struck on Monday, and they were followed on Tuesday by the machinists.

Owing to the rioting and intimidation resorted to the company has offered a reward of $100 for the arrest and conviction of any one participating in these outrages.

Six hundred Pinkerton specials have been pressed into service to patrol the electric lines and guard against tampering with the overhead construction.

Five cable trains, each consisting of a grip car and "trailer," were operated on Cottage Grove Avenue under a guard of 1000 policemen on Tuesday. Twenty-five cars were operated on the Wentworth Avenue line under police protection, and arrangements were made to open other lines.

Chief of Police O'Neill instructed his subordinates to board United States mail wagons if the drivers showed a disposition to blockade street car tracks or hinder the police in their efforts to keep the streets clear. The drivers in such cases are to be arrested after the mail is delivered at the post office.

As usual, all sorts of hold-ups are resorted to by those who hope to profit by the strike. The executive board of the Street Railway Men's Union decided to proceed against the Chicago City Railway in the courts to compel the company to provide vestibules for all its cars according to a law passed during the last session of the Legislature.

Another move was made when George F. Harding, Jr., in a bill, filed before Judge Holdom, asked that a receiver be appointed immediately for the Chicago City Railway, and that the



RESERVES AT DANGER POINTS

receiver proceed at once to operate the road under the old agreement with the strikers, or settle present troubles by arbitration. Mr. Harding, in making the application, alleges that the railway has been operating since last June without a franchise, and makes this allegation the basis of his application.

A conference was held on Tuesday between Mayor Harrison, the officials of the company, and the special Aldermanic Peace Commission appointed by Mayor Harrison at the direction of the City Council. This was followed by another meeting in which President Mahon of the Amalgamated Association of Street Railroad Employees and his legal advisers took part. Mayor Harrison declared that the outlook for a settlement of the strike by arbitration was decidedly flattering.

A noteworthy feature of the situation is the fact that both the firemen and the engineers were under contract with the company not to engage in any sympathetic strike. Their unions are entirely independent of the Amalgamated Association, and as they had no grievance against the management it was assumed that they would continue in the discharge of their duties, the firemen particularly, as their agreement for the coming year had only been signed during the last week. The announcement that both of these labor organizations had repudiated their contracts and violated their pledges to the management in order to assist the motormen and conductors was received in a very different spirit by the strikers and the general public, the former hailing this acquisition to their



A UNION ARGUMENT

forces as a very substantial victory, while the public naturally looked with contempt and scorn upon the organization that could resort to such methods.

The attitude of the company remains exactly the same as it was at the beginning. The management will continue to operate its cars, or such portion of them as may be possible, with the assistance of non-union men, but, of course, the service will be inadequate until the strike is broken. This the officers say will undoubtedly be the ultimate result, as the company cannot possibly make the concessions which the men demand.

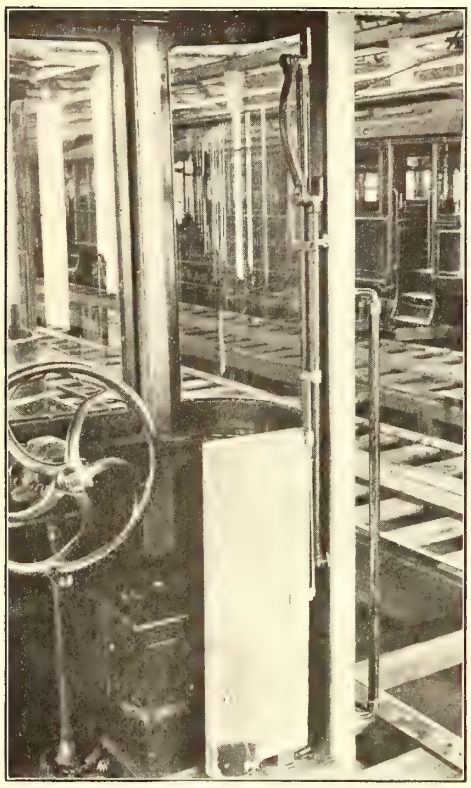
As might have been expected, the present difficulties have been seized upon by the politicians for currying favor with that element of the laboring class which is dominated by union influence, and they are threatening to institute an active campaign for municipal ownership. One result of this movement was the action taken by the Federation of Labor, which has been active during the last week in inciting demonstrations against the company with a view to preventing the adoption of the franchise extension ordinance now before the Council committee. In spite of these facts, however, the company expresses its determination to resist every encroachment upon its rights, and thus far it has consistently maintained its position.

The announcement was made, unauthoritatively, on Friday night, that the State militia would be pressed into service to supplement the efforts of the police in maintaining order. Protest was immediately filed by the strikers with Governor Yates, and at the same time it was declared that the North Side and West Side lines would be tied up by a sympathetic strike if this policy was followed.

The illustrations accompanying this article are reproduced from photographs used through courtesy of the "Chicago Tribune."

PLATFORM GATE AND TRAP DOOR

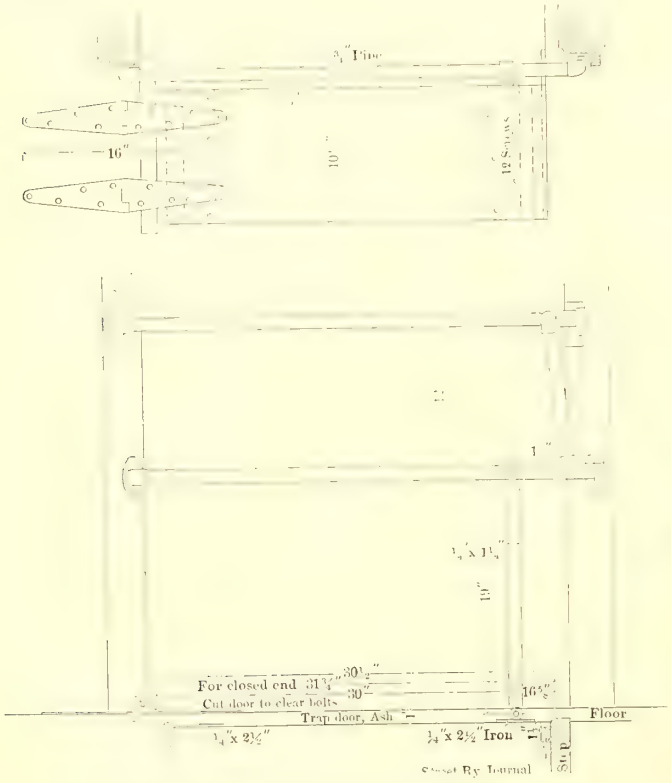
To prevent passengers from alighting from cars on the wrong side and thereby protect them from the danger of being struck by a passing car, the mechanical department of the Pacific Electric Railway Company, of Los Angeles, has designed a combination gate and trap door, the construction of which is shown in the accompanying cuts. The contrivance is now in use on all of the company's Long Beach cars, and is very inexpensive.



GATE FOLDED BACK AND TRAP DOOR RAISED



GATE CLOSED, WITH TRAP DOOR DOWN



DETAILS OF TRAP DOOR FOR STEPS

William Jennings, mechanical superintendent, who, with Joseph McMillan, assistant to General Manager Randolph, is credited with the invention, states that the gate has been in satisfactory operation for several months. The device is not patented. Even a cursory examination of the accompanying illustrations will show that it is of simple construction, takes up very little space and presents a neat appearance.

The gate is made of two pieces of ¾-in. pipe, one end of which is screwed into a brass casting that is secured to the door-post and acts as a hinge. The other ends are screwed to brass castings that rest in brackets when the gate and trap-door are closed.

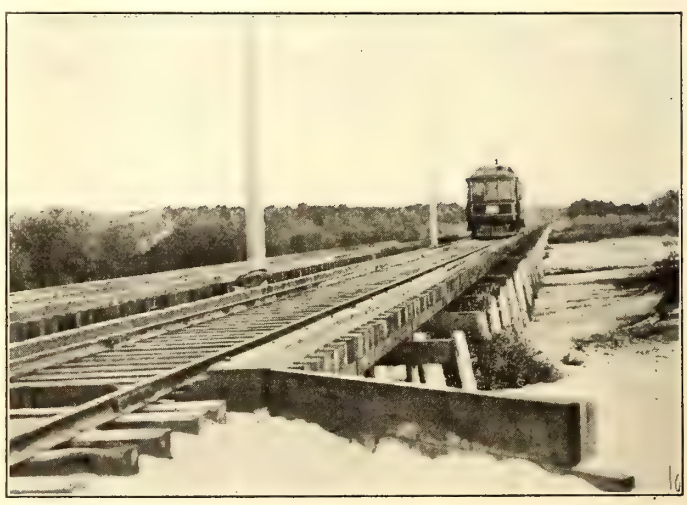
The lower pipe of the gate is secured to a trop-door by a wrought-iron strap. When the gate is raised to a vertical position and folded back to the door-post, the trap-door, by the same movement, is brought to an upright position.

Original experiments were made with the gate alone, for the trap-door was entirely an after-thought. Without it, however, the use of the gate was found to be fraught with some danger, because it left an opening in the floor of the vestibule next to the gate into which people would accidentally stumble. This led to adding the trap-door, which proved profitable, because it increased the vestibule's standing room by two passengers. The trap-door is made of ash.

To equip a car with four of these contrivances costs only $40, approximately. All the work, even to the manufacture of the parts, is done in the shops of the Pacific Electric Railway Company. The cars on all the interurban lines of the company are to be so equipped.

NEW CALIFORNIA LINE OPENED

Another interurban line of the Pacific Electric Railway Company has been opened out of Los Angeles. It runs off east through a beautiful stretch of semi-tropical country to the little town of Whittier, distant 17.38 miles. The line was opened for regular traffic on Nov. 7. Half-hourly service is maintained most of the day (hourly when midday dullness obtains), with



CAR CROSSING 1300-FT. BRIDGE ACROSS SAN GABRIEL RIVER

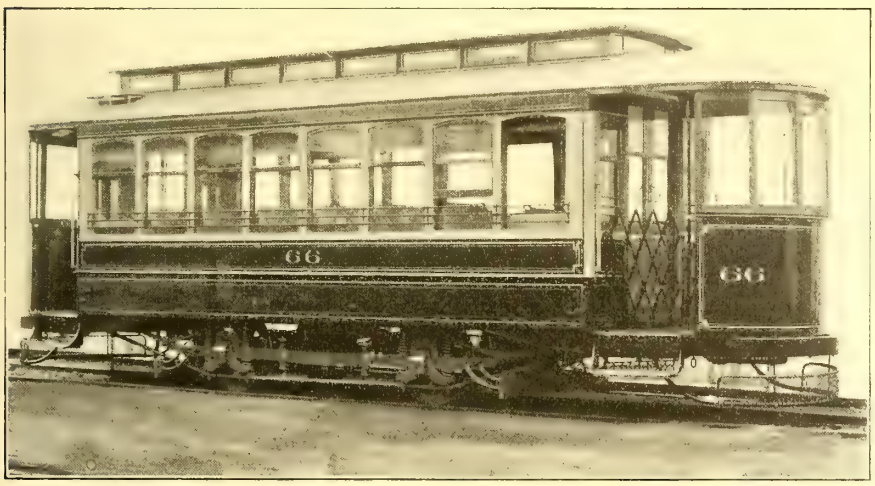
the last car leaving the city of Los Angeles at 11:30 p. m.

When completed the Whittier line will be the equal of any of the other Huntington lines out of Los Angeles, having broad-gage, ballasted, oil-sprinkled tracks, and using exclusively the type of car shown in the accompanying illustration. The difficulty in obtaining steel rails has made it impossible to open the line double-tracked all the way to Whittier, but the grading is completed for the purpose and the poles equipped for overhead work. A few weeks more will see this line a rival of the famous Long Beach line of the Pacific Electric Railway Company.

The new line, outside of incorporated towns and cities, is over a private right of way. The country traversed is rich with freight, and the company is preparing to handle all it can get.

SEMI-CONVERTIBLE CARS FOR ATLANTA, GA.

Ten semi-convertible cars have just been completed for the Georgia Railway & Electric Company, of Atlanta, Ga., by the J. G. Brill Company. Ten 28-ft. cars of this type were built for this railway company last year. The new cars have an unusual and interesting feature, namely, the lower side panels are made to serve as sill plates. These plates are composed of ¼-in. x 18-in. steel, bent around the corner posts and brought to the door posts. This feature is the railway company's idea, and besides stiffening the sides and giving longitudinal strength, provides a guard for the prevention of injury to the car by collision with vehicles. The cars have straight sides, but on account of the guard rail and the division of upper and lower panels in the usual style of curved side cars, an appearance of curved sides is given. The sides are unusually low, bringing the top of the window sills 24 ins. from the floor. The windows are stored in roof pockets in the usual method of this type of car. The runways for the window trunnions are entirely of metal, precluding all possibility of sticking. Three-bar window guards extend from corner post to corner post for protection of passengers' arms. The illustration shows the corner window in roof pocket, and the next window raised part way. The ability to raise the window but a small distance is one of the advantages claimed for the car over the wall window pocket systems. The seats are placed transversely to the car, and the corner seats longitudinally. The total seating capacity is thirty-two. The seats are upholstered in spring cane and are of the "walk-over" type. Interiors of the cars are finished in natural cherry, with decorated birch ceilings. Light, portable vestibules are provided for the platforms, and folding gates at the entrances, which are arranged to close against the corner posts.



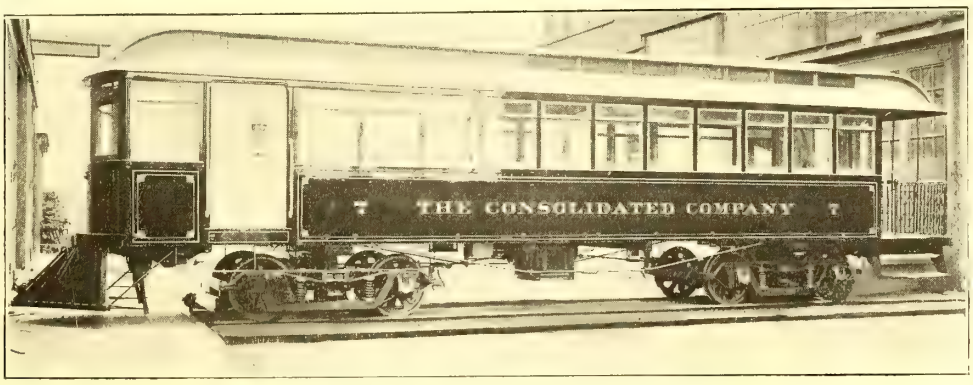
NEW CAR FOR ATLANTA

The general dimensions of the cars are as follows: Length over end panels, 20 ft. 8 ins.; over crown pieces, 30 ft. 8 ins.; from panel over crown pieces, 5 ft.; width over sills, 7 ft. 10½ ins., and over posts at belt, 7 ft. 11 ins.; height from bottom of sills over roof boards, 8 ft. 11 ins. The side sills are 3¾ ins. x 7¾ ins., and the end sills, 3½ ins. x 7¾ ins.; thickness of corner posts, 3¾ ins., and of side posts, 3 ins. Cars are furnished with angle-iron bumpers, ratchet brake handles, folding gates and other specialties.

NEW CARS FOR CAMBRIDGE, OHIO

The American Car Company, of St. Louis, has lately built two fine combination passenger and baggage cars for the Consolidated Company, of Cambridge, Ohio. The cars have a number of interesting features. They are intended to run in but one direction, and are, therefore, provided with a cow-catcher at the forward end, and the controlling appliances are located in the baggage compartment. The rear platform is of the Detroit type, with grill work gates and enclosure. The seating of the passenger compartment is arranged transversely to the car and accommodates thirty-six passengers. The seats have reversible backs, and are 36 ins. long, leaving the aisle 21 ins. wide. The rear seats are stationary, and have hard-wood paneled backs. They are located 2 ft. 9 ins. from the rear end of the car. The windows are composed of two sashes, the upper being stationary and the lower arranged to drop into wall pockets, which have hinged covers. A hard-wood partition with glass in the upper part separates the compartments. Folding seats are provided in the baggage compartment for the use of smokers. The interiors are finished in cherry, of natural color, with ceilings of the same. A sliding door is provided at either side of the baggage compartment. This compartment is 10 ft. 8 ins. long.

The length of the car over crown pieces is 44 ft. 1½ ins., from panel over crown piece at rear end, 5 ft. 7½ ins.; width over sills, 8ft. 6½ ins.; over post at belt, 8 ft. 7½ ins.; from center to center of posts, 2 ft. 9 ins. The cars are equipped with sand-boxes, angle-iron bumpers, gongs and vertical ratchet brake wheels of the Brill manufacture. The trucks are the American Car Company's M. C. B. No. 14-B, with wheel base of 6 ft., 33-in. wheels, and are to be equipped with 50-hp motors.



THE CAMBRIDGE COMBINATION CAR

FINANCIAL INTELLIGENCE

Wall Street, November 18, 1903.

The Money Market

The tension in the money market has subsided materially during the past week. Two causes have combined to bring about this favorable result, one the import of several millions of gold from London, the other the slackening of currency transfers to the interior. While these have been the more conspicuous influences at work, the decrease in loans which has been extremely heavy during the last fortnight, must also be taken into account. This loan contraction has been brought about by the shifting of credits from the local banks to the trust companies and other outside lenders who have been attracted by the high premiums offered for the use of money. Actually, therefore, if it were possible to discover the grand total of the market's outstanding credits, it would probably be found that there has been no very great decrease. But, inasmuch as money rates are always fixed more by the Clearing-House reserve than by any other criterion, and, inasmuch as this surplus has been benefited by the shifting process just described, the operation may be said to have contributed toward the decline in money quotations. In consequence of a further reduction of over $10,000,000 reported in the bank statement last Saturday, the Clearing-House members were able to record a small increase in their surplus reserve in spite of a $3,000,000 loss in cash. Whether or not the sudden falling off in the interior currency movement means that these demands are pretty near over for the season, the best opinion is that the autumn drain to the West and South has passed its maximum, and that from now on the losses to the banks on this account will be comparatively small. A sharp recovery in exchange at the principal interior cities seems to confirm this judgment of the situation. If the market is to feel no longer the strain of domestic requirements, the chances are that no further large amounts of gold will be drawn from Europe. The gold already shipped from London is already enough to afford a considerable help to local cash holdings for the next two bank statements at least. The sharp upturn in sterling exchange during the last few days may be taken as reflecting the belief that the specie importations are over for the time being. While call money on the stock exchange continues to rule around 5 per cent, a noteworthy concession has been made in time money, the rates on all classes of business having fallen during the week from 6 per cent to 5½ per cent. According to the view now held in banking circles, the present rates are not likely to be exceeded during the remainder of the season, and when the first of January settlements are completed most bankers agree that we shall run into a really easy market.

The Stock Market

The stock market of the week has furnished a curious mixture of powerful bear manipulation, directed against a number of the leading railroad stocks and some rather remarkable bull operations in a few other quarters of the market, notably among the local street railway issues. A general reluctance to buy is still manifest. It undoubtedly represents the fear which has presented itself to most men's minds that no considerable improvement can be expected in prices while the business of the country is on the down grade. Admitting that the decrease in trade activity with its accompanying effect upon the earnings of the railroads and manufacturing enterprises has already been pretty liberally discounted, the doubt is still strongly suggested that stocks cannot go up very much, even if they do not go down, until the extent of the industrial reaction becomes better defined. Investors seem, accordingly, to have taken the ground that there need be no hurry about making their purchases, and this sentiment, translated into a market factor, implies a lack of what is commonly known as "buying power." The conviction that no serious resistance will be offered while this inertia lasts is the chief encouragement given bearish speculators in making their depredations. Naturally the favorite objects of attack are the stocks like Pennsylvania and the Steels, where the supply is particularly large, and where there is no particular concentration of holdings. In the decline in Pennsylvania shares, which has been the real feature of the week, these technical conditions have undoubtedly had far more to do with the movement than have considerations regarding the actual merit of the stock. On the other hand, among the western railroad shares, and among other issues which enjoy a more or less organized support, the bear attack has so far accomplished very little. A fair analysis of the general situation would appear to be that a part of the list is still vulnerable, and will probably have to go lower, while in other parts the possibilities of decline are pretty well exhausted.

The strength of the local traction stocks has continued to be by all odds the most impressive feature on the long side of the week's market. Extravagant stories persist in going the rounds, to the effect that some big merger deal is impending, but so far this seems to be a pure invention of the speculators' imagination. The logical reason why the traction shares should be selected as the first to rebel against the general Wall Street pessimism, is the one which these articles have already pointed out, namely, that the prospect of a reaction in general business is far less of a deterrent to purchases of New York traction properties than to buying of any other class of securities. The Street seems to be just waking up to a proper appreciation of the wide extent which shares like Manhattan and Metropolitan have passed into investors' strong boxes during the recent decline. It has been a comparatively easy matter for a coterie of speculators who have perceived the strength in the market position of the stocks to get control of their limited floating supply and bid them up sharply. Similar conditions, although somewhat less pronounced, are an equally satisfactory reason for the advance in Brooklyn Rapid Transit.

Philadelphia

Scarcely anything of note has happened among the Philadelphia traction securities during the week. Considering the pressure upon other quarters of the market this group has held very well, and its action has certainly encouraged the idea that liquidation has run its course. Prices, however, have done little more than hold their position of a week ago. Philadelphia Company common has, as usual, been more active than the rest, selling down from 36 to 35¼, and recovering to 36. The preferred, which sold last week at 42, rallied a point to 43. Philadelphia Traction has been steady at 95, and so has Union Traction, between 44 and 43¾. Fairmount Park Transportation, after selling at 19 for an odd lot, dropped to 18 on the sale of 100 shares. Fractional transactions were reported in Philadelphia Rapid Transit at 12, American Railways at 42⅝, Chicago Union Traction at 5½ for the common and 30 for the preferred.

Chicago

The strike on the City Railway has caused some liquidation of the stock, which has sold off from 166 to 164. Union Traction has also weakened, with sales of the common at 5½, and the preferred at 28½, and later at 29¼. An official of the latter company says that he does not believe the road will be taken out of the hands of the receivers until the ninety-nine-year franchise act has been finally disposed of in court, and this he says may be a matter of some years. Many improvements are contemplated in the service of the system, provided the Eastern interests can be persuaded to put up the money. A single sale of West Chicago was reported at 50, which is the low record price. Northwestern Elevated common sold at 16, and South Side at 92 and 93. Lake Street stock changed hands at 3½, the income bonds sold down from 30 to 27, while the first mortgage 5s gained a point from 98 to 99. The receiver of the Lake Street company has been discharged, and it is now thought that the financial reorganization will be speedily accomplished.

Other Traction Securities

Little change has occurred among the Boston traction specialties. Boston Elevated dropped from 140½ to 139¾, and rallied to 140. Massachusetts Electric common sold as low as 18, and as high as 18¾. The preferred rose from 77 to 78, then fell back to 77. West End common ranged between 90½ and 90, and the preferred between 109½ and 109. The week's dealings in Baltimore have been very light, with scarcely any variation from the previous quotations. United Railways stock sold at 8⅜ and 8½, the income bonds between 58½ and 58¾, and the general mortgage 4s between 90⅞ and 90½. The only transaction in outside bonds was a single sale of City and Suburban (Washington) 5s at 92. On the New York curb Interborough Rapid Transit rose on fractional purchases from 90 to 94, declined to 91⅞, then was bid up sharply to 99, at which figure 1000 shares were sold. This movement was in sympathy with the general advance in the traction securities on the stock exchange. New Orleans Street Railway, on sales of 300 shares, fell from 8¼ to 7¾, then rallied to 8. These are the low

prices for the season. New Orleans preferred sold to the extent of 100 shares at 27.

Cincinnati Street Railway stock was unusually active at Cincinnati. Sales numbered about 1300 shares, all in small lots. Practically all of it sold at 128, but the closing sales were at 129 and 130. Detroit United was firm at 64½ to 65 on sales of 150 shares. Cincinnati, Dayton & Toledo bonds sold at 81½, and small blocks of the stock at 26½. Toledo Railway & Light brought 22½ for small lots, which is a three-point improvement over last week.

Northern Ohio Traction & Light has been the active feature in Cleveland of late. Last week sales numbered about 900 shares. It opened at 13½, and went down steadily to 11. Monday it strengthened and went back to 13. There is a well-defined rumor that a certain member of the Everett-Moore crowd has been forced to liquidate, and is selling Northern Ohio at the best figures available. The stock is in good demand at these prices, which is considered very low, in view of the fact that the road is earning over 2 per cent, and is making fine gains every month. Cleveland Electric was in good demand, and several lots were dislodged at 65, and then the price went to 66½. A small lot of Toledo sold at 21½, and a small lot of Northern Texas came out at 30. A block of Detroit & Port Huron Shore line 5s sold at 94, and Northern Ohio Traction Consolidated 5s at 95½; both of these are gilt-edged securities.

Security Quotations.

The following table shows the present bid quotations for the leading traction stock, and the active bonds, as compared with last week:

	Closing Bid	
	Nov. 10	Nov. 17
American Railways	42	42
Aurora, Elgin & Chicago (preferred)	—	a65
Boston Elevated	140	140
Brooklyn Rapid Transit	37	38¼
Chicago City	165	164
Chicago Union Traction (common)	5½	5¼
Chicago Union Traction (preferred)	28	a35
Cleveland Electric	65	66⅝
Consolidated Traction of New Jersey	60	60
Consolidated Traction of New Jersey 5s	105	105¾
Detroit United	64	63¾
Elgin, Aurora & Southern	a56	a45
Lake Shore Electric	—	a15
Lake Street Elevated	3	2½
Manhattan Railway	138¾	139¼
Massachusetts Electric Cos. (common)	18	18
Massachusetts Electric Cos. (preferred)	76	76
Metropolitan Elevated, Chicago (common)	17	17
Metropolitan Elevated, Chicago (preferred)	55	55
Metropolitan Street	111½	114
New Orleans Railways (common)	7⅛	7¾
New Orleans Railways (preferred)	28	27
North American	70½	70
Northern Ohio Traction & Light	12½	13
Philadelphia Rapid Transit	11½	11½
Philadelphia Traction	95	95
St. Louis Transit (common)	13½	13¼
South Side Elevated (Chicago)	90¼	92
Third Avenue	108	108
Twin City, Minneapolis (common)	86½	87¼
Union Traction (Philadelphia)	43⅞	43⅞
United Railways, St. Louis (preferred)	59	58

a Asked.

Iron and Steel

A halt has been called in the process of readjusting prices which has been going on for several weeks in the finished iron trade. Following the action of the steel billet pool ten days ago a cut was announced last week of $6 per ton in steel bars and in hoops and bands, and a reduction of 20 cents per box in tin plates. In all these cases manufacturers have been influenced by a desire to make the concessions necessary to stimulate consumption again. In other branches, such as steel plates, structural material and steel rails, the former prices are being maintained on the ground that there was not enough advance during the boom to warrant any reduction at present. Whether this notion will prove correct, that is, whether the trade will be willing to buy these products at the level of the past year, remains to be seen. The statistics compiled by the "Iron Age" of pig iron output, show in a very striking manner what has been accomplished by the efforts to restrict production during the past month. On Oct. 1, the capacity of the anthracite and coke furnaces was estimated at 353,142 tons per week. On Nov. 1, it had declined to 273,715 tons. Notwithstanding this remarkable contraction there was an increase of 89,000 tons in furnace stocks during the month, showing that the restriction will have to be carried a good ways further yet in order to become effective. Quotations are as follows: Bessemer pig iron $15.10, steel billets $23 and steel rails $28.

Metals

Quotations for the leading metals are as follows: Copper 13½ cents, tin 24¾ cents, lead 4⅜ cents and spelter 5¾ cents.

THE NEW ADMINISTRATION IN NEW YORK AND MUNICIPAL IMPROVEMENTS

Mayor Low, of New York, has decided to do nothing in the board of estimate and apportionment in the last days of his administration toward the big public improvements which he and his colleagues had planned. This will result in a legacy to the incoming administration of $140,000,000 in the shape of borrowing capacity for the issuance of public improvement and other bonds, and the question is being asked, What will be done in this connection by the new administration?

Some of the improvements contemplated, when it was found to what limits the city could go for gigantic and much-needed improvements, included the new Brooklyn Bridge terminal and Municipal Building plaza contemplated under the plans of Bridge Commissioner Lindenthal and Henry F. Hornbostel, at a prospective cost of $50,000,000. This was the plan to erect gigantic city buildings, the bridge terminal, and office building to be surmounted with a forty-five story campanile, and to convert that section of the city lying between Ann Street, Park Row, Broadway, and Reade Street, into a general municipal plaza.

The plan for the solution of the bridge congestion, with subways and elevated road, at a cost of $25,000,000, was also included.

The other contemplated improvements were the Staten Island Ferry at $2,000,000, the details of which were given in the STREET RAILWAY JOURNAL of May 30, 1903; the Manhattan Bridge contracts, aggregating $6,500,000; the second Brooklyn tunnel, to cost $10,000,000; the East Side rapid transit extension, along Lexington Avenue, to cost $15,000,000; the Broadway spur, to cost $5,000,000, and the moving platform project, to cost something like $7,000,000, making a total of $183,500,000, with many smaller items and improvements also under consideration.

The Municipal Arts Commission, which passes on plans of new structures, is now with its ten members, of which the Mayor ex-officio is one, strongly Fusion. Two members retire each year, and as the two vacancies for 1903 will be created before Mayor Low goes out of office, he will have the filling of the places, leaving a solid vote of nine in the board to the one vote which the new Mayor will have, while during the administration just elected only four vacancies will be created. The statute provides that the members of the commission shall be appointed from a list of thirty submitted to the Mayor by the Fine Arts Federation.

THE TRACTION SITUATION IN CALAIS, FRANCE

J. B. Milner, United States Consul at Calais, France, has kindly furnished the following details regarding the present status of the Calais street railways:

Calais still has horse tramways. These are operated at present by an English company, which has a franchise still valid for seventeen years. The Municipality projected a new system, and was granted the concession by the French Government. One Mr. Boulet was granted permission by the Municipal Council to construct an electric tramway system. About a month ago Mr. Boulet died, and now his heirs are trying to sell the rights, but as yet have not succeeded. The contemplated works were estimated to cost $600,000, in which three lines were comprised, having a length of 16 miles, 8 miles of which were to be within the corporate limits of the city, the contemplated system of traction being the Dickinson trolley. Mr. Boulet intended to begin construction next spring and have the lines in operation within one year. These plans have been thwarted by his death, and a chance now exists for some one to become his successor by arranging with his heirs. An opportunity may exist here for enterprising American capital.

Work on the new electric railway between Brocton and Fredonia, N. Y., is practically completed and it is expected the cars will be running by next week. The fare will be 10 cents, or one-third of what is charged by the railroads.

THREATENED CAR STRIKE IN PITTSBURG

It is reported from Pittsburg that a strike of the employees of the Pittsburg Railways Company, controlling all lines in Pittsburg and vicinity, is imminent. About 2700 men, most of whom are members of the Amalgamated Association of Street Car Employees, would be affected. An ultimatum was presented to President Callary, of the company, on Monday, Nov. 16. It was promptly rejected. The demands are for a rearrangement of the working hours and 23 cents per hour for employees who have been with the company six months.

CHICAGO UNION TRACTION MATTERS

Aside from the general question of franchise renewals in Chicago, considerable interest has been aroused lately over the attempt of the receivers of the Chicago Union Traction Company to secure permits to put overhead trolley wires over certain cable lines in order to make it possible to improve the service. The permits, as originally applied for, were refused by the city authorities. Later, the receivers, through their attorneys, again applied for permits, drawing them up in different legal form. It has been rumored that in case the city authorities refuse these permits, which would enable better service to be given, Judge Grosscup may direct the receivers to go ahead with the improvements in spite of the refusal of the permits on the part of the city authorities, it being the theory that he might do this because of his authority as a Judge of the Federal Court in charge of the receivers, and that he might consider that his authority, together with the apparent needs of the people of Chicago, might justify such an order. Corporation Counsel Tolman, who has gone out of his way in many cases to volunteer opinions detrimental to public service corporations, and incidentally detrimental to the service these corporations can render the public, gave an opinion advising the commissioner of public works to refuse the Union Traction Company permits to extend its overhead trolley system in various places over its cable lines. The main gist of the corporation counsel's opinion is that the city has no power to grant permits for any kind of changes on existing cable lines until the companies can show that they have valid franchises for the lines which would be involved in the permit. The commissioner of public works is advised that it is for the City Council to determine whether the grant of the permits will prejudice the city's interest in the present franchise controversy with the traction companies.

TO HARNESS THE FALLS OF THE OHIO RIVER

The reported plan to utilize the falls of the Ohio River, at Louisville, Ky., for power for electric traction and lighting seems likely to go through. Representatives of the Widener-Elkins syndicate, which is backing the scheme, made the much-mooted trip to Louisville a few days ago to look into the project, and at the conclusion of a conference between them and Major George M. Derby, chief United States engineer for that district, it was announced that the plan for harnessing the falls would be favorably recommended to the War Department. It seems now that the plan is not of such recent origin as the first reports indicated; in fact, it seems that the Widener-Elkins interests have been thinking the thing over for some months past and that their engineers have made a very thorough study of the situation. The plans drawn up by the syndicate's engineers, so the information to hand says, were considered by Major Derby at the conference, and will be given a partial endorsement by him to the War Department. Unofficially, it is said that if the final consent of the Government is secured, about $2,000,000 will be spent for the initial plant, which will be of a size sufficient to furnish power and light not only to Cincinnati and Louisville, but to traction lines and towns within a wide radius, covering southern Indiana and northern Kentucky. To carry out the scheme it is said that the company is to be organized to include directors of practically all the traction and lighting companies that will be served with power from the new plant. The plans are drawn up with a view of being put in execution on the Indiana side of the river, just above the government dam. Nothing has been said as to the capacity of the plant, and details are lacking. Among those present at the recent conference in Louisville was Prof. Louis Duncan, of the Massachusetts Institute of Technology; John Birkinbine, of Philadelphia, who is said to be a representative of the United Gas & Electric Improvement Company; W. Kelsey Schoepf, of Cincinnati, president of the Cincinnati Traction Company; Major George M. Derby, United States engineer; F. A. Joss, an attorney of Indianapolis, and Benezette Williams, an engineer of Chicago.

A VICTORY FOR THE NEW YORK & PORT CHESTER ROAD

The Court of Appeals has sustained the State Railroad Commission in its grantal of the certificate of public convenience under Section 59 of the railroad law to the New York & Port Chester Railway Company, of New York, which plans to build an electric railway from New York to Port Chester. By sustaining the action of the State Railroad Commission, the Court of Appeals decides finally that the original charter of the Port Chester Company is valid. The plaintiff in the action brought to upset the Railroad Commission's dictum was the New York City & Westchester Railroad, one of the subsidiary corporations of the Metropolitan Street Railway Company. It was claimed that the commission had no right to grant the charter, in which, it was urged, there were certain errors or informalities that made it void.

The company now has an application for a franchise pending before the Aldermen of New York. A regular session of the Aldermen was held Tuesday, Nov. 10, when Mayor Low, in a letter, urged that favorable action be taken upon the application. The letter was referred to the railroad committee of the body.

INTERBOROUGH RAPID TRANSIT STATEMENTS FOR THE QUARTER AND FOR SIX MONTHS

The Interborough Rapid Transit Company, of New York, reports earnings as follows for its Manhattan Railway division:

Three months ending Sept. 30:	1903	1902
Gross receipts	$2,938,753	$2,495,112
Operating expenses	1,307,621	1,338,940
Net earnings	$1,631,132	$1,156,172
Other income	80,287	81,287
Total income	$1,711,419	$1,237,459
Interest and taxes	668,475	644,769
Surplus	$1,042,944	$592,690
Dividends on Manhattan Railway	828,000	480,000
Surplus	$214,944	$112,690
Passengers carried	59,443,304	50,464,936
Six months ending Sept. 30:	1903	1902
Gross receipts	$6,210,540	$5,352,362
Operating expenses	2,609,710	2,740,046
Net earnings	$3,600,830	$2,612,316
Other income	170,475	192,575
Total income	$3,771,305	$2,804,891
Interest and taxes	1,353,038	1,300,619
Surplus	$2,418,267	$1,504,273
Dividend on Manhattan Railway stock	1,656,000	960,000
Surplus	$762,267	$544,273
Passengers carried	125,548,740	108,164,184

IMPORTANT RULING ON SPEED IN MASSACHUSETTS

Two decisions were rendered last week by the Railroad Commissioners of Massachusetts which are sure to have an important effect on the running of street railway cars at high speed for long distances in competition with the railroads. These were the orders limiting the speed of cars of the Boston & Worcester Street Railway, in the towns of Wellesley and Lee.

In the case of the former town the Selectmen had established speed regulations which were objected to by the company on the ground that it had been called upon to make heavy expenditures on street improvements in order that a higher speed might be allowed than that which the Selectmen finally decided upon. The company contended that a speed of 35 miles an hour should be allowed in certain parts of the town, while the Selectmen placed the outside limit of speed at 25 miles per hour.

The Commissioners upheld the decision of the Selectmen and made sundry other restrictions as to stopping cars before crossing other street railways at grade, etc. The Commissioners also suggest that, so far as conditions permit, speed on street railways should be the same throughout the State.

This decision makes it impossible for the Boston & Worcester Company to make the time which it had scheduled between Boston and Worcester.

THE DECISION OF THE SAN FRANCISCO ARBITRATION BOARD

In the STREET RAILWAY JOURNAL of Nov. 14, 1903, the four clauses of the actual award in the findings of the arbitration committee which considered the controversy between the United Railroads of San Francisco and its employees were given. The questions before the board were considered at such length and the findings are so important, however, that a more extended consideration of them than it was possible to give in the previous article seems justified.

As will be remembered, the board agreed upon consisted of Patrick H. Calhoun for the company, W. P. Mahon for the employees, and Oscar S. Strauss, mutually agreed upon by Mr. Calhoun and Mr. Mahon. In the findings Mr. Mahon and Mr. Strauss concurred. Mr. Calhoun dissented, and has since filed his reasons.

It seems that on March 16, 1903, the union made certain demands upon the company which completely abrogated a contract which had been entered into on April 26, 1902, after a strike declared April 19. In this controversy the company granted practically all of the demands made by the men excepting one, which has since been granted, namely, the recognition of the union. This settlement provided for a flat rate of 25 cents per hour for time actually at work, and 30 cents per hour for overtime. It was agreed that the hours of labor should not exceed ten per day, and that all runs should be finished within fourteen hours from their commencement. Later this last clause was amended at the request of the employees so as to extend the hours of labor to eleven, and the hours within which a run should be finished to fifteen.

On March 16, 1903, the union served upon the company new demands. By the answer of the company and the contract agreed upon by the conference committee acting on the part of the company and the union, these demands were either agreed to, modified, or withdrawn, with the exception of those referring to hours and wages. These latter demands, the agreement was, to refer to arbitration, and the board already named was finally agreed upon.

The first meeting of the board was held on Sept. 15, in New York. In the question of fair wages the difficulty was met at the outset of the absence of guiding precedents, and then there were no terms of a contract, because of the very fact that the parties to the controversy were utterly unable to effect a satisfactory agreement. Even the old first principle of political economy, that of the law of supply and demand, was outruled. It resolved itself into a purely humane consideration.

By the testimony it appeared that only four street railway companies out of 345, of which statistics were obtained, were paying a higher rate of wages than the San Francisco Company, and that these are located in Montana. They pay an average rate ranging from 27.5 per hour to 29 cents, owing to the prevailing high wages paid for labor in the mines and the high cost of living. Of the other companies only four pay as high a rate as the San Francisco Company, namely, 25 cents. These companies are located in Oakland, Cal., in San Francisco and in Spokane, Wash., and also one in Chicago. The standard of wages of the Pacific Coast, it was agreed, was recognized by the company in the settlement made in April, 1902, when 25 cents per hour was granted.

The evidence showed in comparing the cost of living in 1902 with that of 1903 that there had been an advance. It was claimed on behalf of the street railway employees that that advance had been from 20 per cent to 30 per cent. On the other hand, the company claimed that while there has been an advance, that advance did not exceed more than 3 per cent. The testimony on both sides establishes, so the report says, the fact that there has been for the periods mentioned a rise in the cost of living; that on the average the rent of rooms or apartments such as the employees live in, has advanced about 10 per cent.

In view of all these circumstances the award was:

First—That the United Railroads of San Francisco pay to such of the members of Division No. 205, Amalgamated Association of Street Railway Employees of America, who are now and have been in their employ for a period under two years prior to April 1, 1903, an increase of 5 per cent above 25 cents an hour, and to such of said employees who are now and have been prior to April 1, 1903, in their employ two years and over, an increase of 10 per cent above 25 cents an hour, and that for overtime the like percentages of increase above the present rate be paid.

Second—I adjudge and award that the United Railroads of San Francisco pay to such of its employees who are members of Division No. 205, Amalgamated Association of Street Railway Employees of America, who work by the day, and who are now and have been in their employ for a period of under two years prior to April 1, 1903, an increase of 5 per cent above the daily rate of wage they are now receiving, and to such of said employees who are now and have been prior to April 1, 1903, in their employ two years and over an increase of 10 per cent above the rate of wages they are now receiving.

It appeared by the evidence that the average hours of actual labor by the body of regular men under the present schedule were ten hours and three minutes, or thereabouts; that at the time when the strike was settled in April, 1902, the schedule which was agreed to by the company was ten hours per day, to be completed within fourteen hours, and that this schedule, upon the request of the union, was amended by extending the hours of labor to eleven, to be completed within fifteen hours. In comparing the hours of service on these roads it did not appear that they were longer or more arduous than generally prevail in this line of service; nor did it appear that they are too long considering the health and welfare of the men in this line of service, and, in view of the fact that the climate of the Pacific Coast is exceptionally mild and free from the severity that obtains in the Middle and Eastern part of the United States, the award was:

Third—I adjudge and award that the same hours and schedule that now obtains be continued. It is always within the province of the railroad, on the one side and the employees on the other, to amend their schedule by mutual agreement. I, therefore, decline to disturb the present schedules.

Fourth—In accordance with the agreement under which this arbitration was entered upon, the wage rate adjudged and awarded shall be deemed to go into effect as of the 1st of May, 1903, and continue until the 1st of May, 1904.

Mr. Calhoun, who did not concur in the findings, says that the rate of wages paid by the company is higher than that paid in the large cities where living is more expensive, and that there is an abundance of labor in San Francisco seeking employment. He claims that the testimony showing a 30 per cent advance in the cost of living was unreliable, and that "the general conditions of the country do not now call for advances in wages, but on the contrary for the most prudent, careful, and economical management of corporate properties."

The hearings of the commission were held in New York. The argument of the company was presented in person by Gen. Tirey L. Ford, general counsel of the company. This argument has since been printed, and is a most logical refutation of the exaggerated claims originally made by the employees.

SOUTHWESTERN ELECTRICAL ASSOCIATION

The first meeting of the Southwestern Electrical Association was held at Oklahoma City last month, and was a pronounced success. The following papers were presented: "Possibilities of the Electric Railway in Oklahoma and Indian Territories," by John W. Shartel; "Heating from Central Station Lighting Plants," by T. K. Jackson; "Single-Phase Alternating-Current Motors as a Means of Increasing Central Station Earnings," by T. Bissel; "Central Station Accounting," by U. S. Hart; "The Nernst Lamp and Its Workings," by M. W. Hanks.

In his paper on the "Possibilities of the Electric Railway in Oklahoma and Indian Territories," Mr. Shartel stated that there are several communities in the two Territories located in sufficient proximity to make an inviting field for the construction of interurban lines, and future development bids fair to bring others into similar relations. He emphasized the fact that many electric railways have been laid down without sufficient consideration of their future profitability, and urged that the traffic problem should be very thoroughly investigated before the construction of a street railway is undertaken. The most favorable conditions are when the greater portion of the population is located some distance from the business center, or when a city is spread out over a narrow belt. If a street railway system can be united with interurban service, the proposition becomes much more favorable, for the difference in the cost of maintenance of a power house for 4 miles and for 15 miles of railway is measured chiefly by the fuel bill. Many a street railway system in this country which has been dragging a miserable existence, has been saved by interurban connections, and many a town or village which would be wholly inadequate to support a street railway system has enjoyed the benefit of that facility from interurban railways passing through it.

Mr. Shartel strongly urged that when an electric railway is put down it should be built in the most substantial manner one mile of track constructed for 40-lb. or 50-lb. rails will require more attention and care than five miles constructed of 60-lb. rails, and this is merely an illustration of the burden of maintenance between a poor and good construction. He recommended that wherever possible an electric railway plant should be operated in connection with an electric light plant. Such a plant divides the power house expense in two, and it affords an opportunity which could not otherwise be obtained for selling electricity twenty-four hours in a day.

The association starts with thirty-five active and eleven associate members, the former representing the several electric light, railway and telephone companies of Oklahoma, as well as several plants in Arkansas, Texas and Kansas. The officers elected for the ensuing year are: J. W. Shartel, of Oklahoma City, president; J. N. McLendon, of Fayetteville, Ark., first vice-president; L. F. Duggan, of Wichita, Kan., second vice-president; S. A. Hobson, of Dallas, Tex., third vice-president; J. L. Ellis, of Oklahoma City, secretary and treasurer; T. K. Jackson, of Enid, Okla.; W. K. Berry, of Ardmore, Ind. Ter.; S. P. Render, of Oklahoma City, and W. E. Robinson, of Oklahoma City, executive committee.

It was voted to hold the next meeting of the association at Dallas, Tex., the latter part of April or the beginning of May, 1904.

DISCUSSION ON ELECTRIC RAILWAYS IN PHILADELPHIA

A meeting of the Philadelphia branch of the American Institute of Electrical Engineers was held Tuesday evening, Nov. 10, at the Engineers' Club. A business meeting preceded the reading of the papers, during which a set of by-laws was adopted and new officers elected as follows: Chairman, Charles E. Hewitt; secretary-treasurer, H. F. Sanville; managers, W. C. L. Elgin, Horatio A. Foster, J. Franklin Stevens, W. L. Hodges, C. W. Pike, A. J. Rowland.

C. B. Voynow, assistant engineer of the Philadelphia Rapid Transit Company, presented a paper on "A New Method of Track Laying and Bonding." The paper was very instructive and interesting, describing, as it did, the Nichols-Voynow rail-joint, which is in use throughout Philadelphia, and which has been described in this paper. There was a spirited discussion, in which Messrs. Pike, Hering, Hodges and Hewitt took part.

Horatio A. Foster gave to the meeting reminiscences of his experiences in the early eighties, when installing and trying to operate the first electric railway in the city of Baltimore, for the old Daft Company. The talk was very interesting, and in the light of modern practice, decidedly humorous. Charles E. Hewitt, with the assistance of some lantern slides, showed the development of the railway motor from its beginning to the present time.

The Albert & J. M. Anderson Manufacturing Company sent for exhibition at the meeting their collection of relics of early practice in overhead construction. Some of these relics were very interesting, and, placed alongside of the elaborate new devices, which were also on exhibition, told better than words of the enormous development in electric traction in the last twenty years.

ELECTRIC RAILWAY COMMISSION AT ST. LOUIS EXPOSITION

In view of the growing importance of the electric railway interests of this country, plans are being carried into effect which contemplate a very prominent recognition of the electric railway and electric railway problems at the St. Louis Exposition. The appointment of an advisory commission on electric railway tests of the Louisiana Purchase Exposition has just been announced. The commission is thoroughly representative of each branch of electric railway activity, and will, undoubtedly, receive the support of the entire electrical industry in any plans for the promotion of electric transportation which the commission shall devise.

The personnel of the commission is as follows: J. G. White, president J. G. White & Company, New York City, chairman; H. H. Vreeland, president Interurban Street Railway, New York City; W. J. Wilgus, vice-president New York Central & Hudson River Railway, New York City; George McCulloch, president Union Traction Company, of Indiana, Indianapolis, Ind.; James H. McGraw, president McGraw Publishing Company, New York City.

The commission will act in an advisory capacity in connection with a series of tests on electric railway apparatus to be conducted at the Exposition under the auspices of the department of electricity.

From W. E. Goldsborough, chief of the department of electricity, it is understood that the electric railway test tracks have been laid north of the Transportation Building on the Exposition grounds, and represent a practically level, clear double-track 1400 ft. in length. These tracks will connect with the Intramural Railway and also the steam railway system serving the grounds. It is said that several important manufacturers have already promised complete equipments for exhibition and test, and the present outlook indicates that all of the new systems of alternating-current propulsion, as well as the old direct-current system, will be offered for inspection and operation.

It is not so much the intention to conduct these tests in a competitive sense as it is to arrange for the accumulation of data which will be valuable in promoting further electric railway undertakings from an engineering standpoint. A very complete equipment for testing apparatus will be provided, and all of the work will be done in a thoroughly engineering and scientific manner.

PECKHAM TRUCKS FOR JAPAN

The Tokio-Shigai Railway (Tokio Street Railway), some of whose recent contracts were mentioned in our last issue, has just given an order for 100 trucks to the Peckham Manufacturing Company. The order calls for the standard cantilever extension 8-B single-truck of the Peckham Company, to go under cars with a body length of 18 ft. The order was placed through Okura & Company, of Tokio, who are the contractors for the line.

THE LOW-FARE ISSUE AT CLEVELAND

The City Council of Cleveland has declared the bids made by Will Christy for lines on Denison Avenue, Doan Street, Edgewater Boulevard and Summit Street to be the lowest, and Mr. Christy has made formal application to the Council for franchises to build lines on these streets. As already outlined in the Street Railway Journal, Mr. Christy, a prominent traction man, recently caused much comment in Cleveland by offering to bid two-cent cash fare for lines on the street mentioned. If the franchises are granted and Mr. Christy fails to comply with the stipulations, he will forfeit $20,000 in cash, already posted with the city. Mr. Christy still declines to talk about the plans of his company.

The People's Street Railway Company, which is building an alleged three-cent fare line in the city, has been enjoined temporarily from further work. The company has laid about 1½ miles of double track on Denison Avenue in a remote part of the city, but no wires have been strung and apparently no plans have been laid for supplying power for the proposed line. The injunction was granted by Judge Disette, of the Common Pleas Court. The petition filed by a prominent law firm acting for a property owner cites that the requisite number of consents from property owners was not obtained; also that the ordinance as passed by the Council is not legal.

DECEMBER MEETING PROGRAMME OF THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS

The opening session of the December meeting of the American Society of Mechanical Engineers is to be held at 9 p. m. on Tuesday, Dec. 1, at the usual headquarters, 12 West Thirty-First Street, New York. President James M. Dodge will deliver the annual address, the subject being "The Value of an Engineering Education to a Young Man."

The second session will occur on Wednesday morning, at the hall of the Mendelssohn Glee Club, 113 West Fortieth Street. This will be the business session of the convention and professional papers will also be presented. Following this, luncheon will be served at the Society house, and the afternoon will be spent in making excursions to power stations and other points of interest. The evening of this day has been left free for the members to make their own engagements.

The third session will take place in the Carnegie Laboratory of Stevens Institute on Thursday morning at 10 o'clock. Luncheon will be served at the Institute, and will be followed by visits to points of interest about the grounds. The usual reception for guests and friends will be at Sherry's on Thursday evening, at 9 o'clock, and will be followed by dancing and supper. The closing session will be at the Society house on Friday morning, Dec. 4, at 10 o'clock.

The following nominations for officers of this society for the coming year have been made by the nominating committee:

Ambrose Swasey, of Cleveland, Ohio, president; Professor D. S. Jacobus, of Hoboken, N. J., M. L. Holman, of St. Louis, Mo., William J. Keep, of Detroit, Mich., vice-presidents; George I. Rockwood, of Worcester, Mass., John W. Lieb, Jr., of New York City, Asa M. Mattice, of Pittsburg, Pa., managers; William H. Wiley, of New York City, treasurer.

SUBURBAN NEWSPAPER TRAIN AT CHICAGO

The Chicago "Record-Herald" has arranged with the Aurora, Elgin & Chicago Railway Company to distribute the city edition of that paper, daily and Sunday, to fourteen towns and villages within 35 miles of Chicago. The service has already been started, and was inaugurated owing to the demands of the residents of these towns, who wanted to get the city edition because of the fact that it contains more purely local news than the mail edition, which they have heretofore received. The electric line begins at Fifty-Second Avenue, Chicago, but the two cars for the papers are brought all the way down to the loop over the line of the Metropolitan Elevated. Between 3 o'clock and 4 o'clock every morning the cars are loaded with "Record-Heralds" at Van Buren Street and Clinton Street, and at 4 o'clock they begin their run. Reaching Fifty-Second Avenue at 4:25, they are switched to the surface and commence the journey on the electric line. At 4:55 they reach Wheaton, having made necessary stops en route for paper distribution, and here they separate, one going to Aurora while the other travels to Elgin. Thirty-five minutes is the approximate running time to each of these points from Wheaton. The points reached by the service are Aurora, Geneva, Glen Ellyn, Lombard, Wheaton, Elmhurst, St. Charles, Yorkville, Dundee, Carpentersville, Oswego, Ingalton, Elgin and Warrenville.

SUCCESS OF THE NEW BROOKLYN BRIDGE LOOPS

The four additional car loops at the New York entrance to the Brooklyn Bridge, which the Brooklyn Rapid Transit Company constructed at a cost of about $100,000, were placed in service on Sunday, Nov. 15, and given their first severe test on Nov. 16.

As reported in previous issues of the STREET RAILWAY JOURNAL, these loops were built because the original four loops were insufficient to accommodate the vast rush-hour crowds. The new arrangement does not involve a change in headway, but scatters the passengers over a much larger area, thus enabling the police to keep better order and prevent dangerous blockades.

Vice-President J. F. Calderwood, of the Brooklyn Rapid Transit Company, spent half an hour watching the working of the system during the rush hours. He said:

"What I have seen convinces me that this plan will work all right. Conditions are 50 per cent better than under the old system already. In a week or two the new plan will work with perfect smoothness. Under the present arrangement, the lines are distributed between the various loops with a view of evenly dividing the crowd. I think that the cars carrying the largest number of people ought to be assigned to the four new loops, where the space between the tracks is almost twice as large as in the old section. I think it probable that a change to that effect may be made in the near future. It is now up to the Bridge people to relax the rule which requires 102 ft. headway between each car. If that be done we will be able to run about twenty-five more cars an hour during the rush hours, and that would mean that we would be able to accommodate about 2500 passengers more than at the present time. We are running 280 cars an hour now."

DESTRUCTIVE FIRE AT CLEVELAND

The Holmden Avenue car house of the Cleveland Electric Railway Company was totally destroyed by fire with all its contents at an early hour Monday morning, Nov. 16. Seventy-three cars were destroyed, and in consequence the company, already short of rolling stock, is in a badly crippled condition. President Horace E. Andrews of the company informed the STREET RAILWAY JOURNAL representative that there were in the car house twenty-seven of the latest type of closed cars, twenty-two single-truck closed cars, sixteen ten-bench open cars, seven fourteen-bench open cars, two snow-plows and two carloads of hard coal for car stoves. The loss on the building, which was completely destroyed, was about $30,000. Ten cars which happened to be standing in the yard outside were saved, but the front platforms of some of them were burned, the paint scorched and the windows broken. Nothing was left of the cars in the house but the steel framework, the trucks, motors and controllers, and most of these are ruined.

The Holmden house and yard covered four acres and were used for the storage of cars for the Scranton, Jennings and Clark Avenue lines, and all but the night cars of these lines were in the car house at the time of the fire. The ruined building was an old structure erected by Tom L. Johnson for the Brooklyn line in the horse car days. The company recently erected a large storage house at South Brooklyn, but the Holmden house has been used largely for cars in regular service.

The fire was accompanied by a harrowing fatality. The firemen had the fire practically out when the front wall fell directly on a hose company. Two men were crushed and dead when taken out of the ruins, and two more died after they had been taken to hospitals. A fifth had both legs broken.

President Andrews states that it has not been decided whether the car house will be rebuilt on its present site. It will be necessary to order a large number of cars at once, and as soon as possible the officials communicated with car builders, in order, if possible, to secure immediate deliveries on some cars.

FIRST TEST OF NEW YORK SUBWAY EARLY IN JANUARY

Chief Engineer William Barclay Parsons, of the New York Subway, is of the opinion that it will be possible to run an experimental train in the subway between City Hall and 104th Street, or perhaps as far north as 150th Street and Broadway, early in January. Mr. Parsons also predicts that regular passenger service on this section of the road will begin as early as March or April, bearing out the statement made by Contractor McDonald last week as to when the road will be ready for service.

On the main line of the tunnel, extending from City Hall Park to 104th Street and Broadway, there remain only three short stretches in which tracks have not been laid. These are between the Brooklyn Bridge Station and Leonard Street, at the south end of Long Acre Square, and along Broadway from Seventy-Seventh to Seventy-Ninth Street. These gaps, it is expected, will be completed by Jan. 1. It is at 104th Street that the east and west side lines diverge, and here there is another unfinished piece of work. This work may also be completed by Jan. 1, and in that event it would be possible to operate over the west branch as far as 150th Street.

As to when the entire subway will be open to traffic, Mr. Parsons is reluctant to predict. He says, however, that next September may safely be fixed as a limit. The Harlem River section will not be finished until spring, nor will the section under Washington Heights be bored through before that time.

The only possible delay in beginning actual operation of the tunnel, says Mr. Parsons, is due to the incompleteness of the power houses, and the date when regular trains are to be run will depend upon whether necessary power can be obtained.

DETROIT CARS MUST BE EQUIPPED WITH AIR BRAKES

The Supreme Court of Michigan has just decided that the cars of the Detroit United Railway Company must be equipped with air brakes. This decision affirms the decision of the lower court, which sustained the legality of the ordinance passed by the City Council requiring such brakes to be used.

Two opinions were written in the case, both sustaining the validity of the ordinance. Judge Hooker wrote the main opinion wherein the company was convicted and fined for failing to provide the air brakes required. The reasonableness of the ordinance was determined by the trial judge without a jury, and Judge Montgomery, in his opinion, says that the court having found that the ordinance was reasonable, and the defense having failed to call for a specific finding of facts, the railway company has not put itself in a position to review the decision of the trial judge.

Testimony was introduced to show that it would cost $350,000 to equip the cars of the company with the brakes prescribed; that such brakes were not necessary to the safe operation of the cars; that the average efficiency of the brakes in use is greater than the brakes prescribed; that no city is known to have all of its cars equipped with air brakes; that such brakes are in an experimental stage, etc.

Judge Hooker says the object of the ordinance is to compel the equipment of street cars with the means of stopping with certainty and expedition.

"We may take judicial notice that this is desirable," he says, "for we are judicially cognizant of the fact that the use of street cars is necessarily attended by imminent danger to citizens on the highway as well as passengers."

As to the claim that the ordinance should be held invalid because of the large outlay required, the court says it does not feel called upon to say much, as it is too well settled that the State or city may enforce regulations clearly looking to the safety of the public, and that all property is held subject to the exercise of the police power.

DOUBLE-TRACKING ELECTRIC ROADS

On the question of double-tracking electric railways, which has recently been urged without rhyme or reason by many New England papers, the New Bedford, Mass., "Standard" recently said:

"Recent trolley road catastrophes have caused a demand that all suburban electric lines should be double-tracked. President Sullivan, of the Massachusetts Electric companies, thinks that some roads cannot afford this. The Haverhill "Gazette" replies that 'the only answer to that is that the public thinks it cannot afford to have such speed attempted on single-track lines.' Then the "Gazette" goes on in this certain-sure way: 'The public think is—or ought to be—of prime importance, and after the public have made their decision in such manner that it can be enforced, the corporations may have a different basis of estimating what they can or cannot afford.' Agreeing that 'the public think' is of prime importance, it still remains true that if the public does not think in compliance with the laws of arithmetic, it will run up against a rock, in spite of the intensity or the unanimity of its thought. Double tracks cost money—to build, and to operate. The money comes out of the pockets of the riding public. There is nowhere else for it to come from. If the public does not contribute sufficient to pay the expenses, then there is bankruptcy, which means both private and public loss. Some roads have already had that experience, and some others are expected to have it. Now, without sentiment, and putting aside for a monent "the public think," what is going to be done in such a case? Here is a road which performs a public service, but which nevertheless has insufficient income to support even a single-track line. It is pretty sure to meet financial disaster, anyway. Shall its managers put into it more money, and so make the disaster worse? Or, shall they do what seems much more reasonable, run the road they have, carefully, and thus avoid those occurrences which are misnamed accidents? A public that actually thought would not have much difficulty in deciding."

ANOTHER OUTLINE FOR RAPID TRANSIT IN NEW YORK

The city plan committee of the Municipal Art Society has added to the literature of the New York transit question a report upon the passenger transportation system. The society goes far beyond the extensive scheme outlined some months ago by Mr. Parsons, chief engineer of the Rapid Transit Commission. It would have a belt east side and west side subway system in Manhattan, supplementary to the tunnels now under way there; it would include and belt Brooklyn in its course, and would extend the system from Brooklyn to Staten Island by tunnel. The plan has two things in common with Mr. Parsons'. Neither proposes to spend any more money until the present tunnels are completed, and both treat the rapid transit systems of all the boroughs as one problem, to be solved by a system of tunnels, elevated roads and bridges which are related to each other and meant to make one continuous thoroughfare between the various distant and now slightly related sections of the city. The society believes that the system ought to be built by a monopoly, under such complete control of the city government that the best interest of the citizens would be served.

TWIN CITY CORLISS ENGINE WORKS

The Twin City Corliss Engine has been manufactured about thirteen years; in that time over three hundred have been made and placed in operation. The first one was built by the Twin City Iron Works to run their shops, which it did for over twelve years, or until the tools were removed from the old shops to the new. It is still in good running order and capable of doing duty for many years to come.

The company now building these engines is known as the Minneapolis Steel & Machinery Company. It is incorporated for $1,000,000, stock fully paid in, and has no bonded indebtedness. The main office and shops are at Minneapolis, Minn. There are branch offices at San Francisco, Seattle, Denver, Salt Lake City and Kansas City.

The plant occupies over eighteen acres, the buildings having a floor space of eight acres. The shops are completely equipped with modern machinery and the main buildings are entered by standard gage railroad tracks. Electric cranes, pneumatic riveters, and furnaces fed by crude oil are prominent features in the operation of this plant. Over 600 employees and a construction corps are employed at present. Additional building is to be done in the spring.

The company builds Corliss engines, bridges, car houses and structural steel work of all kinds. It is now erecting a large office building in Honolulu, Hawaii.

PARIS LETTER

(From Our Regular Correspondent.)

Statistical tables have lately been issued by "L'Industrie Electrique" for last year's operation of electric railways and tramways in France. These tables show that the applications of electricity for traction have not progressed in the last period as rapidly as might have been anticipated from a consideration of the preceding stages. After rapid progress in the year 1900-1901, the percentage of increase in electric traction has decreased very much, probably in consequence of the insufficiency of financial returns from the electric railways already in operation.

By Jan. 1, 1901, the length of lines had reached double of what it was on Jan. 1, 1900; and the corresponding increase in the power of central stations was still higher, this power being at the latter date three times as much as it was at the former.

No tabulated data are available for 1902, but the total increase in the length of lines for 1901 and 1902 does not exceed 500 km, which represents an average of 250 km per year. The corresponding increase in the year 1900-1901 was over 700 km. The total power used was 28,000 kw before 1900, 64,000 kw on Jan. 1, 1901, and 74,000 kw on Jan. 1, 1903.

The following table shows the progressive changes in length of lines, power, number of cars and systems, as well as the subdivision of same:

	1893	1899	1900	1901	1903
Total length of track in km	37.4	487.5	752.8	1486.	1995.
Total amount of power in kw	1,525	18,718	28,308	64,383	74,000
Total number of motor cars	20	759	1,295	2,425	3,004
Number of lines operated by trolley	2	42	56	76	85
" " operated by underground conduit	0	2	3	3	3
" " " by 3d rail	1	1	1	4	5
" " " by storage battery	2	6	6	8	8
" " storage battery and trolley	0	4	4	6	13
" " trolley and underground	0	1	2	2	4
" " trolley and surface contacts	0	0	0	7	31
" " trolley without rails	0	0	0	0	3

The years 1901 and 1902 thus showed a considerable increase in surface contact systems.

Among the most noticeable installations in traction matters in Paris should be mentioned the following addition to existing plants: A large steam generating station will be installed at St. Ouen, near Paris, to distribute electric power to the surrounding dictrict and to feed present and future railway sub-stations for converting current for the Metropolitan. Three-phase current at 6000 volts will be delivered, the characteristic feature being to generate it by large generator sets of Brown type connected to Brown-Parsons steam turbines. Four generating sets have been ordered from Brown, Boveri & Cie., of Baden (Switzerland), three of them to run at 750 r. p. m., and having a rated capacity of 5000 kw. One is to run at 1500 r. p. m., and is to have a rated capacity of 3000 kw. One motor generator, consisting of a synchronous motor and direct current generator of 300 kw capacity, will be used for excitation. Another exciter of the same capacity, direct-connected to a steam turbine, will be used as a spare unit.

The complete plant will have a capacity of 18,000 kw, and will be put in service in 1905; but the promoters are said to be already contemplating large additions to the proposed plant. This work has not been undertaken by the Metropolitan Company directly, but by a new company called Société d'Electricité de Paris, which has financial connections with the former. The statutes of the new company, which were registered June 27, 1903, appear to be of the most comprehensive extent, including all electrical applications of commercial, financial or technical nature, besides the construction and installation of electrical work. The first capital stock is 5,000,000 fr., provision being made for doubling that amount in the near future, and still more on the basis of capital stock and funded debt.

An electric railway is to be installed in St Najaire, an industrial city, which hitherto has not enjoyed the benefits of electric traction. A steam plant will have to be built for this purpose and sufficient power generated to permit part of it to be used in the local navy yard and wharves, which are among the most important in France.

Bordeaux, which is well provided with electric tramways, is to have a new water power plant, which will be installed by the Thomson-Houston Company on the Dordogne River, at Thilliers. When this station is completed the present steam plant will be discarded.

ANOTHER EXTENSIVE MEXICAN ROAD

An extensive electric railway is to be constructed and operated by American capital between Victoria and Salinas, passing through the towns of Tula and Guadalcazan. The line will be upwards of 100 miles in length. It will run through the Sierra Madre range, and will carry ore and other freight as well as passengers. It will be built and worked by the Mexican Construction Company, a Pittsburg concern, which is largely interested in mining operations along the route of the proposed road. J. P. Loeder is president of the company.

REPORT OF THE NEW SOUTH WALES GOVERNMENT TRAMWAYS

The report of the Railway Commissioners of New South Wales for the year ending June 30, 1903, shows 124½ miles of tramway lines in operation, as compared with 104 miles last year. The operating report for the year is as follows:

	1903	1902
Gross income	£752,034	£631,757
Operating expenses	654,165	541,984
Gross income less operating expenses	97,867	89,773
Percentage of profit to capital invested	£2-19-3	£3-5-7
Percentage of operating expenses to gross income	86.99	8579
Earnings per average mile open	6,455	6,546
Number of passengers carried	130,405,402	108,135,111
Car mileage	13,695,630	9,344,154

The commissioners report that during the year twenty-four electric cars paid for out of operating expenses replaced twenty-four steam cars and three steam motors. One hundred and sixty four-wheeled electric motor cars and five freight cars were added to the stock during the year and charged to capital. The power station has been extended and the output during the year was 2,826,126 kw-hour.

NEW PUBLICATIONS

Notes on Electric Railway Economics and Preliminary Engineering. By W. C. Gotshall. VI + 252 pages; illustrated. New York, 1903. Published by the McGraw Publishing Co. Price, $2.00.

This book is the most complete—in fact the only book, so far as we know—on interurban electric railways which takes up the subject in a way which appeals especially to the investor and to the engineer in charge of the preliminary work. Other treatises have been published discussing the purely engineering side of electric railroading, but little or no attempt has heretofore been made to outline a comprehensive method by which the owner, investor or consulting engineer can (1) predicate to any certainty the possible business, freight and passenger, between the two points; (2) undertake the preliminary engineering required for the proposed railway and ascertain the cost; (3) prepare the run-sheets for determining the most economical speeds under given conditions and the power capacity required; and (4) draw up the specifications for securing the results sought.

Mr. Gotshall's book contains a great deal of matter outside of these four subjects, including a thorough and up-to-date statement of the principal engineering features of high-speed interurban electric railroading. The main object sought for in the book, however, was an exposition and discussion of the economic side of the subject, and it was for this reason that the title given to the book was selected.

The first two chapters relate to the preliminary office determination by the engineer or promotor of the approximate earnings of a proposed line, based on the tributary population. Chapter iii. discusses the next step, the preliminary field survey and the fixing of tentative lines for the proposed road on which to base closer and ultimate determinations. In chapters iv. to vii. the writer discusses the treatment by the engineer of the data collected from his preliminary field survey. It includes the fixing of the grade line, preliminary determination of schedules, equipment and cost of construction, a more detailed estimate, based on observations taken in the field, of the probable earnings, and an examination into the probable operating expenses based upon the foregoing determinations. In the latter chapter of this group the author analyses in a most valuable way the results being obtained by existing systems and applies them to other schedules and conditions. In this way he has placed at hand a method of accurately determining the costs of operation for almost any proposed system, and points out the fallacy as well as danger of using the percentage of gross receipts method now so commonly employed.

Chapters viii. to xvi. are devoted to describing the final engineering work of the proposed undertaking. Field parties are again sent out, and as a result of the study of conditions thus made, the detailed plans are prepared. Special chapters are devoted in this part of the book to track construction and superstructure, overhead and third-rail construction, power stations, storage batteries, motor equipment and rolling stock. In those relating to track and station construction, tables are given in detail of cost for different classes of work, and in that on third-rail and overhead construction an interesting comparison is drawn between these forms of working conductor.

Chapter xiii, on motor equipment and rolling stock, is particularly valuable, as it contains a discussion on the mooted questions of train resistance, and shows graphically all of the formulæ and results which have been developed to date. It also shows the most economical speeds for a given set of conditions in a manner which is very complete. Tables and diagrams are also given showing the relation between the energy consumed for different schedules and different distances between stops, and are worthy the careful consideration of engineers and financiers having the determination of such matters. The relatively great cost of high speeds is strikingly shown. All of this matter and the accompanying determinations and conclusions are entirely new, and the work and development of Mr. Gotshall are most opportune and valuable to the banker, investor, promotor and engineer. Chapter xiv. discusses the right of way, the following chapter the preparation of the specifications, and chapter xvi. gives some hints on the method followed during the construction period.

The best manner of keeping, systematizing and showing relative construction and operating data and records is considered in chapter xvii, while the eighteenth chapter sets forth the controlling considerations governing the kind and character and consequent permissible cost of a proposed installation. The principles laid down are illustrated by an assumed case representing actual conditions.

The book concludes with a set of complete specifications for the construction of a moderate sized high-speed interurban electric railway operating over its own right of way, and a selected list of articles which have been published on interurban railway work.

It is certain that Mr. Gotshall has made a most important and opportune contribution to railroad literature in this book, for the preparation of which his previous training has eminently qualified him. As a member of both the American Society of Civil Engineers and of the American Institute of Electrical Engineers, and as builder of the Second Avenue Conduit Railway in New York and a number of Western interurban railways, he has been able to look at the proposition from both the civil and engineering, as well as from the financial and commercial sides of the question. Mr. Gotshall's recent connection as president and chief engineer, as well as originator and developer, of the New York & Port Chester Railroad Company, and as general manager and chief engineer for a number of years of the Union Depot Railway Company, of St. Louis, also eminently qualify him to consider the question from the standpoint of the manager and operator. The book throughout possesses the rare merit of being not only absolutely abreast of the art, but actually ahead of it in many respects.

STREET RAILWAY PATENTS

[This department is conducted by W. A. Rosenbaum, patent attorney, Room No. 1203-7 Nassau-Beekman Building, New York.]

UNITED STATES PATENTS ISSUED NOV. 10, 1903

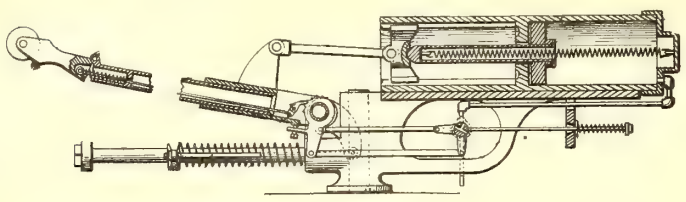
743,435. Apparatus for Controlling Trolley Poles; Judson L. Bogue and David M. Jennings, Denison, Tex. App. filed May 2, 1903. Automatic means for returning the trolley pole to the wire after it has accidentally left it, said means not interfering with the manipulation of the pole by the motorman, by means of the cord.

743,521. Trolley Stand; Frederick Kennington and David L. Fawcett, Leeds, England. App. filed Jan. 14, 1903. A horizontally and vertically movable pole having a spring interposed between a lug on the pole and the vertical socket.

743,542. Trolley Signal; Charles H. Morse, Cambridge, Mass. App. filed June 25, 1901. Current is directed by the passing cars through electro-magnets which control safety and danger signals at each end of the block.

743,654. Electric Car Heater; James F. McElroy, Albany, N. Y. App. filed Sept. 2, 1903. A special electric heater for the motorman's compartment is automatically thrown into and out of circuit by the movement of the door of the compartment.

743,689. Spring Cushioning Device; Clarence P. Byrnes, Sweickley, Pa. App. filed July 8, 1903. A spiral spring having superimposed coils with a continuous angular flange engaging the successive turns and arranged to increase resistance during the stroke.



PATENT NO. 743,435

743,699. Street Car Fender; Matthew Duffner, Allegheny, Pa. App. filed March 30, 1903. An upper shield will automatically close over an object picked up by the fender and so arranged as to prevent the object from rolling off.

743,786. Elevated Railway; Cassius I. White, Nottingham, Ind. App. filed June 15, 1903. The car is hung from a single rail suspended from a series of derricks; relates also to numerous details of the system.

743,789. Railway Station Signal; John L. Wrenn, Washington, D. C. App. filed June 30, 1903. A signal light adapted to be turned on by a prospective passenger is afterwards turned off by the car itself.

743,793. Brake-Shoe Key-Bolt; Edward L. Adreon, Jr., St. Louis, Mo. App. filed April 7, 1903. A brake-shoe key-bolt in the form of an open-seam tube and provided with a funnel-shaped resilient head and a locking key opening provided with a resilient wall.

743,794. Brake-Shoe Key-Bolt; Edward L. Adreon, Jr., St. Louis, Mo. App. filed April 7, 1903. A brake-shoe key-bolt constructed of a single piece of spring metal provided with a locking key opening, and resilient parallel prongs and flaring portions.

743,878. Electric Block Signal; William S. Jackson, Hoboken, N. J. App. filed March 5, 1903. A semaphore is raised by a shoe moved transversely thereto by an electro-magnet, the withdrawal of the shoe permitting it to fall by gravity.

743,888. Electric Safety Appliance; Louis Klentschi, Richmond Hill, N. Y. App. filed Feb. 20, 1903. A third-rail covering adapted to be raised and lowered by the flange of a car wheel operating upon a suitable leverage system.

743,960. Paving Strip; Louis Vogel, Whitelaw, Wis. App. filed June 20, 1903. The paving strip is so constructed that it will fit snugly against the web between the tread and base flange of the rail, the outer side of the strip being inclined downward to increase the cross-sectional extent of the same near the lower edge.

PERSONAL MENTION

MR. E. M. MILLIGAN, city engineer of Warren, Ohio, has been made consulting engineer for the Cleveland & Sharon Railway Company, of Cleveland, Ohio.

MR. CHARLES L. BORGMEYER, for many years attorney and counsel for the Consolidated Traction Company and the North Jersey Street Railway Company, has resigned from the Public Service Corporation.

DR. F. A. C. PERRINE, president of the Stanley Electric Manufacturing Company, has been selected to deliver the "Founder's Day address," Nov. 30, at the Thomas S. Clarkson Memorial School of Technology, at Potsdam, N. Y.

MR. A. G. HEGGEM, for the past four years general superintendent of the Russell Engine Company, of Massillon, Ohio, has resigned and will go to Kansas City, Mo., where he will open an office as a consulting engineer. Mr. Heggem is a graduate of Cornell University.

MR. H. H. VREELAND, president of the Interurban Street Railway Company, of New York, and Mr. J. C. Hutchins, president of the Detroit United Railway Company, of Detroit, Mich., have been elected honorary members of the Tramways & Light Railways Association, of Great Britain.

MR. ROBERT L. POST has been appointed general manager of the Ithaca (N. Y.) Street Railway Company, to fill the vacancy made by the recent resignation of Mr. H. A. Nichol, who left Ithaca the first of the month to take a position in Cleveland, Ohio. Mr. Post has been connected with the Ithaca Street Railway system for nearly six years, having held many responsible positions, and at one time fulfilling the duties of acting general manager for nearly a year.

MR. WILLIAM P. JACKSON has been appointed general superintendent of the Bay Cities Consolidated Railway Company, of Bay City, Mich. Mr. Jackson is an experienced street railway and interurban man. He was formerly with the Union Traction Company, of Indiana. For six years previous he was connected with street railway work in Marion, Ohio. He first entered street railway work in the Columbus, Ohio, car shops after considerable experience in lighting and construction work.

MR. MICHAEL OHMER, of Dayton, Ohio, died on Nov. 11, from an acute attack of cystitis. Mr. Ohmer was born in Bispang, Lorraine, 1826, came to Dayton in 1837 and later established a flourishing furniture business. He was one of the organizers of the original Wayne Avenue & Fifth Street Railway Company, of which he was vice-president and general manager, and for a time the president. His eldest son, Mr. John F. Ohmer, is vice-president and general manager of the Ohmer Fare Register Company.

A WIDE CIRCLE OF FRIENDS will regret to learn of the death of Mr. John Graham Millar, manager of the roofing department of the H. W. Johns-Manville Company, of New York. Mr. Millar was born in Birmingham, England, and came to the United States in 1885. After a short period of employment with the United States Leather Company, he associated himself with the business in which he was engaged at the time of his death. He was with the H. W. Johns Company for fifteen years, and was recognized as an expert in the manufacture of asbestos roofing. Mr. Millar was widely esteemed for his integrity and many engaging qualities, and his death is a severe loss to the company with which he was connected.

MR. FREDERICK A. HUNTRESS, general manager, superintendent and purchasing agent of the Halifax Electric Tramway Company, of Halifax, N. S., has been appointed general manager of the Worcester Consolidated Street Railway Company, of Worcester, Mass., to succeed Mr. Richard T. Laffin, who resigned from the company some time ago to become general manager of the Manila Street Railway, of Manila, P. I. Mr. Huntress is a practical street railway man of twelve years' experience. He is a native of Somerville, Mass., where he was born thirty-four years ago. He was graduated from Harvard with the class of 1891 and immediately became connected with the West End Street Railway Company, of Boston. He remained with this company two years and then accepted an important position with the Montreal Street Railway Company. From Montreal he went to Halifax as assistant manager, and six years ago he was given entire charge of the street railway and lighting system of that city. Mr. Huntress will assume his new duties Dec. 1.

THE PUBLIC SERVICE CORPORATION, of New Jersey, announces some important changes in the personnel of its street railway department. Mr. A. J. Bliss has been appointed division superintendent in charge of the Jefferson Avenue, Pavonia, Court House, Washington Street and Willow Avenue lines, also the Hoboken and Pavonia car houses, Fourteenth Street, Barclay Street and Pavonia Ferry terminals. Mr. Bliss succeeds Mr. Hugh Brooks, who has been assigned to other duties. Mr. W. F. Revoire, division superintendent, in addition to his present duties, has been appointed in charge of the Homestead transfer station, Paterson & Hoboken and Rutherford "Y" lines, also the Secaucus car house. Mr. Revoire succeeds Mr. A. J. Bliss, transferred. Mr. Frank C. Southard, division superintendent, in addition to his present duties, has been appointed in charge of the Forest Hill and Mulberry Street lines, also the Miller Street car house. Mr. Southard succeeds Mr. John Sloane, resigned. Mr. James Smith has been appointed division superintendent in charge of the West Orange, Orange Street, Central Avenue, South Orange, Orange & Passaic Valley Railway Company, South Orange and Maplewood lines, also the Roseville, Orange & Passaic Valley and South Orange car houses. Mr. Smith succeeds Mr. John A. Campion and Mr. James McDonough. Mr. Frank H. Brown has been appointed division superintendent in charge of the Main Line, Front Street, Fourth and Summerset, Arlington Avenue and Rahway lines, also the Westfield car house. Mr. John J. Gettings, division superintendent, in addition to present duties, has been appointed in charge of the Kinney Street, Bergen Street and Crosstown lines, also the Springfield Avenue car house. Mr. Gettings succeeds Mr. William B. Taylor, resigned. Mr. Patrick McDermott, division superintendent, in addition to present duties, has been appointed in charge of the Kerny line, succeeding Mr. John Sloane, resigned. Mr. Hugh Brooks has been appointed in charge of all horses and wagons, with the title of Superintendent of Trucking.

Street Railway Journal

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EDITORIAL NOTICE

Street railway news, and all information regarding changes of officers, new equipments, extensions, financial changes and new enterprises will be greatly appreciated for use in these columns.

All matter intended for publication must be received at our office not later than Tuesday morning of each week, in order to secure insertion in the current issue.

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The Electrical Equipment of the New York Central Railroad

The contracts awarded last week for electrical equipment by the New York Central & Hudson River Railroad Company, and mentioned elsewhere in this issue, constitute one of the most important events which have occurred in the history of electric traction since the equipment of the West End Railway, of Boston, in 1888 and 1899. That installation marked the confidence of the largest street railway company in the world at that time in what was then a new motive power. The contracts awarded last week by the New York Central & Hudson River Railroad, coupled with the adoption of electricity for its New York tunnel by the Pennsylvania Railroad Company, prove in an equally conclusive manner the confidence of steam railroad owners in what has been up to the present a comparatively untried motive power for heavy traffic conditions. It is true that the local conditions in each of these cases are particularly favorable for electricity. The fact that both the Pennsylvania Railroad and New York Central Railroad will enter New York through a tunnel barred steam from consideration. Nevertheless, in the case of the New York Central Railroad the desire to avoid the gases of combustion in the tunnel could not have been the only reason for the selection of electricity. If this was so electric operation could have been used only between Forty-Second Street and Mott Haven, or any other convenient point on the line near the northern end of the tunnel, where a change could be made. If this had been done the installation would have been similar to that in the Belt Line tunnel of the Baltimore & Ohio Railroad, or on the Paris terminus of the Orleans Railway Company, of France. The notable feature of the proposed New York Central installation is that electricity has been adopted not only for the tunnel section but as well for the service extending for a radius of about 50 miles on the main line and branches; in other words, for the entire suburban business.

In other respects, also, the New York Central contract is a notable one, as it includes: the adoption of steam turbines in 5000-kw units, the selection of direct-current distribution by polyphase transmission, in spite of the fact that the conditions are in many respects more favorable for polyphase motors than if the road was an ordinary street or elevated railway, the selection of 2200-hp locomotives, designed for operating at 60 m. p. h., and the use of gearless motors.

For the last ten years New York City has been the greatest center in the world of electrical development, on account of the electrical equipment of its vast system of surface and elevated lines. The work, viewed as a whole, is now approaching completion, but the new work here announced will keep the city for ten years or so longer as the great center of electric railway interest through the equipment of the subway and the electrical installations proposed by the New York Central Railroad and Pennsylvania Railroad. From a traffic standpoint, the former will be, in many respects, the most interesting of any which can be made, for the density of traffic from the Grand Central Station is probably as great as that from any other station in the world, and the possibilities of electricity for suburban traffic will have to be compared with one of the best steam services of this kind in existence. An opportunity will, therefore, be given for determining the relative economies and efficiencies of the two systems under the same conditions. As previously stated, we believe that very little difference will be found in the actual cost of power per ton-mile run, but that electricity will be found to show an enormous saving in practically every other respect, especially in maintenance and in train service, while the incidental advantages of electricity in comfort and higher speeds will have an enormous effect upon the total amount of business developed on the line affected.

Cincinnati's Interurbans

The attitude of most large cities of the country toward interurban electric lines, especially in the Middle West, has been of friendly sympathy and co-operation, but in the case of Cincinnati the most worthy projects for a long time received no encouragement whatever. All who have knocked for admission at her gates have been commanded to wait at the outer portals. This was largely brought about by the local traction interests, which wished to retain absolute control of the local service, and for this reason opposed the operation of interurban cars within the city limits, even over the tracks of the local

company. As soon as amicable arrangements were made for admitting the interurbans, the latter secured ample facilities for handling their prospective business in a convenient locality, and made their headquarters attractive for shoppers from other towns, who appreciate the conveniences afforded. The details of the system worked out by Mr. Scrugham and his associates are fully explained in the articles presented this week and in the last issue of the STREET RAILWAY JOURNAL upon "Cincinnati Interurban Development." A very comprehensive system has been established extending between 30 miles and 40 miles out of Cincinnati and including the Cincinnati & Eastern, the Suburban, and the Rapid Railway, each organized and built as a separate railway, and now operated as a division of the Interurban Railway & Terminal Company. The projectors very wisely built the lines in the most substantial manner, and an excellent idea of the standard of construction adopted in every department may be gained from these articles, which are freely illustrated. Everything about the service is of a superior character, including the roadbed and line equipment, the power plant and distribution system, the rolling stock and the freight and passenger buildings. Under the circumstances very efficient service might well be expected, and in this the community served has not been disappointed.

The manner in which the projectors have approached this problem and the methods they have employed throughout show that they are alive to the requirements of the situation as well as the benefits to be reaped. A study of the plan of operation the organization and the system of management cannot fail to be beneficial to others engaged in the operation of similar lines, as well as those who are about to enter this field.

Cincinnati waited long and patiently for interurban electric service, and the men back of the present enterprise found it difficult to secure a favorable hearing. But now that they have gotten together they are certainly making a brave showing, and a continuation of this co-operation cannot fail soon to produce results that will make the city as conspicuous for its fine interurban service as it formerly was for the lack of it.

The Conversion of Steam Roads

Almost weekly we hear, and often publish, rumors that the suburban system of some prominent railway is about to be reformed and converted to electric traction. Sometimes the report is a mere vague rumor, sometimes very specific and rich in corroborative detail, but the fact is that the change is very infrequently carried out, and that improvements rumored for years still hang fire and nothing is done. On the other hand, competing trolley lines multiply month by month, new suburban and interurban lines are constantly being projected, and usually are promptly put through. The steam line almost always has the advantage of position, in that it operates wholly on its own right of way, with few or no grade crossings, with every opportunity for a complete block signal system, and it generally serves an established community, well trained in the use of its rather infrequent stations. On form, the steam road should be convertible to an unusually effective electric system, with a heavy traffic already built up along the line and a far better chance of paying than a new road running through a partially developed country and under the necessity of building up its own traffic. One must instinctively ask, under such circumstances, why is it that the railroads are so slow in improving their opportunities. It is not wholly due to inertia, and certainly is not due to general distrust of electric traction, for in most matters railroad men are alert enough, and they certainly have had opportunity to learn, to their cost, the deadly competition that a well-run trolley line can put up. In fact, some of the very railroads that cling stubbornly to the locomotive for their suburban service are paralleling their own roads with interurban trolley lines. For example, one of the best short interurban lines with which we are acquainted is that operated between Manchester and Concord, N. H., by the Boston & Maine Railroad, which runs as dingy a suburban service out of Boston as ever roused the ire of a chronically-kicking commuter. And certainly no one has accused that worthy system of lack of means or condoled with it as a victim of cut-throat competition.

No; to view the facts in their proper light, the steam railroads are neither negligent nor asleep, and one has to seek definite reasons for their slowness to take up what is generally recognized as the best form of rapid transit. The broad facts are probably well known to many of our readers that the hesitation comes in the main from two sources of doubt—first, a conservative hesitation as to the probable saving to be accomplished at a somewhat large first cost; and, second, the really grave difficulties that beset the terminal problem. The first count in the indictment must, on reflection, be adjudicated in favor of the electric system, as a general principle. Of late years there have been many comparative estimates made in the light of pretty complete data on the cost and running expense of heavy interurban lines. We know of no case in which a comparison between the known cost of the steam service and the estimated cost of electric service has not, upon the whole, shown a probable saving sufficient to justify the expenditure. More than this, experience has already shown that a well-conducted electric service will in every case so increase the gross receipts as to put the change on a sound financial basis. One is, therefore, driven to the conclusion that the terminal difficulty, the serious problem of working electric trains and steam locomotives through the same yards and into the same or adjacent terminals, is really the one serious bar to the general adoption of electricity as a motive power for suburban trains. In fact, some railroad men frankly state that this is the difficulty over which they stumble. It is, perhaps, unfortunate that so many of the more serious attempts at heavy electric traction have been made by reliance on the third rail; for, useful as that device is within its own proper sphere, the man who undertakes to work out a practical third-rail system through and about a big terminal yard, has cut out for himself a task that is likely to keep him busy for a long time. Nothing delights an old railway man more keenly than to spring this problem on an ardent electrical enthusiast and then to watch his victim squirm.

But while we desire to go slowly in drawing conclusions from very recent experiments, we cannot resist the temptation of throwing up the Berlin-Zossen work at the dubiously minded. For, while the detail of such a system has not been worked out in its relation to suburban rapid transit, as we understand it in this country, and while we are not at all predicting that polyphase motors are the last word on the traction problem, we must, nevertheless, recognize that these experiments have emphasized the great fundamental fact that lies at the bottom of future electric traction. It is this—that if fast and heavy electric trains are to run over long distances, doing serious work, the voltage on the working conductors must be raised far above its present customary limits. Until this fact is fully recognized and the principle is put into regular practice, we are certain to potter along with makeshifts of various sorts, more or less

effective in special cases, but not effecting any material advance in the art. We have often pointed out how heavy electric traction is separating itself from street railroading in general, how the interurban lines may be divided into two rapidly diverging classes, and how these classes are founded on two radically different phases of rapid transit. It is daily becoming clearer that the fast interurban road is tending to follow the lines, as it must assume the responsibilities, of general railroading. This being so it is equally clear that the customary methods of electrical distribution, suited to ordinary tramway work and to minor electric service generally, must be radically changed to meet the conditions of the greater field. We, in this country, have temporized long enough in this matter. The lesson of Zossen must not be forgotten, even though the skill and ingenuity of American engineers may radically improve upon what has been there taught. We have in our country the greatest railroad systems on the face of the earth, and the most splendid opportunities for rapid transit, but if we are to make the most of them we must cut loose from traditions, however sacred, and to build for the twentieth century.

Interurban Limited Service

The buffet cars described in this issue, which are to be employed in the "limited" service given by the Indiana Union Traction Company, again call attention to the increasing importance that this limited service is assuming among high-speed interurban lines. It is the intention to place these buffet cars on the limited runs between Indianapolis, Anderson, Muncie, Marion and Logansport. While it is not the expectation that the small buffet with which these cars are equipped will prove exceedingly profitable in itself—indeed, it is not intended that this feature shall do more than support itself—the management considers that it will have accomplished its object if it adds to the attractiveness of the limited service enough to justify its maintenance. A traveling man who wants to cover as many towns as possible in a week will not fail to appreciate the service which will enable him to secure refreshments on the road.

This limited service, as now carried on, more than competes with the fastest steam railroad trains between the larger towns which it reaches. True, the interurban limited cars are handicapped by being obliged to run slow through the city streets, but as this service is carried on in the vicinity of Indianapolis, the loss of time is compensated for, as far as the passenger is concerned, by the time taken to reach the steam railroad depots from the business centers of the several cities toucehd, which averages as much as is required by the interurban cars in entering over the city tracks. This, together with the lower fares and more frequent service of the electric line, puts the steam railroad practically out of consideration for local traffic. In this connection it may be mentioned that the schedule time between cities for the interurban cars, as usually published, is likely to be misleading, in that it does not represent the actual running time from the center of one city to the center of the other. Thus, in Indianapolis, the leaving time given is that at the interurban waiting room, which is at one side of the business center. The leaving time from the business center is approximately 5 minutes later than this, and the arriving time at the other towns reached en route is likely to be 3 minutes to 5 minutes earlier than the leaving time from those towns given on the time-tables. Many of these details are not taken into account by the uninitiated when considering the time required in going from one city to the other, but they are appreciated by those who travel frequently, to the advantage of the interurban. For example, the leaving time given in the time-tables for limited cars on the Indiana Union Traction Company shows 1 hour and 25 minutes difference between Indianapolis and Anderson, but the actual running time between the business centers of these cities is nearer 1 hour and 15 minutes.

The extent to which this limited service is being developed is astounding to those who have not watched it closely for the last two years, and the best interurban lines recently built have all been surveyed with the idea of maintaining a fast limited service of this class. Besides the direct profits from the limited cars which a company maintains, this service, undoubtedly, has an advertising value and tends to create traffic which would not otherwise exist. An interurban road, depending, as it almost entirely does, on what is known as created travel, that is, travel which did not exist before the road was built, is certainly justified in maintaining such a service wherever conditions are right for it. Experience around Indianapolis indicates that people are willing to pay at least 25 per cent higher fare for the sake of a saving of 25 per cent in time. As to cost of operation, limited cars making few stops cost less per car-mile to operate than the locals, both in wages and motive power expenses. Of course, a time comes when the adding of more limited cars interferes with the locals, because of the large number of meeting points on a single-track road, and then it is time to figure on double track.

Chicago Strike Ended

As we are going to press word comes from our Chicago representative that the Chicago City Railway Company and its former employees have agreed upon terms of settlement, and that the strike on the South Side lines is practically closed. As a result, the entire community relished its dinner, and gave more fervent expression of its gratitude on Thanksgiving than it would otherwise. It has been a trying ordeal for the company and its patrons, and undoubtedly for many of the men, and was marked by great intensity of feeling on all sides.

"This is going to be a very quiet strike," said President Mahon, of the Amalgamated Association of Street Railway Employees, when the men quit their posts. "There will be no violence, no rioting. Everything will be conducted in an orderly manner." With this promise the labor leaders withdrew, and the struggle was on. What was the result?

The first car to leave the barns was assailed with a shower of brickbats, obstructions were piled on the tracks, a blockade was presented at every crossing, and those who had the temerity to patronize the cars were assailed by the strikers, threatened, bullied and roughly handled. The company's property was destroyed and damaged, its employees waylaid and assaulted, the principal thoroughfares on which cars are operated were choked by trucks in charge of belligerent teamsters, and the streets lined with strikers and their sympathizers, ever ready for an opportunity to engage in open warfare with the street railway and its new employees. Cars could only be operated under strong police protection, and then at infrequent intervals. In every scrimmage, where the police succeeded in making arrests, strikers and other union men were found among those leading the disturbances.

Now that the strike is over the folly of these demonstrations is brought home to the men themselves. The men who are known to have participated in these disturbances will not be taken back. We are glad the company insisted upon this point—it makes for law and order. It was a decisive victory in every way for the company.

CINCINNATI INTERURBAN DEVELOPMENT—II

RAILWAY BUILDINGS

In designing the buildings of the system especial attention was paid to artistic effects, the aim being to make them attractive as well as substantial. The manner in which this was done may be judged from the accompanying views of car houses, power stations, sub-stations and the terminal station.

There are two car houses and repair shops, one at Deer Park, on the Rapid Railway, and the other at Coney Island, at the junction of the Suburban and the Cincinnati & Eastern; the latter serving both roads. The buildings and arrangements are practically identical except that the Deer Park house has a wing that is used as a sub-station. The buildings measure 253 ft. 6 ins. x 76 ft. On one side is a three-story office building, 23 ft. x 23 ft. The front is buff colored pressed brick with stone trimmings, and the roof is of tile with ornamental designs. The first floor is partitioned off for the cashier and the starter. The partitions are all Florentine glass, the fixtures and furniture are all antique oak, and the floors all hard wood. A fireproof vault is built in. The second floor is a waiting room for motormen and conductors, and is provided with lockers and tables. Papers and magazines are furnished to the men. The third floor is devoted exclusively to the despatcher's office. One man handles the Cincinnati & Eastern and the Suburban from the office at Coney Island, while the Deer Park man handles the Rapid Railway. To the rear of the office is a store room, 20 ft. x 16 ft.; machine shop, 42 ft. x 16 ft.; blacksmith shop, 22 ft. x 16 ft.; armature room, 18 ft. x 16 ft., and oil room, 16 ft. x 16 ft. The machine shop contains a planer, lathe, drill press, wheel press and other tools. In this shop is a 50-hp motor, which supplies power and operates a pump which takes water from an 8-in. driven well, and delivers it to a 20,000-gal. tank 12 ft. above the roof. There is an automatic sprinkler system throughout the house, and a 6-in. main is connected with hydrants at various points where reels of 2½-in. hose are maintained. The line also supplies a filterage tank which provides the employees as well as the water coolers in the cars with pure water. The car house proper has a cinder floor, and is provided with six tracks. Three of them have pits the full length, in which are used Dorner & Dutton car jacks. The roof supports are all steel, resting on concrete, and the roof is covered with asphalt. At Deer Park a one-story house, 60 ft. x 135 ft., provided with two tracks, is to be erected for carpenter and paint shop.

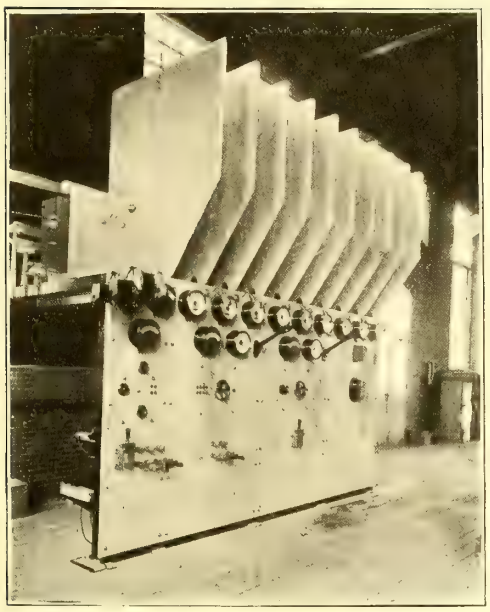


DEER PARK CAR HOUSE, RAPID DIVISION. A DUPLICATE OF THIS HOUSE IS LOCATED AT CONEY ISLAND ON C. & E. AND SUBURBAN DIVISIONS



SIDE VIEW DEER PARK CAR HOUSE

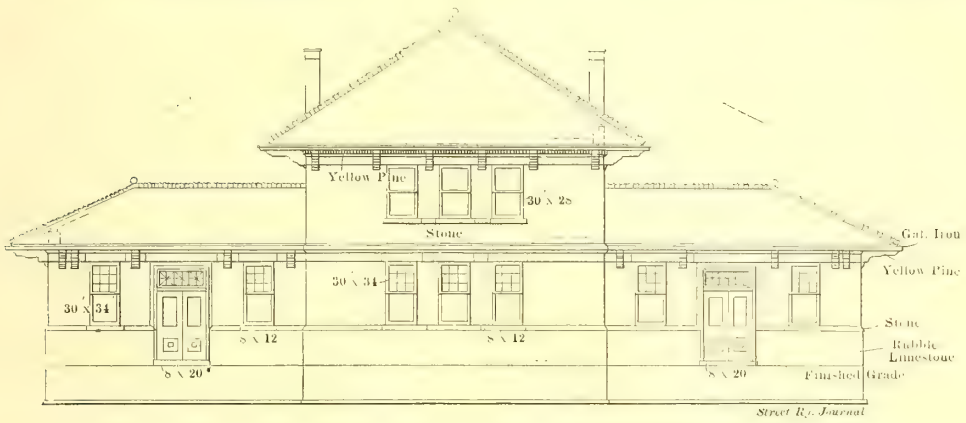
Two very attractive sub-stations are located on the Suburban



SWITCHBOARD, POWER HOUSE NO. 2, SOUTH LEBANON



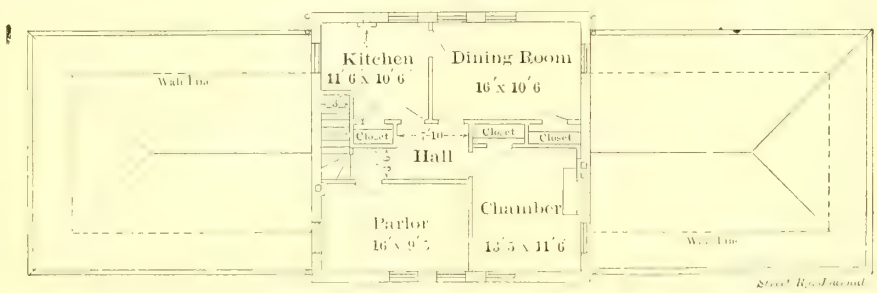
VIEW OF SUB-STATION AT FORRESTVILLE, OHIO (SUBURBAN DIVISION)



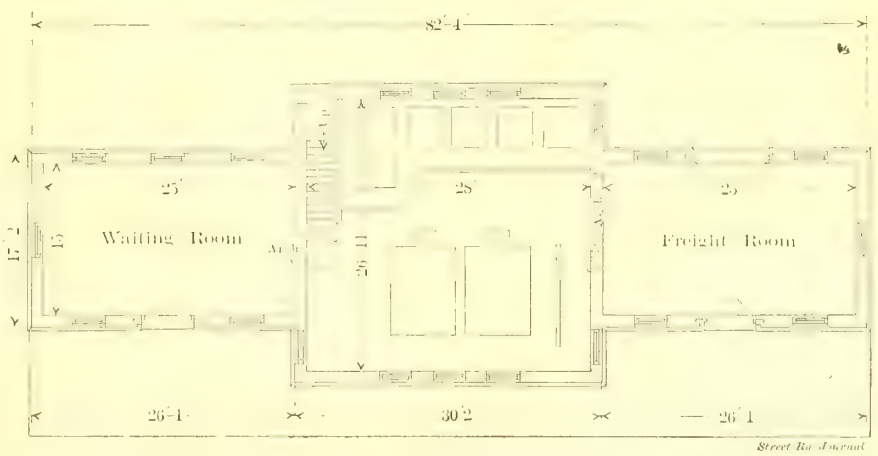
FRONT ELEVATION OF SUB-STATION FOR THE SUBURBAN DIVISION AT FORRESTVILLE, OHIO

Railway. The one at Forrestville is stone and buff pressed brick, with stone trimmings and oranamental tile roof. It is two stories in the center, the upper floor being arranged with a suite of five rooms for the attendant and family, while the lower floor is the rotary and transformer room. There are two 25-ft. wings, one for the passenger waiting room and the other for an express room. The station at Amelia has ornamental slate roof with an extended roof around the entire building, forming a protection for passengers. In front is the waiting room for passengers, and back of this is the express room, which is reached by a spur at the side. The rotary room is in the rear. The attendant has a fine suite of rooms on the second floor, which is reached by a private door at the side.

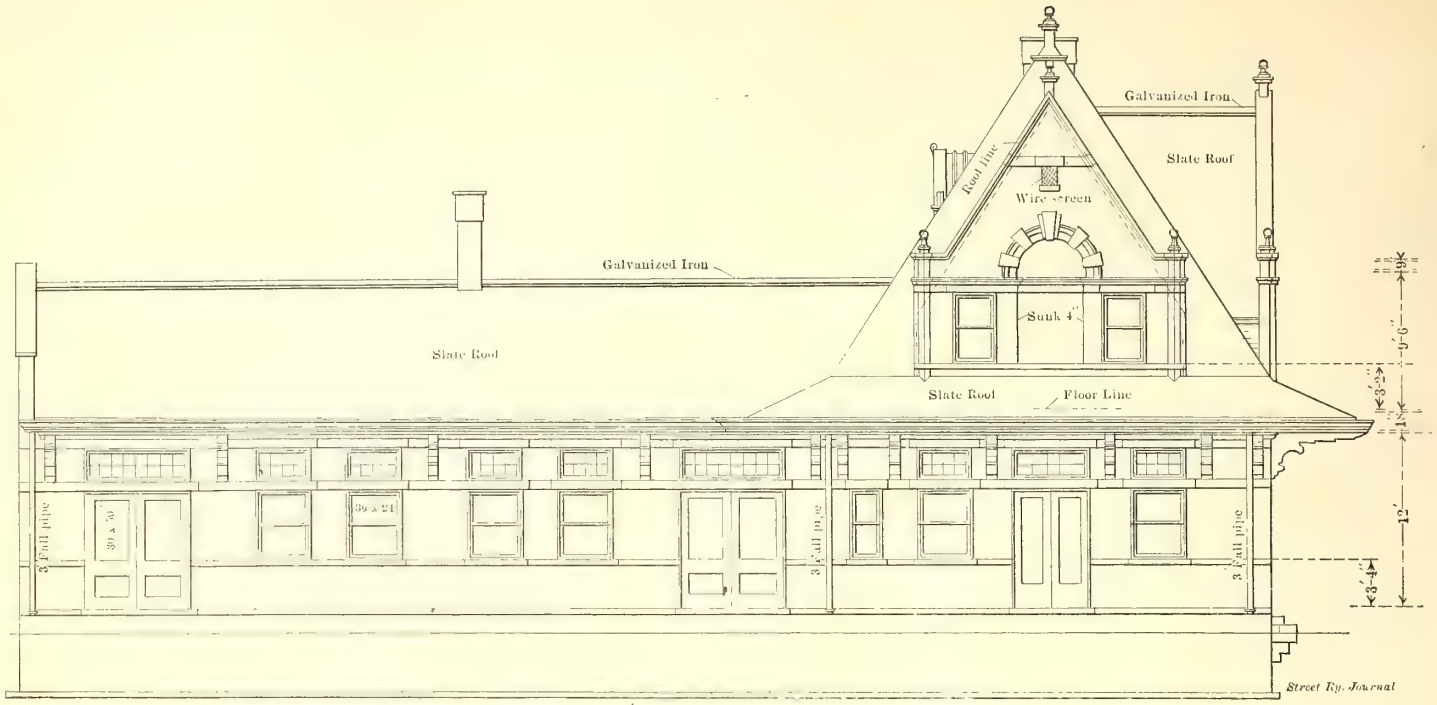
The STREET RAILWAY JOURNAL of Aug. 30, 1902, contained the preliminary plans, together with a description of the terminal station which the Scrugham syndicate proposed erecting. This building has recently been completed, and is now occupied. It is undoubtedly one of the finest structures ever erected by an electric railway, and for elegance and completeness the station portion probably cannot be equalled in the country. The building is six stories high, measuring 60 ft. x 202 ft. 10½ ins. The front is of buff colored pressed brick, with trimmings of selected Bedford stone, much of which was carved after being put in place. The mortise work is all carved stone, and the effect of the whole is very pleasing. Half of the first floor is devoted to the general waiting room and to the express room. In the waiting room are a ticket office provided with vault for tickets, cigar and newsstand, check room and passenger elevator. Adjoining the general waiting room is a waiting room for ladies,



SECOND FLOOR PLAN OF SUB-STATION FOR THE SUBURBAN DIVISION AT FORRESTVILLE, OHIO



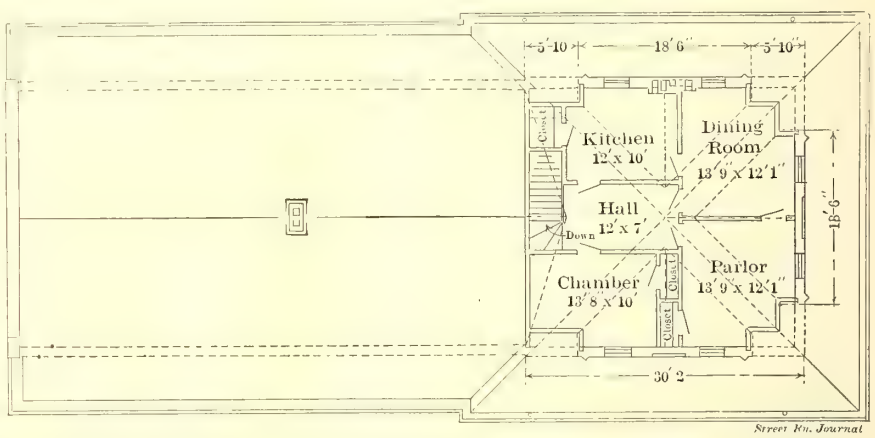
GROUND FLOOR PLAN OF SUB-STATION FOR THE SUBURBAN DIVISION AT FORRESTVILLE, OHIO



FRONT ELEVATION OF SUB-STATION FOR THE SUBURBAN DIVISION AT AMELIA, OHIO

and a colored maid is in constant attendance. The flooring is all mosaic tile in attractive design. The stairways and baseboards are all white marble, and the windows are all chipped glass. The skylight has stained glass of handsome design, the chandeliers are of Pompeian bronze with frosted globes, and there is a marble water-cooler in the center of the room.

All passenger cars run inside the building, and stand there until the time of departure. There are two tracks running through the building, one being used for freight and express. The freight department is in the rear, and is provided with a freight elevator and other necessary appliances. Wagons drive into the building and unload goods onto platforms or directly into the cars. In the basement is a boiler for heating the building and supplying steam to a Buckeye engine, which is directly connected to a 75-kw, 125-volt generator, supplying current for lighting and for two electric elevators. The second floor is fitted up with convenient suites for the general offices of the company, while a portion of the third floor is fitted up for the engineer's offices. The balance of the building will be rented out to tenants, and it is believed that this alone will be sufficient to pay the interest on the investment.



SECOND FLOOR PLAN OF SUB-STATION FOR THE SUBURBAN DIVISION AT AMELIA, OHIO



DEPOT AND SUB-STATION AT FORRESTVILLE

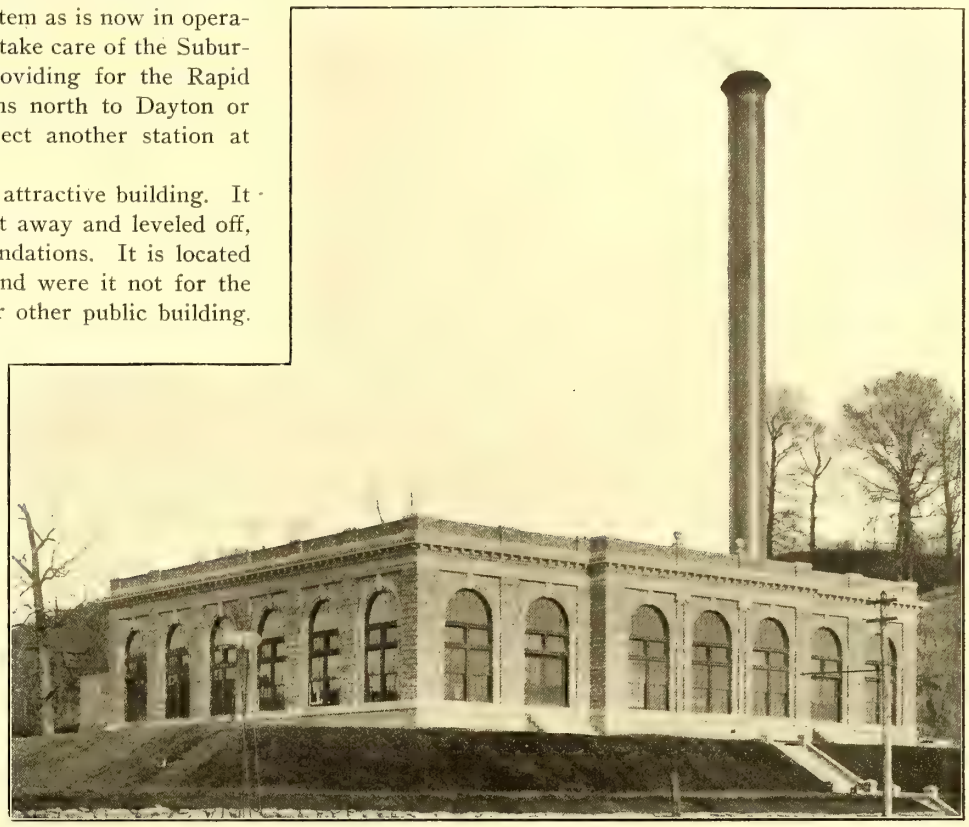


SUB-STATION AND DEPOT AT AMELIA, OHIO, SUBURBAN DIVISION (LIVING ROOM FOR ATTENDANT UPSTAIRS OVER GENERAL WAITING ROOM IN FRONT)

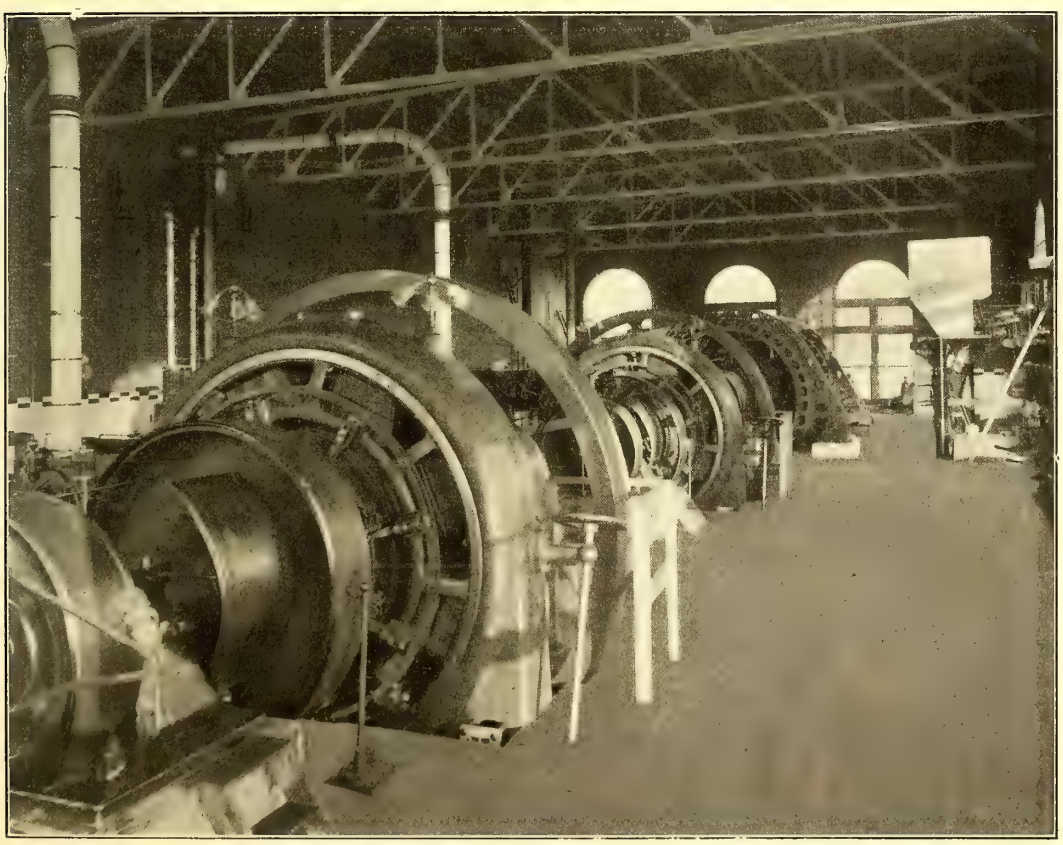
POWER HOUSES

Two power stations are employed in operating the system. The first station was erected at a point near Coney Island to provide for the Cincinnati & Eastern Railway. At that time it was not known whether the syndicate would be able to carry out all its plans, and in consequence the station was not designed to take care of so extensive a system as is now in operation. Later the station was enlarged to take care of the Suburban Railway, but when it came to providing for the Rapid Railway, in view of possible extensions north to Dayton or Xenia, it was thought desirable to erect another station at South Lebanon.

Station No. 1, at Coney Island, is an attractive building. It stands on a bluff, and a hillside was cut away and leveled off, the gravel taken out being used in foundations. It is located directly opposite Coney Island Park, and were it not for the stack it might be taken for a library or other public building. A stone embankment extends across the front, and it is reached by a flight of stone steps. The exterior is of buff brick with Bedford stone trimmings. The windows are arched, with brick designs above, and cornices are carved. The building is 120 ft. x 122 ft., and it is divided through the center by a brick wire wall, provided with steel rolling doors. The roof is supported on lattice work steel trusses, above which are joists carrying matched long-leaf yellow pine flooring, with asphalt roofing above. The interior of the engine room is finished to a height of 5 ft. with Tiffany glazed brick. All foundations are solid concrete. The boiler room floor is concrete, while the engine room floor is hard wood with rubber mats around all machinery. The equipment for the original road included two Buckeye cross-compound condensing engines, cylinders 18¼ and 36-in. x 33-in. stroke, direct-connected to 400-kw, 500-volt, 800-amps. direct-current Westinghouse generators, operating at 125 r. p. m. Steam was supplied by three 325-hp water-tube boilers. This equipment supplies the Cincinnati & Eastern Railway, including 13 miles of single track in one direction and 4 miles of double track in the other direction.



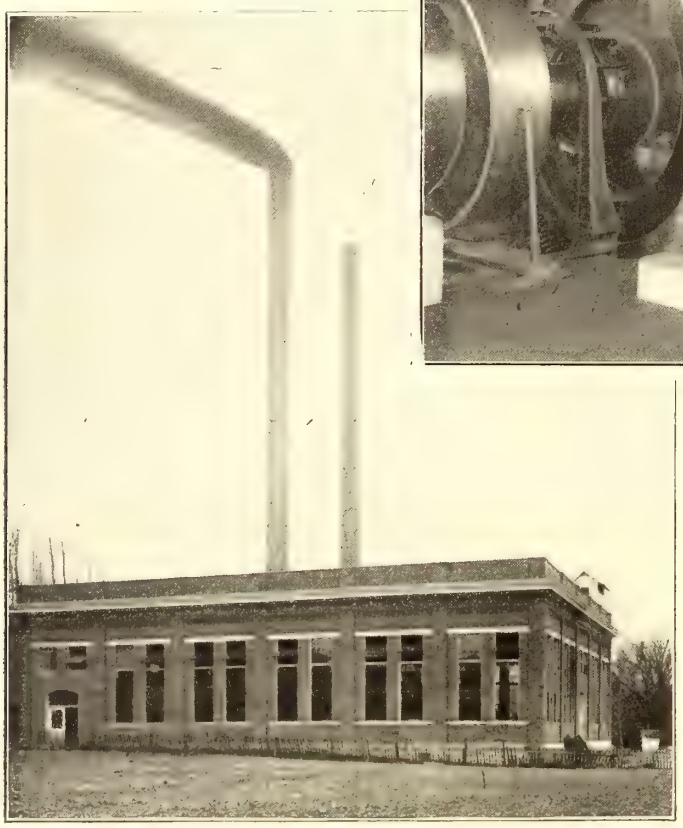
POWER STATION NO. 1, AT CONEY ISLAND (C. & E. DIVISION)



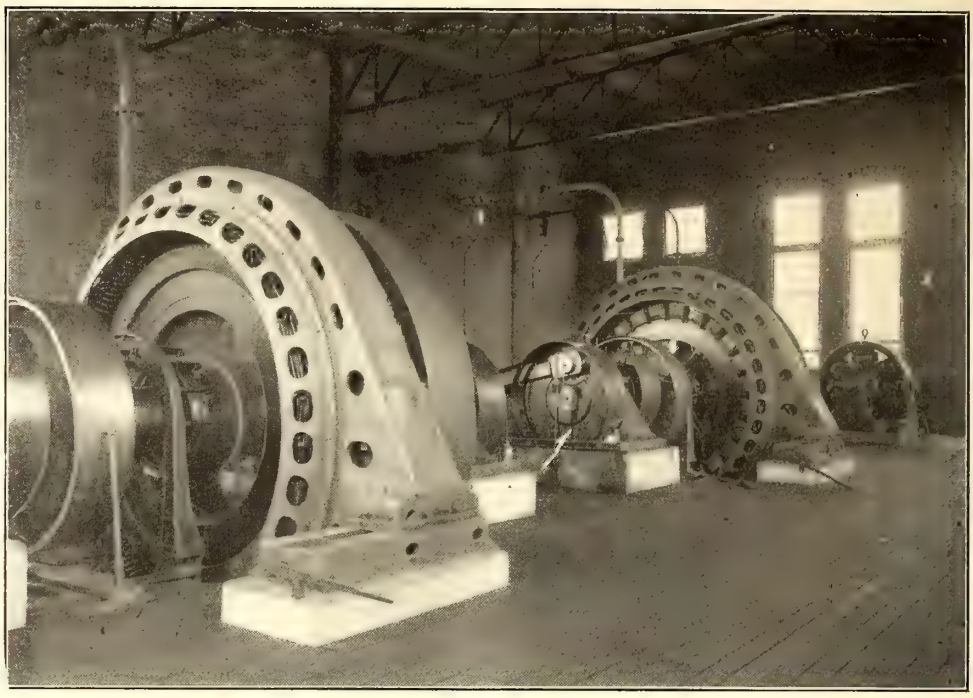
ENGINE ROOM, SHOWING TWO 400-KW DIRECT-CURRENT AND TWO 500-KW ALTERNATING-CURRENT UNITS, WITH SWITCHBOARDS, AT POWER HOUSE NO. 1, NEAR CONEY ISLAND

The new units installed for the Suburban Railway are two cross-compound condensing Buckeye engines, rated at 800 hp each, directly connected to 500-kw, three-phase alternators. The cylinders measure 22 ins. high pressure, 40 ins. low pressure by 36-in. stroke. The engines have piston type valves, and operate at 125 r. p. m. They are designed with extra heavy main bearings, as are the smaller engines in the house. The engines have an economical range of from 600 hp to 850 hp, and are guaranteed to consume not to exceed 15 lbs. of dry steam per ihp per hour. The fly-wheel of each engine weighs 20,000 lbs., is 13 ft. in diameter and has 22-in. face. The generators are of the compound-wound, revolving field type, and are wound for a pressure of 10,000 volts, the same as is used on the transmission lines. The current is three-phase, 25 cycles and 3,000

alternations. The output of each terminal is 28.9 amps. There are two exciter sets, one a 7¾-in. x 12-in. Buckeye simple engine, direct connected to a 37½-kw, 125-volt generator, and the other a 60-hp motor, taking current from the direct-current machines at 500 volts, directly connected to a 37½-kw, 125-volt generator. Ad-



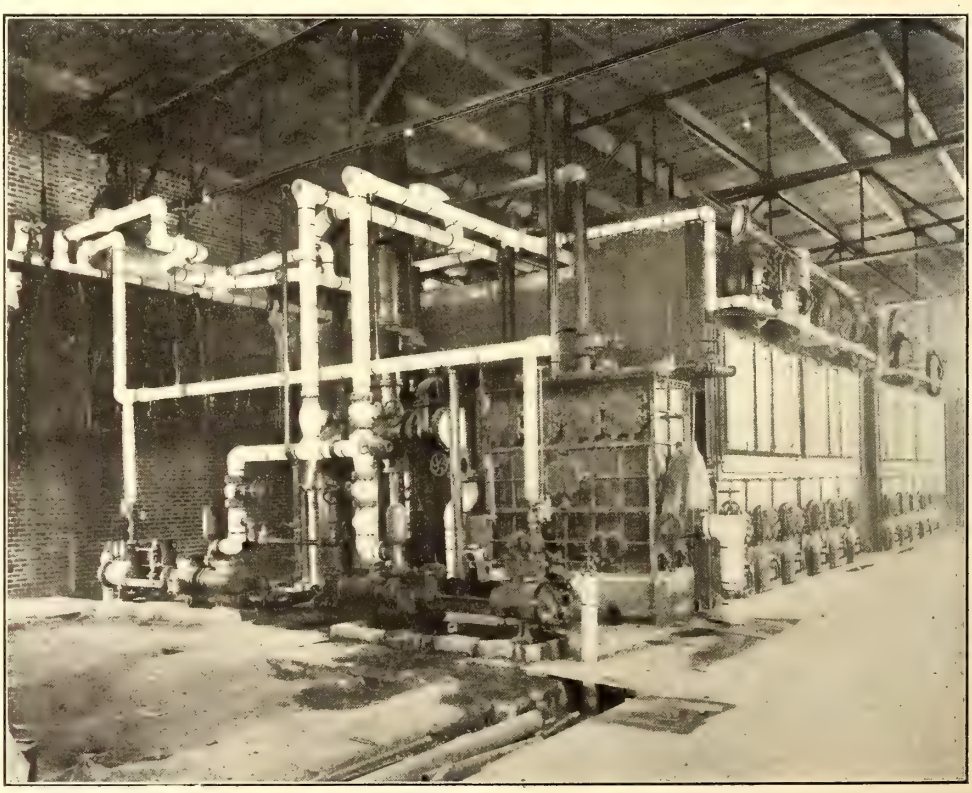
POWER HOUSE NO. 2, AT SOUTH LEBANON—RAPID DIVISION



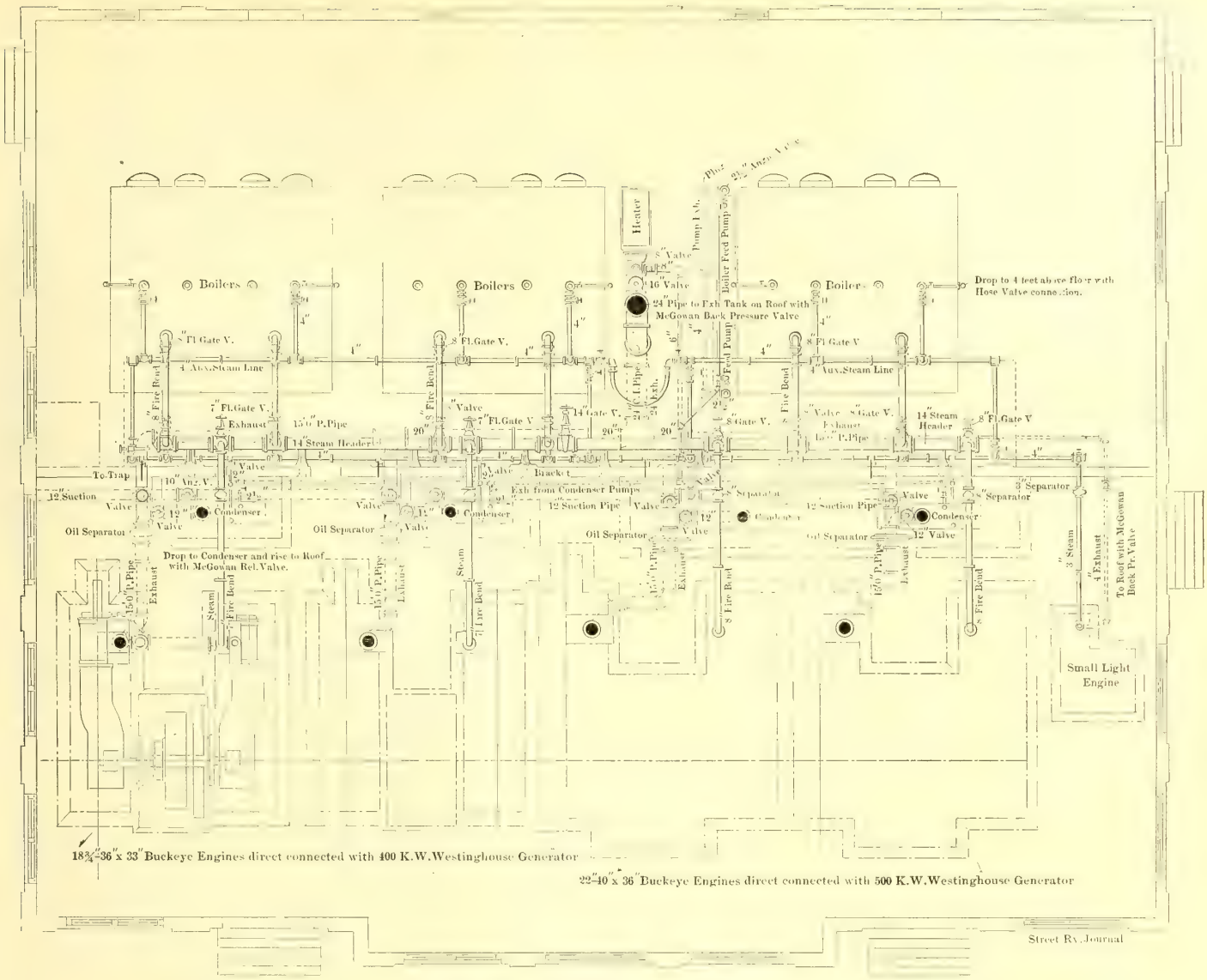
SOUTH LEBANON POWER PLANT NO. 2, SHOWING TWO 500-KW 10,000-VOLT ALTERNATORS AND ONE 400 ROTARY

joining the direct-current machines is the direct-current switchboard, consisting of seven Vermont panels mounted on an angle-iron frame. There are two machine panels, four feeder panels and one load panel. Each machine panel has a main switch, voltmeter, ammeter, rheostat and circuit breaker. Each line panel has main switch, voltmeter, ammeter and circuit breaker. The load panel has a Thomson recording wattmeter, Weston ammeter and Weston voltmeter.

The high-tension switchboard is made of five blue Vermont marble panels 2 ins. thick, 10 ft. 2 ins. tall and 4 ft.wide. The first panel,which is the load panel, contains two 500-amp. direct-current deadbeat ammeters, one 150-volt direct-current voltmeter, two 10,000-volt static ground detectors, three rheostats, a voltmeter plug and receptacle, a 300-amp., 300-volt unit blade switch, two 300-amp.,,300-volt double-pole switches, a 100-amp., 600-volt double-pole switch with field discharge attachment, and a non-automatic starting and stopping rheostat. On a bracket at the side of this panel are two 150-volt alternating-current voltmeters. On the first machine panel, known as panel "B," are three 50-amp. alternating-current long-scale ammeters, one 200-amp. direct-current deadbeat ammeter, one 800-kw polyphase indicating wattmeter, a starting switch rheostat voltmeter and receptacle, synchronizing plug and receptacle and a 200-amp. field discharge switch. The second machine panel contains the same instruments except that the voltmeter plug and receptacle are omitted. Panel "D," the first line panel, contains three 60-amp. long-scale ammeters, a switch, a time relay and a 1200-kw polyphase integrating wattmeter. The remaining panel is the same except that the wattmeter is



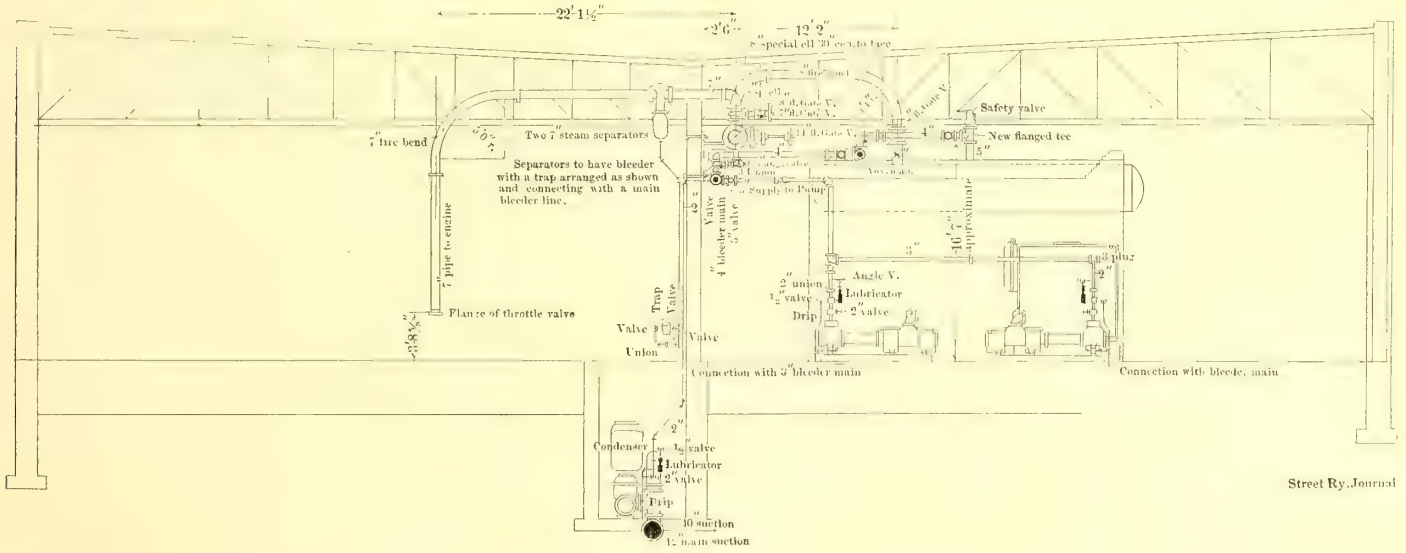
VIEW SHOWING PIPING, PUMPS, HEATER AND BOILERS IN POWER STATION NO. 1. TWO MORE BATTERIES OF BOILERS HAVE SINCE BEEN ADDED



PIPING PLANS FOR POWER HOUSE NO. 1

omitted. Above the panels, and with each leg separated by marble barriers, are 500-amp., three-phase, 10,000-volt stick type circuit breakers, those protecting the machines being hand-operated and those protecting the lines being automatic. The outgoing lines, both high tension and direct current, pass below the engine room floor to a chute in the wall separating the two sections of the building. The direct-current lines pass through tile conduits for a distance of 200 yds. away from the building, and are then carried up to the pole line. The high-tension lines are carried through the chute to the top of the building and are carried to the pole line from the rear. In this way no wires leave the building from the front or sides. The lightning arresters, of the Westinghouse low-equivalent type, are in marble barriers at the base of the chute, and are accessible from the boiler room.

The boilers installed are duplicates of those in the station at



SECTION OF C. & E. POWER HOUSE, SHOWING STEAM PIPING

first. There are now six boilers in use, arranged in three batteries. Each has 3000 ft. of heating surface provided by 144 4-in. tubes, 18 ft. long. They are hand-fired and have plain grates. They are designed for 125 lbs. steam pressure.



LADIES' WAITING-ROOM—INTERURBAN TERMINAL STATION



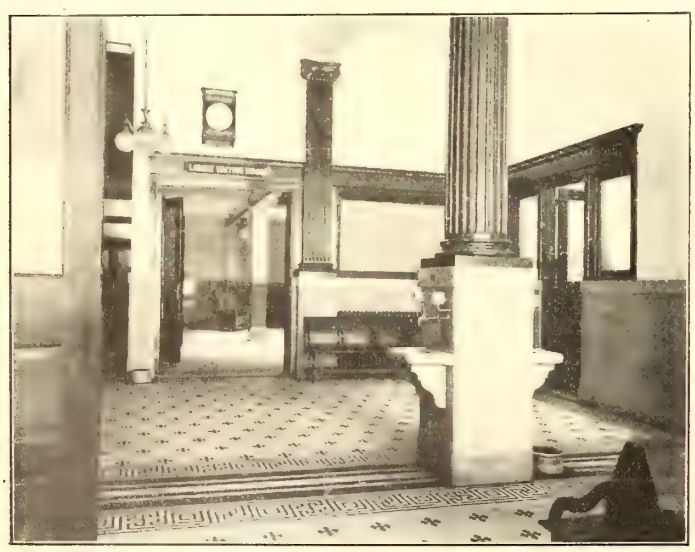
FREIGHT TRACKS—INTERURBAN TERMINAL STATION

The original station piping and auxiliaries were all designed for increased equipment and few alterations were necessary. The boiler feed pumps, two in number, are of the Stillwell-Bierce & Smith-Vaile outside-packed plunger type, 10 ins. x 6 ins. x 10 ins. They are arranged to pump either way. The piping, both steam and water, is in duplicate. A Cochrane heater of 4000-hp rating adjoins the two feed-water pumps in the boiler room, and this heats the feed-water to 190 degs. The main steam header is 14-in. wrought-iron pipe, and it has two Fairbanks gate valves. It is connected to the boilers by 8-in. lines, having 8-in. gate valves at both ends.

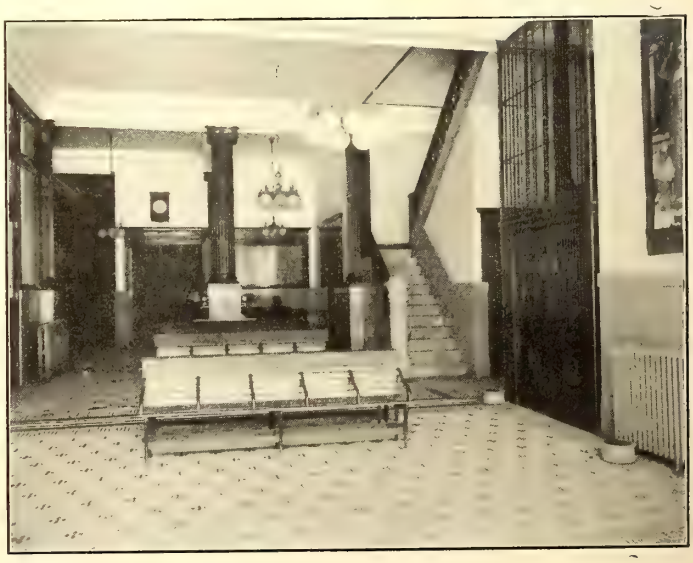


DANCING HALL AT CONEY ISLAND—C. & E. DIVISION

The lines to the engines are 7-in. wrought-iron pipe, and are provided with fire bends. Other details of the steam piping are shown in the accompanying drawings. The condensers are located below the engines and adjoining the dividing wall. There are four installed, and they are of the Wheeler admiralty surface type. Those installed for the Cincinnati & Eastern have 1070 sq. ft. of cooling surface, and those for the latter engines have 1410 sq. ft. of cooling surface. The nominal vacuum is 26 ins. The condensers are provided with Cochrane oil separators. All exhaust is piped to a 24-in. pipe leading up through the roof in the

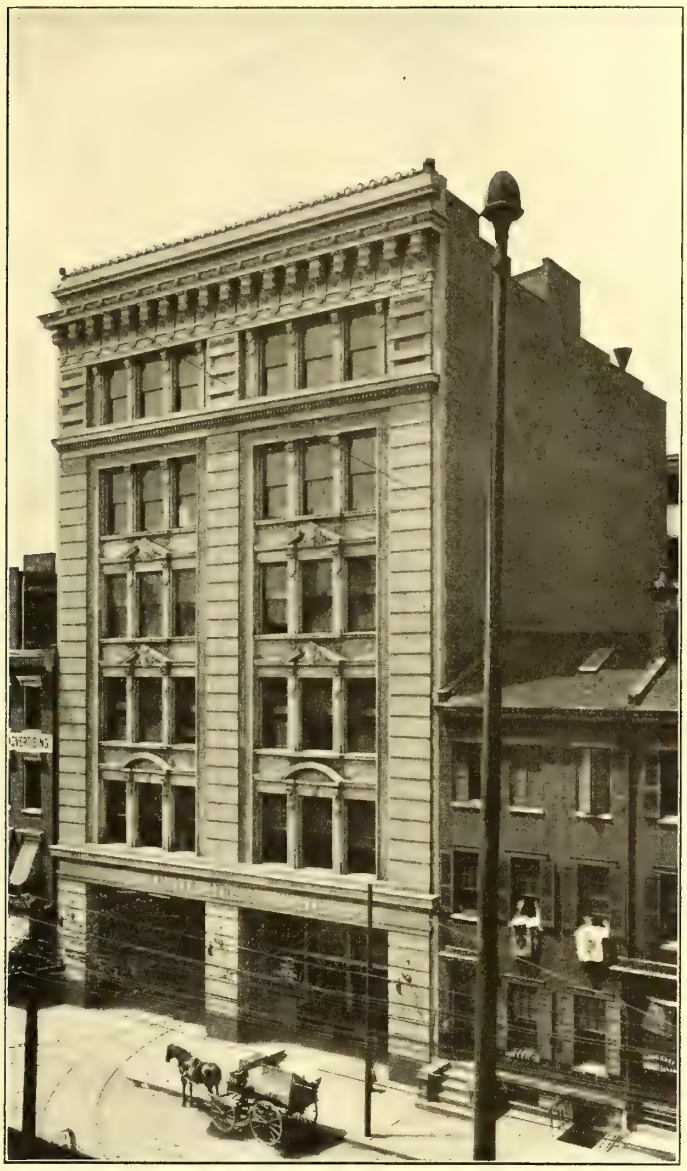


REAR OF GENERAL WAITING-ROOM, SHOWING DRINKING FOUNTAIN



GENERAL WAITING-ROOM—INTERURBAN TERMINAL STATION

boiler room to a 6-ft. steel tank on the boiler room roof. From this the water is drained through a 2-in. pipe to a hot well. Or, if desired, the condensers may exhaust through 12-in. pipes



INTERURBAN TERMINAL STATION

leading up through the roof. Water for condensing and feed-water is taken through lines to Coney Island and Lake, a body of water 35 acres in extent, supplied by a never-failing stream. All drains lead to the far end of this lake. For emergency water supply there are two deep wells adjoining the house, fitted with steam deep-well pumps. All piping for the house was designed and installed by the John H. McGowan Company, of Cincinnati. All electrical equipment was designed and installed by the Westinghouse Company. The stack is outside the building, and is supported on a concrete foundation, 20 ft. x 20 ft. x 23 ft. It is 153 ft. tall and 10 ft. in diameter, and is lined with firebrick, the outside being of steel. Second Poole Pittsburg run of mine coal is used, and it is brought down the Ohio River in boats and unloaded by an elevator into cars a short distance from the station. The coal storage in the rear of the station has a capacity of over 1000 tons.

Power station No. 2 is of attractive design, measuring 120 ft. x 130 ft. Two generating units are installed, and they are exact duplicates of the 10,000-volt machines in No. 1. Steam is furnished by four boilers, duplicates of those in the other house. The feed-water pumps are of the McGowan duplex type, measuring 10 ins. x 6 ins. x 10 ins., while the condensers are 1000 hp, of the jet type, and were also furnished by the J. H. McGowan Company, of Cincinnati. The arrangement of piping is practically the same as that in the other house. The house is located adjoining an old bed of the Little Miami River. There is a dam 3 miles down the river which creates a back water in this channel, and in order to prevent refuse from floating in, the company built a dam a short distance from the house. A 15-ft. cistern has been built adjoining the river, and the river level is maintained in this. Adjoining the cistern is a pump house and tank with a capacity of 21,000 gals. Water is pumped to the tank by a 7½-in. x 5-in. x 7-in. McGowan pump. The bottom of the tank is 4 ft. above the level of the boilers. Condenser water is taken through a 10-in. suction to the cistern. The condenser discharge and all blow-offs are taken through a 12-in. wrought-iron pipe to a point below the dam. The drainage from the building and all drains from traps are carried to the same point through a 12-in. vitrified clay sewer pipe. The house has two 125-ft. x 5-ft. steel stacks, supported on concrete foundations. The fuel supplied to this station is Kanawha West Virginia coal, which is unloaded from a siding to the Pennsylvania, which passes the building. Elevated tracks are being built to facilitate the work. In this house is a sub-station supplying about one-half of the Rapid Railway. There is one 400-kw rotary converter, taking current at 403 volts, 3000 alternations and delivering direct current at 650 volts. On the shaft of the rotary is an induction starting motor, which takes current from the transformers. Three 150-kw oil-cooled transformers are located in the basement directly below the switchboard. They take current at 10,000 volts and reduce it to 403 volts for the converter. They are connected in delta arrangement. Westinghouse low-equivalent lightning arresters



LAKE AT CONEY ISLAND

The Interurban Railway and Terminal Co.

Passenger Tariff No. 1.

Suburban Division.

In Effect September 15, 1903.

SINGLE TRIP FARE.

STATIONS.	Cincinnati.	Carrell Street.	Gwendolen.	Water Works.	California	Coney Island.	Mt. Washington.	Cedar Point	Fruit Hill.	Forestville.	Cherry Grove.	Tobasco.	Withamsville	Hights Farm	Amelia	Hamlet.	Mt. Holly	Bantam	Bethel.
Cincinnati		5	10	10	10	10	10	15	15	15	20	20	25	25	30	30	35	35	40
Carrell Street.	5		5	5	5	5	5	10	10	10	15	15	20	20	25	25	30	30	35
Gwendolen	10	5		5	5	5	5	10	10	10	15	15	20	20	25	25	30	30	35
Water Works	10	5	5		5	5	5	10	10	10	15	15	20	20	25	25	30	30	35
California	10	5	5	5		5	5	10	10	10	15	15	20	20	25	25	30	30	35
Coney Island	10	5	5	5	5		5	5	5	10	15	15	20	20	25	25	30	30	35
Mt. Washington	10	5	5	5	5	5		5	5	10	15	15	20	20	25	25	30	30	35
Cedar Point	15	10	10	10	10	5	5		5	10	15	15	20	20	25	25	30	30	35
Fruit Hill	15	10	10	10	10	5	5	5		10	15	15	20	20	25	25	30	30	35
Forestville	15	10	10	10	10	10	10	10	10		15	15	20	20	25	25	30	30	35
Cherry Grove	20	15	15	15	15	15	15	15	15	15		5	10	10	15	15	20	20	25
Tobasco	20	15	15	15	15	15	15	15	15	15	5		10	10	15	15	20	20	25
Withamsville	25	20	20	20	20	20	20	20	20	20	10	10		5	10	10	15	15	20
Hights Farm	25	20	20	20	20	20	20	20	20	20	10	10	5		10	10	15	15	20
Amelia	30	25	25	25	25	25	25	25	25	25	15	15	10	10		5	10	10	15
Hamlet	30	25	25	25	25	25	25	25	25	25	15	15	10	10	5		10	10	15
Mt. Holly	35	30	30	30	30	30	30	25	25	20	20	15	15	10	10	5		5	10
Bantam	35	30	30	30	30	30	30	25	25	20	20	15	15	10	10	5	5		10
Bethel	40	35	35	35	35	35	30	30	25	25	20	20	15	15	10	10	10	10	

Round Trip Fares.

When Single Trip Fare is	Sell Round Trip Ticket at
15 cents.	25 cents.
20 "	35 "
25 "	45 "
30 "	55 "
35 "	65 "
40 "	75 "

INSTRUCTIONS

To Ticket Agents:

No 1.—Sell Single Trip Tickets at rates given in this tariff until further notice

No 2.—Sell Round Trip Tickets to and from all points for which single trip fares are quoted at the round trip fares given in the tariff shown.

No 3.—Sell Full Fare Tickets for children 7 years of age or over. Children under 7 years of age when accompanied by person in charge holding regular ticket, are carried free

No 4.—No reduction for any ticket when the one way fare is ten cents or less, without special instructions are issued to the contrary

To Conductors:

To and from all Points, collect and register full cash fare from all persons over 7 years of age who do not hold tickets or other evidence of being entitled to passage.

B. E. MERWIN,
General Superintendent.

PASSENGER TARIFF—SUBURBAN DIVISION

The Interurban Railway & Terminal Co.
Cincinnati & Eastern Division.

COMMUTATION TICKETS.
In Effect September 15, 1903.

STATIONS	Single Trip	Round Trip	10 Ride	20 Ride	50 Ride	Monthly Tickets	School
Cincinnati							
Carrell Street.	05	10	50	1 00	2 50	2 50	
Gwendolen	10	20	1 00	2 00	4 50	4 50	3 00
Water Works	10	20	1 00	2 00	4 50	4 50	3 00
California	10	20	1 00	2 00	4 50	4 50	3 00
Coney Island	10	20	1 00	2 00	4 50	4 50	3 00
Sweet Wine	15	25	1 25	2 50	6 25	5 50	4 00
Eight Mile	20	35	1 75	3 50	8 25	7 00	5 00
Nine Mile	25	45	2 25	4 00	10 00	8 00	5 50
New Palestine	25	45	2 25	4 80	10 75	8 50	6 00
Blairville	30	55	2 75	4 80	11 50	9 00	6 50
New Richmond	30	55	2 75	5 00	12 00	10 00	7 00

COMMUTATION TARIFF—CINCINNATI & EASTERN DIVISION

The Interurban Railway & Terminal Co.
RAPID RAILWAY DIVISION.

COMMUTATION TICKETS.
In Effect September 15, 1903.

STATIONS	Single Trip	Round Trip	10 Ride	20 Ride	50 Ride	Monthly Tickets	Monthly School 46 Trips
Cincinnati							
Cypress Avenue	05	10					
Pleasant Ridge	07	14		1 20	3 00	3 00	2 00
Kennedy	08	16		1 25	3 10	3 10	2 10
Silverton	10	20	1 00	2 00	4 00	4 00	2 60
Deer Park	10	20	1 00	2 00	4 00	4 00	2 60
Rosmoyne	10	20	1 00	2 00	4 00	4 00	2 60
Terra Alta	15	30	1 50	3 00	4 50	4 50	2 75
Blue Ash	15	30	1 50	3 00	1 50	1 50	2 75
Winslow Park	20	35	1 75	3 50	5 00	5 00	3 00
Hazelwood	20	35	1 75	3 50	5 50	5 25	3 00
Brecon	20	35	1 75	3 50	5 75	5 50	3 25
Miltomson	25	45	2 25	4 50	8 25	7 00	3 75
Mason	30	55	2 75	5 50	11 75	8 00	4 00
Kings Mills	35	65	3 25	6 50	14 00	9 00	4 50
South Lebanon	10	75	3 75	7 50	16 25	10 00	5 00
Ridge	15	85	4 25	8 25	18 25	11 00	5 50
Lebanon	50	90	4 50	8 75	20 00	12 00	6 00

COMMUTATION TARIFF—RAPID RAILWAY DIVISION

The Interurban Railway and Terminal Co.

PASSENGER TARIFF No. 1.

In Effect September 15, 1903.

Rapid Railway Division.

STATIONS.	Cincinnati.	Cypress Avenue.	Pleasant Ridge.	Kennedy Heights.	Silverton.	Deer Park.	Rosmoyne.	Terra Alta	Blue Ash.	Winslow Park	Hazelwood	Brecon.	Miltomson.	Mason.	Kings Mills.	So. Lebanon.	Ridge	Lebanon.
Cincinnati		5	7	8	10	10	10	15	15	20	20	20	25	30	35	40	45	50
Cypress Avenue	5		2	3	5	5	5	10	10	15	15	15	20	25	30	35	40	45
Pleasant Ridge	7	2		5	5	5	5	10	10	15	15	15	20	25	30	35	40	45
Kennedy Heights	8	3	5		5	5	5	10	10	15	15	15	20	25	30	35	40	45
Silverton	10	5	5	5		5	5	10	10	15	15	15	20	25	30	35	40	45
Deer Park	10	5	5	5	5		5	10	10	15	15	15	20	25	30	35	40	45
Rosmoyne	10	5	5	5	5	5		10	10	15	15	15	20	25	30	35	40	45
Terra Alta	15	10	10	10	10	10	10		5	10	10	10	15	20	25	30	35	40
Blue Ash	15	10	10	10	10	10	10	5		10	10	10	15	20	25	30	35	40
Winslow Park	20	15	15	15	15	15	15	10	10		5	5	10	15	20	25	30	35
Hazelwood	20	15	15	15	15	15	15	10	10	5		5	10	15	20	25	30	35
Brecon	20	15	15	15	15	15	15	10	10	5	5		10	15	20	25	30	35
Miltomson	25	20	20	20	20	20	15	15	15	10	10	10		10	15	20	25	30
Mason	30	25	25	25	25	20	20	20	15	15	15	15	10		10	15	20	25
Kings Mills	35	30	30	30	30	25	25	25	20	20	20	20	15	10		10	15	20
South Lebanon	40	35	35	35	35	30	30	30	25	25	25	25	20	15	10		10	15
Ridge	45	40	40	40	40	35	35	35	30	25	25	25	20	15	10	5		10
Lebanon	50	45	45	45	45	40	40	40	35	30	30	30	25	20	15	10	5	

Round Trip Fares.

When Single Trip Fare is	Sell Round Trip Tickets at
15 cents.	25 cents.
20 "	35 "
25 "	45 "
30 "	55 "
35 "	65 "
40 "	75 "
45 "	85 "
50 "	90 "

INSTRUCTIONS

To Ticket Agents:

No 1.—Sell Single Trip Tickets at rates given in this tariff until further notice

No 2.—Sell Round Trip Tickets to and from all points for which single trip fares are quoted at the round trip fares given in the tariff shown.

No. 3.—Sell Full Fare Tickets for children 7 years of age or over Children under 7 years of age when accompanied by person in charge holding regular ticket, are carried free

No 4.—No reduction for any ticket when the one way fare is ten cents or less, without special instructions are issued to the contrary.

To Conductors:

To and from all Points, collect and register full cash fare from all persons over 7 years of age who do not hold tickets or other evidence of being entitled to passage

B. E. MERWIN,
General Superintendent

PASSENGER TARIFF—RAPID RAILWAY DIVISION

The Interurban Railway & Terminal Company.

Traffic Department.

FREIGHT TARIFF

NAMING CLASSIFICATION RATES

BETWEEN ALL STATIONS ON

THE SUBURBAN RAILWAY.

In Effect September 12, 1903.

BETWEEN TERMINAL STATION CINCINNATI AND	MILES	RATES NAMED IN CENTS PER HUNDRED POUNDS. CLASSES. First	Second	Third	Fourth	Fifth	Sixth
WATER WORKS	7	10½	10½	9	9	7½	5
CALIFORNIA	7½	10½	10½	9	9	7½	5
CONEY ISLAND	9	10½	10½	9	9	7½	5
MT. WASHINGTON	12	11	10½	9½	9	8	6
CEDAR POINT	13	11	10½	9½	9	8	6
FRUIT HILL	14	11	10½	9½	9	8	6
FORESTVILLE	15	11	10½	9½	9	8	6
TOBASCO	17	12	11	10	9½	8½	6½
WITHAMSVILLE	19	12	11	10	9½	8½	6½
AMELIA	21	14	11½	10½	10	9	7
HAMLET	21½	14	11½	10½	10	9	7
MT. HOLLY	22½	14	11½	10½	10	9	9
BANTAM	25	14	11½	10½	10	9	9
BETHEL	29½	15	12½	11	10	9	9

No shipment less than 25 cents.

To find rate between stations take number of miles between stations, then follow down the column and take rate opposite.

Above rates subject to change without notice.

B. E. MERWIN,
General Superintendent.

S. S. MORRIS,
General Freight Agent.

CINCINNATI, OHIO.

FREIGHT TARIFF—SUBURBAN RAILWAY

and Westinghouse long-arm circuit breakers are located above the switchboard, the latter separated by marble barriers. The instruments on the board control the sub-station equipment as well as the operation of the main generators.

The sub-station at Deer Park car house contains two 300-kw rotaries and six 125-kw oil-cooled transformers. The sub-station at Forestville, on the Suburban Railway, contains a similar layout, while the Amelia sub-station has one 400-kw rotary and three 150-kw transformers.

PASSENGER FARES, FREIGHT AND EXPRESS

Passenger rates on the system are substantially 1½ cents per mile. Multiples of 5 cents are used except in the case of two towns near Cincinnati, where the company was obliged to give 7-cent and 8-cent fares to the city to secure the franchise. Commutation tickets include ten-ride, twenty-ride, fifty-ride monthly tickets and forty-six trip school tickets, good between certain points. The fare includes the city fare, which is rung up on an International register. The Ohmer fare register is used for all interurban fares. No cash fare receipts are given.

It early became apparent that to handle successfully the freight and express business, agencies would have to be established in each of the towns and villages. In carrying out this policy, where the business warrants it, buildings have been erected or rented and a special agent placed in charge, and in the smaller towns space has been secured in a prominent store for a waiting room for patrons and an express room and ticket office. This has proven very satisfactory, both to the company and the proprietors of these small stores, as it gives their places of business much more prominence and makes them headquarters for their communities.

A rental is paid for the space so occupied, varying according to the amount of business done at each point, the competition for these agencies among the local stores being such as to make this rental merely nominal. Each agency is provided with a cabinet containing the different forms of tickets used, ticket dating stamp, forms for freight and express business and stationery. These cabinets are divided to fit the forms used, and are so arranged that forms and stationery cannot be wasted. On the sides of these cabinets, in frames, are the freight and express tariff sheets, passenger rates and commuter rates, to which the general public have access.

Each of the agencies is provided with a bulletin board, on

The Interurban Railway & Terminal Co.

W. B. No.

Car No.

Freight Way-Bill from *to* *190*

DIV.

SHIPPER	CONSIGNEE	No. PKGS	DESCRIPTION OF ARTICLES	WEIGHT	RATE	FREIGHT	BACK CHARGES	PREPAID	UNPAID

FREIGHT WAY-BILL

Division

THE INTERURBAN RAILWAY & TERMINAL CO.

DAILY ABSTRACT OF EXPRESS / FREIGHT BUSINESS AT 190

	W.-B.	BILLED FROM	BILLED TO	CONSIGNOR	CONSIGNEE	No. Pkgs.	DESCRIPTION OF ARTICLES	WEIGHT	Rate	FREIGHT	CHARGES	PREPAID	COLLECT	

DAILY ABSTRACT OF FREIGHT AND EXPRESS BUSINESS

EXPRESS. DUPLICATE.

THE INTERURBAN RAILWAY & TERMINAL CO.

DIV.

Date W. B. No.

From to

SHIPPER	CONSIGNEE	ARTICLES	WEIGHT	RATE	FREIGHT	CHARGES	PREPAID

EXPRESS BLANK

Form 3. ORIGINAL.

FREIGHT BILL

190

TO The Interurban Railway & Terminal Company,

Division, Dr.

WAY-BILL No.	No. Packages	ARTICLES	Weight	Rate per	FREIGHT	Advanced Charges
DATE						
CONSIGNOR						
POINT OF SHIPMENT						
CONNECTING LINE						

Received Payment, Agent. 19

Total to Collect

Drayage

Original Freight Bill must accompany all claims for Overcharge, Loss or Damage.

FREIGHT BILL

EXPRESS RECEIPT.

THE INTERURBAN RAILWAY & TERMINAL CO.

190

Received from

Marked

Value

Weight

Charges

Agent.

THIS COMPANY IS NOT RESPONSIBLE FOR DAMAGED CAUSED BY POOR PACKING.
GOODS DELIVERED AT POINTS WHERE THERE ARE NO AGENTS ENDS THIS CO.'S RESPONSIBILITY.

EXPRESS RECEIPT

The Interurban Railway and Terminal Company.

ABSTRACT OF WAY-BILLS FORWARDED.

Station Division.

Enter Way-Bills alphabetically according to stations. to 19 Inc.

No	Date	TO	Advances	Freight	Collect	Prepaid	REMARKS

ABSTRACT OF WAY BILL

EXPRESS. (ORIGINAL) SHIPPER RECEIPT. No. 1901

Div.

THE INTERURBAN RAILWAY & TERMINAL CO.

Conductor Date

From to

SHIPPER	CONSIGNEE	ARTICLES	WEIGHT	RATE	FREIGHT	CHARGES	PREPAID

RECEIPT FOR EXPRESS ORIGINATING AT POINT WHERE COMPANY HAS NO AGENCY

which are posted the schedule, the location of all stops, signs and special notices, rates, etc.

At numerous cross-roads small platforms have been erected, on which are placed sheds, 8 ft. x 12 ft., closed on three sides with windows. These sheds have proven quite a convenience in bad weather, and are appreciated by the communities, who see to it that they are kept clean and in repair.

Small packages, perishable goods, baggage, etc., that require quick and careful delivery, are handled by combination cars, which alternately operate with the passenger cars. All express matter is received and delivered at the company's depot, and the rate charged does not include collection or delivery. This is found very satisfactory, as the company's depot is located in the heart of Cincinnati, and in all the towns and villages the depots are located in the business centers. An arrangement is made, however, to receive and deliver baggage with the local omnibus company.

An express receipt is given for all shipments, and goods are shipped either prepaid or collect to points having agencies, and prepaid only to points having no agency.

THE INTERURBAN RAILWAY & TERMINAL COMPANY.

Traffic Department.

FREIGHT TARIFF.—Naming Classification Rates Between All Stations On The Rapid Railway. In Effect September 12, 1903.

Between Terminal Station Cincinnati and	Miles	Rates Named in Cents Per Hundred Pounds — Classes					
		First	Second	Third	Fourth	Fifth	Sixth
Cypress Avenue (Norwood)	6		10½	9	9	7½	5
Pleasant Ridge	6½		10½	9	9	7½	5
Kennedy	7½		10½	9	9	7½	5
Silverton	8		10½	9	9	7½	5
Deer Park	9		10½	9	9	7½	5
Rossmoyne	10		10½	9	9	7½	5
Terre Alta	10½	15	10½		9	8	6
Blue Ash	11½		10½		9	8	6
Winslow Park (Meyers Grove)	13		10	10	9	8	6
Hazelwood	14		10		9	8	6
Brecon	15		10		9	8	6
Miltomson	18		11	10	9½	8½	6½
Mason	21½		11½	10½	10	9	8½
Kirgs Mills	25		11½	10½	10	9	8½
South Lebanon	28	15	12½	11	10½	9½	9
Lebanon	32	17	13	9	8	6	5

No shipment less than 25 cents.
To find rate between stations, take number of miles between stations, then follow down the column and take rate opposite.
Above rates subject to change without notice.

B. E. MERWIN, General Superintendent.
S. S. MORRIS, General Freight Agent.
CINCINNATI, OHIO.

THE INTERURBAN RAILWAY & TERMINAL COMPANY.

Rapid Railway Division.

EXPRESS TARIFF.—In Effect September 10, 1903.

Stations	Miles	Package Rates — 5 Pounds and under	10 Pounds and not under 5 Pounds	15 Pounds and not under 10 Pounds	20 Pounds and not under 15 Pounds	30 Pounds and not under 20 Pounds	50 Pounds and not under 30 Pounds	100 Pounds and not under 50 Pounds	Per 100 Lbs. Produce and Dressed Poultry
Terminal Sta., Cin'ti, O	0								
Cypress Ave., Norwood	6			20	20	20	25	25	20
Pleasant Ridge	6½			20	20	20	25	25	20
Kennedy	7½			20	20	20	25	25	20
Silverton	8			20	20	20	25	25	20
Deer Park	9			20	20	20	25	25	20
Rossmoyne	10			20	25	25	30	35	20
Terre Alta	10½	10	15	20	25	25	30	35	20
Blue Ash	11½			20	25	25	30	35	20
Winslow P'k (Meyers Gr.)	13			20	25	25	30	35	20
Hazlewood	14			20	25		30		25
Brecon	15			20	25		30		25
Miltomson	18			20		25	30	35	25
Mason	21½			20	25		30		25
Kings Mills	25½		15	20			30		25
South Lebanon	28	15	20	25	30	35	40	40	25
Lebanon	32		20		30	35	40	40	25

To find any rate between stations, take the number of miles between stations, then follow down the column, and take rate opposite.
Ice, packed, to any point, 10c. per 100 pounds.
Bread, in baskets, 25c.
Live Poultry, per coop, 30c.
Fresh Meat, in sacking, 25c. per 100 pounds.
Milk, 2c. per gallon, but no shipment less than 10c.
Berries, per crate, 15c. Per 2-bushel stands, 25c.
Ice Cream, per can, 2 gallons or less, 25c., each additional gallon, 10c.
Eggs, per case, 15 miles or under, 20c., over 15 miles, 25c. per case.
Bicycles or Baby Carriages, 25c. each.
Tomatoes and Peaches, bushel boxes, 10c. each.
Bananas, Tariff rates.
Sugar, to all points under 15 miles, 35c. per barrel, over 15 miles, 40c. per barrel.
Flour, to all points under 15 miles, 25c. per barrel, over 15 miles, 30c. per barrel.
Beer, 1 to 2 quarters, 25c. each; 1 to 2 half-barrels, 30c. each.
Beer, 3 to 10 quarters, 20c. each., 3 to 10 half-barrels, 25c. each.
Beer, above 10 quarters, 15c. each, above 10 half-barrels, 20c. each.
Beer, if packed in ice in barrels, add 5c. additional to rate.
Beer, in cases, 1 dozen bottles, same as quarters, 2 dozen bottles, same as half-barrels.
Dogs, when with passengers, 25c. each.
Dogs, when for shipment (must be securely crated), double Tariff rates.
Calves, in crates (not otherwise taken) to Cincinnati, 60c. each.
Laundry, in baskets, 25c. each.
Trunks (not exceeding 150 pounds), each 25c.
Corpse, $2.00.
Apples and Pears, 15c. per barrel.
Corn, 10c. per sack.
Sewing machines, crated, 40c. each.
Hand Baggage, when carried by passenger, is taken without charge.
No charge made for return of empties to point of shipment except empty Beer Kegs, Barrels and Cases, which must be returned by freight at freight rates.
Goods are received at regular stopping places and delivered at terminals or crossings nearest consignee.
Delivery of goods at points where there are no agents ends this company's responsibility.
Agents and Conductors must use judgment when billing bulky or light shipments to double the weight in order to secure correct charge for space occupied.
This Company reserves the right to change above rates without notice.

B. E. MERWIN, General Superintendent.
S. S. MORRIS, General Freight Agent.

THE INTERURBAN RAILWAY & TERMINAL COMPANY.

Traffic Department.

FREIGHT TARIFF.—Naming Classification Rates Between All Stations on The Cincinnati & Eastern Railway. In Effect September 12, 1903.

Between Terminal Station Cincinnati and	Miles	Rates Named in Cents Per Hundred Pounds — Classes					
		First	Second	Third	Fourth	Fifth	Sixth
Water Works	7	10½	9	9	9	7½	5
California	7½	10½	9	9	9	7½	5
Coney Island	9	10½	9	9	9	7½	5
Sweet Wine	11		10		9	8	6
Eight Mile	14½		10	10	9	8	6
Nine Mile	15	15	10		9	8	6
Ten Mile	16		11	10	9½	8½	6½
New Palestine	16½		11	10	9½	8½	6½
Blairville	18		11½	10½	10	9	7
New Richmond	21	12	12	10	8½	8	7

No shipment less than 25 cents. Stoves, 15c. per 100 pounds.
To find rate between stations, take number of miles between stations, then follow down the column and take rate opposite.
Above rates subject to change without notice.

B. E. MERWIN, General Superintendent.
S. S. MORRIS, General Freight Agent.
CINCINNATI, OHIO.

Each conductor is provided with a numbered receipt book, 8 ins. x 3½ ins., for express originating at points having no agency. These receipt books are numbered and are in triplicate, No. 1, white, being the shipper's receipt, and marked "original;" No. 2, the way bill, yellow, and marked "duplicate," to accompany the shipment, and No. 3, the auditor's copy, is on pink paper, and marked "triplicate." The "original" form is reproduced on page 945.

The handling of heavy and slow shipments, such as groceries, farm produce, etc., is done in special cars, which are similar in general design to baggage cars used on steam railroads. These cars are 48 ft. long inside, and equipped with four No. 56 motors, each side being provided with two large sliding doors. These cars are operated at present during the night only, but arrangements are being made to operate during the day also, as the business has increased so rapidly.

Freight is collected at points along the line on a regular schedule, and delivered in the city at 12:00 midnight, and freight collected in the city during the day leaves at 4:00 the next morning for points along the line.

The freight tariff sheet shows the rate and classification. All freight is receipted for and billed out on regular freight way-bills, showing way-bill and car number, and the agents make a daily report on a daily abstract form.

In addition to the general express and freight business, a number of special cars are operated, handling milk. The hospitals of Cincinnati are supplied by a special dairy operated by French Brothers, located at Lebanon, on the line of the Rapid division, 32 miles from Cincinnati. Milk, cream, etc., that is used during the day leaves Lebanon at 6:00 a. m., and is delivered at the hospitals in Cincinnati at 8:00 a. m., and that used during the night leaves Lebanon at 5:00 p. m., and is delivered at 7:00 p. m. At present 150 10-gal. cans are handled on each trip.

Although the freight and express business has been in operation by the company only about six months its increase has been wonderful, and the proportion of profit is in excess of the passenger business.

The company's independent telephone system is at the disposal of its customers through the country free of cost, and goods may be ordered from the city by 'phone direct, and delivered to the customers' depot, saving time and expense. This feature has materially increased the company's business.

The accompany illustrations include samples of forms used in the express and freight service, and also the passenger, freight and express tariffs. An examination of these will prove convincing that a very simple and comprehensive plan of handling this business has been developed.

PLEASURE TRAFFIC

The management of this system does not believe it good policy for an electric railway to operate parks. It is believed that it will prove more satisfactory in the long run to have pleasure resorts operated independently.

Coney Island, which is reached by the cars of both the Cincinnati & Eastern and the Suburban roads, is owned by interests closely allied with the railway syndicate, but there is no connection between the two. There is a spur running directly to the pavilion, and the railway gives frequent service to this point during the summer months. The park embraces 122 acres facing the river. The buildings include a club house, 200 ft. x 100 ft.; dance hall, 300 ft. x 130 ft.; open-air theater seating 2000 people, and a grand-stand. Among other attractions are "shoot-the-chute" into the river, roller coaster, bowling alley, rifle range, merry-go-round, baseball park, tennis courts, naphtha launches on the lake, pony track, etc. Admission to the grounds is 25 cents, and all attractions are free.

ORGANIZATION AND MANAGEMENT

The three railway properties and the terminal station were built by separate companies with organizations almost identical. On Nov. 4, 1902, the Cincinati & Eastern Railway Company, the Suburban Traction Company, the Rapid Railway Company and the Interurban Terminal Company were consolidated into the Interurban Railway & Terminal Company. The capital stock is $2,500,000, and the authorized bond issue is for the same amount. Of this amount $2,250,000 is to be issued, the remaining $250,000 to be held in the treasury for extensions. With 101.24 miles of track the bonded indebtedness is on a basis of $24,750 per mile, including the terminal station. The securities of the company have never been floated on the open market. The bonds of the original propositions were subscribed by the members of the syndicate, and the money was paid in from time to time as it was required. The securities are still carried by the members of the syndicate, by whom they are regarded as promising permanent investments. No engineering companies were formed to build the roads, and all work, including planning and erecting buildings and installing equipment, was done by the company's own engineering departments, under the direct supervision of George R. Scrugham, president of the system. Mr. Scrugham personally designed the terminal station, the power stations and the car houses, and he was in active charge of the construction work. Werner & Adkins, Cincinnati, were the architects for the several buildings.

The officers of the Interurban Railway & Terminal Company are: George R. Scrugham, president and general manager; Lee H. Brooks, first vice-president; Ellis Kinkead, second vice-president; W. E. Hutton, secretary; J. M. Kennedy, treasurer; B. E. Merwin, operating superintendent; F. H. Talbot, construction superintendent; C. J. Williams, auditor; J. M. Kennedy, Jr., purchasing agent; W. L. Hallpike, cashier. Directors, G. R. Scrugham, L. H. Brooks, Ellis Kinkead, W. E. Hutton, J. M. Kennedy, Charles H. Davis, George H. Worthington and Guy W. Mallon.

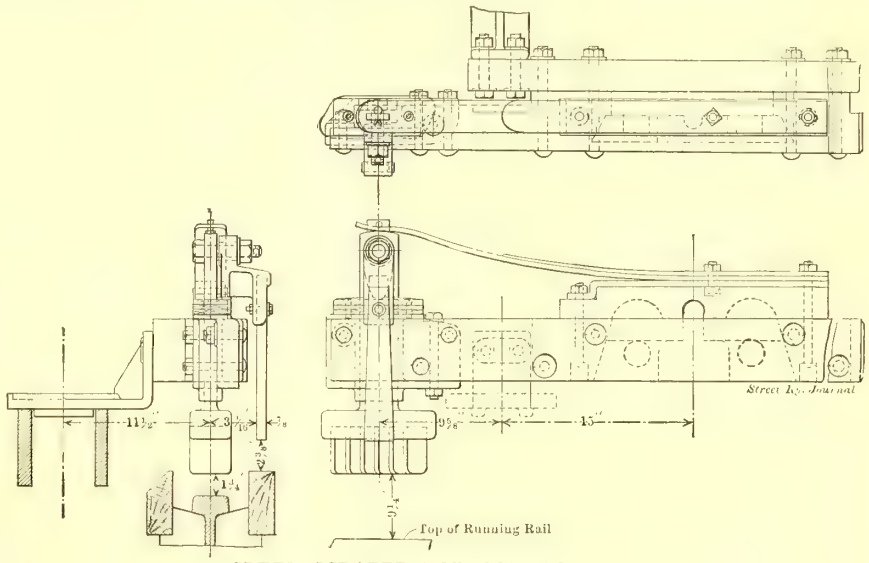
The Toledo, Bowling Green & Southern Traction Company has arranged with the Toledo Terminal & Belt Railway (steam) to haul its freight cars into the center of the city and will utilize the Terminal Company's freight station of Cherry Street. The former company is interested in the Toledo Urban & Interurban Railway, which is building a new line into Toledo from Maumee, and the tracks of this line will be used in bringing the Toledo, Bowling Green & Southern cars from Maumee.

SLEET-CUTTING MACHINES ADOPTED FOR MANHATTAN

The Interborough Rapid Transit Company has decided to make a radical departure this winter in the method adopted for keeping the elevated system open during the season when snow and sleet might interfere with the operation of the electric trains. It will be remembered that the old Manhattan management had considerable trouble last year, but this was due partly to the fact that early storms found the company unprepared, and largely to inexperience in handling the new equipment made necessary by the recent change in motive power, and by the fact that only a part of the cars was electrically operated.

The brushes which were used last year have been abolished entirely, and a sleet cutter has been substituted. The accompanying illustration shows the design of this machine and also its application. It is the invention of Frank Hedley, general superintendent of the Interborough Rapid Transit Company, and is a modification of a form of sleet cutter originally designed by him for the Lake Street and Northwestern Elevated Railroad systems in Chicago.

The cutting machine itself consists of thin sections or sheets



SLEET SCRAPER FOR CONTACT-RAIL

of steel cast into a block which is suspended from the car truck, and may be lowered or raised at will by the motorman, or automatically by a special tripping device operated from a central office. The scraping plates are arranged in an inclined relation to the block, and are oblique to the length of the rail, riding in such a manner as to scrape from the rail any obstruction of ice, sleet or snow and carry it to one side of the contact rail, where it is dropped to the surface below. The scraping plates, as already mentioned, are inclined, and this permits the device to glide over the intersections of rails without obstruction. The scraping block, as will be noticed by a reference to the cut, is pressed against the contact-rail by a spring, and the pressure exerted upon it may be adjusted by the mechanical department when the equipment is originally introduced to suit the requirements of the service. It is proposed to attach one of these scraping devices to the motor truck just ahead of each contact-shoe, so that the third rail may always be kept clear of sleet, snow and ice, and perfect contact be thus ensured. It will necessitate the use of four scrapers on each truck of a motor car, or eight altogether for each motor car, as there will be as many scrapers as there are contact shoes.

The mechanical department of the Interborough Company is rapidly equipping all motor cars for operation on the elevated system with these scrapers, and it is confidently expected that the discomforts and delays experienced last winter will be averted.

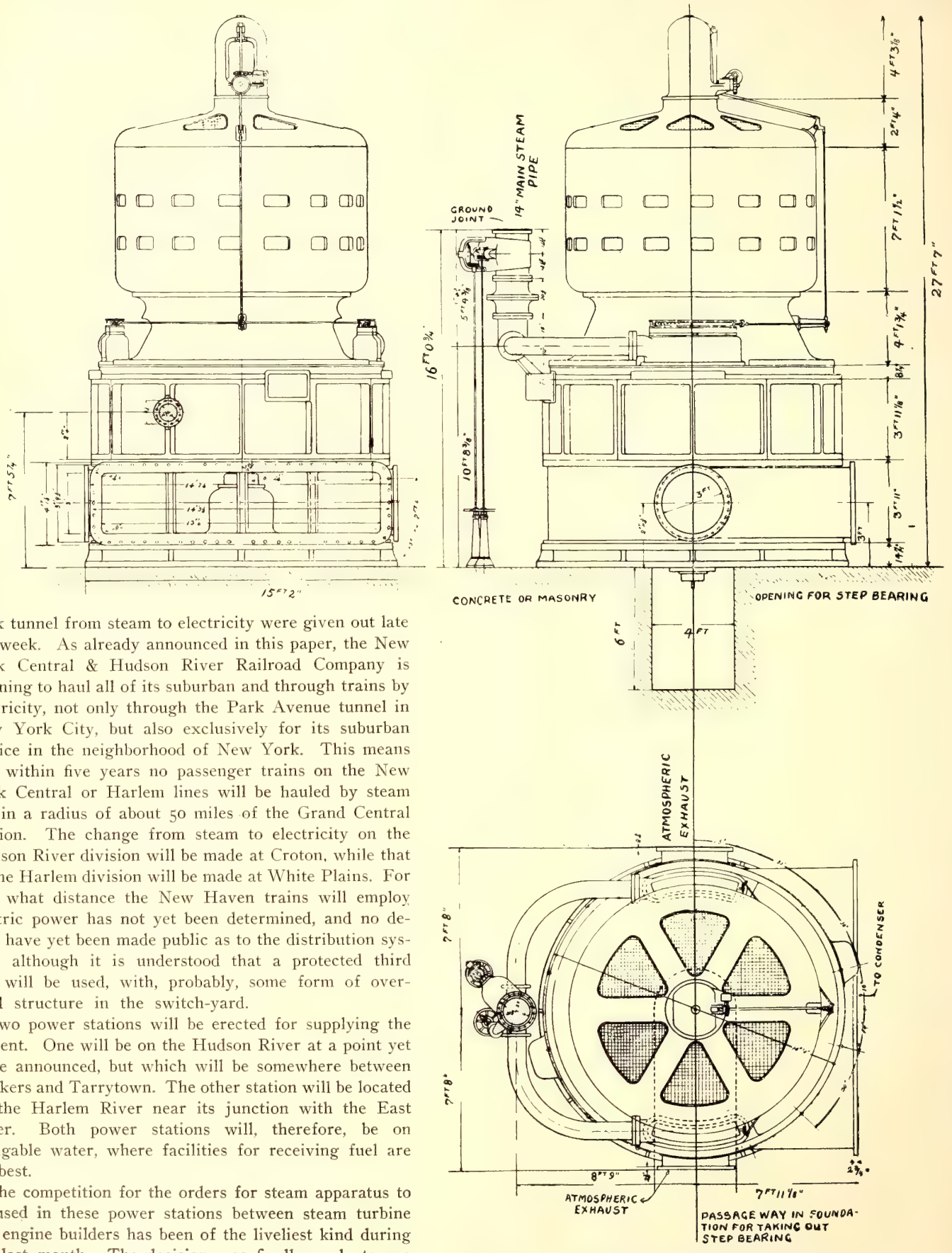
ELECTRICITY FOR THE NEW YORK CENTRAL RAILROAD

The first large contracts for electrical apparatus to be used in the conversion of the New York Central Railroad's New York tunnel from steam to electricity were given out late last week. As already announced in this paper, the New York Central & Hudson River Railroad Company is planning to haul all of its suburban and through trains by electricity, not only through the Park Avenue tunnel in New York City, but also exclusively for its suburban service in the neighborhood of New York. This means that within five years no passenger trains on the New York Central or Harlem lines will be hauled by steam within a radius of about 50 miles of the Grand Central Station. The change from steam to electricity on the Hudson River division will be made at Croton, while that on the Harlem division will be made at White Plains. For just what distance the New Haven trains will employ electric power has not yet been determined, and no details have yet been made public as to the distribution system, although it is understood that a protected third rail will be used, with, probably, some form of overhead structure in the switch-yard.

Two power stations will be erected for supplying the current. One will be on the Hudson River at a point yet to be announced, but which will be somewhere between Yonkers and Tarrytown. The other station will be located on the Harlem River near its junction with the East River. Both power stations will, therefore, be on navigable water, where facilities for receiving fuel are the best.

The competition for the orders for steam apparatus to be used in these power stations between steam turbine and engine builders has been of the liveliest kind during the last month. The decision was finally made to use steam turbines, and the contract was awarded last week to the General Electric Company for eight turbo-generators of a capacity of 5000 kw each. The turbines are of the four-stage vertical type, and side elevation and plan of the turbine to be used is presented herewith. The generators are 25-cycle, three-phase, and will generate current at 11,000 volts. This order is said to be the largest order for steam turbines ever placed in this country or abroad.

The electric locomotives to be used will differ in general construction from those used in the Baltimore & Ohio Belt Line, as the latter are designed to develop a speed of only 10 miles an hour, while the New York Central locomotives will

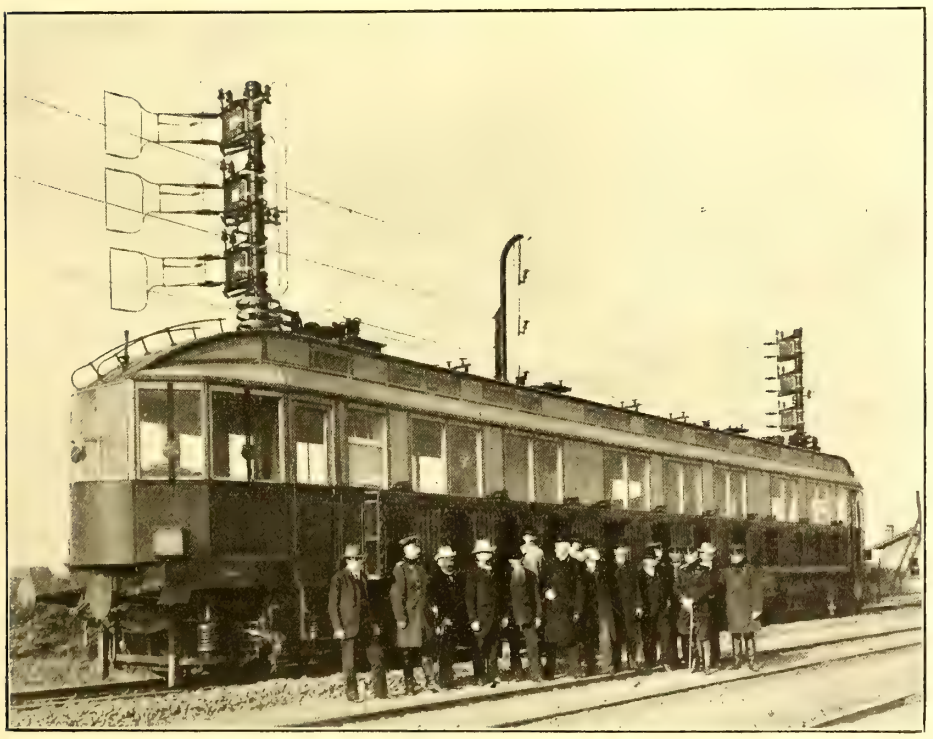


5000-KW STEAM TURBO-GENERATOR FOR POWER STATION OF NEW YORY CENTRAL RAILROAD

be designed for a speed of 60 miles an hour. The number of trains now passing in and out of the Grand Central Station every day is between 600 and 700, and some 300 electric locomotives will be required to handle this traffic. The order placed by the New York Central Railroad Company last week was for thirty locomotives, and was given to the General Electric Company. These locomotives will have a capacity of 2200-hp each, or between 700-hp and 800-hp more than the steam locomotives of the New York Central Type "999," or those used on the Empire State Express. They will be equipped with the Sprague-General Electric multiple unit-control system, so that two or more locomotives if necessary can be coupled together. Each locomotive will weigh 85 tons, and will have an adhesive weight on its drivers of 67 tons. The specifications provide that each single locomotive will be capable of hauling a 500-ton train at a speed of 60 miles an hour. The motors will be of the gearless type. The Schenectady works of the American Locomotive Company is associated with the General Electric Company in this order, and will, it is understood, supply a considerable part of the locomotive outside of the electrical apparatus.

The contracts mentioned above were awarded upon the recommendations of the engineering commission of the New York Central Railroad, consisting of W. J. Wilgus, fifth vice-president, chairman; J. F. Deems, superintendent of motive power; B. J. Arnold, F. J. Sprague and George S. Gibbs. The commission has also recently secured the services, in an advisory capacity for its power station plans, of Frederick Sargent, of Sargent & Lundy, of Chicago.

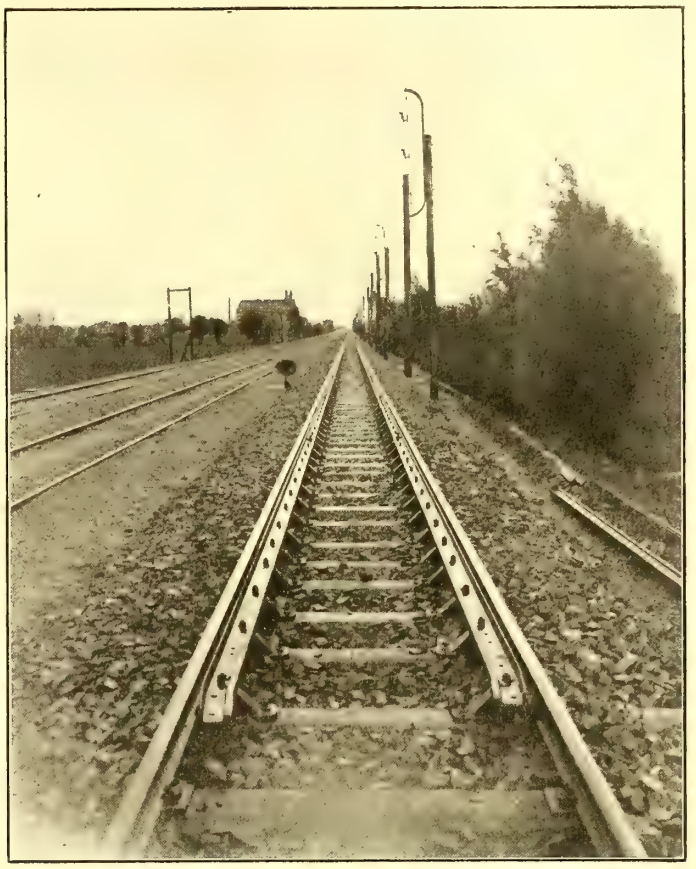
One of the conditions in the agreement between the Auckland Electric Tramway Company, Ltd., of Auckland, New Zealand, and the city, was that cars should not be operated within the city limits on Sunday until a poll of the citizens had been taken and their wishes expressed on the subject. On Wednesday, Sept. 20, the question was submitted to the people. Out of about 12,300 persons on the electoral roll, 8024 voted on the question. The division was 3933 against the measure, 3955 for the measure, and 136 informal. The Sunday city service was, therefore, begun Oct. 4, and 12,528 passengers were carried, a very satisfactory result.



THE SIEMENS & HALSKE CAR USED DURING THE HIGH-SPEED TESTS

A REVIEW OF THE MARIENFELDE-ZOSSEN HIGH-SPEED TESTS

As the high-speed traction tests on the military railway between Marienfelde and Zossen have been temporarily closed, it may be of interest to review the progress made since the tests were begun in 1899 by the "Studiengesellschaft für Elektrische Schnellbahnen." This society was formed by the following banks and firms: Deutsche Bank, Delbrück, Leo & Company, National Bank, Allgemeine Elektricitäts Gesellschaft, Siemens & Halske, Friedr. Krupp, v. d. Zypen & Charlier. The technical committee drew up the plans for the proposed tests and ordered each of the two electrical companies to furnish one complete operating equipment. The order for car bodies and trucks was given to v. d. Zypen & Charlier. The overhead work was undertaken by Siemens & Halske, and the 12,000-volt to 15,000-volt alternating-current used was transmitted from the Oberspree works of the Allgemeine Company.



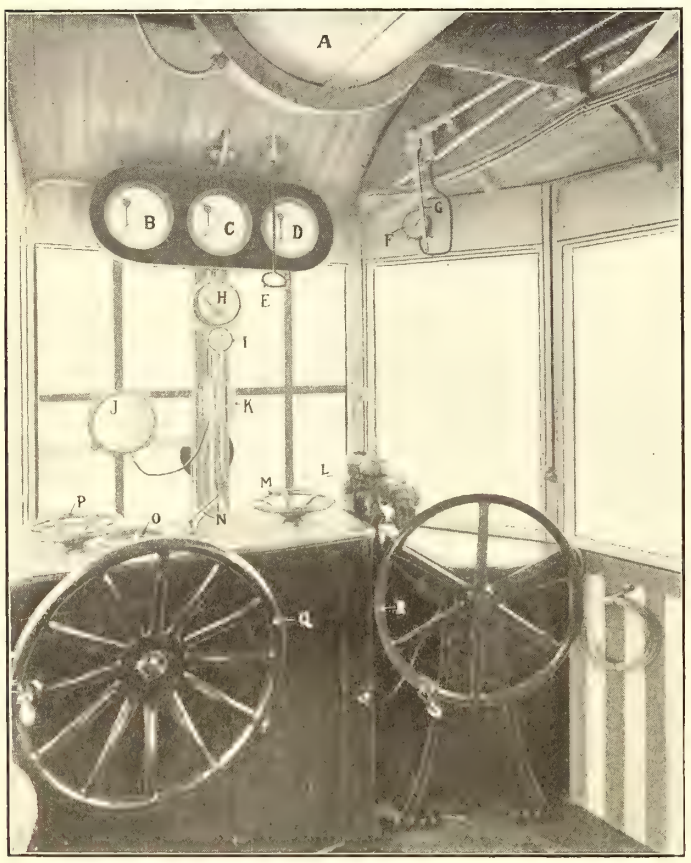
RECONSTRUCTED ROADBED BETWEEN MARIENFELDE AND ZOSSEN, SHOWING GUARD-RAILS

The first trials were made late in 1901, but were discontinued because the roadbed weakened after 130 km an hour had been attained. A new roadbed was built up as follows: The foundations consisted of broken basalt. Upon this sixteen heavy wooden ties were laid every 12 m (2 ft. 5½ ins. apart). The new track weighed 41 kg, instead of 34.4 kg (82 lbs. per yard instead of 69 lbs.) per running meter, and was securely fastened to the ties by wooden dowels and screws. To minimize truck swaying, guard rails were laid very close to the running rails and 5 cm (2 ins.) above the latter. One of the illustrations shows the

reconstructed roadbed. The car trucks, which were six-wheeled, were also rebuilt, the wheel base being lengthened from 3.8 m (12 ft. 5½ ins.) to 5 m (16 ft. 5 ins.).

Experiments were renewed in September, 1903, and both the roadbed and apparatus gave satisfaction, particularly the guard rails and longer trucks, which did much to prevent swaying. The Siemens & Halske car was the first to pass the 200-km mark, attaining 201 km (125½ miles) an hour. This speed was later exceeded by the Allgemeine car, which reached 210.2 km (131.4 miles) an hour on Oct. 27. The Siemens & Halske car traveled 206.7 km (130.7 miles) an hour on Oct. 23, the difference in speed of the two cars being solely accounted for by the fact that during the Allgemeine test on Oct. 27 the frequency of the current was somewhat higher.

Certain changes were also made in the motor wiring on the



VIEW OF CAB OF HIGH-SPEED ZOSSEN CAR

Allgemeine car. At first all the motors were started simultaneously, but later the stator windings of the four motors were placed in circuit one after the other, the motors being started by gradually short-circuiting the rotor windings. This arrangement avoided an unnecessarily heavy current intake at starting, and also permitted the cutting out of the stators of one or more motors after normal speed had been attained, and only two or three motors were required to continue running the car at the same speed. Although these motors were rated at 250 hp they carried 750 hp each at starting without rising more than 20 degs. C., because the motors were cooled by air blast.

The apparatus used during the trial runs is shown in the general view of the cab, and consists of the following: A is the principal compressed air reservoir for operating all of the apparatus; B and C are ammeters for truck No. 1 and truck No. 2, respectively, D is the line voltmeter, E is the handle for the air whistle, F is the pressure gage, G is the acceleration indicator, H is the pressure gage for the brake cylinder, I is the pressure gage for the train line pipe, J is the speed indicator, K is the switch for connecting up the speed indicator, according to the direction of running, L is the Westinghouse air-brake valve, M is the motor switch, N is the controller switch, O is the rheostat indicator, P is the air compressor switch, Q is the starting rheostat and R the hand-brake wheel.

To enable all readings to be taken simultaneously a clock was used which rang a bell twice every 10 seconds, the instruments being read immediately after the second ringing.

The speed was measured in several ways. One of the methods included the use of a precision voltmeter, which indicated the voltage of a small direct-current generator coupled to a car axle, and which also had a scale divided into kilometer-hours. Besides a number of mechanical speed indicators, the Siemens & Halske Company used a graphical recording instrument which made three different records. Each marker was operated by an electromagnet, and the recording paper strip by clockwork. One of the markers punched a hole along one part of the strip every second; the second marker was actuated by a current flowing through a battery and a contact device on the free middle axle of one of the trucks, one perforation being made for every revolution of the axle; the third marker perforated the paper every time a kilometer was passed, this being accomplished electrically by having a small contact brush strike iron projections placed near the track and spaced 1 km apart.

To determine the air pressure several openings were made in the walls of each car, each opening being connected with a U-shaped glass tube partly filled with water and graduated to millimeters. The pressure was, therefore, measured by noting the change in the height of the water columns in the branches of each tube.

The acceleration was determined according to the method suggested by Kapp. A vertical glass tube was placed at each motorman's stand, both tubes being connected by a pipe running through the car floor parallel to the rails. The tubes were filled to a certain height with colored water. When the car started the liquid in the front tube fell, while that in the rear tube rose. The acceleration was determined by measuring the distance between the tubes and the difference in height of the water colmuns.

Another interesting device used was an automatic brake pressure regulator, combined with a speed indicator, which served to keep the brake pressure proportional to the retardation desired. Several instruments were also used for measuring the torque of the motors and the swaying of the car.

No further attempts are to be made to exceed the speeds already attained, but it is expected to renew the experiments to determine more accurately the amount of power consumed, air resistance, etc., at speeds from 140 km per hour to 180 km per hour. In this connection the Siemens & Halske Company states that all reports regarding contracts with the German Government for high-speed electric railways are premature.

"HAVE YOUR BAGGAGE CHECKED"

In Detroit new arrangements have been made by the Detroit United Railway for handling baggage in connection with the Detroit Omnibus Company, so that trunks can be handled without inconvenience to passengers to or from any station reached by the interurban lines centering at Detroit. Under the head of "Have Your Baggage Checked" the Detroit United "Weekly" makes announcement of the new arrangement in the following words:

This is a matter of business information, not a vaunting of the fact that electric railway systems are receiving recognition from all the agencies that facilitate public travel. Hereafter the Detroit Omnibus Company will take all baggage checks on incoming trains and boats, inquiring or accepting the information as to whether you want it transferred to the steam or electric cars. If you are destined to a point reached by both, you hold the option, but the new arrangement is that your trunk from now on can be sent, without any care on your part, to any station reached by the interurban lines centering at Detroit. You have only to name your point and the well-known omnibus company will do the rest.

CORRESPONDENCE

INTERURBAN DESPATCHING AND EMERGENCY STOPS

Indianapolis, Nov. 20, 1903.

EDITORS STREET RAILWAY JOURNAL:

I notice in the STREET RAILWAY JOURNAL of Oct. 31, 1903, a communication, by A. P. Johnson, on "Interurban Train Despatching," which refers to the discussion on that subject at the New York State Street Railway Association convention, published in the issue of Oct. 17. The two principal questions brought up by this discussion are: First, is the plan of cutting current off from a section of line upon which a collision is imminent worth consideration in connection with electric railway train despatching; and, secondly, how does cutting off the current supply affect the ability of cars to stop?

First, as to the advisability of giving despatchers standing orders to cut off current from any section of the line upon which, through the giving of wrong orders, the despatcher knows a collision is imminent, it seems as if there could be no question. While it may not be an absolute safeguard against head-on collisions, it would certainly be valuable in preventing them in certain cases, and it is wrong to condemn this practice as worthless because it is not infallible. If it would only prevent one collision in a hundred it is worth using. It does not require any very radical changes in the operating methods of any road to make it possible for the despatcher, either by telephonic communication with sub-stations or otherwise, to have the current cut off of any section of the line where two cars may be approaching each other with danger of a head-on collision. In the discussion a case was cited where, it was said, the despatcher had the current cut off of a section, but two cars happened to be approaching each other on opposite sides of a valley, and having no power with which to stop on the down-grade, came together in collision. Without knowing anything about the circumstances of this particular case, it seems very strange that a collision of this kind should be blamed to an absence of current supply. I say this because I do not believe that in ordinary high-speed interurban service much reliance can be placed upon reversing the motors with the aid of trolley current as a method of stopping. For an emergency stop I believe that either the air brake or the use of the motors as generators will give far better results than reversing with the aid of the trolley current. This should be apparent, both from theoretical and practical considerations. Practically, the motorman is more than likely to open the circuit breaker on an interurban car if he tries to stop by reversing when going at a high speed, but even leaving this aside the possibilities of making a quick stop by reversing with the aid of trolley current are nowhere near as good as by an intelligent application of the air brake. Both experience and braking tests teach us that the maximum braking effect is secured just before the wheels are retarded to a point where they begin to slide. In other words, the greatest braking effect is secured by keeping a rolling contact between the wheel and rail rather than a sliding contact. When motors are reversed with the use of trolley current, the wheels are soon spinning in a reverse direction, and it does not stand to reason that as great a braking effect and as quick an emergency stop can be made with the wheels spinning as could be made with the brake-shoes applied nearly but not quite to the point of sliding the wheels. Of course, if the motorman is so excited that he applies the air brakes hard enough to slide the wheels, he would be no better off than if they were spinning, due to a reversal of the motors; but I am assuming that the motorman is educated in the art of making emergency stops with the air brake, as every motorman should be before he is allowed to take out a fast interurban car. But even assuming the air brake out of order and the trolley current cut off, there is still left the chance to stop by reversing the motors and throwing them in multiple so that they act as generators. This is commonly called "plugging" or "bucking" the motors. This method of stopping is entirely independent of the trolley current supply, and, further than this, since the motors only act as generators when the wheels driving them are turning them, the wheels are automatically released by the motors as soon as they begin to slide. With some controllers wired to four-motor equipments it is only necessary to throw the controller handle to "off" and pull the reverse handle to secure this braking effect. With two motor equipments it is necessary to turn the controller handle into a multiple position after having reversed in order to secure this effect.

It is undoubtedly true that but little is known regarding the value of reversing without the use of trolley current in making an emergency stop, and it would not be amiss for interurban companies to make tests as to the practical difference between the stops which can be made by "plugging" the motors and stops that can be made with the air brake.

There is no doubt that reversing by the use of trolley current is a valuable emergency measure for use in city service, where cars are equipped with hand brakes and where reversal can be accomplished much quicker than full application of the brakes. But I do not think it should in any way be relied on in fast interurban service.

M. C. RICHARDS.

PARK AT SACRAMENTO

SACRAMENTO ELECTRIC, GAS & RAILWAY COMPANY,
Sacramento, Cal., Nov. 12, 1903.

EDITORS STREET RAILWAY JOURNAL:

Gentlemen:—Our company has been maintaining a public park at the end of our street railway line, and during the past season has made an extra effort to establish a line of amusements that will attract attendance and add largely to the street railway traffic. We have maintained baseball grounds for a number of years, and this season have tried a new venture in the line of free open-air theatricals. These performances were of a vaudeville character, and included a complete change of actors and performances every week.

We are now considering the construction of some kind of a theater that will afford shelter from the sun, so that matinee performances can be given in the day time, and that may be enclosed during cool and stormy weather. It will be comparatively inexpensive, with a concrete floor, on such a grade as will enable those sitting in the rear to see the stage. Instead of having the entire performance entirely free, as we have done this season, we are planning to charge an admission of 10 cents to about one-half or one-fifth of the seating space nearest the stage. This would add something to the revenue and keep a certain class of people from monopolizing the best seats.

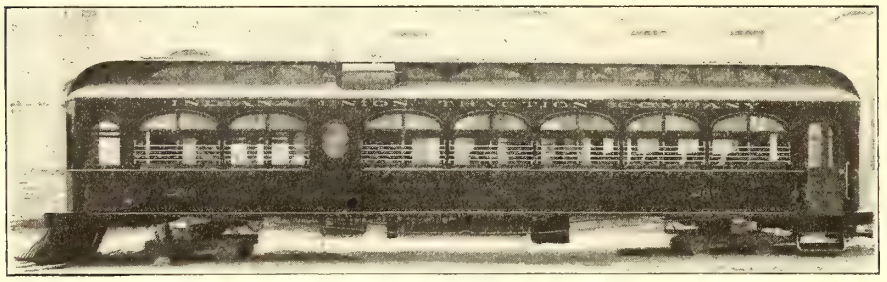
Knowing that your paper reaches all of the street railway companies in the country, reaching resorts of this kind, we have thought best to send this inquiry to you, hoping that you will publish it, and that we may get the benefit of the experience of other companies in regard to theaters and attractions of this kind in a terminal park, such as I have described. We have recently leased the right to put up in our park a scenic or toboggan railway, in the form of a double figure eight, which we think will add largely to the attractions of the park. In addition, the same persons are constructing a laughing gallery. Other persons have asked for concessions for bowling alleys, for shooting galleries, and for a swimming bath. This latter, we think, can be made a very desirable feature.

ALBERT GALLATIN, Manager.

It is reported that the Boston & Worcester Street Railway Company, of Boston, Mass., will begin immediately the construction of 3 miles of snow shields at several places along its line.

A NEW ELECTRIC BUFFET CAR

Quite a departure from the usual design of an electric interurban car is being made by the Cincinnati Car Company, of Cincinnati, Ohio, in its construction of twenty new cars for the Indiana Union Traction Company. These are probably the first electric buffet cars ever put in service on regular runs, and are intended for service on the "limited" runs on the Indiana Union Traction Company's lines. The cars now being used on



BUFFET CAR FOR INDIANA UNION TRACTION COMPANY

that company's limited runs will be employed in the local service. At the present time limited service to the extent of four cars per day each way is being given between Indianapolis and Muncie. Some of the cars on the latter division connect with limited cars at Anderson for Marion. The company is now completing a line from Indianapolis north through Tipton and Kokomo to Logansport, 80 miles from Indianapolis, and it is probable that the run from Logansport to Indianapolis will be made in about 2 hours and 45 minutes.

The general dimensions of the car are: Length of body, 41 ft. 6½ ins.; length over bumpers, 53 ft. 5½ ins.; width over side sills, 8 ft. 6 ins.; height of rail to top of roof sheathing, 13 ft. 6 ins.; truck centers, 29 ft. 6½ ins.

Experience with similar cars in high-speed service having shown the need of a strong bottom framing, these cars were constructed with a framing which it is believed will withstand all strains to which it may be subjected. The center sills consist of two 4-in. x 6-in. steel I-beams, placed 13 ins. apart. The intermediate timbers are composed of yellow pine, 4 ins. x 7⅛ ins. The side sills are made in three parts; one piece yellow pine, 5½ ins. x 8 ins., and one piece 2 ins. x 7⅛ ins., with a ¾-in. x 7-in. steel plate bolted between and running full length of sill. Tie-rods, ¾ ins. in diameter, are placed along the side of each bridging. The single side posts are of ash, measuring 2 ins. x 4 ins. Every other post is a pier post, consisting of two 1¾-in. x 4-in. posts, placed 3½ ins. apart.

In the construction of these cars special endeavor has been made to overcome the tendency to give down in the center and for the platforms to drop, in that, in addition to the steel plate alongside of sills, I-beams of bottom framing and the customary plank, measuring 1¾ ins. x 10½ ins., the center of the car is supported by two trusses. One consists of ⅜-in. x 2½-in. flat refined iron, gained into inside of posts under belt rail, running to steel strut immediately over bolsters, and from this point sloping downward to enter side sills, terminating in 1-in. round refined iron, anchored in suitable casting. The other body truss consists of 1¼-in. x 8-in. ash, gained ¼ in. into outside of posts and running for a distance under belt rail, then descending and mortised into side sill over bolster. From the latter point braces of the same size ascend and are gained into corner posts under belt rail.

Each platform timber is supported by steel plates, ⅝ in. x 6 ins., bolted securely to timbers and to center and intermediate sills. In addition to these there are bolted to the outside platform timbers 4-in. x 6-in. angle-irons, which, upon passing under end sills, bend out and upwardly to run along side sills to a point beyond bolsters.

The interior of the cars is of Honduras mahogany, with dull finish, and consists of a large rear compartment, smoking compartment, buffet, heater room and toilet room. The rear compartment is provided with Hale & Kilburn reversible seats, upholstered with deep blue plush; the front or smoking compartment contains ten comfortable wicker chairs. The cars are carpeted throughout with Wilton carpet.

The buffet is located directly across the aisle from the hot-



PASSENGER COMPARTMENT OF BUFFET CAR



SMOKING COMPARTMENT OF BUFFET CAR

water heater. It is ample in size for the purpose intended, and contains an Adams & Westlake buffet urn, ice box, cupboards and drawers for silverware, dishes, etc.

A colored attendant will be placed in charge of the buffet of each car when the buffet service is inaugurated. While the management of the traction company does not expect that the buffet service will in itself be profitable, it is hoped that enough traffic will be attracted to justify its maintenance.

The heater, which is a Baker No. 8, is enclosed in a neat compartment adjacent to the toilet room. This heater closet

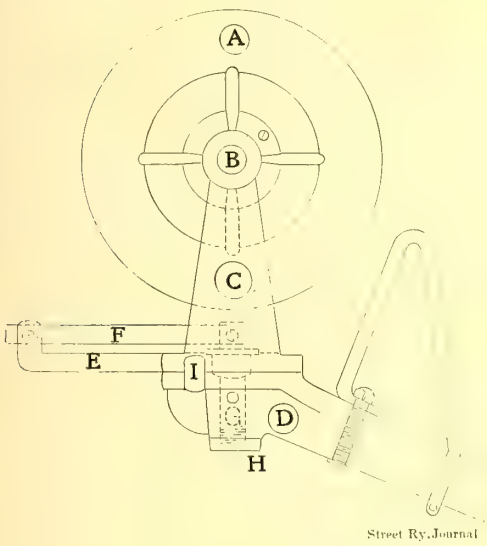
is lined with asbestos, covered with sheet iron, and finished in imitation mahogany to correspond with the interior car finish. A coal box was provided for by raising the heater 12 ins. from the floor, thereby allowing space for placing a large coal box underneath.

The upper deck, finished in light blue, is of the Pullman style, and its vaulted appearance adds greatly to the lofty effect desired. The upper deck sash, as well as the upper sash, are glazed with opalescent glass, presenting a pleasing exterior appearance and harmonizing well with the interior finish.

The car is mounted on Baldwin locomotive trucks, with steel-tired wheels. The operating equipment consists of four Westinghouse No. 85 motors with L-4 controllers, which have proven amply sufficient to give the car a speed of 60 m. p. h. The auxiliary equipment consists of Christensen air brakes, Nichols-Lintern sanders, Van Dorn draw-bars and Mosher automatic headlights. Total weight of car, as estimated by J. L. Matson, master mechanic, is about 72,000 lbs.

TROLLEY HARP AND WHEEL

The accompanying cut is an illustration of a trolley harp and wheel invented by R. I. E. Dunn, of Dallas, Tex. The harp is made of malleable iron, and has a connecting bolt (G) to hold together the top and bottom. Ball bearings are employed between the top (C) and the bottom (D). The spring (F) is used to keep the wheel exactly under the wire at all times, whether the wheel is in use or not. The bottom of the connecting pin is square in the bottom of the harp and round at the top, so that the top may turn without turning the pin. The arm (E) is part of the top of the harp, and has fastened to it one end of the spring. The other end of the spring is not fastened but slips through the connecting pin, and when the wheel turns the spring rights it. The lug (I) on the base is used to keep the wheel from turning too far in either direction. There is a tap (H) on the bottom of the connecting pin, and also a set screw on the side of the base as a precautionary measure should the tap come off. A guard is placed before the wheel to permit the latter to slip under obstructions.



TROLLEY HARP AND WHEEL

DESTRUCTION OF CLEVELAND CAR HOUSE

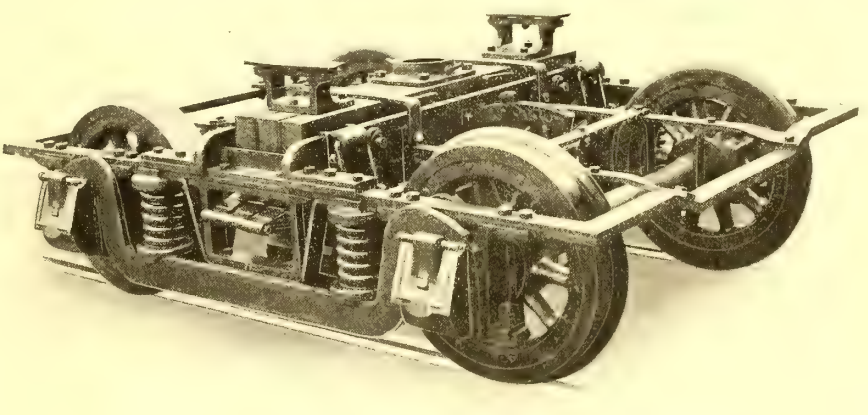
The accompany illustration shows the complete destruction wrought by the fire which destroyed the Holmden Avenue car house of the Cleveland Electric Railway, on Monday morning, Nov. 16, and which caused the death of several firemen. The details of this catastrophe were given in the STREET RAILWAY JOURNAL of Nov. 21.



RUINS OF HOLMDEN AVENUE CAR HOUSE

TRUCKS FOR THE NEW YORK SUBWAY CARS

The New York Subway cars were described in the STREET RAILWAY JOURNAL of Aug. 22, 1903. One of the trucks, as made by the St. Louis Car Company, to go under these cars is illustrated herewith. This truck was built according to specifications of the Interborough Rapid Transit Company, and is in general of the M. C. B. type. The top frame is forged and of but one piece. The equalizing springs are double spirals, located as closely as possible to the journal boxes. There are three elliptical springs under each bolster. The brake-shoes are inside hung. Transom plates are forged and machine fitted; several other parts of the truck are machine fitted. These trucks have a 5-ft. 6-in. wheel base, and weigh about 8800 lbs.

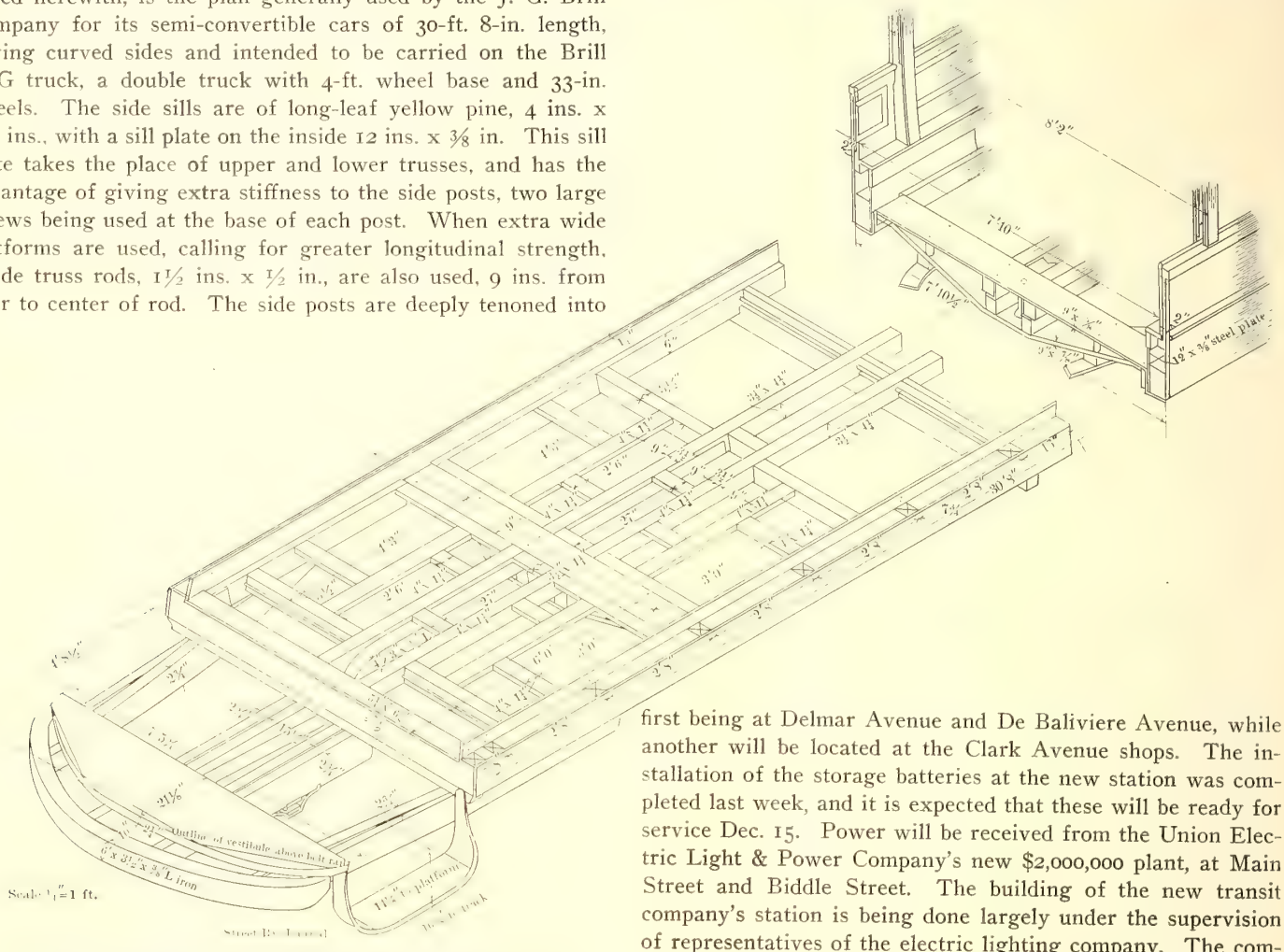


TRUCK FOR NEW YORK SUBWAY CARS

STANDARD BOTTOM FRAMING OF BRILL 30-FT. 8-IN. SEMI-CONVERTIBLE CAR

When it is realized that the bottom framing of a car has to bear the brunt of the weight and strains; that the upper structure depends entirely upon it for stiffness and support; that the platforms frequently carry several tons and are a long way from the points of support, the need of large experience and greatest care in planning this part of the car will be appreciated. The fundamental principle of bottom framing is, of course, to bring the load to the body bolsters as directly as possible through members which are given the greatest amount of strength possible within the limitations of size and weight.

The bottom framing shown in the isometric drawing, reproduced herewith, is the plan generally used by the J. G. Brill Company for its semi-convertible cars of 30-ft. 8-in. length, having curved sides and intended to be carried on the Brill 27-G truck, a double truck with 4-ft. wheel base and 33-in. wheels. The side sills are of long-leaf yellow pine, 4 ins. x 7¾ ins., with a sill plate on the inside 12 ins. x ⅜ in. This sill plate takes the place of upper and lower trusses, and has the advantage of giving extra stiffness to the side posts, two large screws being used at the base of each post. When extra wide platforms are used, calling for greater longitudinal strength, inside truss rods, 1½ ins. x ½ in., are also used, 9 ins. from floor to center of rod. The side posts are deeply tenoned into



ISOMETRIC VIEW, SHOWING THE BOTTOM FRAMING OF 30-FT. 8-IN. SEMI-CONVERTIBLE CAR

the side sill, and are also heavily strap-bolted through the sills. In the straight-sided semi-convertibles a round steel bar is wrought through each post and through the top rail and the sill.

The perspective view of the cross section of the car shows why wide sill plates are used, namely, by not having high inside truss rods the side linings are permitted to be set in between the posts against the backing of the panels. The walls between the posts are but 2 ins. thick, and the ends of the seats are placed against the side lining, thus saving it part of the width of the posts on either side, adding, it is claimed, 6 ins. to 7½ ins. to the width of the car. The window system of this car, as is well known, includes roof pockets for the sashes. The center sills are 3½ ins. x 4¼ ins.; end sills, 5¼ ins. x 6⅞ ins.; 5-ft. 8-in. tie-rods pass through the sills and along the sides of each of the crossings. Open steel body bolsters are used, which, besides having great strength, leave space for brake rods, etc. The center platform timbers are reinforced by 4-in. x 3-in. x ½-in. angle-iron. The angle-irons extend back along the center sills to a distance of 4 ft. 5 ins. back of the center of the body bolster, thus bringing a large part of the platform load directly to the bolster. For protecting and strengthening the platform timbers 6-in. x 3½-in. x ⅜-in. angle-iron bumpers (Brill patented) are used. The platform steps are 16⅜ ins. from rail-head; from step to platform, 14½ ins., and from platform to car floor, 8 ins.

THE NEW SUB-STATION OF THE ST. LOUIS TRANSIT COMPANY

Work is almost completed on the new sub-station of the St. Louis Transit Company, at Eighteenth Street and Locust Street. It is the second of three stations of the company, the first being at Delmar Avenue and De Baliviere Avenue, while another will be located at the Clark Avenue shops. The installation of the storage batteries at the new station was completed last week, and it is expected that these will be ready for service Dec. 15. Power will be received from the Union Electric Light & Power Company's new $2,000,000 plant, at Main Street and Biddle Street. The building of the new transit company's station is being done largely under the supervision of representatives of the electric lighting company. The complete operation of the station will not be begun until the inception of the World's Fair traffic, however. By that time the Union Company's power house will be finished. The capacity of the new plant will be about 10,000-kw-hours, which is the same as the capacity of the Delmar De Bolieviere station.

FROM ERIE, PA., TO CLEVELAND OHIO

President R. L. Forest, of the Conneaut & Eastern Traction Company, and Vice-President Stanley, of the Pennsylvania & Ohio Railway Company, are working on a plan for traffic arrangements between these two companies and the Cleveland, Painesville & Ashtabula Railway and the Cleveland, Painesville & Eastern Railway, whereby a certain number of cars may be operated daily from Erie, Pa., to Cleveland. The lines are now all connected up, and if fast through cars could be operated the line would prove a strong competitor for the Lake Shore & Michigan Southern Railway (steam). The distance from Erie to Cleveland is 101 miles. Through connection is now possible from Erie to Toledo.

FINANCIAL INTELLIGENCE

WALL STREET, NOV. 25, 1903.

The Money Market

Further shrinkage in bank reserves has caused a rise in call money rates, and increased firmness in time money, during the past week. Cash holdings in last Saturday's local bank statement were reported $3,700,000 lower, and surplus reserve was thereby brought down $2,227,000. The latter item stands now at $3,910,000, which is the lowest reached since last April. A year ago the surplus was $19,500,000, and two years ago $14,500,000; so it will be seen that, judging by these comparisons alone, the market's available capital is unusually small. Other matters, however, of larger significance, must be taken into account, before passing judgment on the present situation. Neither in 1902 or in 1901 did we have the hold we now enjoy upon the foreign exchanges. Europe, in both these years, was a heavy creditor in this market, and rates for sterling exchange, so far from favoring gold imports, verged closely on the export point. It is very different now. We have liquidated the greater part of the foreign obligations, and our cotton exports have reached an unprecedented value. The $8,000,000 gold engaged in London since Nov. 1, was arranged without raising demand sterling a cent in the pound. What this means, plainly enough, is that, should more gold be actually needed, it will be brought in here with very little difficulty. Two other great facts in which our money position makes favorable contrast with the previous years are these: The higher surplus reserves of last autumn, and the autumn before, were made possible only by the most vigorous efforts of the government to put idle Treasury money into circulation. Bank resources were, therefore, artificially sustained, whereas now they are moving under natural influences. Secondly, the great decline of the last twelve months in the security market has made the ordinary run of banking collateral much safer, and consequently much more attractive. It is feasible for the banks to lend their funds out more freely, and to let their surplus fall much lower than it was a year ago. Fundamentally, therefore, the money conditions now are immensely stronger than they were last season, irrespective of the unfavorable comparison in surplus reserves. Call money has loaned as high as 8 per cent during the week, but the bulk of the business has been done between 5½ and 6. For sixty-day loans 6 per cent is the ruling rate, but for longer periods 5½ is still quoted.

The Stock Market

A professional trader's market, with some improvement in sentiment, covers in a word the story of the Wall Street week. Genuine operations, whether buying or selling, are an insignificant part of the present business. Whatever activity there is, is confined to the professional contingent, and the course of prices from day to day is governed very largely by their conflicting views of the situation. It seems to many unprejudiced observers as though the market were in a position to undergo a substantial improvement if the powerful financial interests would take the initiative. But this they seem unwilling to do. It is possible, therefore, for the strong bear party to keep a heavy hand on the general list pretty much all the time, and to make successful forays upon individual stocks whose position is particularly exposed. The United States Steel shares and Pennsylvania are the favorite objects of bearish operations, among the regularly active stocks, on account of their large market supply. The only declines of consequence during the past week, however, have occurred in various minor industrials like Republic Iron and Steel, Corn Products and Pressed Steel Car, where doubt as to the continuance of dividends has intimidated holders. Many of the railroad stocks, the Western shares in particular, have, on the other hand, exhibited decided strength. Southern Pacific has been heavily bought on the idea that the extraordinary outlays for improving and extending the system have been so far completed that within the next year the company will be ready to give its stockholders some of the benefit of the present abundant surplus earnings. The granger railroad issues have also held remarkably well, and the signs seem to point to real liquidation being pretty well over in this quarter. That the stiff call money rates have had something to do with holding operations for the rise in check, is probably true. But the main reasons for the market's inactivity remain as before, that the investment community is exceedingly cautious about buying into a period of declining trade. Until the limits of the industrial reaction are more definitely fixed than they are at present, this conservatism seems likely to continue.

The local street railway group have again given a good account of themselves this week. A spirited advance in Metropolitan Securities stock appears to reflect the growing appreciation that the company occupies a very strong financial condition. It is claimed that there is now $3,000,000 cash in the treasury, and that the securities held have a value of $20,000,000. Naturally, the old Metropolitan stock, as the guaranteed property, has sympathized with this advance. Profit-taking sales, some of them from rather influential sources, have checked the rise in Manhattan. The pool in Brooklyn Rapid Transit continues to give the stock strong support, and to talk higher prices for it in the near future. The prospect that the Brooklyn company may be given the privilege of a loop in Manhattan Borough, enabling it to run its cars on a continuous circuit over the new Williamsburg Bridge, as well as the Brooklyn Bridge, has occasioned considerable discussion.

Philadelphia

There has again been little change on the week among Philadelphia traction securities. Some activity appeared at times in Union Traction, but the price never went above 44 nor below 43⅞. It has looked for some time as though a steady investment demand was absorbing all offerings of the stock around these figures, and that a similar demand was taking all the Philadelphia Traction offered around 95. Philadelphia Company common sold down a point from 36¼ to 35⅛, but recovered the loss rather easily, closing yesterday at 36¼. The preferred sold at 43. Philadelphia Electric was strong, advancing from 5¾ to 6, then reacting to 5⅞. A single 100 shares of Fairmount Park Transportation was taken at 19, a point better than the last previous sale. One hundred New Jersey Consolidated sold at 61, also a gain of a point. American Railways, after advancing to 42⅝, fell back on fractional sales to 41¾. Other transactions of less note included United Traction of Pittsburg preferred at 50, Chicago Union Traction common at 6⅞ to 6⅜, and the preferred at 30¾.

Chicago

Traction sales in Chicago have scarcely amounted to anything on the week. Metropolitan Elevated sold at 17 for the common and 55 for the preferred, Northwestern common rose from 15¼ to 16, South Side sold at 94 to 96, and Lake Street first mortgage 5s at 99. All these transactions occurred on fractional lots. Among the surface line shares, Union Traction common sold at 5½, and 10 shares of North Chicago changed hands at 95, which is the lowest price of the season. One of the curious incidents was a sale of 60 shares of City Railway at 170, an advance of 6 points over the last previous sale, in face of the strike on the road. A member of the Lake Street reorganization committee says that the committee has been furnished with expert data as to the physical condition of the property, and that it has been found in far better shape than expected. It is figured that after the financial readjustment the company will be able to earn at least $100,000 a year over fixed charges, which is equivalent to about 3 per cent on the new preferred stock. Rigid economies are to be put into effect, and these, with the growth of traffic which is expected to come with the improved service, ought to place the stock on a permanent dividend basis at an early date.

Other Traction Securities

Massachusetts Electric issues have been somewhat depressed during the week by fears that the company's forthcoming annual report will make an unfavorable showing. One estimate places the extra cost of the year's fuel alone at $280,000. The common stock sold down from 18 to 17, but rallied later to 17½, while the preferred, after going as low as 76½, recovered to 77½. Boston Elevated was steady on light transactions between 140 and 141. West End common rose from 89 to 90, and the preferred from 109½ to 110. Some idea of the dullness on the Baltimore Exchange may be had when it is stated that not a single sale had occurred during the week in the usually active stock of the United Railways Company until yesterday, when 600 shares changed hands from 8¾ to 9. The income bonds of the com-

pany have been stronger, selling up to 59⅝, and the general 4s have been taken freely between 90¾ and 91¼. Other Baltimore sales for the week include Norfolk Street Railway 5s at 105¼, United Traction of Pittsburg 5s at 111, Baltimore Traction convertible 5s at 100½, City & Suburban (Washington) 5s at 92, and Charleston Railway 5s at 105. On the New York Curb the only feature in the traction group was the sharp recoil in Interborough Rapid Transit. The stock after selling as high as 99½, fell a sheer 10 points to 88½ on sales of 1500 shares. It recovered later to 90. No explanation was forthcoming other than a desire to market some of the syndicate stock. Brooklyn Rapid Transit bonds, when the accident on the system was announced last week, dropped to 74½, but quickly rallied in the course of the next day or two to 76¼. New Orleans Street Railway common was a trifle firmer, rising from 8 to 8¼, and the preferred gained a point to 28½. One hundred St. Louis Transit sold yesterday at 13¾ and 100 United Railways of St. Louis preferred at 61½.

Northern Ohio Traction was again the active issue in Cleveland, about 800 shares selling at 12½ to 13⅛, an advance from 11, the low record of the week previous. Cleveland Electric was up several points and ranged from 66¾ to 67⅜, the last sale at the top figure. Northern Texas Traction sold at 31, an advance of 1 point. None of this is now in sight at less than 33, and there are plenty of offers. A small lot of Western Ohio receipts sold at 11, a new low mark. Several lots of Miami & Canal 5s sold at 39⅝, the lowest ever touched. Two Northern Ohio 4s sold at 53, also a low mark. On Monday, three blocks of Northern Ohio Traction Consolidated 5s, among the best traction bonds on the market, sold at 95¼. A $5,000 lot of Northern Ohio Traction & Light 5s sold at 62½, an advance of 1 point over last previous. Later another lot sold at 62. A small lot of Cleveland & Southwestern preferred sold at 60, which is 4½ points below last sale made some time ago. Northern Texas Traction sold at 32, an advance of 1 point.

Cincinnati Street Railway was the strong feature on the Cincinnati Exchange. The stock opened the week at 130, the point at which it has been selling for some time, and advanced steadily to 133½. The asked price is now several points above the closing figure, and it is predicted the stock is good for a 10-point advance. About 700 shares were sold, all in small lots. Cincinnati, Covington & Newport preferred suffered a decline, opening at 83½ and falling during the week to 80½; the sales were very small, however. Detroit United opened at 64½ and after several sales advanced to 66, but fell back to the old figure at the close; sales, about 200 shares. A block of $22,000 worth of Miami & Erie Canal 5s sold at 50, but later in the week a small lot sold at 39¾.

Security Quotations.

The following table shows the present bid quotations for the leading traction stock, and the active bonds, as compared with last week:

	Closing Bid Nov. 17	Nov. 24
American Railways	42	41
Aurora, Elgin & Chicago (preferred)	a65	a68
Boston Elevated	140	140
Brooklyn Rapid Transit	38¼	38⅝
Chicago City	164	164
Chicago Union Traction (common)	5¼	5
Chicago Union Traction (preferred)	a35	27
Cleveland Electric	66⅝	67½
Consolidated Traction of New Jersey	60	60
Consolidated Traction of New Jersey 5s	105¾	106½
Detroit United	63¾	64
Elgin, Aurora & Southern	a45	—
Lake Shore Electric	a15	a14⅞
Lake Street Elevated	2½	1½
Manhattan Railway	139¼	138⅞
Massachusetts Electric Cos. (common)	18	17¼
Massachusetts Electric Cos. (preferred)	76	76
Metropolitan Elevated, Chicago (common)	17	17
Metropolitan Elevated, Chicago (preferred)	55	50
Metropolitan Street	114	115⅝
New Orleans Railways (common)	7¾	8¼
New Orleans Railways (preferred)	27	28¼
North American	70	71½
Northern Ohio Traction & Light	13	12⅛
Philadelphia Rapid Transit	11½	11½
Philadelphia Traction	95	95
St. Louis Transit (common)	13¼	13½
South Side Elevated (Chicago)	92	95
Third Avenue	108	107
Twin City, Minneapolis (common)	87¼	89¼
Union Traction (Philadelphia)	43⅞	43⅞
United Railways, St. Louis (preferred)	58	57½

a Asked.

Iron and Steel

There is a general feeling in the iron trade that the recent action of the steel billet pool in reducing prices to $23 a ton, and continuing the "gentlemen's agreement" in force, is by no means the end of the matter. Many well-informed observers expect that when the pool meets again next month, it will decide that a further cut will be necessary in order to meet outside competition. The active effort to stimulate the export trade continues, and as an indication of what concessions are being offered to get the foreign business, it is reported that the recent contract for 20,000 tons of steel rails for delivery at Beirut was made on a basis of less than $19 a ton. Dullness is very pronounced in structural material and in plates; the heavy cut in steel bars has so far met with no very satisfactory response on the part of buyers; and a readjustment of prices has been found necessary in the sheet trade. Quotations are as follows: Bessemer pig iron $18.10, steel billets $23, steel rails $28.

Metals

Quotations for the leading metals are as follows: Copper 12¾ cents, tin 25¼ cents, lead 4⅛ cents, and spelter 5½ cents.

BOSTON CAR TUNNEL ROUTE

The Massachusetts Railroad Commission has declared in favor of a Washington Street route for the tunnel to be constructed in Boston for the elevated trains of the Boston Elevated Railway Company. The Boston Rapid Transit Commission had proposed a route to Haymarket Square through Devonshire and Union Streets, and the railway company had appealed to the railroad commissioners from this finding. In thus fixing a route the commission deems it advisable to stop at the junction of Washington Street and Adams Square, instead of at the junction of Union Street and Haymarket Square, as fixed by the Boston Transit Commission, because further legislation may be desirable to permit such changes in the present subway and approaches as may be requisite to connect properly the tunnel with the rest of the railway system. In addition to this tunnel, which is to be used exclusively for elevated trains, a subway for surface cars is to be constructed under Devonshire Street, and the elevated trains are to be removed from the present Tremont Street subway.

CHANGE OF NAME IN NEW YORK

The Interurban Street Railway Company, of New York, has filed an application at Albany for a change of name to the New York City Railway Company. As some time is required for the approval of an application of this kind, the new name will probably not go into effect until during the early part of 1904. A change of name has been under consideration by the directors of the Interurban Street Railway Company for some time. This was partly because the old name did not properly represent the business done by the company, only a small proportion of which is interurban, and also because to those who are not acquainted with New York City conditions and companies there was a confusion between the name of the company and that of the Interborough Rapid Transit Company, which owns the subway and operates the elevated roads in the city. The new name will properly identify the enterprise with New York, and is interesting as being a return to the form of name which was generally in use some fifteen or twenty years ago.

"Electricity," of London, credits to a lady correspondent of the "Chicago Daily Tribune" the solution of the problem of women getting off street cars backwards. It seems that the method of operating cars is at fault, and not the ladies themselves. Cars in the United States, unlike those in England, run on the right, instead of the left, pair of rails, and here is where the secret is. As the lady in question points out, the left arm is essentially a carrying arm, for dealing with parcels, children and such like impediments, leaving the right arm and hand free for protection and for grasping any necessary support, such as the hand-rail of a car. This reversal of the natural order of things caused the accidents that are so frequent.

CHICAGO UNION TRACTION PROPOSED IMPROVEMENTS

Judge Grosscup addressed the Corporation Counsel of Chicago at his court, Nov. 21, regarding the improvements proposed by the receivers of the Chicago Union Traction Company. Judge Grosscup said:

"Along with the mayor, the members of the Council and the people of this city, the court is hopeful that an early solution of the whole street car problem, carrying with it complete rehabilitation, will be reached. The suggestion contained in the corporation counsel's letter to the transportation committee may have in it the basis for such a solution. If put into concrete form it will be carefully considered by the court and will be brought to the consideration of the several companies constituting the interests in the court's keeping. But pending any solution—especially if the questions underlying the problem should have to go to the Supreme Court of the United States—it is certainly desirable to make such immediate improvements as will give the public a better service while fitting in with the system when complete rehabilitation comes.

"The modified leases of last August and the action taken by the court at that time and since to keep control of that subject matter have made available to the receivers out of the resources of the company sufficient sums to enable them to make somewhat extended and systematic plans for the improvement of the service.

"These plans, which the receivers are now ready to enter into, contemplate the putting in of underground trolley loops in the business district; the hitching together of the outlying trolley lines where they are disconnected and the introduction into the service of 500 or 600 new, up-to-date electric cars. The underground trolley loops could be made substantially to conform to the plans which have heretofore met the approval of the city in connection with a complete new system of street car service.

"The permits asked for in the application before me would, of themselves, without the carrying out of the larger plan, greatly improve the service; but their chief value is in connection with, and as a part of, such plan. The plan as a whole would give to the people tributary to the Lincoln Avenue lines, the Clybourn Avenue lines, the Belmont Avenue line, the Wells Street line south of North Avenue, the Ogden Avenue lines, the Blue Island Avenue lines and the branches of these lines, continuous electric car service, without change, to the heart of the city, and around the loops contemplated.

"It would enable the people traveling on these lines to alight and get on at any place around the loops nearest their place of business or destination; to make the trips in a much shorter time than is now consumed; to avoid breaks in their journey by transferring from the electric to the cable lines; and it would relieve the lines not electrified of much of their present burdens.

"One hundred new cars have already been ordered and are to be delivered Jan. 1. The receivers, with the resources at their disposal, will be able to add to these from thirty to forty cars each month until the 500 or 600 contemplated are in use.

"Whether such plans shall be entered upon as a part of existing rights under the existing law and ordinances, even though no permits are granted, is one question; whether the improvement to the service contemplated shall by consent of all parties be entered upon is another question. The two questions must be kept distinct.

"The corporation counsel has advised the denial of the permits on purely legal grounds; but he has accompanied his opinion with the suggestion that the Council had full power in the premises. It has been stated that there is some fear on the part of the Council that the permits asked for might affect unfavorably to the city the legal questions involved. This need not, it seems to me, be the case. The improvements can be put in without adding to, subtracting from or in any way affecting the attitude of the parties to the street car situation or their legal rights. I take it that this is the view of the corporation counsel, and that he and Mr. Miller could readily draft a proviso that would permit the introduction of these improvements, leaving untouched the legal status.

"This being the case, it seems to me that we may expect that the City Council will, pending a final settlement of the street railway problem, permit the receivers to devote the resources at their command to the improvements suggested.

"I have been speaking, of course, only from the standpoint of the improvements as a business proposition. Whether the court would have power, apart from the granting of these permits, to go ahead and put in the improvements is another question upon which I have not formed an opinion. The question of the permits, I understand, is now before the Council. I will not, therefore, enter upon a hearing of the legal question at the present time, but will set it down for Dec. 3 next at 10 a. m."

Corporation Counsel Tolman agreed upon Dec. 3 as the time for presenting the views of the City Legal Department upon the matter. The mayor has expressed himself as favorable to whatever permits for improvements can be made without prejudicing the city's legal rights in the franchise controversy. The reason for the denial of these permits for temporary improvements heretofore has been mainly that it was feared such permits might be construed as an admission on the part of the city of some legal rights of the company under the ninety-nine-year act, which rights the city has denied. A proposition, somewhat indefinite in form, has been made by the committee on local transportation that one solution of the Chicago Union Traction franchise matter might be the purchase by the city of the various lines at an early date, but this has not assumed a definite form and no opinion has been expressed upon it by the receivers of the Chicago Union Traction Company.

Arguments before Judge Grosscup on the validity of the ninety-nine-year act as affecting the Chicago Union Traction franchise will be held Jan. 16, 1904. The city attorneys announce that the city will then be fully prepared to present its case. David T. Watson, of Pittsburg, has been engaged as special counsel for the city to argue this case. Mr. Watson is well known through several prominent cases in which he has recently figured. He represented the United States before the recent Alaskan boundary commission and was also connected with the Northern Securities case.

CHICAGO STRIKE SETTLEMENT

A settlement of the Chicago strike was effected at 1 a. m. November 25, when an agreement was entered into between the representatives of the company and the union, after a session lasting ten hours. To this compact the Council committee, the mayor and the company and union representatives were parties. The company secures practically all the important points for which it took a positive stand at the beginning. The right is reserved by the company to hire such men as it pleases, and to take back only those who have committed no violence during the strike. The question of wages may be arbitrated, the decision to be reached by a comparison with rates paid for similar service in other cities. The present scale of wages paid by the company is not to be considered in this connection. It is likely that this will result in a reduction of the wages of some of the men, while in other cases an increase will probably be paid. The company's power over the men is to be absolute. It is to have the right to hire, discharge and discipline men without union interference or arbitration. The strike has resulted in a big loss to the company, the citizens have been greatly inconvenienced, and the union has met with a crushing defeat.

In the last issue of the STREET RAILWAY JOURNAL an illustrated account of the first week of the great strike of the Chicago City Railway was given. The rioting which marked the first days of the strike greatly diminished as time went on, and a thorough police protection was maintained. The Wentworth Avenue electric line was the first one opened, and later, the Halsted Street electric line and the Cottage Grove Avenue and State Street cable lines were opened. Owing to the danger from mobs, however, cars were only operated during such hours as they would be least likely to disturbance from the hoodlum element.

An attempt was made on Monday to wreck the cable system at Sixty-third and State Streets, when steel rails slipped between the 4-ft. spokes of the big wheel on which the State Street cable revolves caused more trouble than any other barricade the strikers have yet constructed. The rails were not noticed when the cable was started, and as a result they twisted and bent the great spokes of the wheel all out of shape, stopping the wheel and threatening to put the line out of service for the day. The obstruction was found in time to save the cable, and men were set to work sawing the rails in two. They were so twisted by the spokes of the turnwheel that they could not be extricated. This caused a delay of a half hour in starting the State Street line.

Much indignation has been expressed over the action of the teamsters and firemen in repudiating their agreement not to indulge in a sympathetic strike. Some of the national labor leaders have expressed themselves very strongly on this subject, and have announced that the charter of the local teamsters union, which violated the agreement, would be taken away. A mass-meeting of labor unions was held at Tattersall's Sunday, Nov. 22. The resolutions passed at that meeting were about as nearly unadulterated rot as ever finds its way into print. The mayor and City Council were called upon to withdraw police protection from the company's cars. One resolution says that the company "has demanded and has received the protection and assistance of one-half or more of the entire police force of the city in the pursuance of its arbitrary and wicked course, in consequence of which one-half of the law-abiding citizens of the city are denied police pro-

tection altogether." Another resolution sets forth that the company for more than ten days has "by its obstinacy and lawless conduct utterly neglected and refused to give the people of the south side of the city any transportation whatever or to perform any of its duties, thus causing great hardship, annoyance and suffering."

Of course, the "law-abiding citizens" (?) who passed these resolutions and who demand that the city grant the company no more franchises have nothing whatever to do with the bricks that have been thrown, or with the necessity for police protection on the cars, nor are they in any way responsible for the fact that the company has been unable to give the public regular service since the strike began. Oh, no! These resolutions, however, are somewhat in line with the regular attitude of labor leaders in every strike. They hold up their hands in horror at the mob violence which always occurs, but never fail to enter an emphatic protest against any display of police or military force to prevent riots and mob rule.

IMPROVEMENTS ON THE CHICAGO & MILWAUKEE ELECTRIC RAILWAY

The Chicago & Milwaukee Electric Railway, extending from Evanston to North Chicago, is making very extensive improvements on its line and in its power equipment. The road was built in 1899, and at that time there was installed a central power plant at Highwood, with two sub-stations, one at Winnetka and the other at North Chicago. The generator capacity of the central plant was 750-kw, with two engines of 600 hp and 1200 hp respectively. In the sub-stations were installed rotary converters and storage batteries, together with the usual sub-station equipment. At present large additions are being made to all parts of the equipment. The transmission and feeder lines have been increased in capacity by about 100 per cent. The generator capacity in the power plant has been increased by 1500-kw, and the engine capacity by about 2300-hp. For the sub-stations, new buildings are being provided, together with entirely new equipment in the way of rotary converters, transformers, switchboard apparatus, etc., all of the latest pattern, and of sufficient capacity to provide for the present additions with liberal allowance for future increase in business. New track has been laid from Lake Forest to Libertyville, this being part of the proposed extension to connect the system with the Wisconsin Central, a steam road. Besides this, it is proposed to double-track the whole line from Highwood to North Chicago, thus giving double-track service over the total length of the original line. The Arnold Electric Power Station Company, which designed and constructed the original power station for the road, is consulting engineer for the betterments to power plant and distributing system now in progress, but the work is to be carried out by the railway company's force.

THE NEW WORTHINGTON PLANT

An extensive pump manufacturing plant, the largest in this country, and probably in the world, is now under construction at Harrison, N. J. It is to be occupied by the firm of Henry R. Worthington, who employ about 3,000 men in the present works at South Brooklyn, L. I., and Elizabethport, N. J. The new plant at Harrison will accommodate from 4000 to 5000 men, and will cost in the neighborhood of two million dollars. It consists of a main machine shop with side galleries over 1006 ft. long, an erecting shop 592 ft. long, and of the same section as the machine shop, and a high erecting shop 210 ft. in length, and four galleries in height in the side bays connecting the two shops. The main foundry is 600 ft. in length, and there is also a special foundry for small work, 410 ft. in length, with a building 200 x 60 ft. in size, for cleaning castings, connecting the two. The pattern building is four stories high and 550 ft. long, and is divided by fire walls into four sections. The north section will be used for offices and drafting rooms; the adjoining section for the pattern shop and the balance of the structure for pattern storage. The power-house, which will be equipped with the most modern boilers, engines and generators, is a building 172 x 102 ft. Electric power distribution is to be employed throughout, and the grounds will be illuminated by electric arc lights. There are many other buildings which will be used for packing, storing and shipping goods, etc. The buildings are so arranged that additions can be built when the work demands it. All will be connected by a complete system of railroad tracks entering the ends of the buildings and placing the works in direct communication with the Delaware, Lackawanna & Western, The Erie and the Pennsylvania Railroad systems. The new plant will be devoted entirely to the manufacture of waterworks machinery, water meters, cooling towers, condensers, feed-water heaters, centrifugal pumps and steam pumps of all kinds.

SUBWAY IN MANHATTAN TO CONNECT BRIDGES

The committee on plans of the Rapid Transit Commission, of New York, composed of President Orr, John H. Starin and Comptroller Grout, held a conference last Saturday with representatives of the Brooklyn Rapid Transit Company, and discussed plans for railroad service across the Williamsburg Bridge. The conference was held behind closed doors, but after the meeting was over it was stated that the plan had been put forward to build a four-track subway running from the bridge to Delancey Street, Manhattan, to Centre Street, and thence down Centre Street to connect with the Brooklyn Bridge. It was also suggested that surface cars be run on Delancey Street as soon as that street is widened. These recommendations will be made to the Rapid Transit Commission at an early meeting. Comptroller Grout is reported to have said that President Winter, of the Brooklyn Rapid Transit Company, is well pleased with the subway idea. Mr. Grout said it is his intention to use all possible effort to have condemnation proceedings commenced at once on the Delancey Street property, and that he will see to it that there is no undue delay in carrying out this improvement to provide an approach to the bridge. A plan formerly advocated provided for the construction of an elevated structure to connect the bridges.

SERIOUS ACCIDENT ON THE BROOKLYN ELEVATED

An accident in which two men were killed, nine other persons injured and four cars practically destroyed by fire, occurred on the Fifth Avenue line of the Brooklyn Elevated Railroad at Thirtieth Street, on Thursday, Nov. 19. One train was run into in the rear by another train and the cars were telescoped. This caused the fire, which soon enveloped the trains in flames. A wild panic ensued among the passengers, who rushed madly to the doors and windows and made their way as best they could along the track to the nearest station.

The trains in collision were one bound to the Brooklyn Bridge from Sixty-fifth Street and a train that had just started from the station at Thirty-sixth Street for the same destination. It was rush hour, and exactly 5:05 p. m. when the Sixty-fifth Street train left its station; the train from Thirty-sixth Street followed five minutes later. The Thirty-sixth Street train came to a standstill at Twenty-ninth Street, because a fuse blew out, it is said. The conductor of this train says that he ran to the rear platform and held a red lantern as a signal to warn the approaching train. Despite this signal, the Sixty-fifth Street train bore down on the stalled one and crashed into it. As stated, fire followed the collision almost immediately and it was necessary to call on the fire department for assistance in extinguishing the flames.

It is hardly probable that the accident will ever be fully explained. The motorman of the Sixty-fifth Street train was found dead at his post, as was also the conductor of that train. The theories as to the cause of the accident differ, but the most likely one seems to be that the motorman of the second train fell dead at his post from heart disease a moment or two before the collision occurred.

Happening as it did at the rush hours, the accident caused a complete tie-up on the Bay Ridge and Bath Beach divisions of the line and led to a great jam of South Brooklyn and Suburban passengers at the Park Row end of the Bridge and also at the Bridge terminal of the elevated railway in Brooklyn.

An investigation of the accident was begun at once by the railroad commissioners. About the only thing emphasized at the hearings was that the company had taken every possible precaution to prevent an accident by equipping cars and stations with proper signals and apparatus. It was also shown to the evident satisfaction of the State officials that all the signals and apparatus were in proper running order at the time of the collision of the trains.

THE LAMME SINGLE-PHASE ELECTRIC RAILWAY SYSTEM

A section of the track of the Westinghouse Interworks Railway, at Pittsburg, Pa., has been equipped with the Lamme single-phase motor system. This railway connects the different Westinghouse works at East Pittsburg, Wilmerding, and Trafford City, and has sufficient straight track so that a speed of 45 miles per hour can be attained. A single car equipped with four 125-hp single-phase motors has been in operation for some time on this line with very satisfactory results. The car accelerates quickly, and the sparking at the commutator is no more noticeable than with a direct-current equipment. The line voltage used is 1200.

REPORT OF THE LONDON TRAFFIC COMMISSION

The members of the sub-committee of the London Traffic Commission, who were in America about a month ago, have just made a preliminary statement to the London press in regard to their visit to the United States. The trip was regarded as highly successful in accomplishing the objects sought, which were, "to inquire into the various means of transit and transport existing in the principal cities of the United States, with their relative efficiencies from the public point of view; to ascertain the respective authorities from which, and the procedure according to which, franchises and charters relative to rapid transit are granted in the principal States, and to investigate the extent and nature of the control exercised over the carrying into effect of the powers granted by such franchises or charters."

The committee visited New York, Boston, Washington and Philadelphia, where the method of handling the traffic in each city, especially at the congested points, was inspected. In addition to information on purely traffic matters the members investigated the nature of and procedure of granting franchises in New York State, under which railroads, elevated railways, and subways are constructed, and the character of the powers of control therein vested in or reserved to the State Board of Railroad Commissioners, the Rapid Transit Commission, or the City Council.

Very full statistical information as to the operation of the Boston subway and elevated railway system was secured from General Bancroft. In Massachusetts, also, the committee met the Massachusetts Board of Railroad Commissioners, from whom they obtained a comprehensive account of the system in Massachussetts of granting franchises for railroads and railways, and of the extent and character of the control exercised by the board over the subsequent working. In regard to the main line railroads entering Boston, the commission obtained much valuable data, particularly as to the attitude adopted by the trunk line companies in the matter of rapid transit.

In Washington, the committee was received by the President of the United States, who evinced great interest in the matter of the inquiry, and also visited the Inter-State Commerce Commission, from whose library a great deal of valuable information relating to the subject matter of inquiry was obtained.

In Philadelphia the committee reports that it was also given full facilities for inspecting the surface systems, and discussed their operation and the construction of the proposed subway with the street railway officials. The Western cities were not visited, but the testimony offered in New York by Mr. Vreeland and Mr. Arnold related to much of the work outside of New York City, and Mr. Arnold's testimony was particularly valuable in regard to Chicago. In addition to the regular investigation the secretary of the committee, Mr. Macassey, made a special trip of inquiry to Chicago, Detroit, Cleveland and Albany, as well as to certain other cities, and the information obtained by him was laid before the committee. The members of the committee concluded their preliminary statement by saying that they were highly gratified by their hospitable reception in the United States, and by the efforts of all connected with rapid transit in its various forms to give them such information as they required. Where such was not at the moment available, a special investigation was at once ordered, and no trouble was spared to make the visit as instructive and profitable as possible.

PROGRESS OF GERMAN ELECTRICAL CONSOLIDATIONS

The consolidation of the Siemens & Halske Company with the Schuckert Company of Vienna, which was carried out some time ago by the Austrian Landerbank, of Vienna, and the Deutsche Bank, of Berlin, is now so far advanced that the united working of the two companies will commence Jan. 1, 1904. This amalgamation includes the Siemens & Halske works at Vienna and Leopoldsan, the branches at Budapest, Graz, Larbech, Lemberg and Olmutz, the Vienna establishment of the Schuckert Company, and the entire plant of the Vienna Electric Tramway Company.

THE MOVING PLATFORM SCHEME AGAIN

It is said that Mayor Low is inclined to give favorable attention to the application of Schmidt & Gallatin, promoters of the moving platform scheme for carrying passengers across the Williamsburg Bridge and through Nassau Street to the Battery Schmidt & Gallatin offer to pay the city $135,000 a year as a rental of the bridge for its moving platforms. This, they say, represents 4½ per cent on $3,000,000, which they estimate will have to be spent to build the system. They declare that they will put the moving platforms on the bridge and have them working properly inside of three months. They make as a condition of their rental proposition, however, that the city shall allow them to tunnel the necessary streets to the Battery. The promoters say that a system across the bridge proper would not pay, as it would leave people too far away from their destination. They are willing to put the new system on the bridge and stand the loss of operating it until the new tunnel can be built, which, it is thought, would take at least three years. Mayor Low has requested further data from Schmidt & Gallatin, and in the meantime a contract is being prepared for the consideration of the Rapid Transit Commission.

Corporation Counsel Rives sent the mayor an opinion that the franchise desired by the syndicate would have to be granted in the ordinary way. The Board of Aldermen would first have to grant the franchise, and then it would have to be approved by the Board of Estimate and Apportionment and the Rapid Transit Commission.

RAIL WELDING IN A LECTURE ROOM

A meeting of the American Society of Mechanical Engineers is to be held at Stevens Institute, Hoboken, on Dec. 3, at 2 p. m., at which Dr. Hans Goldschmidt, inventor of the thermit process, will present a paper on his process of welding. Dr. Goldschmidt will illustrate his lecture by producing several crucibles of molten iron by his method, and welding, in the lecture room, a 9-in. girder railway joint, a third-rail joint, joints in wrought-iron pipes, etc.

MORE FOREIGN PROJECTS

Construction work will begin shortly on an extensive electric traction system in Guadalajara, one of the principal cities in Mexico. A company called La Electra, S. A., was recently organized to take over the existing mule lines—aggregating about 30 miles—and to acquire the Compania de Luz Electrica de Guadalajara, which operates a 2500-hp steam plant and lights the city. The mule lines will be converted and extended. C. A. Malau is the chief engineer of La Electra. He is now engaged in drawing up plans for the new system. Power to operate the new electric lines will be generated by an hydraulic plant which will be built on the Rio Grande at a point about 2 miles distant from Guadalajara. The initial capacity of the plant will be 1500-hp.

The Compania Ferro Carril Villa Isabel, which operates a short horse road in Rio de Janeiro, Brazil, is to equip its system with electricity.

The Compania de S. Christovao, which controls a mule and electric traction system between Rio de Janeiro and Tijuca, a suburb of the Brazilian capital, located at an altitude of 1200 ft. above the sea level, is about to electrify its main line from the Usina to the Muda along the Rua Con de Bomfim. The portion of the system between the junction to the Alto da Boa Vista, which is now worked by mules, is also to be changed into electric traction. In all there will be about 3 miles of road to be electrified.

STREET RAILWAY PATENTS

[This department is conducted by W. A. Rosenbaum, patent attorney, Room No. 1203-7 Nassau-Beekman Building, New York.]

UNITED STATES PATENTS ISSUED NOV. 17, 1903

744,051. Time Limit Device for Motor Controllers; Fred B. Corey, Schenectady, N. Y. App. filed May 24, 1902. Comprises a dash pot and a step member constructed to prevent a too rapid movement of the controller while allowing a free movement from one contact point to the next.

744,055. Electric Railway System; William Embley and Abraham A. Shobe, Jerseyville, Ill. App. filed April 10, 1903. The hangers in which the conductor is mounted are free to slide in their supports to accommodate expansion and contraction of the conductor.

744,079. Brake for Cars; Sarah H. Kendall, Davenport, Ia. App. filed April 24, 1903. Details of construction of a handle for mechanical brakes.

744,125. Circuit Breaker; Samuel B. Stewart, Jr., Schenectady, N. Y. App. filed Jan. 23, 1901. Relates to improvements in an overhead switch for trolley cars.

744,159. Switch Turning Device; Lewis L. Biglow, Seattle, Wash. App. filed Jan. 31, 1903. Means for throwing the switch from a moving car.

744,168. Automatic Switch; Joseph M. Comer, Spokane, Wash.

App. filed March 30, 1903. A railway switch is thrown by a magnet operating through a pawl and ratchet and levers.

744,187. System of Electric Traction; Lucius T. Gibbs, New York, N. Y. App. filed April 13, 1903. The vehicles are provided with dynamos and motors and are connected with the line whereby any extensive power generated will be delivered to the line for use by other vehicles.

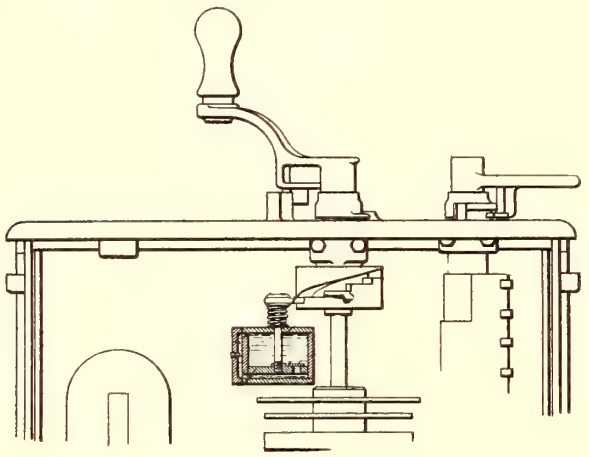
744,221. Car Wheel; David N. Nickerson, Detroit, Mich. App. filed Jan. 5, 1903. The hub of the wheel is allowed diametrical movement upon cushions of sufficient resiliency to largely overcome vibration.

744,246. Electric Railway System; Abraham A. Shobe and William Embley, Jerseyville, Ill. App. filed April 10, 1903. The conductor is so mounted as to permit of its expansion and contraction without injury to its support or insulation.

744,247. Electric Railway System; Abraham A. Shobe and William Embley, Jerseyville, Ill. App. filed April 10, 1903. An insulated conductor for the return current is mounted upon the traffic rail.

744,248. Railway Signaling System; Judson Shoecraft, Eskridge, Kan. App. filed Aug. 30, 1902. Details.

744,261. System of Electric Lighting for Cars; Charles P. Tolman, Boston, Mass. App. filed July 30, 1903. An arc and an incandescent lamp located in the same headlight and provided with automatic means for throwing the incandescent lamp into circuit in case the arc lamp fails.



PATENT NO. 744,051

744,446. Trolley Guide; Milton Walker, Cambridge, Mass. App. filed April 3, 1903. A guide rail located beneath the trolley frog and upon which the trolley wheel runs to properly guide the wheel across the frog.

744,463. Trolley Head; Joseph Bishop, Westbrook, Maine. App. filed March 26, 1903. A device for retaining the trolley wheel upon the wire.

744,513. Automatic Switch Operating Mechanism; Henry T. Dumas, South Hadley Falls, Mass. Details.

744,569. Car Brake; John B. Leu, Newark, N. J. App. filed June 13, 1903. The brake-shoe has a straight under side to engage the track, a concave upper side to receive the wheels and is loosely connected with the forward end of the brake lever, said lever being adapted to lower the shoe upon the track in advance of the wheel.

744,665.—Controller; Thorsten Von Zweigbergk, Preston, England. App. filed April 7, 1902. The combination of a pair of series-wound motors connected together in series independently of the controller, the fields and armatures being thus on a closed local circuit and a controller adapted to convert said local circuit into a derived circuit from the source of current, or form a bridge across it for braking action.

PERSONAL MENTION

MR. T. A. HENDERSON, general superintendent of the Chicago Union Traction Company, of Chicago, Ill., has resigned from the company.

MR. HOWARD S. KNOWLTON, formerly with Stone & Webster, of Boston, has joined the engineering department of the Colorado Telephone Company, at Denver.

CAPTAIN G. D. Howell has been made temporary superintendent of the Erie Rapid Transit Company and the Lake Erie Traction Company, of Erie, Pa., vice Mr. A. C. Harrington, resigned.

MR. M. B. HERLEY has been appointed general superintendent of the Chicago Union Traction Company in place of Mr. T. A. Henderson, resigned. Mr. Herley was formerly traffic manager of the company.

MR. JOHN J. MAHONEY has been appointed general superintendent of the Indianapolis Traction & Terminal Company, of Indianapolis, Ind., to fill the vacancy caused by the death of Mr. Miller Elliott. Mr. Mahoney has been in street railway service in Indianapolis for about twenty years, and was paymaster just before his appointment as superintendent.

MR. CHAS. V. WESTON, of Chicago, has severed his connection with the Chicago Engineering & Constructing Company, of which he was president. His duties as chief engineer of the South Side Elevated Railroad Company, which is about to build extensions, naturally call for much of his time along with other consulting practice which he enjoys.

MR. T. C. CHERRY, for some time manager of the Lorain Street Railway Company, of Lorain, Ohio, has resigned, to take effect Dec. 1, to become manager of the Saginaw Valley Traction Company, of Saginaw, Mich. The new position includes the management of the traction lines in Saginaw and Bay City, an interurban line and an electric light plant.

MR. CHARLES REMELIUS, chief engineer and master mechanic of the Indianapolis Traction & Terminal Company, of Indianapolis, Ind., has resigned. Part of his duties have been assumed by Mr. Charles Hogate, who will be chief engineer of power stations. The foremen of the various shop departments formerly reporting to Mr. Remelius, as master mechanic, now report directly to Mr. James M. Jones, vice-president and assistant general manager. It is understod that Mr. Remelius is considering several offers and is taking a brief rest before making a decision.

MR. E. J. WILCOXEN, superintendent of the Rochester & Sodus Bay Electric Railway Company, of Rochester, N. Y., was seriously injured in a collision between two cars on the Rochester & Sodus Bay line, on Wednesday, Nov. 18. Mr. Wilcoxen was acting as motorman of one of the cars in collision. The vestibule of his car was crushed in, and he was jammed against the front of the car proper. His right leg was broken, his left foot was badly crushed, and he sustained other injuries. After he had been removed to the hospital it was found necessary to amputate the foot that had been crushed.

MR. GEORGE W. SPINK, master mechanic of the San Francisco, Oakland & San Jose Railway Company, of San Francisco, Cal., who was injured Sunday, Nov. 15, while riding in a car on the new system, died Tuesday, Nov. 17, from concussion of the brain. The lamentable accident which caused Mr. Spink's death occurred near the Emeryville subway. Mr. Spink was riding with the motorman for the purpose of observing the working of the trolley, which had been giving trouble earlier in the day. He leaned too far out of the window and was struck by a trolley pole. At the time of his death Mr. Spink also was master mechanic of the Oakland Transit Company and was in charge of the shops of that company. He was a young man, being only thirty-five years of age. He is survived by a wife and two children.

MR. J. R. BEETEM has been elected first vice-president and general manager of the Peckham Manufacturing Company, of Kingston, N. Y., and New York City, and will make his headquarters at the works of the company, at Kingston, N. Y. Mr. Beetem brings with him to this position, an extended and valuable experience in both construction of cars and street railway work, which well qualifies him for the management of the company and the construction of the trucks. Mr. Beetem was born at Carlisle, Pa., and in 1872 entered the employ of F. Gardner & Company, builders of cars and engines at Carlisle, Pa., as an apprentice in the machine shop, and served his time of four years. Later, he became the confidential accountant of this firm, and after it was organized into a stock company, became its general manager and treasurer. In 1890 he became connected with the Jackson & Sharpe Company, of Wilmington, Del., being assistant to President Jackson, in the car department. In 1892 he resigned from this position and became connected with E. W. Clark & Company, bankers, of Philadelphia. Mr. Beetem's first work in street railways was the reconstruction of the Atlantic Avenue Railroad Company, in Brooklyn, N. Y. From there, in the interests of the Clark Company, he largely reconstructed the Scranton system, and made such an excellent record as operating manager that, in 1895, upon the consolidation of the Philadelphia lines, under the Union Traction Company, he was offered the position of general manager of that company. Mr. Beetem remained in Philadelphia for nearly two years, when he resigned and accept a position as vice-president and general manager of the New York & Queens County Railway, of Long Island City, which position he held until May of the present year. He is progressive, with a very wide acquaintance with street railway men and conditions, and has an intimate knowledge of the requirements of trucks in street railway service.

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The Chicago Strike

Now that the terms of agreement between the Chicago City Railway Company and the Amalgamated Association of Street Railway Employees have been made public and an opportunity has been afforded to study the results and their bearing upon the labor situation, so far as they relate to the street railway field, it must be apparent to every unprejudiced observer that the strike, so far as the men were concerned, was a most dismal failure, and that while it entailed great financial loss upon the company, and, for a time, disorganized the system, it was not entirely without its compensating feature, as it enabled the company to secure a readjustment of affairs that had long been unsatisfactory and distasteful to the management.

First of all, it is interesting to note that the company did not recede from its position on any issue where it had taken a positive stand before the strike. The question of wages, which is left to arbitration, is not likely to be determined against the company, as the scale now in effect makes very liberal provision, and has been cited by unions throughout the country as a model of what should be adopted elsewhere.

On the question of employing union labor only the strikers were compelled to abandon their position, and the best terms they could secure comprised a pledge of non-discrimination against themselves. One thing is now certain. The company will no longer tolerate interference with the management and discipline of employees, and much of the annoyance that has been caused during the last year by "arbitration" boards will thus be entirely eliminated. In a word, the company will manage the business and the men will attend strictly to the duties which they are paid to perform. The company will treat the men fairly, as has been its policy at all times, whether they are organized or not, but it will not, under any circumstances, reinstate the men who participated in the disorder which marked the strike. It has shown a generous disposition in taking back the firemen and others who went out on strike without any grievance whatever, and in direct violation of existing agreements which prohibited engaging in sympathetic strikes until arbitration had been refused by the company, and this is sufficient proof of its good will toward the great body of its employees. It is not likely, after the experience of last month, that Chicago street railways will be hampered with further strikes for some time. The union has had a severe lesson, not only in the loss sustained by members in the form of wages, but in prestige and in many valuable concessions which had been secured from the company during the present administration.

The Proper Place for Block Signals

Notwithstanding the great amount of interest being manifested by street railway managers in block signals for interurban roads, the actual interurban mileage at the present time protected by such means is but a small percentage of the whole. The majority of the high-speed interurban lines of the Middle West, which would, naturally, be the first to utilize such systems, have as yet made but little headway in their adoption. This condition of affairs is likely to be materially changed in the course of the next five years.

It would seem almost too apparent to need repetition that the proper place of a block signal system in the operating routine of the ordinary single-track road is as an adjunct to the despatching system, or, in other words, as an additional precaution, acting as a check on the despatching system. It is entirely out of the question to attempt to operate a single-track line without a despatcher if there is more than one car running over the road. The function of the block signal system should be to prevent collisions due to a misunderstanding of orders or mistakes on the part of the despatcher. When it comes to a double-track road, where despatchers are not necessary, the block signals may be used as the means to keep the trains apart with a reasonable degree of safety; in fact, the block signal system is the only theoretically correct method of keeping a certain distance between trains operating over a double-track road, as the time interval, as a means of keeping trains apart, is very uncertain, and disappears altogether when a train stops between stations, which is just the time when protection is most needed.

Steam Road Ideas

Electric railway companies have recently drawn extensively on steam railroads for managers and ideas. The use of steam road men and methods of operation has, of course, been more noticeable since the interurban roads increased in length and raised the schedule of speed, thus approaching more nearly steam road conditions of operation. It has become a trite saying that interurban roads can learn much from steam roads as to

methods of operation. This certainly ought to be expected, since steam railroads have been at the business for over half a century, and their standards are the result of a survival of the fittest during that period. It must never be forgotten, however, that there are many essential differences between steam and electric roads, and that the success of the electric road is due to the fact that it fills a new field unoccupied by steam roads.

It is for the manager to determine how far steam road methods are desirable in interurban operation, and, in this connection, it may not be amiss to call attention to some points where at the present time there seems to be a tendency to follow too closely steam railway practice in the operation of electric interurban properties. In steam railroad practice there is accumulated an enormous mass of red tape, an inheritance which steam railroad managers would be glad to get rid of if they could, and it is well for the electric railway manager to take a lesson from this and adhere to simplicity as far as it is consistent with safe operation and satisfactory service. It is notable that some railroad men who have become managers of interurban properties have abandoned steam railroad methods as completely as their brother managers who have entered interurban railroading from the street railway field have broken away from the lines of local service. Other steam road men have adhered to many of their old customs in the management of interurban roads. For example, in the matter of time-tables, there is room for discussion as to how much should be sacrificed to make a time-table according to the usual interurban custom, giving cars hourly or half-hourly, and always leaving a certain point at a certain number of minutes after the hour. Is the management justified, except under extreme conditions, in breaking up the regularity of the time-table and running cars on irregular intervals as on a steam road? Is the value of having a time-table which is easy to remember as great as is usually supposed, and is cost of operation for a fast schedule to be somewhat subordinated in order to secure such a regular time-table?

Another question is that of tickets, some managers believing that ticket complications should be avoided like poison, and that the simpler the ticket and fare system the better, while, on the other hand, many roads have adopted very elaborate ticket systems and a great variety of forms and prices of tickets, on the theory that special rate tickets help to create traffic.

It is generally admitted that steam railroad despatching methods should be followed as far as possible. Many former steam railroad men do not believe in using the telephone instead of telegraph for sending interurban orders, but are obliged by force of circumstances to do so nevertheless, and it is a question whether their preference for the telegraph is, after all, not due more to an operator's affection for his old familiar way of conducting business rather than to any inherent merit of the telegraph as compared with the telephone. In general, it may be said that the efficiency and discipline shown in interurban train despatching depends more on the vigilance of the management than on whether the manager has received his training as a street or steam railway man. In view of the many remarks that have been made recently in various conventions as to the adoption of steam railroad methods, it will certainly be in order during the next few years for the electric railway man to analyze thoroughly the question of how far steam railroad methods should be adopted in interurban railroading.

The Peak of the Line Load

It has often been remarked that the load line of a city street railway plant gives a wonderfully precise idea of the general habits of the citizens. The movements of workmen, the habits of the business men, the matutinal migration of shoppers and their return, the homeward rush of belated workers, and the hours of opening and closing the theaters are plainly marked in the serrated line on the tell-tale sheet. The morning and afternoon peaks tower like the Alps, the former generally stretching into a ragged range, the latter rising sharp as the Matterhorn. These peaks are a source of constant sorrow and maledictions to the practical street railway man. If his cars are fairly well patronized during the dull hours they will be jammed long before the summit of the peak is reached, and if, by desperate activity, he can come somewhere near giving decent accommodations during the rush he must run empty cars, or take off cars, the rest of the time. Practically, the situation means that a large number of extra cars must be put in operation during the hours of maximum travel at morning and evening, and then one faces the dismal "tripper" problem, the cause of eternal kicking among the employees. In earlier times the trailer used to furnish some relief by doubling the capacity per trip when needful, but at present the trailer, for a variety of reasons, has fallen into disfavor in this country. There are some practical difficulties with it to be sure, but it strikes us as altogether preferable to the double-decked car of which something has been heard recently.

American skyscraping buildings have produced so acute congestion of traffic that the work to be done here is altogether more difficult than is found in foreign cities. Before we try the double-decker it would be well to consider the trailer in the light of modern conditions. It takes more length on the street, to be sure, but probably gains in time all that it loses in space. One of the troubles with trailers in the past has been the facilities for entrance and exit, but the ordinary trailer was merely an extra street car without motors, and was not at all specialized for its use as a trailer. We are inclined to the belief that if trailers were planned especially for this service and modified in design so as to meet some of the practical difficulties which have been found with them, they might become of great assistance in dealing with the peaks in traffic. What is wanted is not a mere car to hitch on behind a motor car, but a rear section to form a working unit with the motor car when attached to it. Its proper design would probably be a troublesome job, but any sort of relief from the present situation requires skill and hard work. The principal objection urged against the trailer is that it is more dangerous to operate, owing to the liability of accidents between the cars. We believe that this might be overcome by proper design, and also that when allowance is made for the reduction of the number of cars in the street by the use of trailers the total number of accidents will not appear so proportionately large. The statistics of street car accidents in Germany, which have been carefully compiled for a number of years back by the Verein Deutscher Strassen und Kleinbahn Verwaltungen, show that in that country, where trailers are very largely used, the ratio of accidents to car mileage is from 40 per cent to 50 per cent more with motor cars than with trail cars.

By designing a trail car especially for this use the liability to accidents might be materially reduced. A combined motor car and trailer would certainly be as manageable as an ordinary two-car train on a cable or interurban road, and upon the whole would economize track space, since the distance between trains

would certainly be less than double the distance necessary between separate cars. At any rate, a modernized trailer is certainly well worth trying again. From the street railway man's standpoint any way out of the tripper trouble is desirable in itself. Here is a good chance for the car builders, who are usually prompt to meet a public demand, to get down to work and evolve some construction that will increase car capacity faster than it increases first cost or labor of operation. It is a tough proposition, perhaps, but American industry has grown fat on tough propositions.

Reform and Street Railway Extensions

A year ago a reform movement, headed by the Merchants' Association, swept over New York, and a spirited crusade was conducted by these moulders of public opinion against the transportation companies. There were loud cries for improved service, increased facilities, etc., and an investigation with several public hearings was held to devise ways and means of solving the recognized "congestion problem." In the end the public, the city administration and the State Railroad Commission were convinced that the fault did not really lie with the companies, that they were doing all in their power to meet the constantly growing demands upon them, and that they suffered chiefly through lack of co-operation on the part of the city and property owners in securing better facilities, extensions of lines and permission for establishing new routes.

The claim of the Interurban Street Railway Company that it was not given satisfactory support in its efforts to institute better transportation facilities in New York City was criticised at that time in several quarters, but the force of its contention has been emphasized in a very striking manner during the last week in connection with the proposed construction of a trolley line in West Street. There is probably no street in New York where there is a greater need for good traffic facilities, and on which at the same time the present service is so totally inadequate as on this street, which extends for some 3 miles along the Hudson River front. On West Street are located the ferry slips of all of the trunk railway lines to the West, the docks of all of the North River and of all of the principal Sound steamboat lines, also those of all of the transatlantic lines and most of the coast steamship lines that land passengers in Manhattan. The result is that there is a tremendous demand for transportation between and to these termini; added to this is the army of commuters, estimated at about 150,000 daily, who are landed at the several ferries from the Jersey shore. Many, if not most of these persons, would naturally take West Street as the shortest and quickest route to their points of destination, if anything like decent transportation service was provided, and the lack of it is a serious inconvenience to them and detriment to the welfare of the city.

The impracticability of building an underground electric conduit system on West Street has long been recognized. The street is only slightly elevated above mean high-water mark, and a conduit would frequently be flooded by salt water backing up through the sewer system. This is shown by the difficulties which have been experienced at the West Twenty-Third Street, Christopher Street and Cortlandt Street termini of the present underground conduit system. The Interurban Company would undoubtedly prefer to install a conduit system on West Street, if it were practicable, as the slight difference in cost between that and the trolley system would be more than counterbalanced in the economics of operation by the inconvenience of maintaining two sets of equipment, one for use on the conduit lines proper and the other on both lines. We have urged on several occasions the importance, from every civic standpoint, of establishing a modern and reliable transportation system (which means a trolley system) on West Street, and the Interurban Street Railway Company has finally offered to construct such a system and operate it with cars equipped with trolley poles and plows, so that they will be interchangeable with cars on other lines.

The principal property owners along the line, including the different railroad companies, the International Mercantile Marine Company, and others, have expressed themselves in favor of the improvement, but the objectors seem to be made up of those who have only a theoretical interest in the matter and no knowledge of practical railroad conditions.

Some of the arguments urged in print against the trolley system on West Street are of the most puerile character, and read as if they had been resurrected from the files of the Podunk "Herald" of fifteen years ago. The overhead wire is clothed with all manner of death-dealing properties; it is urged that every one of the thousands of commuters who passes under it on his way to and from the ferry is liable to electrocution; insurance rates are to be raised to fabulous percentages if the trolley is introduced, and a thousand and one other evils are to follow if the advent of the overhead system is permitted. Although we feel proud in many respects of New York City, we cannot help admitting that when it comes to a question of city improvement a host of kickers invariably puts in an appearance with arguments of the character quoted, which would disgrace an intelligent Hottentot.

In a recent interview, Dock Commissioner Hawkes gave out for publication a characteristic statement on this proposition, which may be accepted as fairly representing the attitude of the "reform" element toward this much-needed improvement:

> The Metropolitan Company must prove to me beyond a shadow of a doubt that the underground system is impracticable, and then, before I would grant the consent to a change in the power of the line, I should have to know that the best interests of the city demanded this change before I would consent to an overhead trolley system, and I am not sure that I should give my consent even then. An overhead trolley system is the most undesirable thing in the world, and they will have to be very weighty considerations that cause me to consent to such a system.

Such a statement is simply absurd on its face. "I am not sure that I would give my consent," says the Dock Commissioner, even if the overhead trolley proved to be the only practicable system and its construction was for the best interest of the city. This expression prepares one for the next pronunciamento of this official regarding the "undesirable" character of the overhead trolley, which concludes the quotation.

The proposed improvement on West Street will not only be a benefit to passenger transportation but it will also add enormously to the trucking capacity of the street. It is one of the striking accompaniments of a line of electric cars through a city street that it directs and promotes the amount of vehicular traffic possible. Without its two lines of cars on Broadway the traffic on that street would soon become very congested, and the investigations of the Royal Traffic Commissioners, of London, show that there is an actual gain in traffic capacity in a street from the introduction in it of a double line of electric cars. We anticpiate a revulsion in sentiment over the proposed West Street franchise soon, and that the proposed change will be carried out to the great improvement of the West Side of New York City.

THE SYSTEM OF THE CAMDEN & SUBURBAN RAILWAY COMPANY

Several extended articles have appeared in the columns of this paper during the last two or three years discussing analytically the operating practice of different large city railways. The value placed upon these articles by operating managers has been evidenced by the favorable comments received by the editors in regard to them, and the request has been made that similar articles discussing the operating practice of smaller companies should be published. In many respects the methods required on the smaller road differ from those on a large proposition, and practice cannot be bodily transferred from one to the other. For this reason it is proposed in a series of four articles to take up in detail the methods employed by the Camden & Suburban Railway Company, of Camden, N. J. The present article will be devoted to a description of the physical condition of the system; the second article will take up the method of handling the men and assigning runs; the third will describe the system of blanks and forms used by the company, particularly in keeping its operating records, while the fourth will be devoted to a discussion of the repair shop operation, with costs of essential operations in the repair work.



THE FEDERAL AND MARKET STREET FERRY, CAMDEN,—FROM THE RIVER

The city of Camden has been selected partly because it has been under one management for some eight years, and hence exhibits in many of its features a harmonious scheme of construction and operation; partly because the company has developed an important suburban business which has had a most important bearing on the earnings of the property, and partly because the system is being operated under improved methods and is in a high state of efficiency. The operating report of the company for the last four calendar years is given below:

	1899	1900	1901	1902
Receipts from passengers	$296,471	$332,467	$394,163	$473,826
Receipts from other sources	33,338	15,482	16,839	19,479
Receipts total	329,809	347,949	411,002	493,305
Operating expenses	158,155	166,582	185,608	217,557
Earnings from operation	171,654	181,367	225,394	275,748
Exp. for repairs (ordinary)	61,760	49,716	39,724	64,912
Exp. for repairs (extraordinary)	155,918	47,197		
Net income	*46,024	84,453	185,670	210,836
Operating ratio not including repairs	53.3	50.1	47.1	45.9
Operating ratio including repairs	126.8	79.2	61.7	59.6

*Deficit.



FOOT OF MARKET STREET, CAMDEN, SHOWING FERRY TO PHILADELPHIA

LOCATION AND POPULATION

The city of Camden is located on the Delaware River directly opposite Philadelphia, with which it is connected by three ferries. It is the site of a number of large manufacturing

plants, including that of the New York Ship Building Company, which are the largest in the country and one of the largest in the world, one of the works of the Diamond Match Company, large gas and coke plants belonging to the Public Service Corporation of New Jersey, and other manufactories. The population of the city proper is 67,000, but as the city boundaries have recently been extended the actual population of what might be called "Greater Camden" is 83,000 people.

TRAFFIC POSSIBILITIES

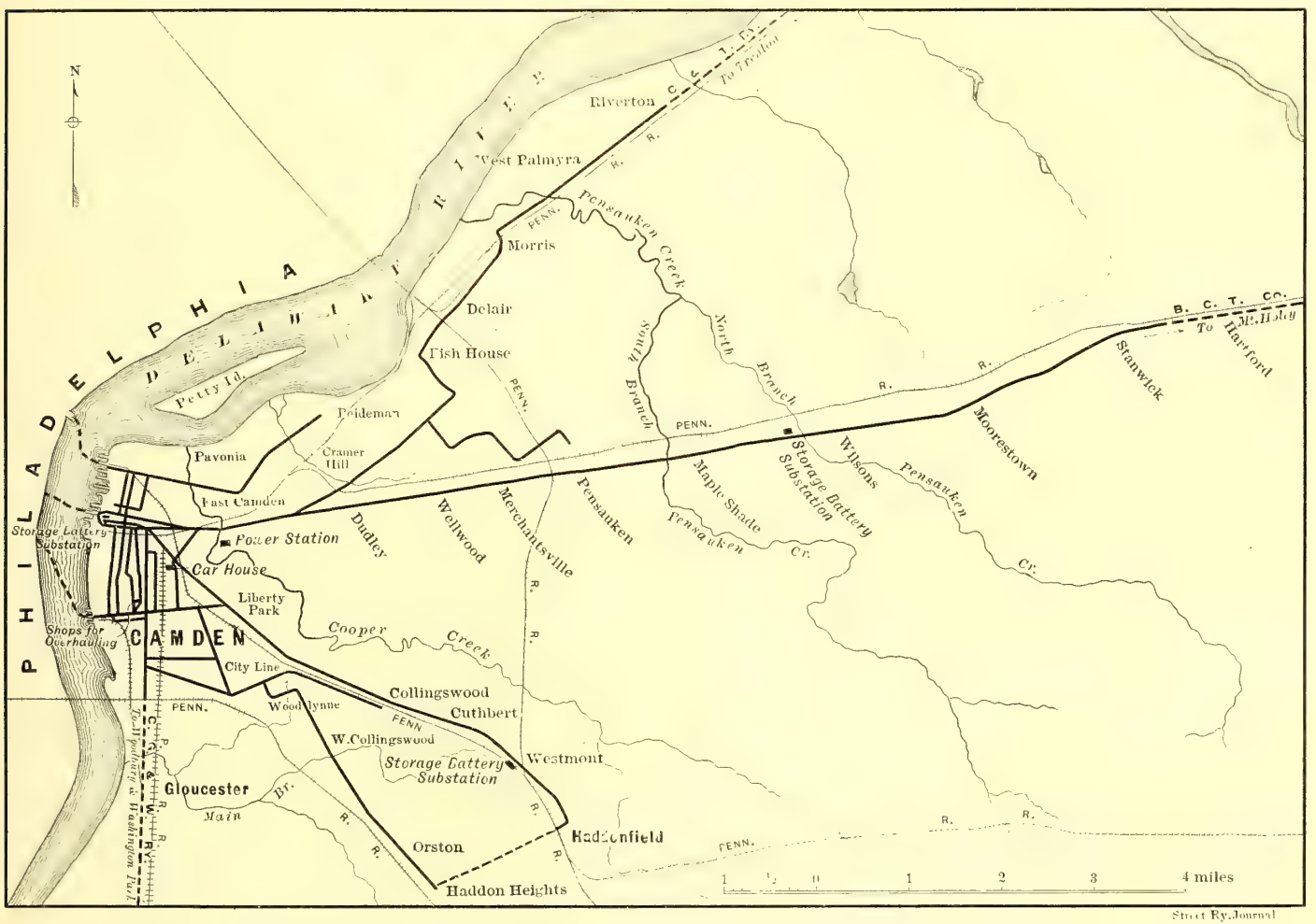
The layout of the city is not such as to be especially conducive to a large amount of street railway traffic. The three ferries to Philadelphia are about a mile apart, and the growth of the city has been radially from each ferry. The result is there are practically three "centers of population," all of which are within one-half mile to three-fourths of a mile from one of the ferries. Another fact which affects the riding in Camden is that while it is a suburb of Philadelphia it does not have the proportional amount of commuter or pleasure traffic which is usually associated with suburbs of large cities. The most attractive suburban districts of Philadelphia lie to the north and west of that city, and as Camden is largely a manufacturing town, one great inducement, perhaps the principal one, which it can offer to commuters from Philadelphia is cheapness in transportation. For this reason a large proportion of the passengers from the ferries do not use the cars but walk to or from the ferries, to save car fare.

The layout of the city also prevents it from obtaining the usual amount of local patronage. As the city extends along the water front for 2 miles or 3 miles, and is only about 1 mile wide, there is plenty of building sites, and most of the workmen in the factories live in the vicinity of their places of work. It soon became evident to the management, therefore, that suburban extensions to the Camden city system were necessary to develop the business, and a very successful policy was adopted of building up the sparsely settled territory to the east, northeast and southeast of the city.

Up to the time that this plan was begun, or until about 1896, approximately 90 per cent of the traffic was to and from the ferries. Since the construction of suburban extensions, to which reference will be made shortly, this condition of affairs has changed, and only about 42 per cent of the traffic is now due to Philadelphia, the balance being internal traffic. In a subsequent article in this series the amount of traffic secured by the suburban extensions will be considered. In this number the physical condition only of the system will be discussed.

THE EXTENT OF THE SYSTEM

Reference to the map on this page will indicate the general arrangement of the system of the Camden & Suburban Railway Company, which now comprises 83 miles. The system extends northeast as far as West Palmyra, where a connection is nearly completed with the Camden & Trenton Railway, with which a traffic agreement has been made by which the cars of the latter road will enter the city of Camden. Only 2500 ft. of this connection now remains to be finished.



MAP SHOWING SYSTEM OF THE CAMDEN & SUBURBAN RAILWAY COMPANY

On the south, the system extends to the city line, where a connection is made with the system of the Camden, Gloucester & Woodbury Railway, whose cars now enter the city over the tracks of the Camden & Suburban Railway under a traffic agreement. This line touches Washington Park, which is one of the large summer resorts of Philadelphia, but which is also served by a steamboat line from that city.

To the east the Camden & Suburban Company has three lines, one reaching to Haddon Heights, 6½ miles; one to Moorestown, 11 miles, and one to Haddonfield, 7 miles. At

Moorestown connection is now being made with the line being built by the Burlington County Traction Company, which will extend to Mt. Holly, 9 miles further to the east.

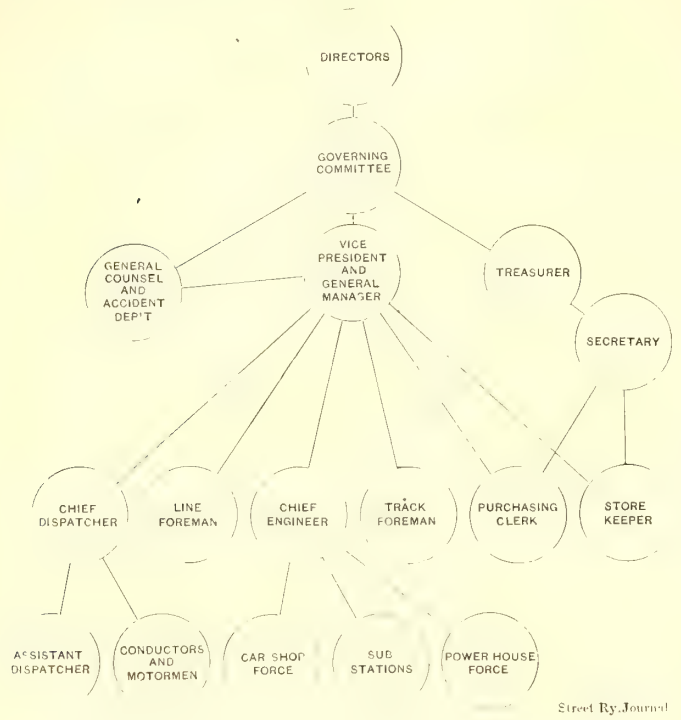


CHART SHOWING ORGANIZATION OF THE COMPANY

The Camden & Suburban system is operated in eight divisions, the gross receipts of which average throughout the year about as follows:

Line Number	Gross Receipts per cent
1—South Fourth St. and South Fifth St.	5
2—Second St. and Third St.	7
3—Broadway	19.5
4—Haddonfield	17
5—Haddon Heights	8
6—Kaighn's Avenue	3.5
7—North Cranmer Hill	10.5
8—Merchantville and Moorestown	29.5
Total	100

The following table gives the car miles and car hours from April 1 to Aug. 31, 1903, or the first five months of the fiscal year 1903:

Period	Gross Receipts	Car Miles	Car Hours
April 1 to August 31, 1903	$241,424.56	1,218,998	148,973
April 1 to August 31, 1902	218,958.01	1,159,153	146,131
Per cent increase 1903 over 1902.	10.5	5	2

TRACK MILEAGE

The company has 83 miles of track, laid as follows: Forty-four miles of 7-in. 80-lb. girder rail, 21 miles of 9-in. 90-lb. girder rail, 15 miles of 70-lb. T-rail, 3 miles of 6-in. 70-lb. girder rail.

Of the 83 miles, 35 miles of track are laid with rails of 60-ft. length and the balance with 30-ft. rails.

PAVING

The company is obliged by its franchise to do a certain amount of paving, and has laid 47,146 sq. yds. of asphalt paving, 30,000 sq. yds. of brick paving, 11,800 sq. yds. of belgian blocks on concrete foundations, 9547 sq. yds. of 8-in. macadam, 16,000 sq. yds. of 6-in. macadam, and 6676 sq. yds. of Telford paving. It has also laid 10,000 sq. yds. under its own tracks of broken stone ballast to a depth of 4 ins.

JOINTS AND BONDS

In making joints, both angle-plates and cast-welding have been used. Market Street, which is one of the principal lines, was originally cast-welded by William Wharton, Jr., & Company. Later the railway company purchased its own cast-welding outfit, and has cast about 621 joints. The results have been very satisfactory, as only about 1 per cent of the joints have broken. Outside of the cast-welded joints the company is also using a considerable number of Churchill and Atlas joints.

The subject of bonding has been very carefully gone into, as the general manager of the road, Mr. Harrington, is an expert on this subject. A number of bonds have been used, several of Mr. Harrington's own design, and as a result the company has practically settled on a bond which is known as the "Camden & Suburban Bond No. 2." Each terminal of this bond consists of a cast-copper plate, 4 ins. x 6 ins., with two grooves in it, each of which is of proper diameter to take in a 0000 wire. On top of the wires is placed a cast-iron plate with corresponding grooves, and both of these plates are drawn up tight to the web of the rail with two 1-in. bolts. The bond wires, of course,

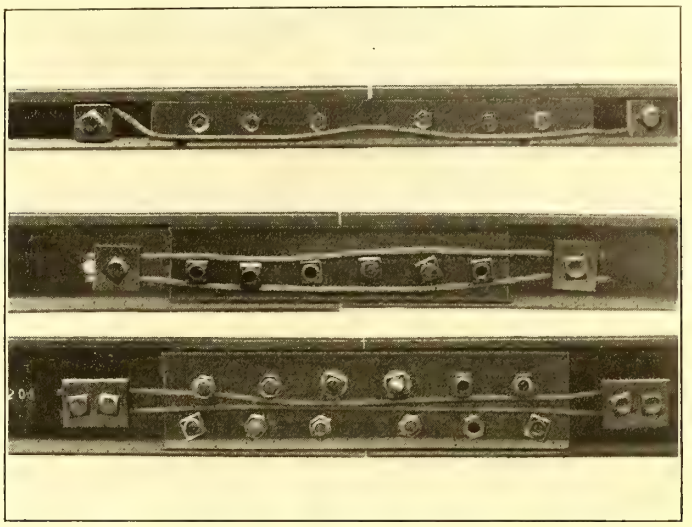


VIEW AT END OF MOORESTOWN LINE, SHOWING SIGN ON SPAN WIRE INDICATING SECTION INSULATOR

span the angle-plate. In applying the bond the web of the rail is first ground down until it is bright and the surface is then treated with Edison-Brown alloy. The contact surfaces of the copper plates and of the wires are also amalgamated with the same material. A similar construction of bond is used on T-rails except that the terminal plates are disc-shaped, and only one connecting wire is used. This wire is carried around between the terminal plates in a circular groove. Both types of bonds are illustrated herewith.

The company has found from tests that a joint bonded in this way has a lower resistance than the same length of a straight track; in fact that the resistance of the bonded rail, including the double-wired joint, is only 45 per cent of that of a solid rail section. The company also has a few Ajax bonds which were used before this new type of bond was developed.

The track construction possesses a number of very novel features. For instance, opposite and supported joints are used on practically all of the track. There is one section of about 3 miles in length laid with staggered joints, but the rail has been ground out in spots opposite the joints, and the management is very positive in its opinion that opposite joints give much greater satisfaction under the conditions existing in Camden. The ties used are 6 ins. x 8 ins. x 8 ft., and combination brace and base plates are used in keeping the track to gage instead of tie-rods.

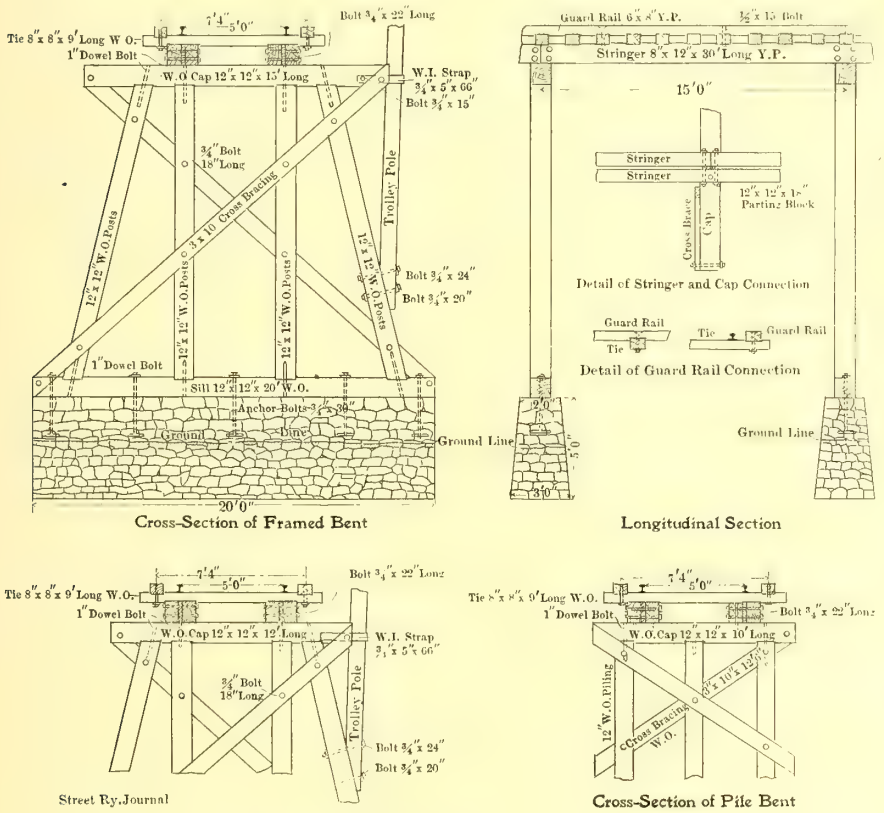


THE CAMDEN & SUBURBAN RAIL-BOND NO. 2. THE UPPER VIEW SHOWS BOND ATTACHED TO T-RAIL. SECOND VIEW SHOWS BOND ATTACHED TO A 5-IN. GIRDER RAIL, AND THE LOWER VIEW, TO A 9-IN. GIRDER-RAIL

T AND GIRDER RAIL

For a large part of the suburban line T-rail is used, but on certain sections a girder rail was employed, because the authorities through which these lines ran insisted upon its use. For certain cross-overs on this class of work a split girder switch has been installed. This split switch was made by the Pennsylvania Steel Company, and is one of the very few split girder switches in use.

The question of T vs. girder rails for suburban extensions has been one which has attracted considerable attention in the neighborhood of Camden. Although the gage of the track is 5 ft., most of the vehicles used in Camden are of this gage, and the authorities of many of the neighboring towns originally insisted upon the use of the girder rail, sharing the common belief that the track would be of considerable use to vehicles in furnishing them a metal highway. Under this pressure the company was obliged to install considerable amount of girder rail, but decided to conduct a count, at frequent intervals, of the number of vehicles which used the track for this purpose. It was found that when the track was laid in the centre of the street the rails were used largely by vehicles, but that when the track was laid at the side of the street, as in most of the suburban work, the use of it was much less frequent. In fact, a record which extended over considerable time showed that under these conditions only 12 per cent of the vehicular travel was on the track. The rest of the vehicles either straddled the track or used the turnpike. As a result of this investigation the company has been allowed to install T-rail on its recent extensions.



SECTIONS OF TRESTLE CONSTRUCTION ON WEST PALMYRA BRANCH

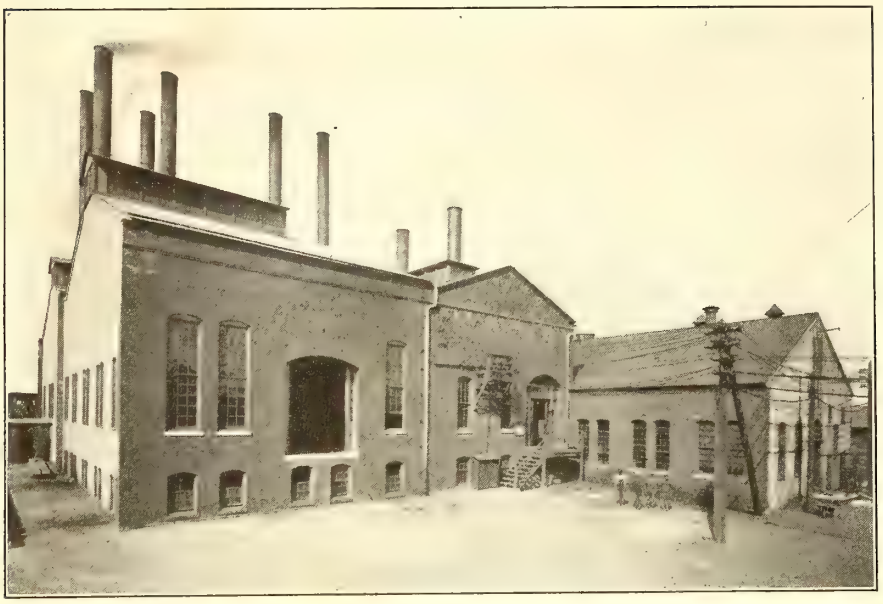
BRIDGES AND TRESTLES

On the suburban turnpike, where the track crosses a stream, the company has in every case built its own bridge, so as to be independent entirely of the Board of Freeholders, as far as their supervision over bridges is concerned.

All drawbridges over which the lines run are operated by electric power with current from the railway circuits.

On its West Palmyra line the company has been obliged to build a large amount of trestle, and a section is given of the construction employed, with an end view of one of the bents. The bent consists essentially of yellow pine stringers, 8 ins. x 12 ins. and 30 ft. long, mounted on white oak caps, 12 ins. x 12 ins. and 15 ft. long. The posts and sills are of white oak, 12 ins. x 12 ins., and the cross-braces of white oak, 3 ins. x 10 ins. The guard rail is of yellow pine, 6 ins. x 8 ins., the part-

ing blocks of yellow pine, 2 ins. x 12 ins. x 18 ins., and the ties of sawed white oak, 8 ins. x 8 ins. x 9 ft. The piles are of white oak, 12 ins. in diameter. The trolley poles, which are



EXTERIOR OF POWER STATION, FROM EAST

fastened by straps and bolts to the bent, are 8 ins. in diameter at the top.

OVERHEAD LINE

The trolley wire is mostly No. 0, although in all recent construction a No. 00 trolley wire has been used. It has been found that the latter size is no more costly to install; that is, the same number of men can string the same amount of No. 00 wire as quickly as No. 0 wire, and, of course, it is much more durable. On curves the company is using No. 0 phono-electric wire. The record of the line gang in stringing trolley wire is probably some recent work done on the Haddon Heights extension, when 3½ miles of trolley wire, including twelve curves, were installed in twenty-four hours. The work included putting on the bells and clips, but did not include stringing the span wire. This work was carried out with one construction car, fitted with a tower and manned by two men and a line foreman.

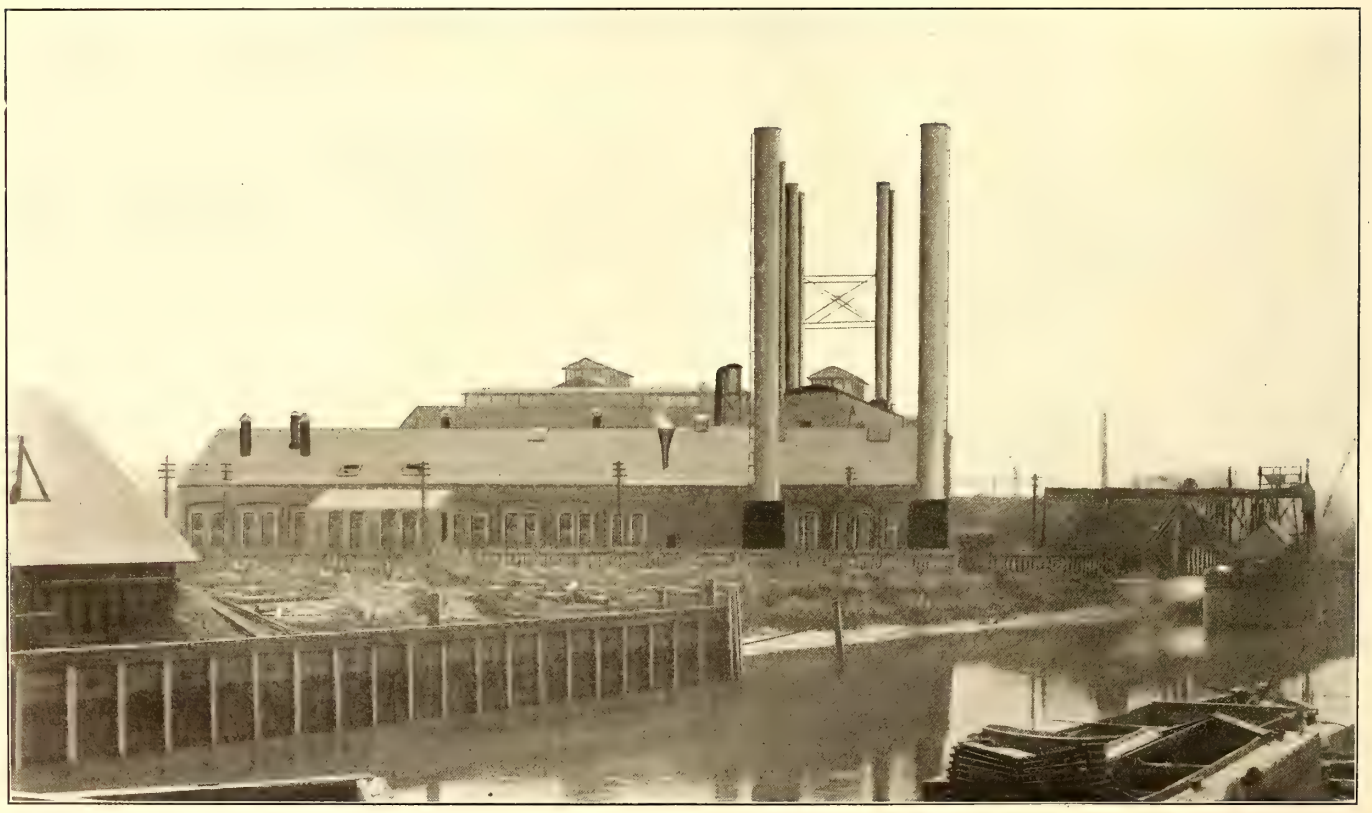
The trolley line appliances used for the most part are of the Johns-Manville type, and the heaviest material has been adopted, as it has been found to pay in the long run. The bells used are the galvanized iron No. 100 and 107, with insulated inside bell. Soldered ears, 15 ins. long, are employed on straight track, and No. 00 clips are used, even when No. 0 trolley wire is used.

For feeder taps the line department uses a solid insulated No. 0000 feeder wire as a span. The wire is stripped at the center, and a solid brass bell or curve yoke is clipped onto it to hold the trolley wire. The feeder is tapped into the trolley wire every 500 ft.

For both feeder and trolley connectors brass tubes are used, as copper tubes have been found to deteriorate, and the wire is soldered in place in them. In this connection it might be interesting to note that the tubular trolley wire connector was originally patented by Mr. Harrington, manager of the Camden & Suburban Railway, and the patent was sold by him to the General Electric Company eight years or nine years ago.

STOPPING AND SECTION INSULATOR SIGNS

On the suburban lines the points at which cars stop are indicated by stopping signs. They are made of sheet-iron, with the words "Cars Stop Here" in black letters on a white ground, the sign being hung on the span wire. In addition, every section insulator in the trolley wire is indicated to the motorman by a sheet-iron sign painted white with a red circle, to call the attention of the man to the necessity of running over the insulator slowly.



VIEW OF POWER STATION FROM COOPER'S CREEK

FEED WIRES

In running its feed wires the company has adopted the practice of many companies of tapping in the feeders to the trolley wire at distant points, largely to permit boosting if necessary. The average voltage at the outlying points is 500, which is 70 volts lower than the power station voltage. The feeders are tied together at the ends of circuits through automatic magnetic circuit breakers, so that they can assist each other, but the breaker will open in case of short circuit. The company carries a 500,000-circ. mil cable to the end of each of its lines, also one directly to each of the battery sub-stations.

The feeders are mostly No. 0000, although there are some 500,000-circ. mil cables, and the latter are being used largely in new work. Owing to the method of tying in, described above, the investment in copper on the Moorestown line, 11 miles long, and with a car headway throughout the day of twenty-four minutes, was less than $30,000. This is partly owing to the fact that two positive bus-bars are used, one of higher voltage than the other, as described in connection with the power station.

For splicing the No. 0000 feeders a very long soldered and

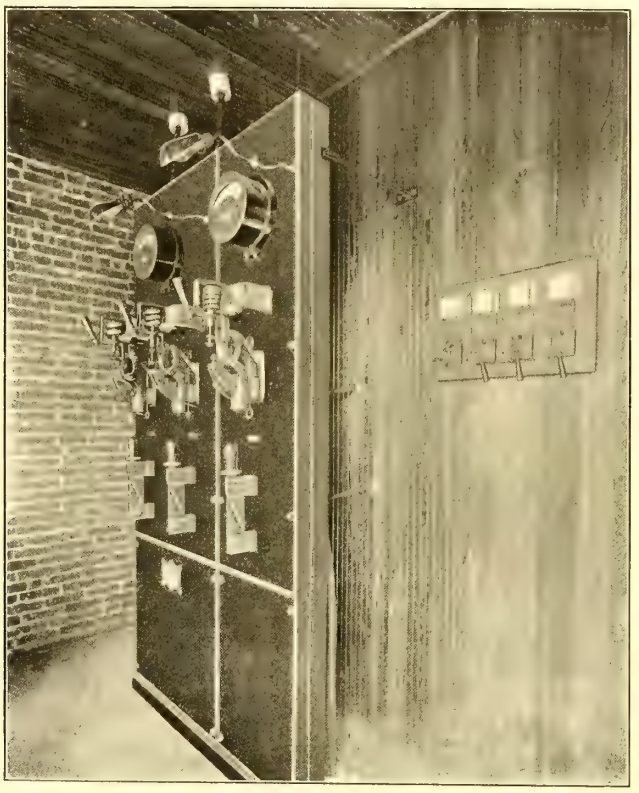


INTERIOR OF WESTMONT BATTERY SUB-STATION

twisted joint is used. The ends of the wires are first stripped for about 2 ft. and clamped together side by side. They are then twisted under strain and soldered. For splicing the 500,000-circ. mil feeders a stranded connection is used. The strands are cut back for a distance of 6 ins. to 12 ins., and a regular sailor's splice is made, after which the entire joint is soldered and taped. So well is the splice made that at a little distance it is almost impossible to see the joint. In fact, this same practice has been followed for 1,000,000-circ. mil cable and 2,000,000-circ. mil cable connections in the power station with very satisfactory results so far as appearance is concerned.

In recent work the company has been stringing a considerable amount of 500,000-circ. mil feed wire by electric power in mile lengths. The feeder is laid first over the cross-arms and is then drawn taut by the construction car, which receives its current from the trolley wire, which is erected first. The feeders are then slipped onto the insulators. This makes a very taut feeder construction and one which is very attractive in appearance. The insulators used have toggle holders, which do not let the feeder slip, even if there is a break in it. The practice, as stated above, is now toward the use of 500,000 circ. mils as a standard feeder, and it has been found that this sized feeder will stay up longer without getting slack than a No. 0000 feeder. The construction gang mentioned above, with the electric construction car, has erected 3 miles of No. 0000 feeder in a day of ten hours, including putting on the pins and insulators and making all joints.

The company has installed recording voltmeters at six dif-

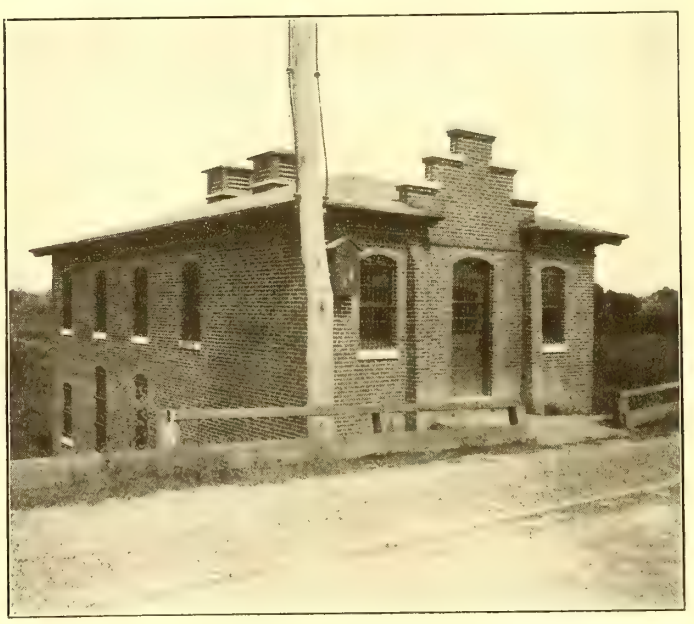


SWITCHBOARD IN BATTERY SUB-STATION

ferent points on the line. Daily records from each point are filed at the power station. These instruments are placed at each of three battery stations, also at the Kaighn's Avenue Ferry, at Woodlyn and at the power station.

CONSTRUCTION FORCE

The construction force consists of two track and line wagons, of which one is used in new construction and one in repairs.



EXTERIOR OF WESTMONT SUB-STATION

The usual force per wagon consists of two men, supervised by a foreman. The line foreman has charge of the repair of the line, construction of line, the block signal system and the telephone system.

The block signal system is used on single track, and is of the usual double-lever switch type.

TELEPHONE SYSTEM

The telephone system, which also forms part of the overhead line department, is quite complete, and consists of thirty-eight telephones with twenty drops. Instruments are located at the terminals of all lines, also at other important points along the lines, such as the offices, power stations, repair shops, etc., of the company, and at the residences of the operating officials and department foremen. The central is in the despatcher's department at the repair shop.

There are 38 miles of telephone line, all constructed of duplex, twisted, braided, rubber-insulated wire. The whole system is laid out so that 'phones can be introduced on the system by bridging. There are 1600 ohm ringers on the 'phones and 50,000 ohm magnetos. The drops on the switchboard also have a resistance of 1600 ohms.

The telephone system is not used in general despatching, but on the night trips all crews are required to call up the car house on their arrival at the terminals. The telephone system has been found very useful in emergency work, especially during snowstorms, as the crews can call up the main office from time to time and report how they are getting along. The system has also been found of great convenience in permitting the assistant despatchers to report to the main despatcher at different points as to car movements. These reports are afterwards submitted in writing.

The Camden & Surburban Railway Co.

STORAGE BATTERY WEEKLY REPORT

Station Number..... Location.....

Reading began, " ended, } A. M. P. M.

Discharging / Charging / Swinging } Time taking .... .. hrs . min.

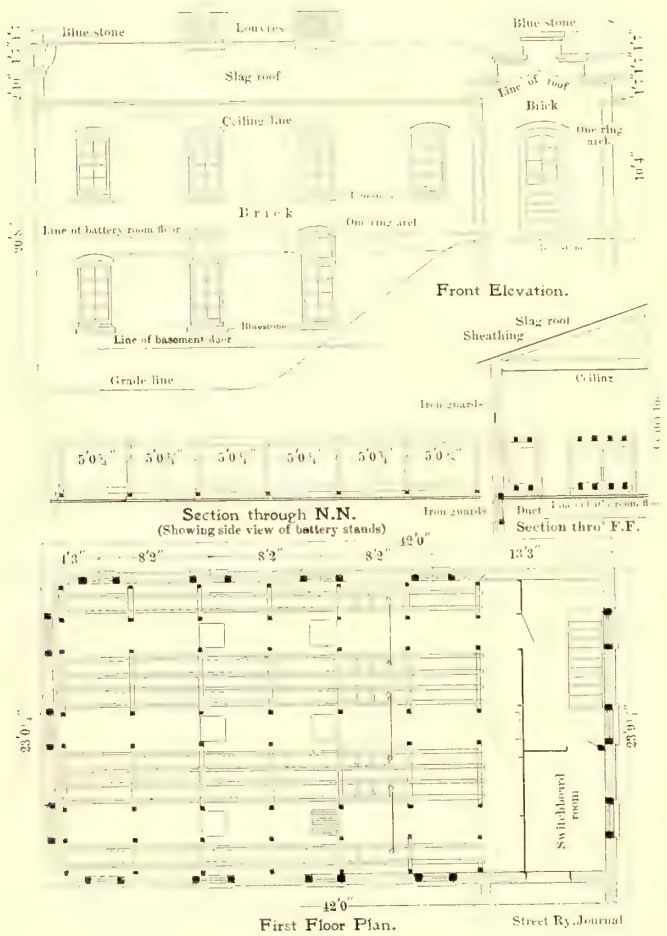
Date .....

Date ..... Last Watt Meter Reading Present " " Difference .....

	Charge.	Discharge.	Difference.

Cell.	Sp g	Volts	Condition	Cell	Sp g	Volts	Condition	Cell.	Sp g.	Volts	Condition	Cell	Sp g.	Volts.	Condition	Cell.	Sp g.	Volts.	Condition.	Cell	Sp g.	Volts.	Condition.	REMARKS
1				51				101				151				201				251				
2				52				102				152				202				252				
3				53				103				153				203				253				
4				54				104				154				204				254				
5				55				105				155				205				255				

FORM FOR RECORDING WEEKLY TEST OF STORAGE BATTERY



PLAN AND SECTIONS OF WESTMONT STORAGE BATTERY SUB-STATION

LIGHTNING ARRESTERS

Lightning arresters are located every 1000 ft. The ground side is connected directly to the rail with a No. 0000 wire. Ground plates have been given up absolutely, as the connection has been found to deteriorate. The company burns out from fifteen to eighteen lightning arresters a year.

STORAGE BATTERIES

There are three storage battery sub-stations, as indicated on the map. As all are practically alike, except in the type of cells used, it will be sufficient to illustrate and describe one, and that at Westmont has been selected.

The battery station is of brick, with wooden girders and plank roof. It measures 25 ft. x 37 ft., and contains a battery of 240 cells of the chloride 9-F type, manufactured by the Electric Storage Battery Company, and having a capacity of 160 amps. at a one-hour discharge. The batteries are in glass jars on wooden racks, and the station is arranged to permit of 100 per cent increase in the capacity of the sub-station. The Moorestown storage battery installation consists of 240 cells, of the 11-S type, and with 200 amp.-hours capacity, while the Federal Street storage battery sub-station consists of 265 17-F type cells in lead lined wooden cells, and with a 300-amp.-hour capacity. The general experience of the company in the use of these storage battery sub-stations has been that the cost of the battery installation has been less than that of the cost of equivalent copper for obtaining the voltage results secured by the battery, and that the battery possesses the additional advantage of equalizing the load on the station and in part providing for the extra demands for power so frequent in railway work. The load line at the power station is noticeably uniform.

The cost of battery depreciation has been very low. The first battery, that at the Federal Street sub-station, has been in use for five years. Its original cost was $14,000, and the depreciation up to date has amounted to $872. The Westmont storage battery has been in use for three years, and the Moorestown battery for one year, with no depreciation account up to date.

The batteries take care of themselves, and are visited only once a week, when a careful voltage and specific gravity test is made of each cell. This is done by two men, who make their report on blank No. 70, reproduced herewith, one man taking the readings while the other puts down the results. The time required to test each complete battery by the two men is about one hour. It is found that each battery evaporates about 50 gals. of water a week.

POWER STATION

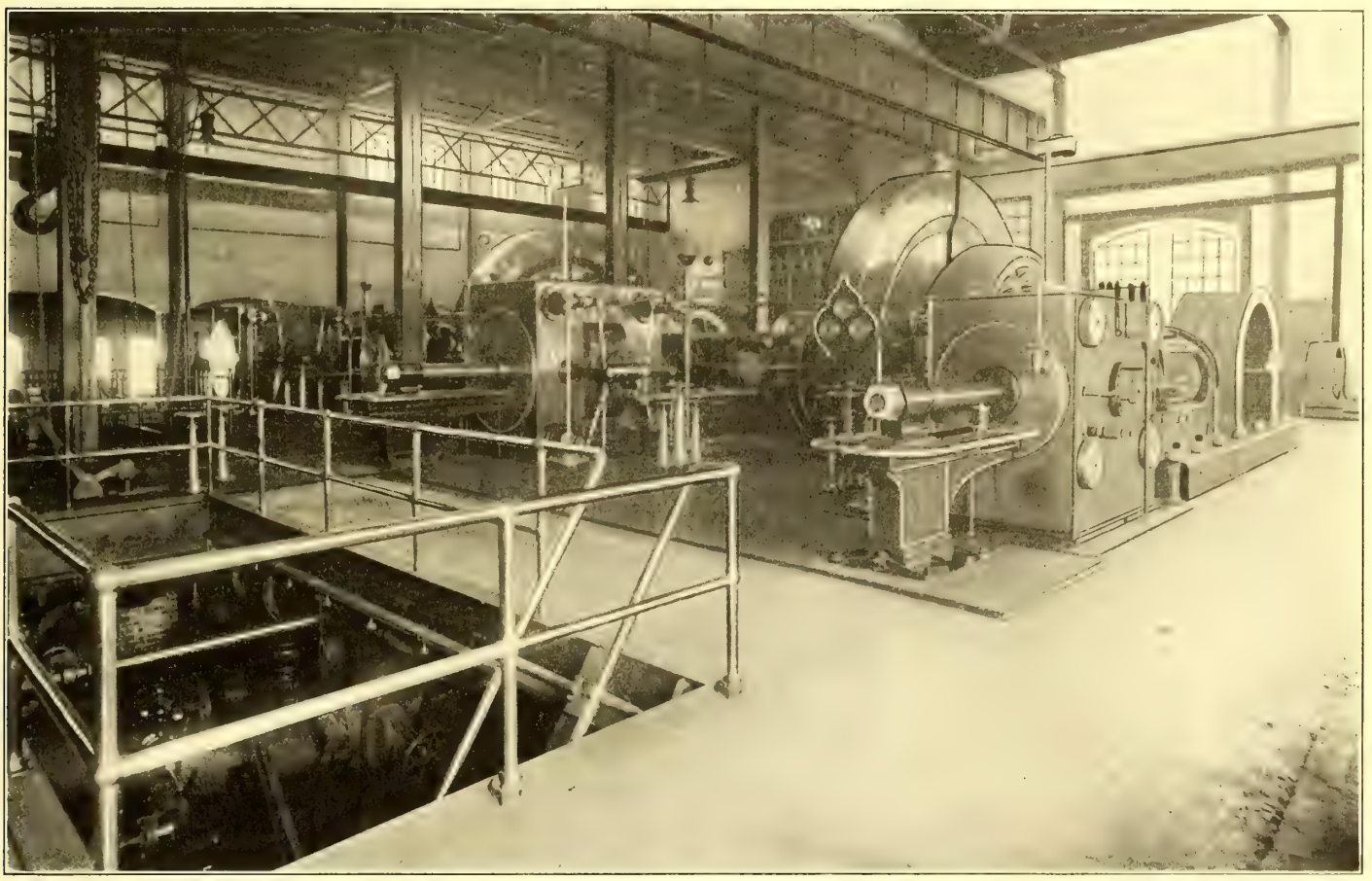
The power station shown in the illustrations on page 968 is located on Cooper's Creek, at approximately the center of gravity of distribution. It has been extended twice during the last four years, but both extensions have been made on a har-

monious plan, so that with the exception of the original installation in 1896 the station is quite modern.

The station is in three parts. The old part has an engine room 44 ft. 6 ins. x 131 ft., and contains two Westinghouse compound engines, 20 ins. x 20 ins. x 10 ins., each belted to a 100-kw Edison bi-polar generator, and two vertical cross-compound Ball engines, 16 ins. x 16 ins. x 18 ins., belted to a General Electric 200-kw generator, and a 225-Westinghouse M P generator. These old machines are wired to the new switchboard in the later extension. A small independent switchboard is located in this room, and is connected to the bi-polars, and is used for lighting the company's park at Wood-Lynne. The boiler room of the old station contains four horizontal Coatesville return tubular boilers, 17 ft. x 18 ft. by a 36-in. brick wall. The engine room faces south and east, and the boiler room south and west, and as the windows are ample there is plenty of light and air at all times. The drip pumps and condensers are located in the basement. The basement walls are lined and sealed to prevent tide-water from entering the basement.

FOUNDATIONS

Located in the center of the basement are the foundations for the engines and condenser. The sub-foundation consists of 1500 piles, driven on 3-ft. centers. These piles are capped and tied together with 30,000 ft. of capping. Above this capping are laid 18 ins. of concrete. Above this foundation is a grid of old railroad iron laid in concrete. From the top of the capping and to the first layer of brick foundations is a dis-



INTERIOR OF ENGINE ROOM

with sixty tubes 4½ ins. in diameter, and fire boxes 6 ft. x 6 ft. 6 ins. The boilers are piped with a duplicate system of 12-in. mains, to feed the engines in the old station, and also with a branch main to the new engines in the later extension. They have brick flues leading to two self-supporting stacks, 85 ft. high and 70 ins. in interior diameter.

Located outside of this building is an artesian well, 6 ins. in diameter and 160 ft. deep. The water from this well is pumped to a reservoir or tank of 1800 gals. capacity. The water is used for drinking purposes, priming the pumps and condensers, and as an emergency supply in the event of accident to the regular pipe lines which draw water from Cooper's Creek.

NEW EXTENSION

In July, 1900, a new extension was started directly south of the above described plant. The building is a brick and stone structure, 114 ft. long and 36 ft. 8 ins. wide. The main floor of the new station is 8 ft. above the floor of the old station. The new station is divided into two rooms, the engine and the boiler rooms. The engine room is 36 ft. 8 ins. x 76 ft., and the boiler room is 36 ft. 8 ins. x 37 ft. 3 ins. The two are separated

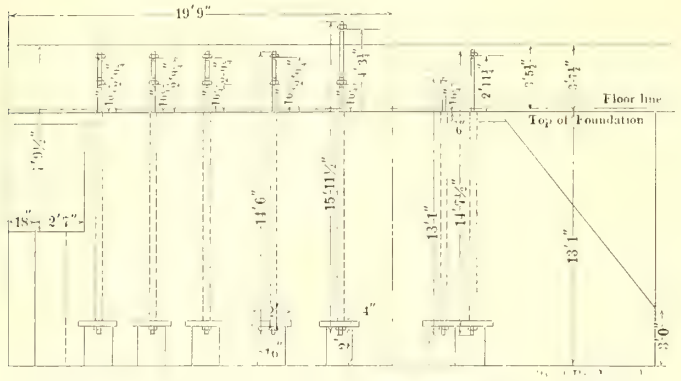
tance of 3 ft. 6 ins. On the brick arches supporting the brick angle plates is a solid brick structure, walling in the generator and fly-wheel pits and supporting the engine bed at the floor level, all laid in Portland cement.

The arrangement for the anchor bolts used for fastening down the engine and generator base plates is quite different from that usually employed. The bolts are not bedded in the concrete but slipped through tubes left in the structure, the novel feature consisting in the fact that arches are left in the sub-foundation by which there is always access to the nuts on the ends of the foundation bolts.

BOILERS, PUMPS AND CONDENSERS

The boiler room is at present equipped with six 300-hp vertical Berry boilers, with independent stacks. The boiler feed pumps in the first extension are of especial design, are Barr duplex outside end packed, and have cylinder dimensions 10 ins. x 6 ins. x 12 ins. Those in the second extension are of the Snyder-Hughes duplex outside end packed, brass lined, duplex type with balanced valves. The rest of the equipment of the boiler room includes three Goubert feed-water heaters,

one between each engine and the condenser of 1200-hp capacity, and another of 2400-hp capacity in the boiler room, through which the steam from the auxiliaries exhausts.



SECTION OF ENGINE FOUNDATIONS, SHOWING OPENINGS WHICH GIVE ACCESS TO FOUNDATION BOLT NUTS

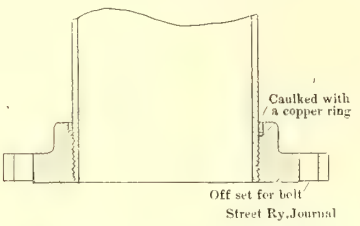
All of the piping connections are made by a special screw flange, illustrated in section herewith. As will be seen, at the end of the thread the shoulder of the flange is provided with a groove for caulking purposes. A special copper ring is used for caulking, as illustrated. The outside of the flange is then cut away for the bolts and a copper gasket is used. In this connection it might be said that the company has never had any leaks in its steam piping. Each unit division of the station is piped and wired separately, so that it can be operated independently.

The condenser in the first extension is of the single-acting fly-wheel type, with rotating steam valve and throttle governor, and that in the second extension of the double fly-wheel type with Corliss valves. The condensers are so piped that the exhaust can be thrown into the condensers themselves or through the auxiliary heaters. The water supply for the condenser is drawn from the creek and is discharged into the creek or into the hot well. In the basement is a drip pump and receiver, 3 ins. x 2 ins. x 3 ins., which automatically delivers the live steam drip to the boilers. An independent gravity oil system is used in which the oil is filtered and used over again.

CONDENSING TANK

A very novel and economical feature of the oiling system is an arrangement both for recovering the cylinder oil and utilizing the latent heat in the water in the hot well. The overflow from the condensers discharges into a large concrete and masonry tank, 60 ft. long x 14 ft. wide x 6 ft. deep, set the level of the boiler room floor.

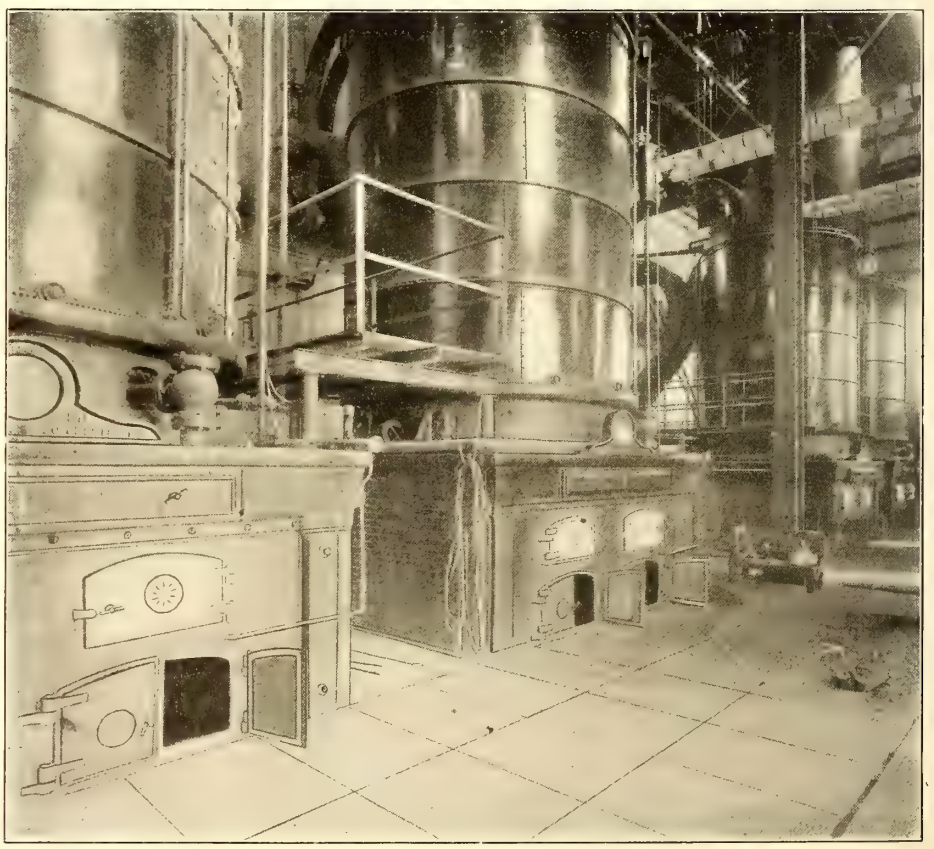
This receptacle, a rough section of which is shown on page 974, is divided by barriers into four compartments, the barriers being so arranged that the water has to flow over the first, then under the second, over the third, and so on. The overflow from condensers is led into the first of these compartments, and as it flows under and over the barriers of the tank the cylinder oil collects on the surface of the water in each compartment. In this position it is automatically skimmed off by funnel-shaped drain pipes, about 6 ins. in diameter at the top, as illustrated. It has been found possible in this way to recover about one-fifth of the oil used in cylinder lubrication. It has also been found not only practicable but desirable to use the overflow of this tank for boiler feed purposes. The temperature of the water averages about 115 degs. F., and the little oil that is mixed with the water seems to act as a boiler compound and be just enough to precipitate the mineral matter in the water; in fact, since the introduction of this water the boilers have been entirely free from scale or corrosion. No other boiler compound is used except occasionally a little soda, which is mixed with the feed-water to coat the interior of the pipes. Before this water was used there was considerable trouble with scale in the boiler tubes.



SECTION OF PIPING, SHOWING METHOD OF MAKING JOINT

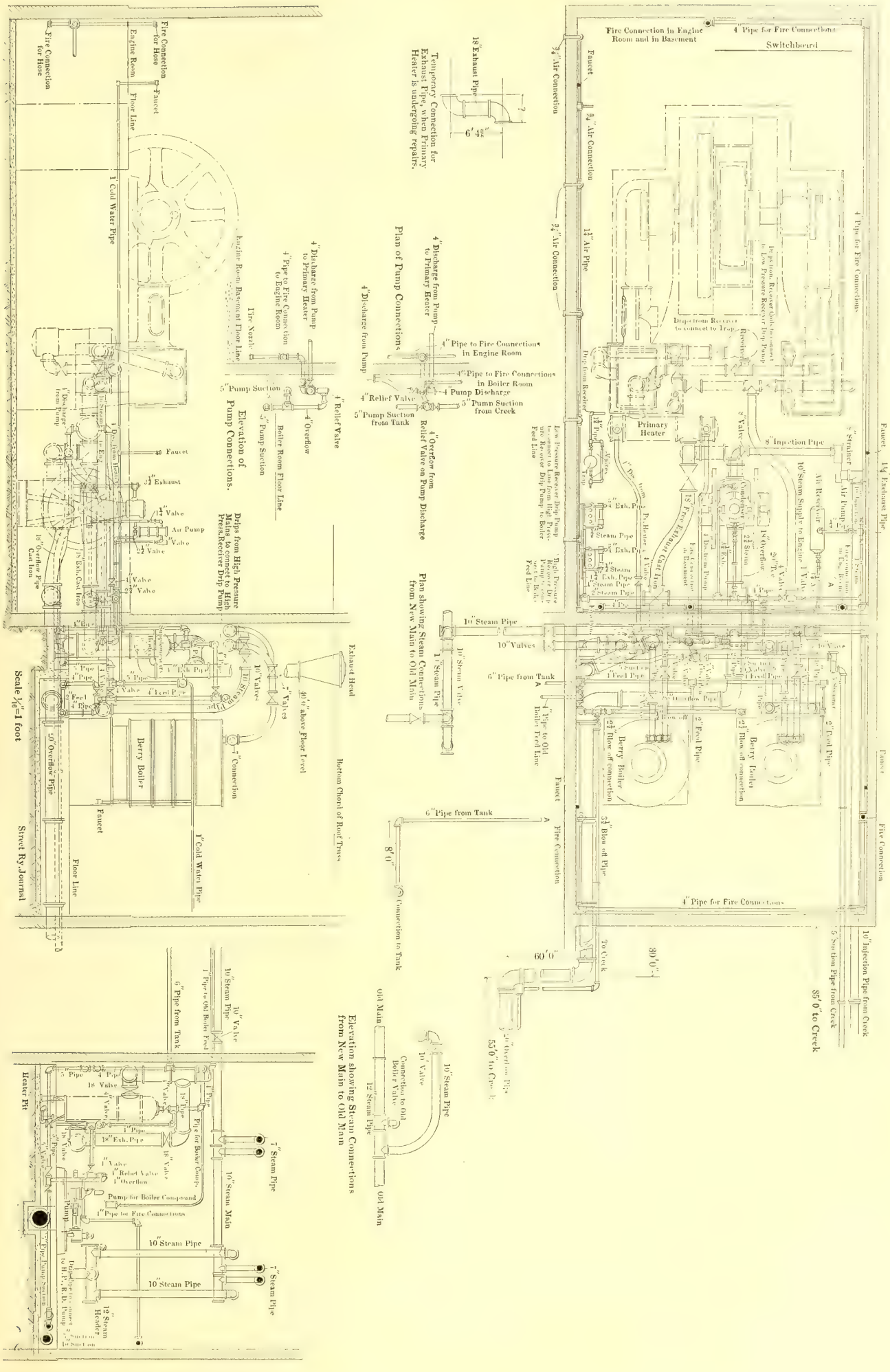
ENGINES

Taking up now the engine room, the new engines are two in number and of the horizontal cross-compound condensing Corliss type. They were made by the Pennsylvania Iron Works Company, and have cylinder dimensions 30½-in. and 52-in. x 42-in. stroke. They operate at 80 r. p. m., and are fitted with double-ported Corliss valves with rocker arms and double-eccentric motion. The governor is operated by an positive-motion gear and shaft. There is also an auxiliary governor, which is belted to the main shaft of the engine, and which runs idle at about ten turns lower than the operating governor. This governor is so arranged that if the operating governor fails to work, an increase in speed of 10 r. p. m. will throw in operation a trip releasing a heavy weight and closing a butterfly valve, thus shutting down the engine. Both of the engines are of the 1200-hp capacity, and have been made especially heavy. For instance, the fly-wheel weighs about 160,000 lbs., which is about 60 per cent heavier than the fly-wheel usually furnished for this size of engine.



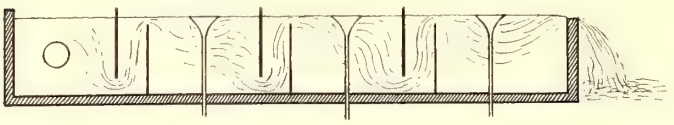
INTERIOR OF BOILER ROOM

The engines are practically identical except that in the second engine tail rods have been adopted, supported on ad-



PLAN AND SECTIONS OF EXTENSION NO. 1 OF POWER STATION

justable tail bearings. The use of tail rods is quite novel in this country, although very common in Europe, and they were introduced to remove the strain which otherwise falls on the bottom of the cylinder. While the reduction in pressure on the bottom of the cylinder from the piston does not amount to very much during light loads, it is considerable during heavy loads, on account of the fact that the steam enters on top of the piston. Experience with tail rods in this station indicates



SECTION OF HOT-WELL TANK, SHOWING SKIMMERS FOR RECOVERING CYLINDER OIL

that it is possible to work the engine equipped with tail rods at about 10 per cent greater capacity than the other engine.

As will be seen in the illustration on this page all of the fly-wheels have been encased in metal housings. The object of doing this was threefold. The first is that the current of air generated within the housing is led up through the armature to the generator and so keeps the latter cool and clean. Second, there has also been found to be a gain in horse-power of about 1½ per cent. The third advantage is the general appearance of the engine room, cleanliness and safety to the attendants. The fly-wheel metal housings as well as the crank shaft housings and the lubricator system employed in the station were manufactured by Bingham & Company, of Camden.

Each engine is directly connected to a Westinghouse 800-kw, ten-pole generator.

SWITCHBOARD

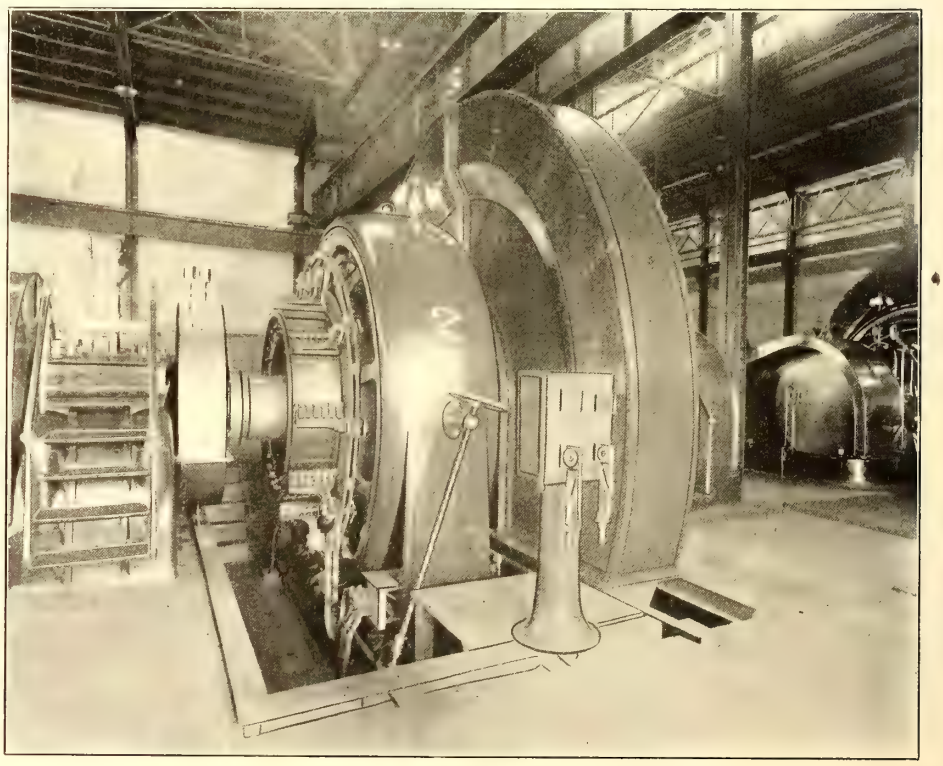
The switchboard is located at the eastern end of the station on a gallery commanding a view of the entire engine room, as shown in the illustration showing the interior of the station. The switchboard connections are shown in the accompanying schematic diagram, and, as will be noticed, are quite novel. Two positive bus-bars are used, and the equalizer is on the negative side of the generators. This has the advantage of reducing the possibility of short circuits between the equalizer and the ground, as there is a very small difference of voltage between them. It also reduces the complications on the board, as one switch only is required instead of two or three, which are needed when the equalizer is on the positive side. The current can also be run directly to the instruments, and the arrangement of the lightning arresters is also simplified. The switchboard is of the single-pole type, the negative pole being grounded and the positive put to the trolley. The negative equalizer switches are not placed on the board but are carried on a small panel mounted on a post directly in front of the generators, as shown in the view of the generators. The board is also provided with a five-point switch, which can unite any two or more of the machines, independently of the remaining machines. By following out the connections on the diagram, it will also be seen that by this switch any group of machines can be connected to any feeder or feeders, either with or without the booster, by an independent circuit not connected with the bus-bar.

In the diagram *W*, *A*, *B*, *C* and *D* are booster feeders, *W* being the lighting feeder to Wood-Lynne Park. Booster feeder *B* goes directly to the Delaware Avenue storage battery without any taps, feeder *C* to No. 2 battery at Westmont, and feeder *D* to No. 3 battery at East Pensauken. Feeder *A* is for the Riverton branch.

The switchboard itself is of the double-deck type. The lower deck is devoted to the five generator panels, one main negative panel and two small panels with booster outfit. The upper deck comprises the five panels for the ten line feeders and the two panels for the four booster feeders. Another interesting feature of the circuits, and one which has been in use for two years, is the employment of two automatic magnetic circuit breakers of the General Equipment type, connected in multiple on each machine before tapping to the bus-bars. The opening of these two circuit breakers has been found to be, to all intents and purposes, simultaneous. By using two in multiple the arcing is divided between twice the number of contacts, thus reducing the destructive effect of the arc to a minimum. A further advantage of the use of two circuit breakers is in the ability to operate if one should fail to act; another is that it is possible to employ a cheaper type of circuit breaker and one that is more readily repaired.

The double-throw switches permit the connection of any machine to the upper or lower potential bus-bar, and the former can be run at any voltage within the limits of any machine. The main negative panel carries the main station ammeter and wattmeter.

The booster is connected in an ingenious way to the switchboard. One of the usual troubles with a motor-driven booster is that if the circuit breaker of the motor opens the booster will run as a motor, and being a series machine will rapidly accumulate speed. There are, of course, various plans for opening booster circuits, but the management believes that nearly all of these have failed, as their electrical operation depends upon magnetism. For this reason the motor circuit breaker on the station switchboard is interlocked with the circuit breaker of the booster, so that when the motor breaker goes out it automatically opens the booster breaker. The interlocking connection prevents the switchboard attendant from closing the booster breaker until the motor has again been started.



METAL HOUSING AROUND ENGINE FLY-WHEEL

The building is protected by a double battery of lightning

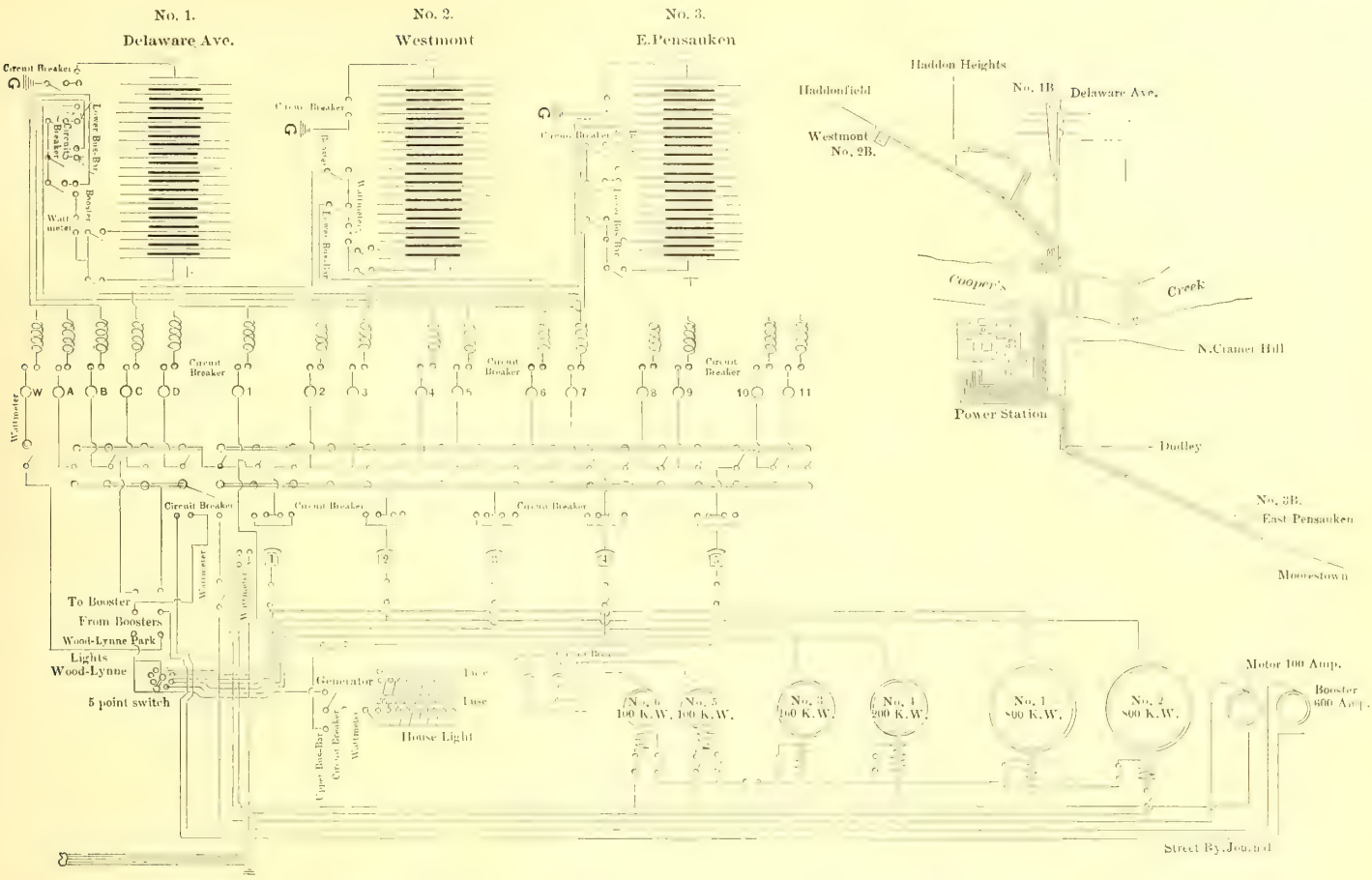
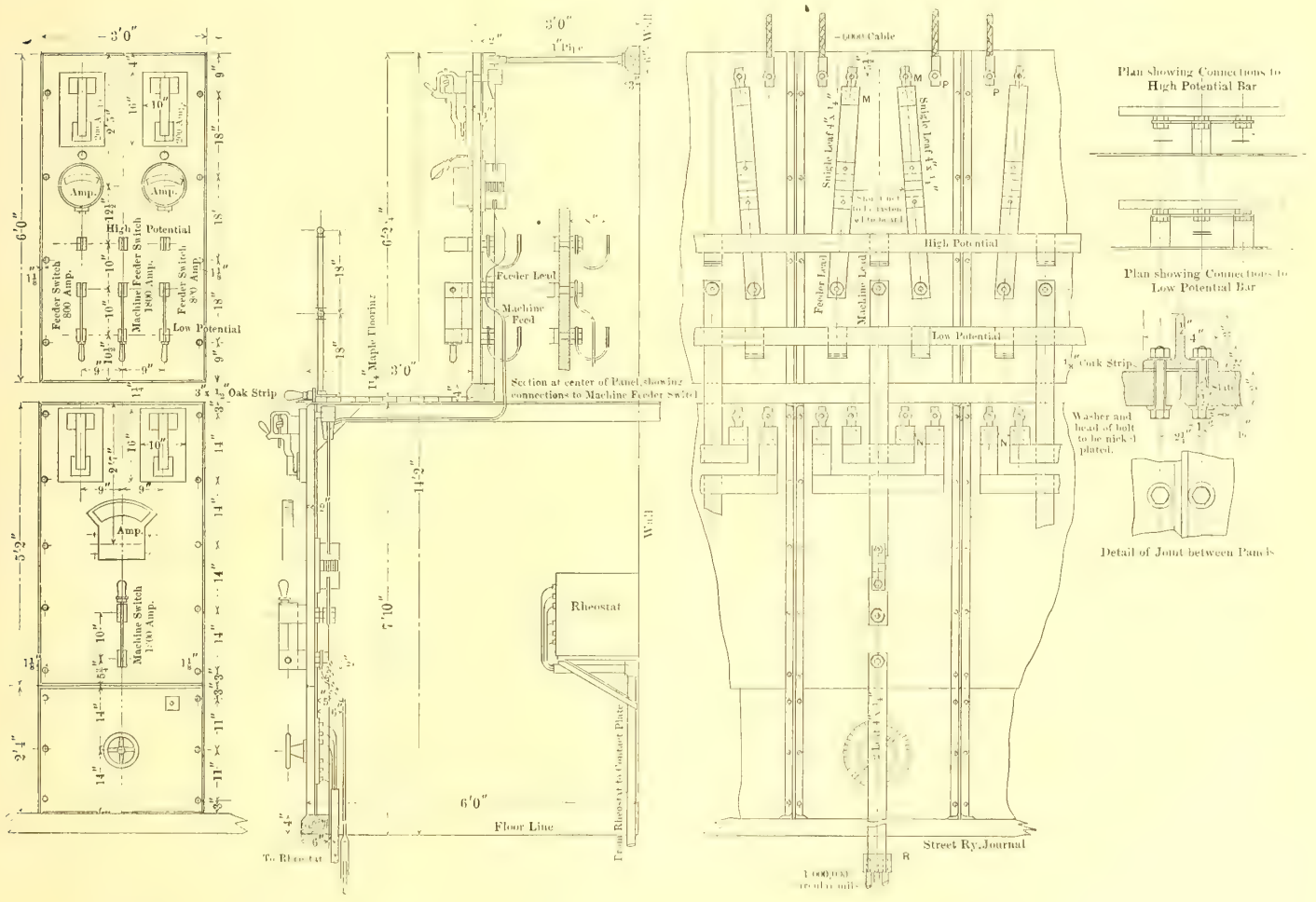


DIAGRAM OF SWITCHBOARD CONNECTIONS, MAIN POWER STATION



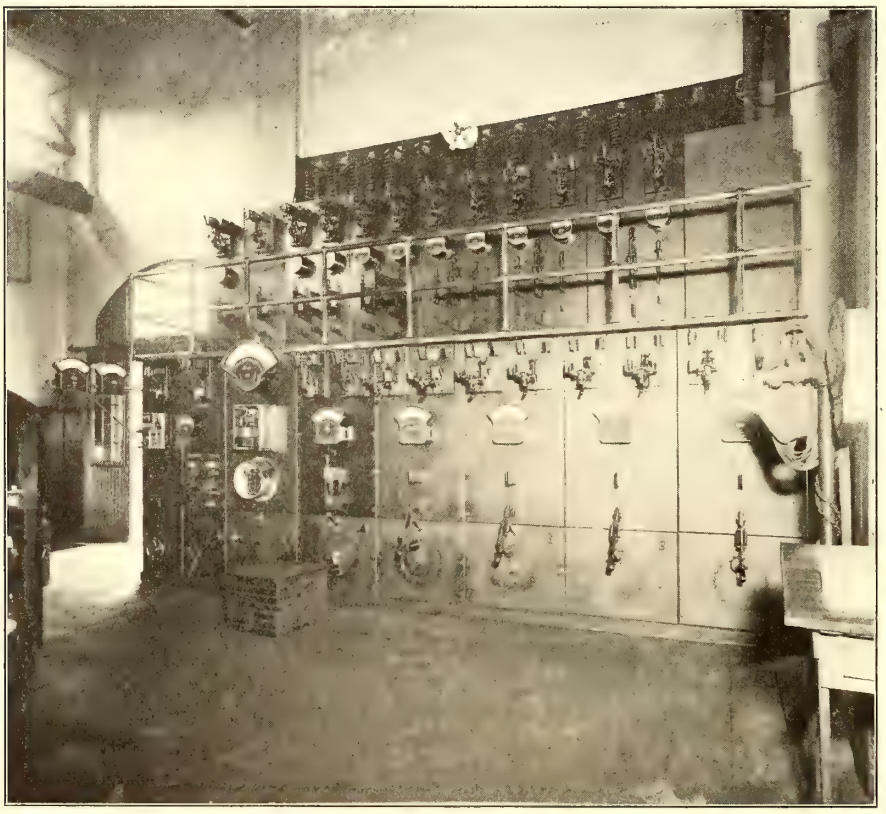
SECTION OF SWITCHBOARD AND DETAIL OF PANEL

arresters, one on the inside of the building, and choke coils and Ajax arresters on each feeder, and on the inside of the building each feeder is protected by Garton-Daniels lightning arresters.

ROLLING STOCK

A record of the rolling stock apparatus and equipment is entered on a tracing kept up to date by adding additional equipment when purchased. This tracing contains thirty-five columns, giving the following statistics:

Car Body—
Truck No.
Open Car, No.
Box Car, No.
No. of Benches,
Make,



SWITCHBOARD AT MAIN POWER STATION

Length of Body—
Platform
Body,
Over all,

Extreme Width,

Height Trolley Base to Rail,
Seating Capacity,
Windows on Side,

Motors—
Type,
Horse-Power,
No. on Car,
Gear Ratio,

Trucks—
Make,
Wheel Base,
No. Under Car,
Wheel Diameter: Driving,
Pony,

Axle Diameter: Driving,
Pony.

Journal Lubrication,

Brakes: Automatic,
Hand.

Track Scraper,

Miscellaneous Electrical Equipment—
Type Controller,
Type Resistance,
Type Circuit Breaker,
Type Fuse Box,
Type Trolley Base,
Lightning Arrester,

Headlights: Arc,
Oil.

This record also contains a summary of the rolling stock, viz., total number of 16-ft., 18-ft., 20-ft., etc., cars, total number of trucks of each type, motors of each type, controllers, circuit breakers, fuse boxes, trolley bases, lightning arresters, headlights, extra armatures, controllers, etc.

Briefly, the equipment consists of 122 car bodies, of which twenty-three are of the ten-bench open type, and thirteen of the eight-bench open type, sixteen are ten-bench semi-convertible, twenty are double-truck 28-ft. box cars, 40 ft. over all, with a smoking compartment, twenty are 10-ft. single-truck box cars, twenty-one are 18-ft. single-truck box cars, and nine are 20-ft. single-truck box cars.

The company has 102 single trucks, principally of the Brill make. It has twenty double-truck equipments, seven of which are the Brill 27-G type, eight of the St. Louis maximum-traction type, and five of the Peckham 14-B-3 type. In this connection it might be said that in its open cars the company is giving up the use of side steps and is changing its open cars to center-aisle cars, principally on account of the danger of accidents.

The company has 209 motors, most of them of the Westinghouse No. 3, No. 49 and No. 38-B types. All new double-truck cars are equipped with Westinghouse No. 56 motors, and the company has five 4-motor equipments using this type of motor.

The company also has as a snow-fighting equipment five sweepers, one Peckham-Ruggles rotary snow-plow and two sprinklers. The track on all the suburban lines is sprinkled once a day. All of the cars are equipped with United States fenders, manufactured by the United States Fender Company, of Camden, and are heated with Spear stoves.

All new minor car apparatus, such as carbon brushes, gears, patent ventilators, etc., are tested on the same car. In this way they can be watched very easily, and records can be kept more certainly as to their service. This is car No. 143. The total number of cars available for service in 1903 was eighty-four, of which thirty-six were open cars, twenty double-truck, and the rest single-truck box cars.

NEW STANDARD CAR

The company is now engaged in the design of a standard double-truck car. This car will have a 30-ft. or 33-ft. body, with 5½-ft. platforms and 6-ft. wheel bases. It has a smoking compartment, which is fitted with longitudinal seats, and takes in two windows. The seats in the main part of the car are cross-seats, except at the end, where there are two longitudinal seats which take in two windows. The aisle is 21 ins. wide at the narrowest point, that is at the seat bases. Between backs of seats the aisle is 24 ins. wide. The interior side lining of the car is omitted so as to permit of a seat 36 ins. wide. The sash lintel will be only 25 ins. from the floor. The outside width of the car is 8 ft. 2 ins. As there is no interior lining to the car the sash will be stationary in the winter and will be taken out in summer.

The car is equipped with a monitor roof. The vestibule will also be lighter than usual, as it will be mounted on the ordinary dash, and its side sash will be stationary. The center sash will be made to open laterally by being mounted on rollers, which move on a horizontal rail somewhat after the practice sometimes used with vestibuled doors. The car will be equipped with four 56-Westinghouse motors, K-14 controllers and air brakes. All cars will also be equipped with arc headlights, which the company has been using for four years, and which have now been adopted as standard on all of the divisions except those operating entirely within the city limits.

AIR BRAKES

The company is now proposing to equip all of its double cars with air brakes, and is now conducting a competitive test between Christensen air brakes, as made by the National Electric Company, of Milwaukee; Standard Traction brakes, as made by the Westinghouse Traction Brake Company, of New York and Wilmerding, Pa., and the brakes of the Philadelphia Air Brake Company. The Westinghouse equipment is of the new type, in which the motor and controller are completely enclosed. The air valve is of the slide valve type, instead of the rotary valve employed on the Christensen equipment. A duplex air gage is also used, with two hands.

The Christensen equipment is of the usual type.

In the Philadelphia air brake equipment the compressor is driven with a worm instead of by gearing. The brake cylinder is of the duplex type with pistons at each end. The air is admitted at the center, and each piston operates the brake rigging at one end of the car, thus, of course, dispensing with the usual equalizing lever.

TAIL LIGHTS

In this connection it might be said that all of the cars of the system are equipped with red tail lights. These are oil lights, and are considered very important for safety purposes. They are distributed at dusk to the cars at the different terminals by a special lamp car, illustrated on this page.

PARKS

The company owns a park at Wood-Lynne, which is part of an old estate acquired sometime ago. It contains 13 acres, with a lake, shrubs and trees and a rolling character of ground, which makes it very attractive for park purposes. The former owner was very much interested in arbor culture, and some of the trees in the park are quite rare. Several other varieties of rare trees and shrubs have been added since the railway company has been the owner of the park.

The special attractions at the park consist of a pleasure railroad, carousel, pavilion, dancing pavilion, theater, swings, boats, shooting gallery, monkey cage and band-stand. The former residence in the park has been remodeled with large porches, and makes an attractive center of attraction. The park is within the 5-cent limit of the center of Camden, and the attendance during the year aggregates over 100,000. The park is not operated directly by the railway company, as this was found to be very unsatisfactory, as it interfered with the regular duties of the company's force. It is leased for a nominal rental to a park manager.

CAR HOUSE AND REPAIR SHOPS

The main car house and repair shop of the company are located on Newton Avenue, not far from the power station. A full discussion of the repair methods followed will be given in a subsequent article. The tools in the carpenter shop are operated by one 5-hp motor, and consist of one joiner, one circular saw and one band-saw. The machine shop is also operated by a 5-hp motor, and its equipment comprises one 22-in. swing 15-ft. bed lathe, a 28-in. swing 14-ft. bed lathe, one 16-in. swing 8-ft. bed lathe, one vertical drill press, capable of drilling up to a 1¾-in. hole, one small drill press, one shaper with a 14-ft. sweep, one emery wheel, one baking oven, heated by electric boilers, one large car-house jack, swinging jib-crane, etc. The blacksmith shop consists of two forges and blowers. All repair work is done by contract with the repair shop foreman, at a certain specified price for each essential operation. Some of these prices will be given in a later article.

NEW REPAIR SHOP

The company is planning to install a new repair shop at Fourth Street and Kaighn Avenue, and this shop will not be used for ordinary repairs but exclusively for the thorough overhauling of cars.

The management believes that the two operations, that is, minor repairs and thorough overhauling, should be kept thoroughly distinct, and periodically the cars will go to the new repair shop for the work which it is necessary to do. In this shop the car bodies will be painted and varnished, or varnished only, as the case may be, the motors and trucks will be run out and all parts carefully inspected and repaired.



INTERIOR OF LAMP CAR USED FOR SUPPLYING HEADLIGHTS AND TAIL LAMPS TO THE CARS AT TERMINALS.

Some idea of the magnitude of the business of the Birmingham Railway, Light & Power Company may be gained in knowing that on circus day recently the company handled 150,000 fares, with 10 cars in service as a maximum, without an accident. The entire street railway population is not more than 125,000. The circus had something like 12,000 at two performances, who were hauled 2 miles from the city proper. This required that each car carry during the day 1250 fares, or at sixty to the car make twenty trips. This required also 240 motormen and conductors, and at least ten inspectors and despatchers. The company has been engaged for the past two years in making some very extensive improvements to its system, including power stations, rolling stock and track work. It has now about completed this new construction, having spent, during this time, in the neighborhood of $2,000,000.

RECONSTRUCTION OF OLIVE STREET TRACKS IN ST. LOUIS

The reconstruction of the tracks on Olive Street, in St. Louis, as recently carried on by C. A. Moreno, chief engineer of the St. Louis Transit Company, is remarkable in several respects. The problem was to take up an old cable track and lay in its place an electric track. It was also necessary to rebuild this track without interfering with the regular operation of cars, as the traffic on the Olive Street line is very heavy. It is one of the company's most important lines, and cars are operated over it, at thirty-second headway, morning and evening.

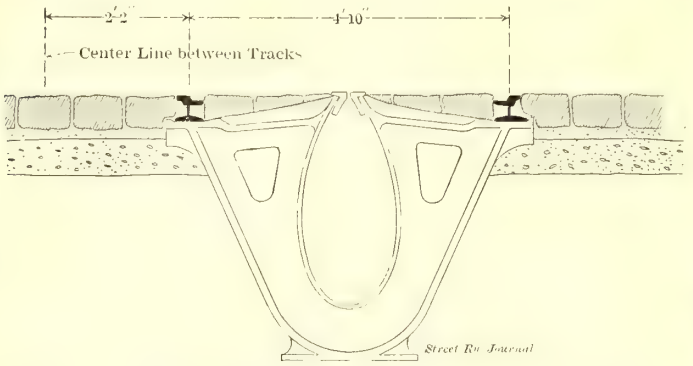


FIG. 1.—SECTION OF OLD CABLE TRACK IN ST. LOUIS

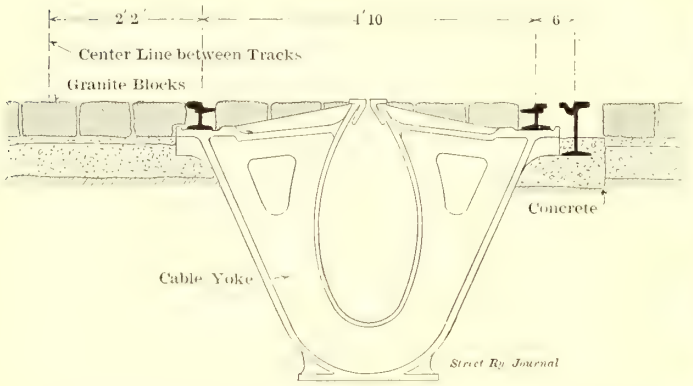


FIG. 2.—SECTION SHOWING 9-IN. RAIL OUTSIDE CABLE YOKE



FIG. 4.—VIEW AFTER REMOVAL OF SLOT RAIL

The track to be reconstructed was an old cable track, Fig. 1, consisting of a 4-in. girder rail set in yokes. The distance between track centers on this street was only 4 ft. 4 ins., and as the cars which are now being operated over these tracks are wider than the old cable cars, the distance between the new cars was uncomfortably small. It was, therefore, decided to move each track out 6 ins., increasing the distance between the track centers 1 ft. To accomplish the reconstruction the outer rail of the new track was first laid, as shown in Figs. 2 and 3. This outer rail is 9 ins. high and of the grooved pattern, which has been adopted in St. Louis. To lay this rail a trench was excavated just outside of the old cable rail, 12 ins. wide and 15 ins. deep, except at the joints, when an additional 2 ins. were excavated, to give that much more concrete under the joints. The outer rail was then laid, surfacing it on blocks placed 12 ft. apart. Concrete was placed under and around the rail, allowing 6 ins. of concrete under the rail, except at the joints, where there were 8 ins., and the concrete was brought up 3 ins. above the base of the rail. For joint fastenings, twelve-hole angle-bars, 32 ins. long, were used, and joints were bonded with four No. 0 copper bonds, 42 ins. long.



FIG. 3.—VIEW AFTER LAYING OUTSIDE 9-IN. RAIL

So far the work interfered in no way with the existing track for the operation of the cars. It was all completed independently, and allowed to remain ten days undisturbed in order to give the concrete a chance to set thoroughly. The granite blocks with which the track was paved were then removed, together with the slot rails of the cable conduit, as shown in Fig. 4. The sand was cleaned off the old concrete which supported the yokes. The top of this old concrete was 6½ ins. below the grade of the street. To avoid having to dig up this concrete to accommodate a 9-in. rail similar to that used on the outer rail of the track, a grooved rail only 6 ins. in height was used for the inner rail. The "owl" cars were taken off this section of the line from midnight until 5:30 a. m., to give a chance to break out the yokes, throw out the old rail and lay the

new 6-in. inside rail. The inner rail was secured by tie-rods to the 9-in. outer rail, already imbedded in concrete, as shown in Fig. 5. The track could then be operated upon the next day, and the balance of the work completed during the daylight. The top of the old concrete in the cable track being level and

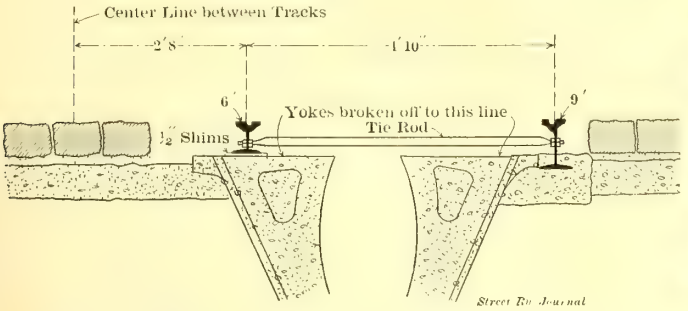


FIG. 5.—SECTION WITH ELECTRIC RAILS IN PLACE



FIG. 7.—VIEW OF TRACK WITH CONDUIT FILLED

the inner rail, which rested on this concrete, having a flange width of 6 ins., it was held securely in its position without difficulty, but to increase its stability metal shims, 8 ins. wide and from 1¼ ins. to 1 in. in thickness, were laid every 3 ft., to bring the head of the rail up to the grade of the street. This left the base of the rail between shims from ½ in. to 1 in. above the surface of the old cable track concrete foundation. To take

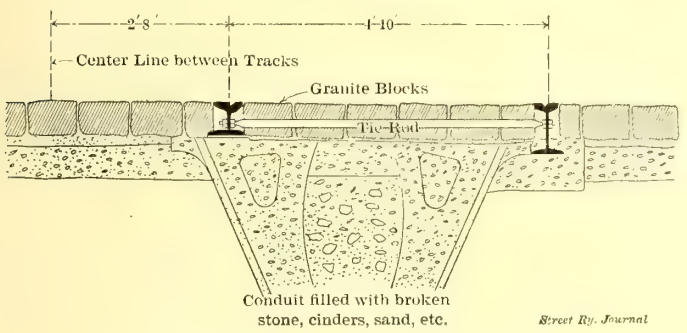


FIG. 6.—SECTION OF COMPLETED TRACK

up any movement in that portion of the rail between the metal shims, iron borings from machine shops were tamped under the rail. As this tamping was done the borings were kept constantly wet with salt water, which caused them to rust quickly, and make what is known as a rust joint between the beds of the rail and the concrete. The old cable conduit was filled up with cinders, sand, broken stone and other debris that happened to be at hand. This was thoroughly rammed and flushed with water. The filling was carried up to within 6 ins. of the top of the old concrete. The remaining 6 ins. was filled with new concrete to support the paving. The paving was then laid to complete the track, as shown in Fig. 6. In Fig. 7 is shown a view of the track in which the cable conduit has been filled,



FIG. 8.—VIEW AFTER BORINGS HAVE BEEN RAMMED UNDER RAIL

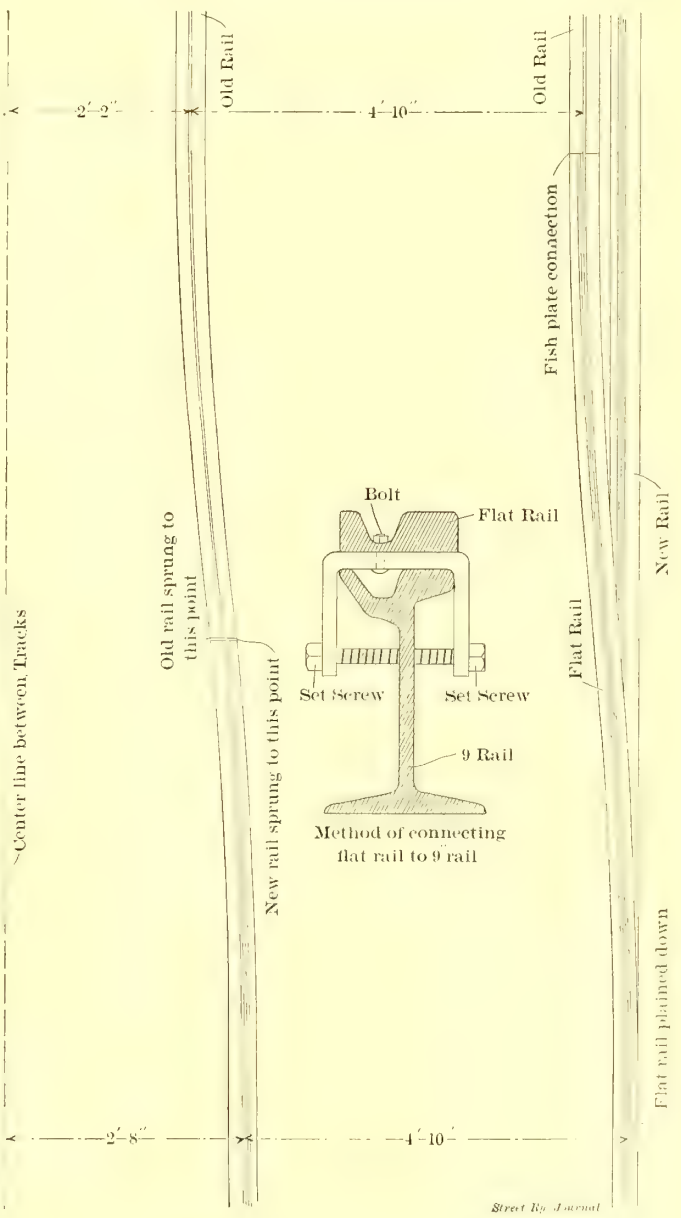


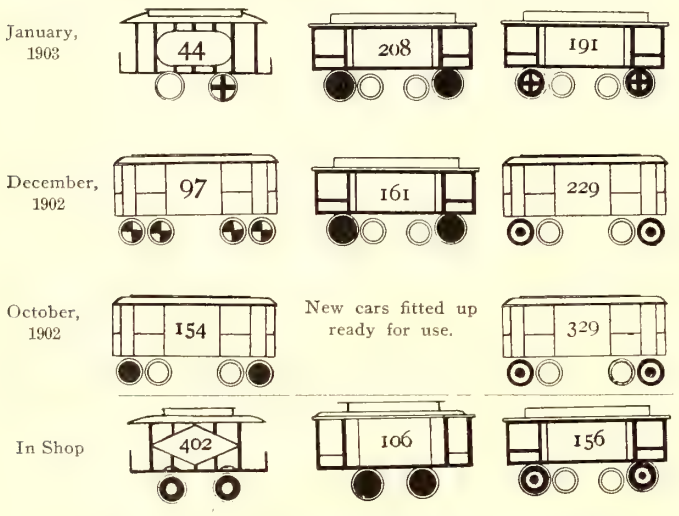
FIG. 9.—CONNECTIONS BETWEEN OLD AND NEW CONSTRUCTION

but the steel borings have not been rammed under the 6-in. rail. In Fig. 8 the cable conduit has been filled ready for the last 6 ins. of concre, and the borings have been rammed under the 6-in. rail.

When each night's work was finished the old track was connected with the new by means of connecting rails, details of which are shown in Fig. 9. This connecting rail was moved ahead from day to day until the work was completed. Several gangs of men were worked on this job in order to complete it as rapidly as possible, and it was found that with a gang of forty men about 1500 ft. of track could be laid each night in 5½ hours. This, of course, did not include the daylight work. For breaking out the tops of the old cable yokes lengths of old rail were used as rams.

SHOP RECORD FOR CARS IN LOS ANGELES

An ingenious system of shop records is kept by General Manager Muir, of the Los Angeles Railway Company, for his own private and instant information, concerning all of the company's cars, showing the last date each car passed through the shops for general overhauling, painting, varnishing and re-



REPRODUCTION OF PART OF REPAIR-SHOP RECORD

building. The type and equipment of all cars are also shown graphically on this shop record; in fact, every time a car enters the shops (except for running repairs) the fact appears on the record.

While the accompanying chart shows a wide range in type of cars, it is only fair to the Los Angeles Railway Company to say that its standard is the combination double-truck, and that but few of any other style remain in the service at this time, owing to the rapid work of standardizing and rebuilding now going on in the Los Angeles shops.

The record hangs on the wall in a case, 3 ft. x 4 ft., covered with glass conveniently attached so as to open. Inside are twenty grooves, running horizontally. To fit these grooves are flat blocks of wood, 2 ins. x 1¼ ins. On these blocks are pasted blue prints, showing number of car, style of car, whether it be trailer, open, closed, single-truck combination or double-truck combination; whether longitudinal or cross-seats are used, and the type of equipment used.

At the beginning of each groove, on the left-hand side of the case, is a block bearing a date (month and year), and following this block are the blue-printed blocks, to represent cars that passed through the shops during that month. Furthermore, when new cars pass through the shops during any month a block is inserted in that month's groove, reading: "New cars fitted up ready for use."

Thus, for January, 1903, Mr. Muir's shop record shows: "Overhauled, etc.," cars Nos. 25, 26, 33, 34, 36, 38, 230, 231, 232; "fitted up ready for use," cars Nos. 289, 290, 291, 292, 293, 294.

Reserving the two lower grooves in the case for cars in the shops a block is inserted reading, "In shops." When a car is ordered out of service and into the shops, the block representing this car is taken from its place in the grooves above and put in the shop groove, where it remains until the car is ready for service again. It is then taken out of the shop groove and put in the proper groove above, which will show the month when the work was done.

As an instance showing how accessible is information contained in this shop record, assume the inquiry is concerning the status of car No. 44. First, the manager looks on the chart for a block carrying that number. This block is found in the groove headed "January, 1903," indicating that month as the last time car No. 44 passed through the shops.

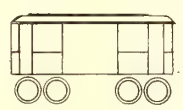
The appearance of the blue print indicates that the car is a single-truck open car, equipped with one Westinghouse No. 3 motor.

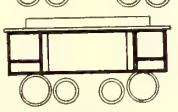
The motor equipment of any car is shown in the wheels of the blue-print cars, according to the following chart:

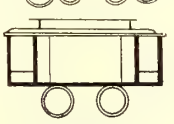


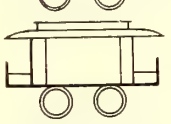
Westinghouse, 38B
" 49
" 12A
" 12
" 3
General Electric, 800

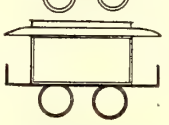
The following conventional diagrams, to illustrate the different types of cars used, have been adopted:

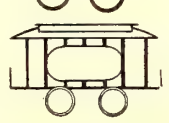

Combination double-truck car with cross seats (the standard of the Los Angeles Railway Company).

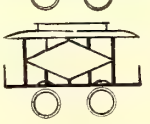

Combination double-truck car with outside seats.


Combination single-truck car with glass ends.


Combination single-truck car without glass ends.


Single-truck closed car.


Single-truck open car.


Single-truck trailer.

In each case the number of the car is marked on the side, as shown in the reproduction of the shop record.

A similar record has just been installed by the Pacific Electric Railway Company, to show at a moment's glance the number of cars in service on its various lines and full particulars concerning these cars.

MOTORS AS EMERGENCY BRAKES

BY CALE GOUGH

It is a generally known fact that by throwing the reverse lever of a four-motor equipment, or by moving the controller handle to the multiple position and throwing the reverse lever of a two-motor equipment, the motors may be used to brake the car.

Just why this braking action takes place is probably not clear to many who, in cases of emergency, have repeatedly used this method of avoiding accidents. The explanation usually given is that the motors "generate," or that they "buck" each other, and while this may be sufficient for many, there are others probably who desire a more thorough statement of the conditions governing this action. It has for its foundation the difference in the magnetic properties of the iron composing the fields of the motors.

With line current cut off and the controller in the multiple position, the conections of a two-motor equipment are as in Fig. 1, that is, two motors are close-circuited in series with each other. The connection at A is made on the controller cylinder. The fact that both motors are grounded on the car framing makes the junction at B.

On the off position of the controller, a four-motor equipment, as usually wired, is interconnected as in Fig. 2. The connection at C is formed through the common trolley for No. 1 and No. 2 motors, which separate at the reverse cylinder of the controller. The common return wire forms the connection at D, and the ground that at E.

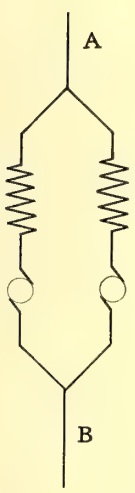


FIG. 1.—CONNECTIONS OF TWO-MOTOR EQUIPMENT.

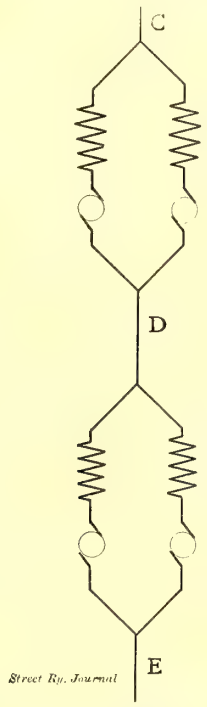


FIG. 2.—CONNECTIONS OF FOUR-MOTOR EQUIPMENT.

When the line current is cut off by throwing the overhead switch, the difference in the hardness of the iron of the fields causes the fields of one of the two motors in series to retain considerable more residual magnetism than its mate.

The counter e. m. f., generated in a motor armature, varies directly with the number of magnetic lines of the field, or, in other words, the strength of the field, and since the motors under a given car have the same number of conductors in their armatures and are revolving at the same speed, the motor with the stronger residual magnetism will generate the greater e. m. f. when the current is cut off.

Let motor No. 1 of a two-motor equipment be the one retaining the stronger residual magnetism. Assume the line current to have been in the direction of the arrows in Fig. 3, and the direction of the rotation of the armature as indicated. The back e. m. f. of the motor, when supplied with power from the trolley, was such as to oppose the flow of the line current; that is, it was in the direction of the dotted arrows. When the reverse is thrown, since the direction of rotation has not changed, the e. m. f. is generated in the armature in the same direction as before. But throwing the reverse lever so changes the armature terminals relative to the field terminals that when circuit is completed, through motor No 2, the generated e. m. f. of No. 1 sets up a current in the fields of No. 1 in the direction of the original or line current. This, of course, strengthens the weak fields and correspondingly increases the generated e. m. f. and the resulting current.

Motor No. 2, all of the connections of which are the exact duplicate of those of No. 1, likewise sets up an e. m. f. This tends to oppose the current forced through by No. 1, but it is not strong enough to prevent the flow.

At the instant any current does flow, this opposing e. m. f. is eliminated by reason of the fact that the current flows in the fields in a direction opposite to the original line current; this completely destroys the residual magnetism, and with it the opposing e. m. f. of motor No. 2. The e. m. f. of motor No. 1, now receiving no opposition, sets up a larger current, which builds up the fields of motor No. 2 with reversed magnetism. The direction of the original opposing e. m. f. of motor No. 2 is now reversed so that it aids the flow of the current. Both motors now act as generators, power to operate them being derived from the moving car, which is eventually stopped. The limiting value of the current that would be built up is determined by the tractive effort required to slide the wheels on the rail. The current increases until the power required to turn the armatures becomes so great that the wheels slide. When this takes place, the armatures ceasing to revolve, the entire e. m. f. is destroyed and the current stops. The wheels again take hold of the rail, current is again generated, and the operation is repeated several times or until the car stops. The amount of current which would cause sliding of the wheels may be obtained approximately by assuming a car of given weight and studying the characteristic curves of the motors.

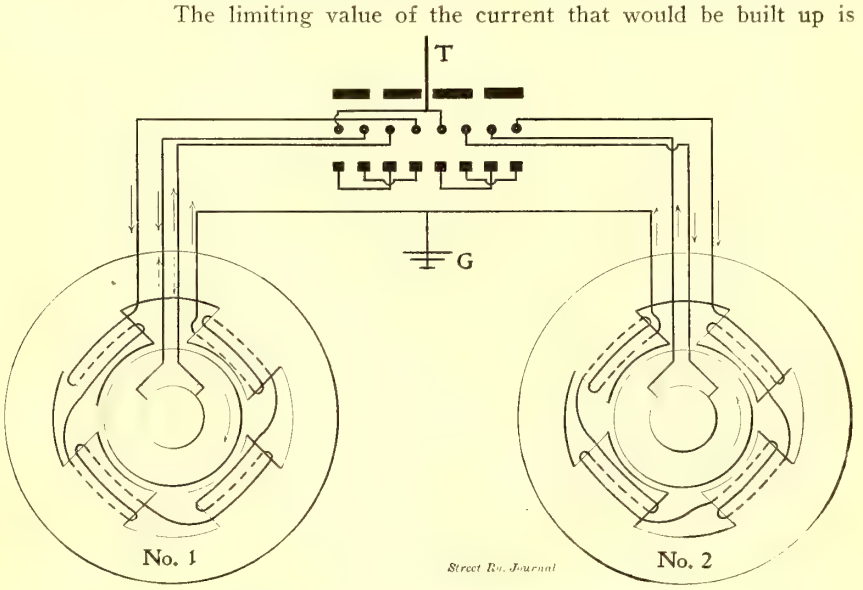


FIG. 3.—CURRENT CUT-OFF IN TWO-MOTOR EQUIPMENT.

Assume a car weight of 14,000 lbs. The weight on each axle is 7000 lbs. With a coefficient of friction of 0.90 the tractive effort to slide the wheel would be 6300 lbs. The characteristic curves of a motor suitable for such a car, as given by the manufacturers of the motor, show it as producing, with 110 amps., a tractive effort of 2250 lbs. at the tread of a 33-in. wheel.

Assuming that this current is sufficient to saturate the field magnet, the tractive effort will increase directly with increased current, so that 308 amps. will be required to produce a tractive effort of 6300 lbs.

A question which might reasonably be asked is why do not the motors generate with the reverse lever forward; that is, where the car is running under normal conditions and the trolley leaves the wire? A reasoning similar to that just given will readily explain this point. When the trolley flies off, the e. m. f. of motor No. 1, which we will assume retains the stronger residual magnetism, tends to send a current through both armatures and fields in a direction opposite to that of the original line current. Any current so flowing acts against the residual magnetism, destroying it, and, consequently, the e. m. f. creating the current. At the same time this generated current would flow through motor No. 2 in the direction pursued by the original line current. This would build up the field magnetism of No. 2, and create a counter e. m. f.

It will thus be seen that with the reverse lever forward any current generated will build up an opposing magnetizing force which destroys the cause of its own creation.

In the reasoning here given special reference has been made throughout to a two-motor equipment. This theory, however, applies equally well to a four-motor equipment, the only difference being that with the latter equipment, instead of one set, there are two sets of two motors each in series.

The Los Angeles Railway Company is taking down its poles on the principal streets and attaching the supporting wires to the building walls.

SHOP KINKS ON THE MUNCIE, HARTFORD & FT. WAYNE RAILWAY

The shops of the Muncie, Hartford & Fort Wayne Railway Company, at Eaton, Ind., while not elaborately fitted up are well arranged for taking care of the repairs on an eight-car interurban road while not involving heavy investment. Some of the "kinks" made use of in this shop by H. J. Lake, master mechanic, are here illustrated. Figs. 1 and 2 are views of an armature hoist which can be used for removing armatures in the pit, and can also be used as an armature truck for carrying armatures around the shops. It is homemade. The jack is worked with a ratchet, which can be thrown either way to screw up or down. There are two top pieces which can be put on this jack to hold the armature, one with rollers, as in Fig. 1, and the other with removable wedge-shaped blocks. In Fig. 2 the latter is shown with one of the blocks removed and placed on edge to show the dowel pins.

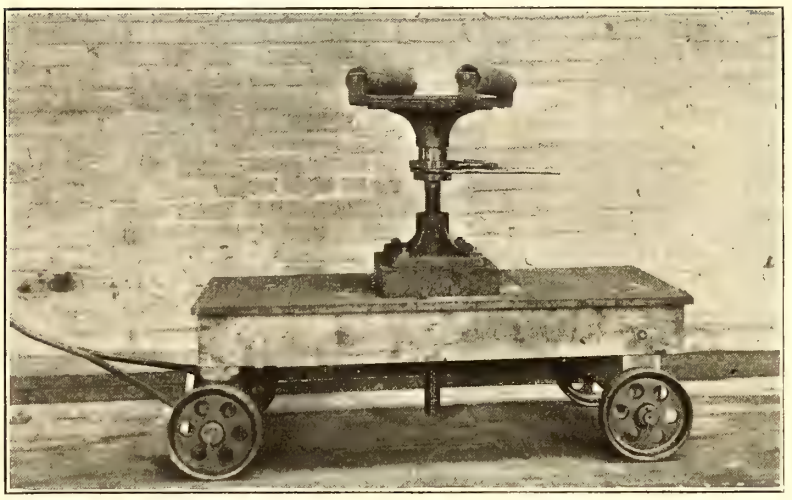


FIG. 1.—ARMATURE HOIST WITH ROLLERS ON TABLE

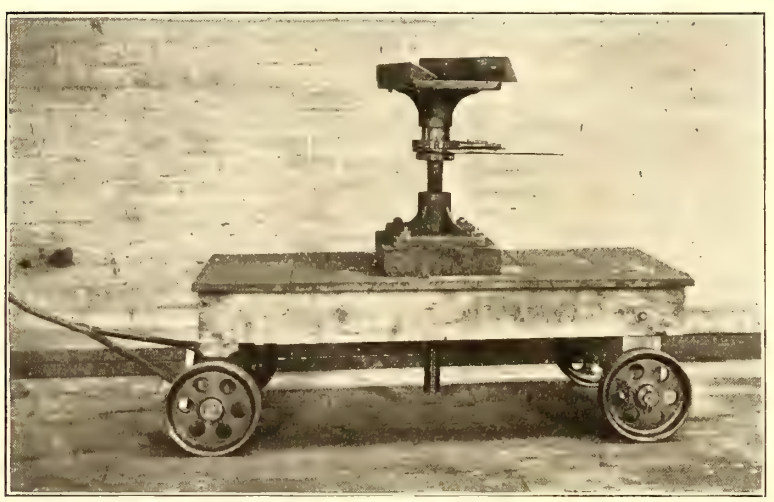


FIG. 2.—ARMATURE HOIST WITH WEDGE-SHAPED BLOCKS ON TABLE

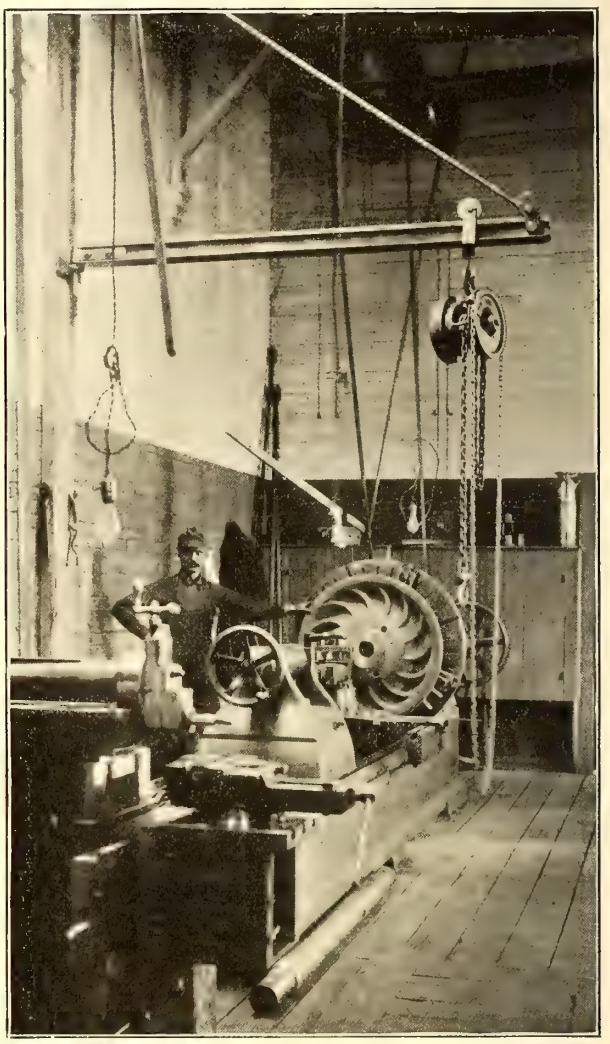


FIG. 3.—SWINGING CRANE OVER BORING MACHINE

The lathe for boring wheels and turning down commutators is served with a swinging crane, as shown in Fig. 3. Similar cranes serve both ends of the repair pit in an adjoining room. The wheel press is in the repair pit room, and wheels are rolled in and out of it without the use of a crane.

For testing engineers' valves and other parts of air brake equipment compressed air is piped into the shop through a wall from the storage reservoir of a car in the car house to testing connections, as seen in Fig. 4. Attachment can be made to this piping for blowing out dirt and dust from motor cases and armatures. Compressed air from the brake reservoirs is used in cleaning cars. It is especially useful for starting dust from

cracks behind hot-water pipes and in cane seats, though, of course, it does not remove the dust after it has dislodged it.

Mr. Lake has recently equipped the cars of this road with pilots similar to those used on locomotives, as it is becoming daily more apparent that a pilot is a good safety precaution on a high-speed road to prevent cars from being derailed by animals on the track.

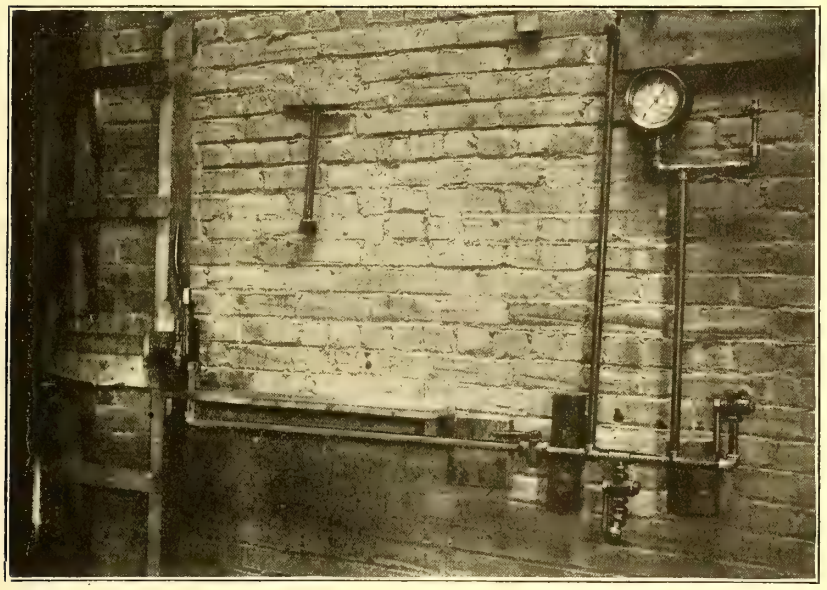


FIG. 4.—AIR COMPRESSOR FOR CLEANING MOTORS AND CARS

PUBLIC SQUARE WAITING ROOM, CLEVELAND

The plans for the suburban station to be erected on the Public Square, Cleveland, have been completed and formally approved by the city and the interested companies. Work on the structure will begin at once, as it is desirous of having the station ready before cold weather. The arrangement under which the structure will be erected is a peculiar one. The city officials have long felt the need of public toilet rooms on the Public Square, and the railroad officials, appreciating this, offered to erect and maintain a building fitted with these conveniences if the city would permit it to be erected on the Public Square and used as a waiting room for the interurbans. The agreement, which was informally closed without any action by the City Council, provides that the station be erected after plans approved by the city, but without any expense to the city treasury, either for construction or maintenance, the building to become the property of the city as soon as completed. The railroads are given the right to use the station by sufferance, but no length of time is specified. The next city administration, if it sees fit, can order the interurbans to vacate, because, as a matter of fact, the interurban roads have no official standing or recognition in Cleveland, and their cars simply run into the city as the leased cars of the Cleveland Electric Railway Company. The agreement provides that nothing except tickets may be sold in the station, and a check room, which will probably be included, will have to be maintained free of charge.

The building, a sketch of which is presented herewith, will be similar in appearance to other waiting sheds now on the Public Square, but it will be considerably larger. The structure will be 13 ft. x 62 ft., the roof extending 12 ft. on the ends and 4 ft. on the sides. On one side the roof will extend over the sidewalk, while on the other side it will extend to the curb. The city company will be permitted to lay a third track long enough to accommodate several interurban cars at a time, immediately next to the curb, so that in wet weather a passenger can step directly into a car. A ticket office and check room will be located so as to divide the interior into two rooms; the smaller room to be a smoking room and the larger the passenger room. Doors at the ends will open to stone steps leading to the basement, where there will be toilet rooms for both men and women. There will also be a furnace in the basement, to supply heat in winter. The partition on the track side will be made so that it can be removed, making the station open for summer weather. The exterior will be brick with stone coping, the framework structural steel, and the roof will be of tile. The building will cost about $10,000, and the city company will pay two-sevenths of the cost, and each of the five interurbans one-seventh. The consummation of the project is due largely to the persistent efforts of President Warren H. Bicknell, of the Lake Shore Electric Railway, and Secretary H. J. Davies, of the Cleveland Electric Railway.



WAITING STATION FOR TROLLEY CARS ON PUBLIC SQUARE AT CLEVELAND

ANOTHER INTERURBAN LINE TO ENTER CINCINNATI

The Cincinnati Traction Company has submitted a proposition to the Cincinnati, Lawrenceburg & Aurora Electric Railway Company for a traffic arrangement whereby its cars may enter the center of the city over the tracks of the city company. At present the interurban road operates only to Anderson's Ferry, 5 miles from the center of the city. The interurban road has standard gage, while the city company has 5-ft. 2½-in. gage. It is proposed that the traction company secure a permit from the city to lay a third rail, as has been done in Columbus.

CORRESPONDENCE

TRAMWAY DEVELOPMENT IN THE WEST OF LONDON

16 Great George Street, Westminster, London.
Oct. 22, 1903.

Editors Street Railway Journal:

You ask me to furnish you with some notes on what we are doing in tramway and kindred matters in London. My first inclination in view of the condition of suspended animation in which the great problem of London traffic now remains, was to suggest that you should allow me to postpone my letter for a time, so as to have something more definite to write about. But, in truth, I am getting very tired of that same word "postpone," for London has in the past suffered and still suffers from the tedium of this kind of waiting. And while the existence and the long-drawn out proceedings of the Royal Commission on London Traffic has reduced nearly all of us to a position of inactivity, I am glad to feel that it has not wholly stifled our progress in several important directions, and that I and those with whom I am associated can put in evidence, not only a condition of "masterly inactivity," in view of what the Royal Commission may do, but also some masterly activity in directions where our hands are still free and our powers received from Parliament are still unexhausted.

I think that we shall at some day, now not far distant, spring an agreeable surprise, but still a surprise, and one of whose extent few have any idea, upon the community of this great metropolis. But before I can bring into prominence the nature and extent of this as yet unanticipated boon we propose to confer on London, some detail as to what has been achieved in the past must be set forth. I have used the phrase "heart breaking" on several occasions when writing of the obstacles and oppositions we have had to encounter in this "tight little island" in the course of the past fifteen years or twenty years. And it has often been really heart breaking to find that the legislation of the past seemed so often to have "marshalled its forces" on the side of delay and difficulty, rather than of encouraging healthy and progressive enterprise in the direction of useful public improvements. I do not allege that this has been done of deliberate purpose, but from sheer fatuity as to the probable effects of the legislation. What, for example, could be more soul-depressing than that "standing order" of Parliament which has enabled municipal and other local authorities, antiquated in mind as regards public needs, or, worse still, as competing promoters, or seeing a chance of driving a hard bargain, to withhold assent to great projects of public usefulness, and so prevent (or at least try to prevent) the case being even brought before Parliament. In every other case than tramways—railways, even light railways, gas, water or electric lighting—the power to demand a Parliamentary decision on the merits of the measure has been enjoyed, and in the evidence already given before the Royal Commission the case for the removal of this veto has been abundantly shown. Not without opposition, however, for the gentlemen who have come up to represent the London County Council have urged, forsooth, the maintenance of the veto in their own case, and the refusal of the veto for all others. Most sensible people hope that the London County Council will be disappointed in the result.

But this is an old story, as is also the tale of my own efforts to triumph over all the many difficulties of the London United Tramways in the past ten years. Let us take courage, and to-day content ourselves with the story of accomplished facts, and of achieved success, in the western and southwestern suburbs of London, and especially with the great prospects soon to be opened up, and now to be described.

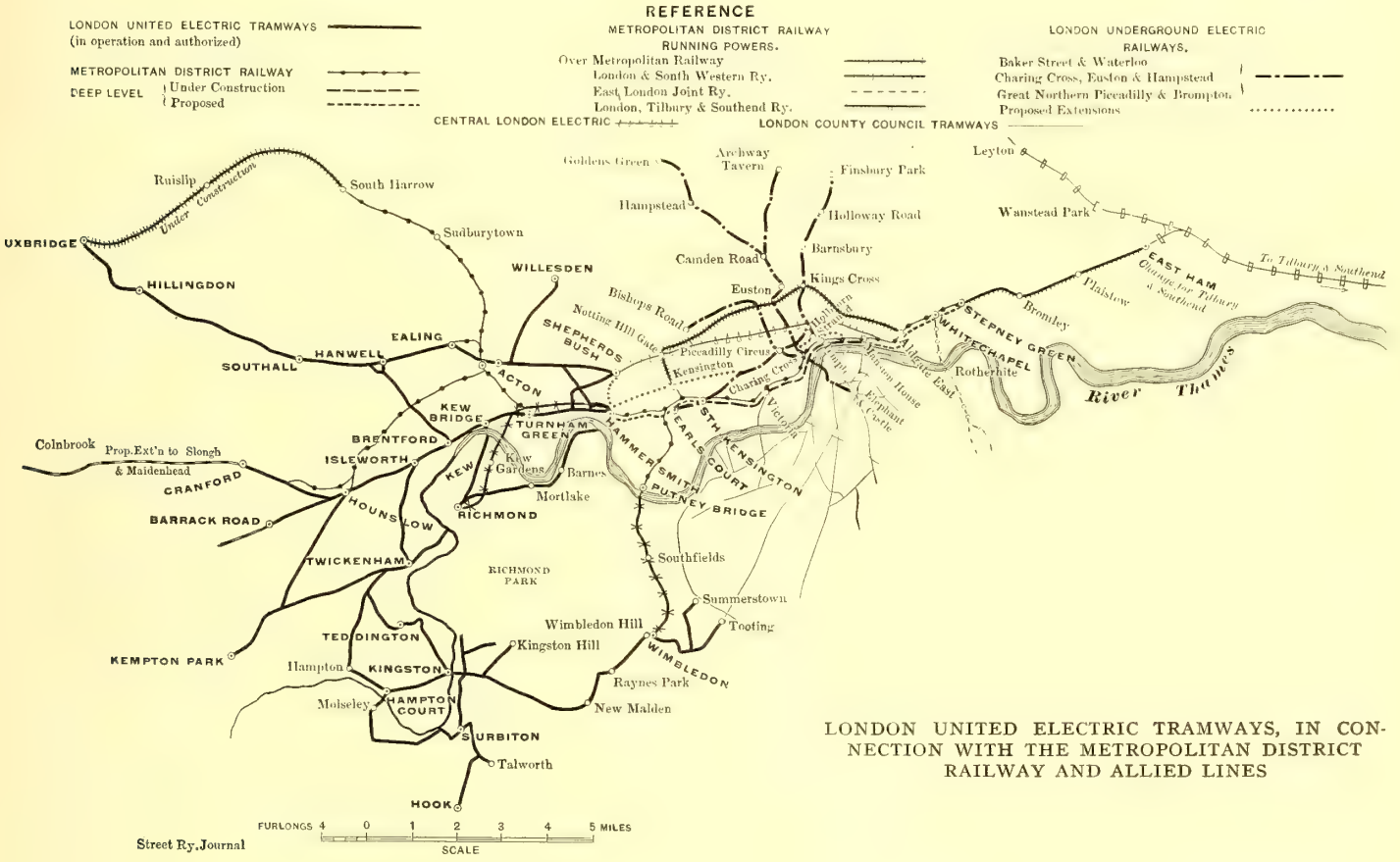
Two years and a half ago the first electric tramway was opened in London. This will, to the American mind, seem almost incredible, but it is nevertheless true. I might have been able to add almost two years to the story, for, in fact, we had a considerable mileage ready for inauguration, and the power house standing idle, the while that the savants talked away about magnetic currents and the observatories. It was not till our then chairman, George White (in whose praise much could be said), determined to beard the treasury in its den, and paid down £10,000 out of our own funds alone, that stagnation was at an end. There was a startling transformation scene on April 4, 1901, and the first 16 route miles of electric tramway in London were brought into successful operation.

The London United Electric Tramways commence at the western terminus of the Metropolitan District Railway—part of the original "underground" line—at Hammersmith, and from the Shepherd's Bush terminus of the Central London (tube) Railway. The 16 miles originally opened are now increased to 30 miles, and we have in progress of construction about forty additional miles. We occupy, and hold against all possible opposition, the finest and historically the most interesting portions of suburban London. Even at the risk of being tedious I must mention the chief points on our lines, as to which see the diagram enclosed. From the terminus at Hammersmith we proceed to Chiswick and Kew, and on the Surrey side, a little beyond the new bridge leading to the world-famous Botanical Gardens there, the line bifurcates, the northern portion leading through the quaint old town of Brentford to the not less famous Hounslow Heath. Extensions of the system are in progress, or authorized, to Cranford, and others projected in the present session as far along the Thames Valley as Slough, Maidenhead and Staines. The southern line seems to include names that might be set to music. The routes include Teddington, Twickenham, Hampton Court, Hampton Wick, Kingston-on-Thames, Bushey Park. When the extensions now in progress are completed we shall get through Kingston-on-Thames to Wimbledon, Surbiton, Esher and the Dittons, and many other places whose names not only embody much of the history, poetry and art of our land, but include centers devoted to our national sports. Our system will soon embrace Richmond, Mortlake, Barnes and other familiar centers of attraction with connection across the new King Edward VII. Bridge at Kew. The lines serving all these districts from Hammersmith are also accessible by cross lines by Goldhawk Road to Shepherd's Bush, and the Askew Road to the District Railway, Hammersmith, from which point also will run our northern branch from Acton, Ealing, Hanwell, Southall, Hayes, Hillingdon, Uxbridge.

If your readers follow me thus far, they will naturally ask—especially when they read that our annual number of passengers already reaches 50,000,000—what do we propose to do to carry those crowds into London, and this really opens up the second chapter of the story. The Metropolitan District Railway occupies the southern section of the original Underground Railway of London. Although hitherto working in unison with the Metropolitan, which occupies the northern half of the circle, the two lines are separate properties, and in course of time both have greatly extended their boundaries. The district line has lately entered into close alliance with the London United Tramways, both systems being joined up in union with the London Underground Electric Railways, now to be noticed, and which are (like the London United Tramways) under the chairmanship of Charles T. Yerkes. The Metropolitan District has several outlying branches to the west of London—besides running powers over other lines—these branches extending to Hounslow, Ealing, Harrow, etc. On the east of London extensions and alliances have also been made, so that there will eventually be a clear unbroken connection from Harrow and Hammersmith right across London from west to east, the eastern termini being Bow and Bromley, with running powers over the city portion of the Tilbury & Southend Rail-

way. A glance at the map will show what all this means, but this is not all or nearly all that the united boards hope to be able to secure for London travelers, as I shall hope to show in the third section of this already lengthy letter. In the meantime there will only remain the necessity for change of carriage at Hammersmith, but this will be facilitated by the fact that a plan is under consideration by which the tramway cars from the surface line may be run underground alongside the platforms of the Underground Railway. There will be through tickets issued over the whole of the combined systems, and as the Underground Railway will be relieved of the smoke and fume which for forty years have stifled and disgusted the people of London, an enormous increase of traffic may be anticipated.

The recent terrible calamity in Paris gives much importance to the statement, made by Mr. Yerkes, as I write, regarding the provision made against fire in the vast system of communi-



LONDON UNITED ELECTRIC TRAMWAYS, IN CONNECTION WITH THE METROPOLITAN DISTRICT RAILWAY AND ALLIED LINES

cation here described. Besides the very careful construction in non-inflammable materials of all the cars and motors to be run on the District Railway and its allied tube railways, all wooden platforms and staircases will be removed and cement-concrete substituted. This will go far to increase public confidence in these lines. For many years it has been my practice to keep the danger from fire always in mind, and Mr. Yerkes gives expression to the only correct view, that the best safeguard from fire occasioned by electricity is the use of fireproof material.

When last year the whole work of legislation, so far as concerns London railways and tramways, was set aside to await the enquiry of the Royal Commission, it was seen that so far as concerned proposals already sanctioned by Parliament, nothing was to be gained by delay. In any case existing facts had to be recognized, and amongst those was the useful fact that lines authorized and already under construction could be energetically proceeded with. Among the "tube" railways in this position were a number of lines controlled by Mr. Yerkes and his fellow-promoters, and which they were far-seeing enough to know could be thrown into and worked in combination with the tramways and railways described in the foregoing paragraphs.

Among lines in this position were the following:

Baker Street & Waterloo.

Great Northern, Piccadilly & Brompton.

Charing Cross, Euston & Hampstead.

Great Northern & Strand.

There were besides, in the hands of the Metropolitan District Railway Company, statutory powers to construct a "deep level" railway, extending from Earls Court to Mansion House, which, as regards general features, ranked alongside the "tube" lines already made, or in process of making, in London.

With these notable evidences of actual advancement, I now proceed to what may be called the third chapter of this letter. The great desideratum in London is now, and has been for many years, a speedy, or even tolerable, means of communication between north and south. The two original underground lines run mainly east and west, even the "Twopenny Tube" runs from east to west. By some extraordinary blindness there was many years ago made a resolution, tacit if not written down (but equally effectual), that no tramway lines should be admitted into the business heart of London; thus effectively checking any free transit north and south. It is true this resolution was made against horse and steam cars, there were then none else, but the prohibition still holds good, and if we may judge by certain evidence already laid before the Royal Commission the short-sightedness which created such a rule still subsists in certain circles in London. Of course, what did not exist could not be converted, and I should just like to hear the comments of any American street railway man on the condition of the traffic at the tram termini at Hampstead Road or Moorgate Street, where passengers have been for the past thirty years incontinently dumped on to the roadway, and then allowed to extricate themselves from the maze of other traffic as best they may.

The tube railways already named, and proposed to be operated as one system with the London United Electric Tramways and the Metropolitan District Electric Railway, are of

such a nature as to supply the long-felt want in the way of north and south connecting lines. The City & South London Tube, which I assisted in promoting some seventeen years ago, and which till the opening of the Central or "Twopenny Tube" in 1900, was the only line of the sort in London, is not in the combination, although it serves a most useful end, and since its extension to Islington, has helped to open up the north with the Surrey side of the water.

The line from Waterloo Station, under the Thames, to Baker Street, is now nearly completed, and will, when opened, offer a most important link in the connection north and south, besides giving much needed access to South London. Next in importance, as partly filling up the long-felt want, are the two lines, Charing Cross, Euston & Hampstead and Great Northern & Strand. Then the Great Northern, Piccadilly & Brompton affords a splendid new railway connection east and west, about midway between the existing underground routes, and interchanging traffic with the north and south connections, already named, while the deep level of the District Railway will supplement and increase the means of travel over a much congested district. When brought into use in combination with the tramways and the converted railway already described, there will be found such an extensive system of through booking and through connection as Londoners have never enjoyed or even dreamed of enjoying. And in nothing of all this is anything being done that need discount or embarrass the labors of the Royal Commission, who will find, in other directions, plenty of scope for good work on behalf of the public of London, and may, moreover, find in those operations which we have been fortunate enough to carry through, an "object lesson" in unified through working of which London stands so much in need.

I fear I have exhausted your patience in the foregoing narrative, so that I cannot go into detail of any other of the numerous schemes being carried out or proposed for London. The County Council has assumed the ownership of extensive tramways, and tentatively they have introduced the conduit system on a part of their line in Surrey—the only authority in Great Britain having the temerity to do so. The unreasoning opposition to the use of the only real economical method of electric traction, that by overhead trolley, which has caused this doubtful method of conduit traction to be introduced, with all its adventitious glamor of superiority and heavy comparative expenditure in construction and operation, is to my mind a huge error, and what may follow cannot be foreseen. Not being wholly free agents, however, the London County Council has been compelled to introduce the overhead trolley over above one-half of the next 50 miles of horse tramways to be converted to electricity. Perhaps we may yet hope to see the Council satisfied of their error and adopting common sense methods hereafter, even to the surrender of their aspirations in the way of amateur tramway administration and management.

J. Clifton Robinson.

CHANGING TO STANDARD GAGE IN TACOMA

Tacoma Railway and Power Company.—Puget Sound Electric Railway.

Tacoma, Wash., Nov. 14, 1903.

Editors Street Railway Journal:

The enclosed is true, and may be an interesting story for you. We are changing to standard gage all our city lines (some 86 miles) in order that the city tracks may conform to the Puget Sound Electric Railway interurban line (third rail system between Tacoma and Seattle), as both lines do a large freight business, interchanging with each other.

W. S. Dimmock, Manager.

[The enclosure referred to by Mr. Dimmock is a clipping from the Tacoma "Daily News" of the same date, under the head, "How Five Miles of Street Railway was Changed from Narrow to Standard Gage in Two Hours." The account is in the breezy style of the daily newspaper reporter, but is, nevertheless, of considerable engineering interest and is reprinted here in full.—Editors.]

(From the Tacoma "Daily News")

"I'll fire any man that ain't sweating in half an hour!"

The speaker was a small, wiry man, but with a squareness about his chin and shoulders that denoted considerable determination. Around him were gathered a number of workingmen. They had just shed their outer wraps ready for the work in hand. Some of them shivered, for the day was cold, with a suspicion for snow in the air.

"Mind what I'm saying now," and the eyes of the leader traveled critically along the line. "This track has got to be ready for the cars in two hours. Them's the orders of the Old Man. Now get in and hustle, and the devil take the hindermost."

And every man in that gang had "turned a hair" in less than half an hour. The same thing held true of nine other gangs, twenty-five men to each gang, and in charge of a foreman. They were strung out along the South Tacoma line from Holy Rosary Church to Thirty-Eighth Street. Like an army well officered all details had been arranged in advance. From General Manager Dimmock to the last man on the tail end of the force, each knew what was expected of him. And the dominating energy of the head officials seemed to electrify the whole line of workmen.

It was a race against time.

Over all of the foremen was General Foreman George Bichsel, mounted on a horse. Wm. Bosworth, the civil engineer, who had laid out the work, was on hand to help things along. Superintendent Franklin had established telephone connections at Thirty-Eighth Street and the South Tacoma end of the line with the car houses. Train Master Haskell was on guard at the car houses, subject to Mr. Franklin's call, and Assistant Train Master J. Russell was the connecting link at Thirty-Eighth Street. Nothing was left to chance.

The civil engineer declared that five miles of track could be standardized in two hours if the men did their part. Each gang had half a mile to cover. The general foreman said his men could do the work in the time named. Mr. Franklin said he would attend to his part and have the standard gage cars ready to run over the track the minute it was ready. But there were some skeptical ones who laughed at the idea. They said both rails of a narrow-gage track could not be changed in that time. They admitted it might be done by moving one rail, but not otherwise.

Every other spike fastening the rails had been pulled in advance so as to lessen the work as much as possible. The men were placed along the track like squads of soldiers along the firing line. The last car came off the old track at 10 o'clock. That was the signal to go to work and a whirlwind of activity agitated the long line into a concentrated energetic force, where every lick told. It seemed like the wildest confusion to the spectator, but from out of the apparent confusion rapidly grew tangible results. The general foreman galloped up and down the line. And woe to the foreman who was not working his men to the best advantage.

The narrow-gage rails were 3 ft. 6 ins. apart. Each rail had to be moved 7¼ ins. for the 4 ft. 8½ ins. necessary for the wide gage track. A line had been spiked the day before on one side of the track the whole distance as a guide line for one of the standard gage rails.

Previous to the starting of the work Superintendent Franklin had had the new South Tacoma standard gage cars brought from Puyallup Avenue and placed on the side track in the order in which they would go out on the track as soon as it was ready. These cars are fitted with four large motors to each car, air brakes and other modern improvements, the same as on those now running on the Point Defiance line. Relief crews were held for the cars to take them out as soon as the track was ready.

Just a minute before 12 o'clock Foreman Bichsel galloped up to Superintendent Franklin and stated that the track was ready for the cars. Mr. Franklin sent a message over the telephone and a wrecking car in charge of Master Mechanic Glenn promptly turned out and slowly and carefully picked its way over the new track, feeling every inch of the space. It served as a pilot for the first passenger car which followed in its rear. The rails bore the strain and the standard gage track was open for traffic. True, it was not in such shape that cars could speed over it and keep on schedule time, but it answered the purpose and was ready in time to handle the immense afternoon and evening traffic on the line. A small gang of men is still busy spiking up the rails and ballasting the road. Just as soon as it is in shape the company will give a fifteen-minute service to South Tacoma.

RECENT ENGLISH ALTERNATING CURRENT MACHINES

A recent trip through the works of Dick, Kerr & Company, at Preston, England, disclosed great activity in the alternating-current and other departments of these large works. This work has compelled the extension of the works by a new bay 450 ft. long and 60 ft. wide. The company's direct-current machinery has been thoroughly described in previous issues, but it may also be a matter of general interest to state that important developments have been carried out in the alternating-current department, including the manufacture on a large scale of machinery and high-tension switchboard gear with alternating-current motors. Among the orders for polyphase plants which Dick, Kerr & Company are completing may be mentioned the following:

London County Council, two 1500-kw alternators, twelve motor generators of 300-kw, and three of 50-kw.

Horndean Tramways, two 200-kw motor generators.

Portsmouth Corporation, two 200-kw motor generators.

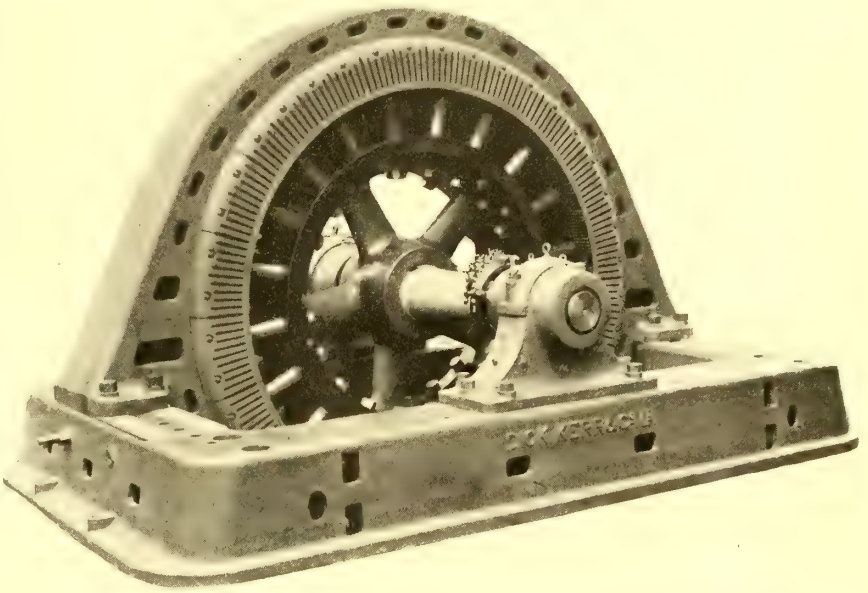
Sydney, one 300-kw alternator, two 600-kw alternators, and six 300-kw motor generators.

Stalybridge, three 500-kw alternators.

Osaka, one 210-kw alternator.

Durban, one 500-kw alternator.

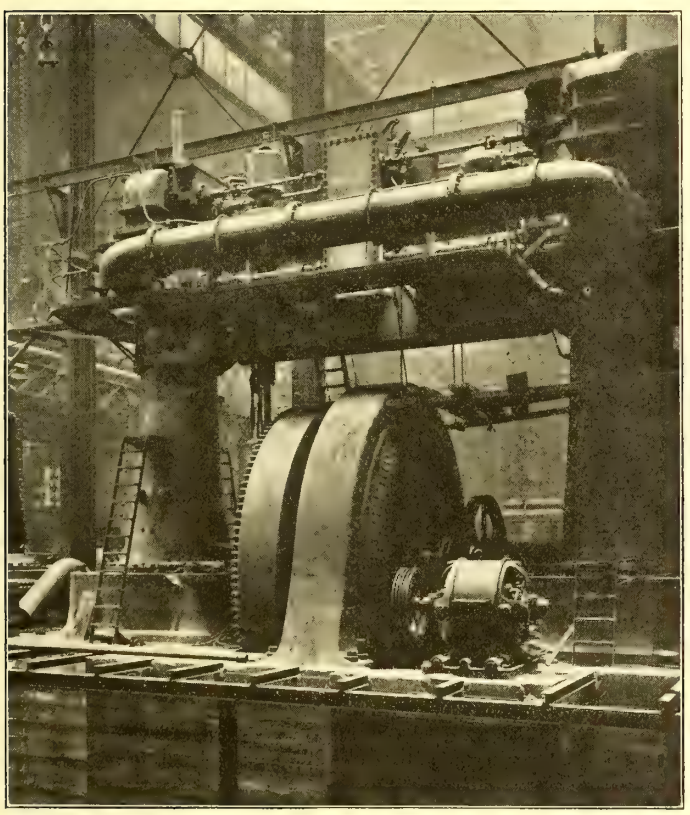
Shawinigan Water & Power Company, Montreal, Canada, one 3750-kw alternator.



4000-KW ALTERNATOR FOR SHAWINIGAN FALLS POWER COMPANY

The following description covers the main features of the standard Preston alternator:

The rotor spider is of cast-iron. The hub is provided with a flange for bolting to the engine fly-wheel, and is pressed on to the shaft by hydraulic pressure, and then key seated. On the spider rim, dove-tailed laminations are fixed by means of machined bolts and cast-iron flanges, the pole pieces being then bolted on. The laminations are built up in such a way that ample spaces are provided at defined positions, the number and size of ventilating spaces being dependent on the width of the stator.



ENGINE AND ALTERNATOR FOR DEPTFORD STATION, LONDON COUNTY COUNCIL TRAMWAYS

The pole pieces are made of laminated steel, held together between two cast-steel end plates of strong construction. The upper part is constructed of T-shape, in order to hold the field coils securely in position. The lower part of the pole piece is dove-tailed for fixing on the rim of the rotor, and is then held in position by means of keys. The removal of field coils is effected by sliding the pole piece from the dove-tailed groove parallel to the shaft without disturbing any other part of the machine, such an arrangement being of extreme convenience not only when it is necessary to remove a field coil but also for the removal of a stator coil. It should be added that the design and shape of the pole pieces gives a distribution of lines of forces in the air gap to produce an approximately sinusoidal shaped wave of e. m. f.

In the winding of the field coils it is obviously a mechanical advantage to use edge-wound strip, and whenever the excitation voltage permits, the field coils are wound with a single layer of copper strip wound edgewise and insulated between the turns by means of specially prepared fibrous material. The external surface of the windings is left practically bare, being protected merely by insulating varnish, which allows a rapid radiation of heat.

The stator frame, even in the largest type, is built in two halves, which are securely bolted together by means of finished bolts. The lower half of the frame is provided with feet which rest upon the foundation bed-plate. In the larger size machines the lower part of the underframe is provided with a special screw for vertical and horizontal centering of the stator relative to the rotating field. The general construction of stator frame is shown in the accompanying engravings.

The frame is made of high grade cast-iron, and is designed to allow complete ventilation of the laminations and at the same time to secure rigidity of the frame.

The core is made up of thoroughly annealed soft iron laminations, the individual laminations being well insulated from each other, to minimize eddy current losses. The laminations are held in position in the frame by means of retaining machined bolts.

The winding is formed of separate coils, thoroughly insulated, having great rigidity and a well-defined mechanical shape. The coils are form-wound, and embedded in rectangular slots, and held in position by wooden wedges, and can be easily and quickly replaced. The connections between the stator coils are

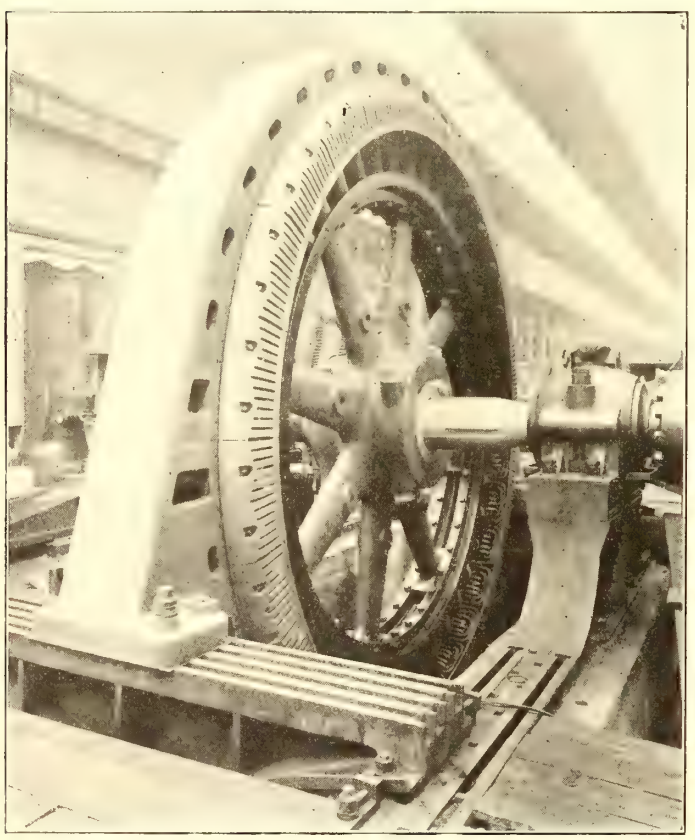
made by means of highly insulated cables, and are easy to trace and locate.

The coils are protected outside the laminations by means of a cast-iron shield, cast in sections, bolted to the frame and easily removable. This shield is of a perforated design, and does not interfere with the ventilation of the stator winding. The collector is composed of rings of suitable metal, fixed to the shaft next to the rotor by means of a spider and insulated pins, ample provision being made for free air circulation around the same.

The brushes are made of carbon, of ample surface, are in duplicate, and can be set and replaced while the machine is running. The brush holders are so constructed that the current will not pass through moving joints or tension springs, and will allow for tension adjustment.

The leads carrying the current from the collector rings to the field coils are firmly attached to the spider of the rotor by means of strong insulated clips, and are of ample capacity.

The question of testing completed alternators is of the utmost importance, and every machine is subject to the closest test before leaving the works. Moreover, it should be stated that if a generator passes the high potential test on the coils which is always imposed, it is extremely unlikely to break down after erection, because the humidity of the atmosphere in the neighborhood of the works is so marked—a condition extremely suitable for the staple industry of the district, viz., cotton spinning, it means that very high insulation is necessary to meet the rigid tests.



1500-KW GENERATOR FOR LANCASHIRE & YORKSHIRE RAILWAY

One of the three machines illustrated herewith is a 1500-kw three-phase alternator, for the electrification of a portion of the Lancashire & Yorkshire Railway, between Liverpool and Southport; the machine is to be coupled to a horizontal engine by Yates & Thom, of Blackburn, and gives its full output at a voltage of 6600 and a periodicity of 25. A second view shows a two-phase alternator, of a capacity of 3750 kw, constructed for the Shawinigan Falls Power Company, Canada. It is to be coupled to an Escher Wyss turbine, running at 180 r. p. m., the periodicity being 30 and the voltage 2200. Quite a number of machines have been built at Preston for export to Canada, and the third illustration shows a 400-kw alternator, recently built at Preston for the Shawinigan Falls Power Company.

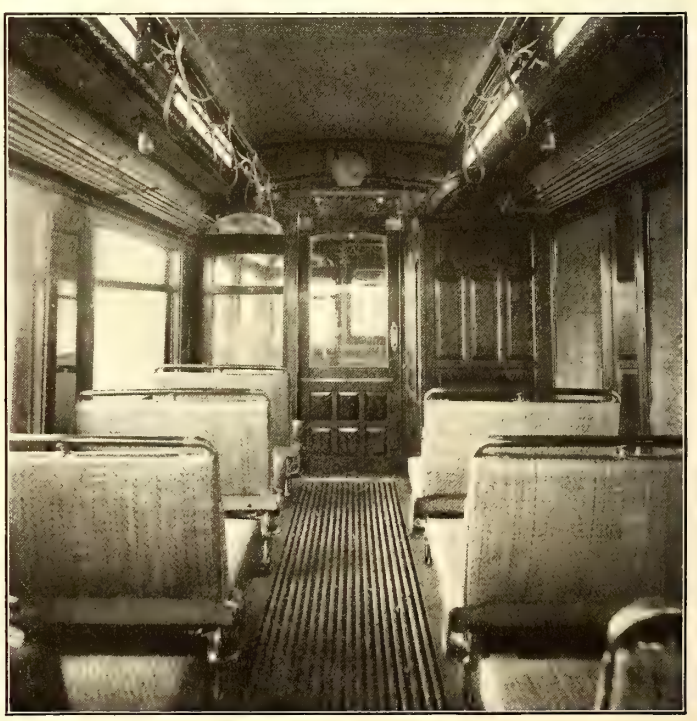
It remains to be added that the alternators have been constructed to the design of A. P. Zani, who, possessing unique experience in alternator design, gained both in the United States and on the Continent, has had the co-operation of a very able staff of engineers.



EXTERIOR OF EVANSVILLE & PRINCETON CAR

EVANSVILLE & PRINCETON CARS

The interurban cars recently turned out by the St. Louis Car Company for the Evansville & Princeton Traction Company, of Princeton, Ind., are of the semi-convertible type built with the familiar steel channel side sills so commonly used in the construction of the long city cars built by this car company. These cars are of the combination passenger and baggage type, the bodies being 31 ft. 4 ins. long and having roofs of steam coach pattern. They are mounted on St. Louis No. 23 trucks.



INTERIOR OF EVANSVILLE & PRINCETON CAR

An exterior and interior view of one of these cars is shown in the accompanying illustrations.

The vestibules have double doors, and, as is usual in steel channel bottom construction, the car platforms are low. The front end is equipped with a cow-catcher or pilot. The saloon is located in the main compartment, the finish is mahogany with brass trimmings and with mirrors in the panels between the windows. Seats in the baggage and smoking compartment are longitudinal, and can be folded up to accommodate baggage. The hot-water heater is placed in the motorman's cab on the front platform.

The operating and controlling equipment consists of four motors, air brakes and St. Louis vertical hand-wheel brakes. The headlights and sand-boxes are also of the builder's manufacture.

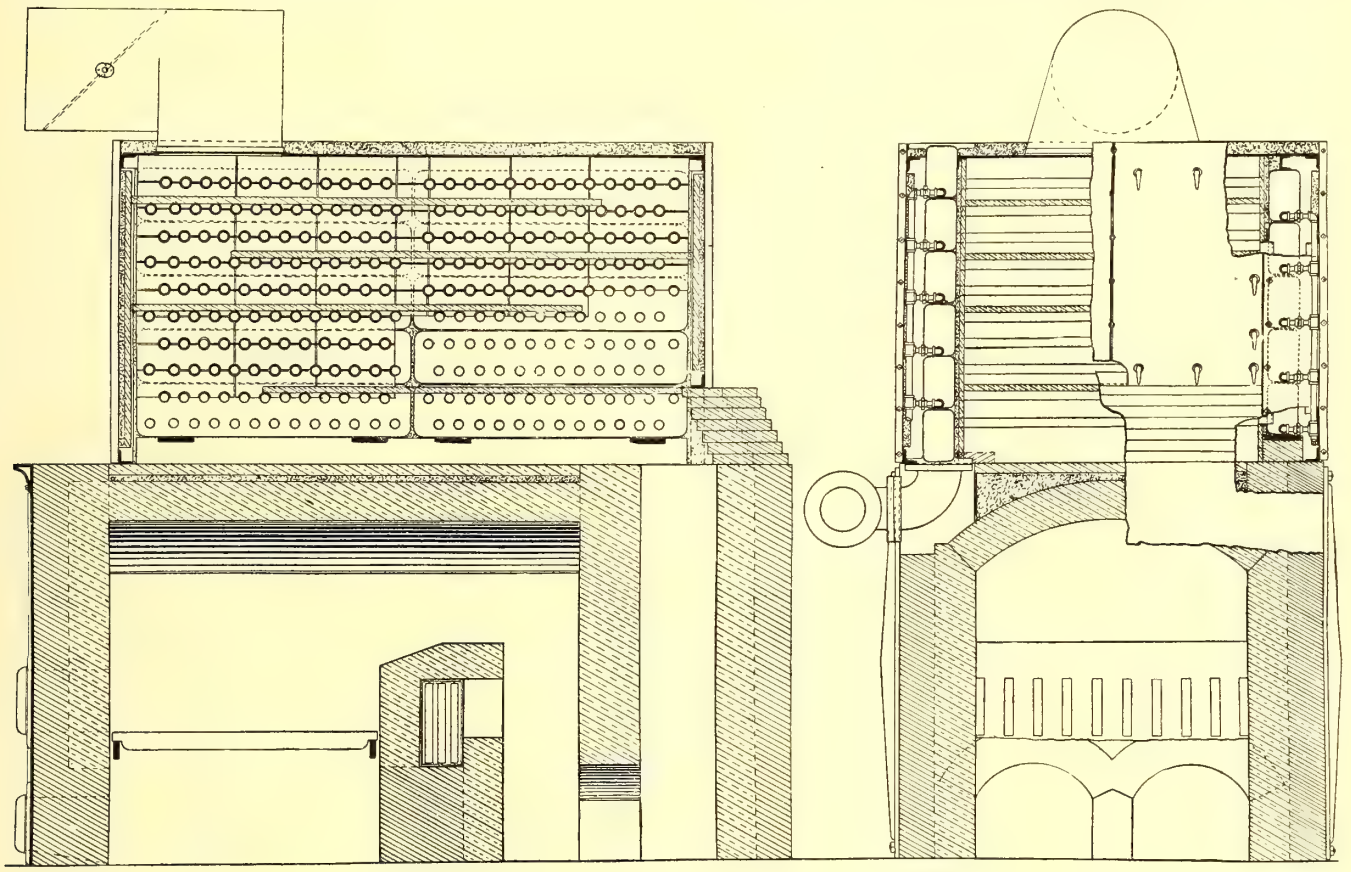
A SIMPLE SUPERHEATER

Although the advantages of using superheated steam have been long recognized the complex and inefficient construction of the early superheaters deterred most engineers from trying to realize in practice the saving indicated by theory. In recent years, however, research has been renewed along this line, and after careful experiments extending over a number of years the American Steam Superheater Company, of Boston, Mass., has perfected a superheater which it believes to be both simple and economical.

The construction of the superheater in the form known as the "separately" or "independently fired" type is shown in the accompanying illustration. It consists of a furnace, surrounded by brick work, combustion and mixing chambers, and a system of straight steel tubes and headers. The steam from the source of supply, entering the topmost header, flows across through the first pass of tubes to the opposite header, from whence it flows through the next lower row of tubes back again, and so on back and forth, finally leaving the bottom header through the outlet connection.

The products of combustion, after leaving the furnace and passing through the brick-lined chambers, traverse the tubes backward and forward and emerge at the top, their direction of flow being guided through the superheater by refractory tile baffle plates. A damper in the smoke bonnet is provided to regulate the flow of the gases, and a register on the side of the setting allows admission of air through the hollow bridge wall for the purpose of tempering the initial heat. It has been found that the desired degree of superheat can be closely maintained under conditions involving rapid fluctuations in the quantities of steam superheated. Drip connections from the lowest point in each header allow the water condensed while the steam is being formed in the boiler to be drawn off. Access is had to the sides and ends of the tube system by the removable casing plates.

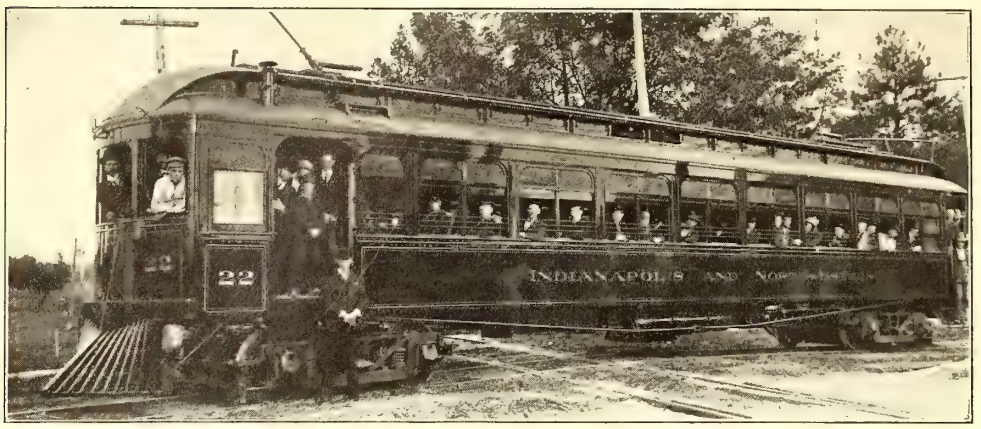
The reverberatory form of furnace, which is practically smokeless, embodied in the design of this superheater, insures high efficiency of combustion, and the ample volume and design of the mixing and combustion chambers promotes the thorough mingling of the products of combustion before they reach the tubes, while the large area of exposed firebrick surface acts as a fly-wheel in absorbing and giving out heat, thus maintaining excellent uniformity of superheat under varying operative conditions.



SECTIONAL SIDE AND END ELEVATION OF SUPERHEATER

The tubes are straight and of standard commercial sizes. They are expanded into the steel headers, and the joints are not exposed but are protected from direct heat of the products of combustion as shown; the superheating surface comprises, therefore, the net exposed tube surface only. In designing the superheater the manufacturers have obtained a construction of headers and tubes which gives perfect freedom for expansion and contraction, a simple and effective heating surface occupying little space and affording a long dwell of the steam in the track of the combustion products, as well as a thorough mingling of all the steam particles at their entry into each succeeding header; this periodic intimate mixing action producing a condition which is a necessary one for rapid and

economic transfer of heat through the tube surfaces. The vertical fire tiles protect the asbestos blocks from any abrading action of the impinging products of combustion, while the non-conducting material between the tiles and the headers affords insulation of the header surfaces. The "dead-air" space between the headers and outer casings of the superheater, combined with the above-described insulation, produces a degree of header temperature in operation but little above that of the steam itself, while the thick non-conducting lining of the casing plates reduces the heat loss by external radiation to a minimum.



EXTERIOR OF INDIANAPOLIS & NORTHWESTERN CAR

Superheaters of this type are delivering steam at temperatures of 600 degs. F., and it is said that the cost of repairs has been practically nil, although the superheaters have been in use for about three years, under frequent and sudden variations of steam. The company is prepared to fill all requirements of capacity, pressure and temperature.

The flexibility of design admits of the superheater being placed in positions where either the floor space or the head room is limited.

COMBINATION INTERURBAN CARS FOR THE INDIANAPOLIS & NORTHWESTERN TRACTION COMPANY

The Jewett Car Company, of Newark, Ohio, has just shipped several combination interurban cars on an order of twenty to the Indianapolis & Northwestern Traction Company. The fine appearance and handsome design of these cars are very striking, and they are equipped with all modern conveniences.

As will be seen from the accompanying floor plan the cars are unusually long, the total length over buffers being 60 ft. 8¾ ins. The other principal dimensions are: Width over posts, 8 ft. 4 ins.; width over all, 8 ft. 8 ins.; total height from rail to top of roof, 12 ft. 9 ins.; distance center of trucks, 40 ft. 7½ ins. The bottom framing consists of six yellow pine sills, the side sills being of compound construction, composed of one piece, 5 ins. x 8 ins., and one piece, 2 ins. x 6 ins., with a 6-in. x ½-in. steel plate sandwiched between. The end sills, cross timbers, buffers, etc., are made of best quality white oak, and are strengthened by steel plates and angles wherever necessary.

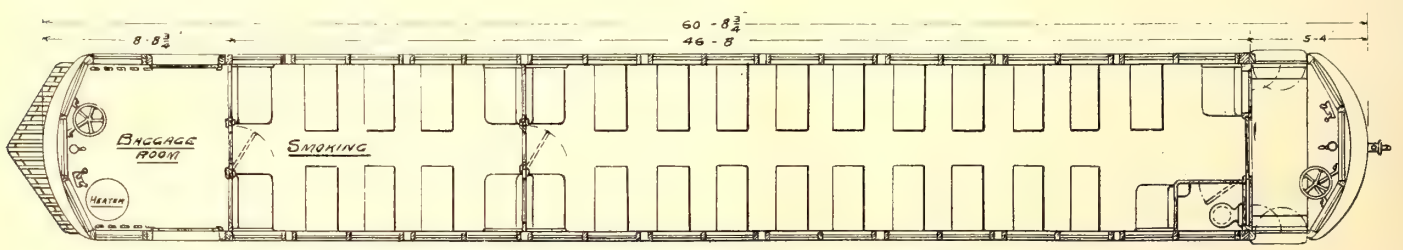
The under truss is made of 1⅜-in. round iron, with a 1½-in. turnbuckle in the center and M. C. B. anchors over the bolsters. The bolsters are made of steel plates and cast fillers, M. C. B. style of construction. The body framing throughout is made of white ash and the construction is of the steam coach type. The vestibules are what is known as the Jewett wide vestibule, with double folding doors at each side and automatic trap-doors over steps.

As will be seen from the accompanying floor plan the cars are divided into three compartments, the main compartment in the rear, the smoking room in the center and the baggage room in the front end. The main compartment is finished in mahogany, the smoking compartment in quartered oak, with a green finish, and the baggage compartment in white ash. The finish in the main and in the smoking compartment is inlaid with neat marqueterie. The ceiling is of the semi-Empire type, and is painted green with gold decorations.

The seats in both main and smoking compartments are of the walk-over type, with high roll-top backs, and are finished with green plush in the main compartment and with green leather in the smoking compartment. They were manufactured by Hale & Kilburn.



INTERIOR OF INDIANAPOLIS & NORTHWESTERN CAR



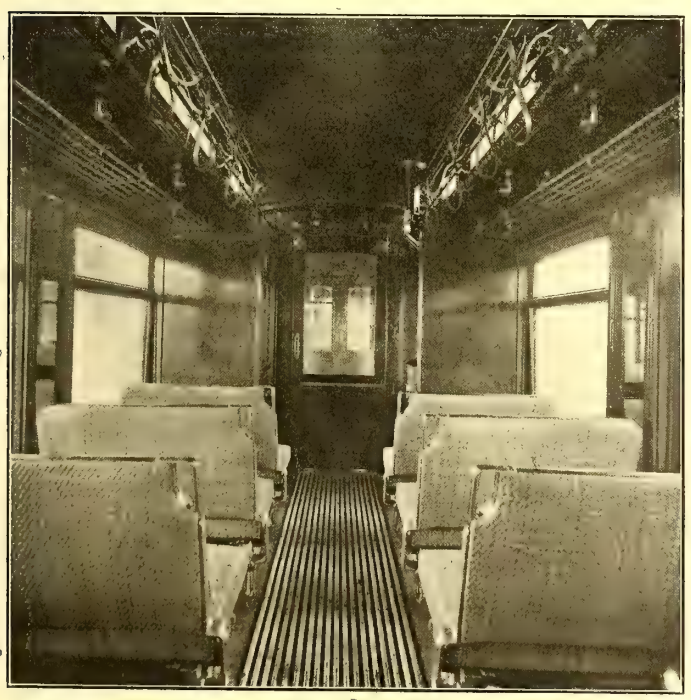
FLOOR PLAN OF INDIANAPOLIS & NORTHWESTERN CAR

Polished plate glass is used throughout the car, except the gothics and deck lights, which are of green opalescent leaded glass. All trimmings are of solid bronze; curtains are of pantasote, of the Forsyth type.

The cars are lighted by forty-five incandescent lamps, which are so placed that they form arches of five lamps each across the ceiling. This gives a beautiful effect and also distributes the lights equally through the car. The lamps are of the frosted globular type.

The cars are mounted on Peckham M. C. B. No. 36-B double trucks, 5½-in. axles, 4¼-in. x 8-in. journals, locomotive-type of wheels, steel tired. The motor equipment consists of four General Electric No. 73, 75-hp motors, geared for 72 m. p. h., operated by the General Electric multiple-unit control system. The cars are heated by the Peter Smith hot-water heater system, and are equipped with Westinghouse straight air brakes, as well as hand brakes, Van Dorn draw-bars, locomotive-type of pilots, Mosher arc headlights, Knutson trolley retrievers, toilet room, water cooler and De France air blast sanders, manufactured by the Newark Air Sand Box Company, of Newark, Ohio. This sander, which has just been put on the market, was described in the STREET RAILWAY JOURNAL of Nov. 7. It is regarded by railroad men, who have cars equipped with it, as an excellent sander for cars with air brake equipments, as it delivers the sand the instant the air is applied directly in front of the wheels, even on the shortest curve.

The circuit breaker, all the switches necessary to operate the car, and all other equipments are located on a switchboard in the motorman's cab. The wires are run in waterproof conduits, and no two wires of different potential are run in the same compartment. There are no joints or splices made inside of these conduits. Rubber cushions are used between trolley boards and roof to deaden the sound of the trolley. The installation of the entire electrical equipment was under the supervision of James Wilkens, master mechanic of the Indianapolis & Northwestern Traction Company. The Indianapolis & Northwestern Traction Company runs from Indianapolis to Lafayette, a distance of 56 miles, via Lebanon and Frankfort,



REGULAR PASSENGER COMPARTMENT OF ROCKFORD & FREEPORT CAR

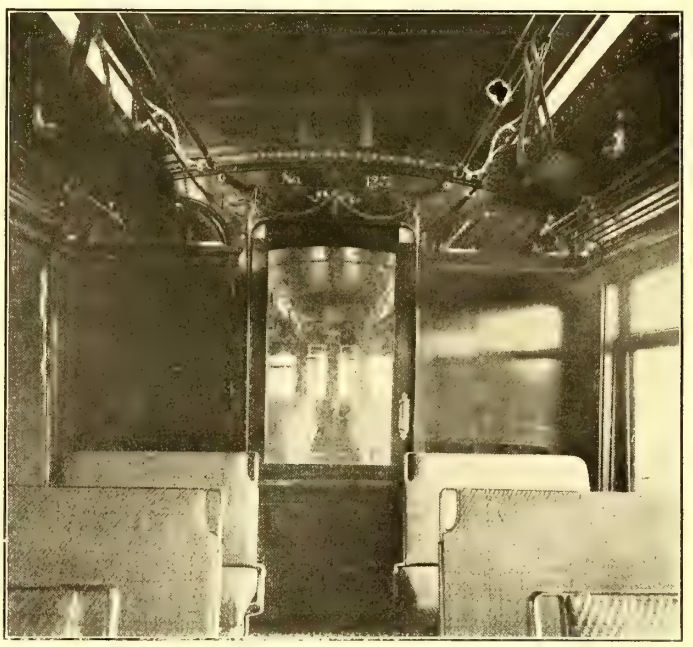
and has a branch from Lebanon to Crawfordsville, 24 miles long. Townseed, Reed & Company, of Indianapolis, are largely interested in this line as well as being the builders of same.

ROCKFORD & FREEPORT INTERURBAN CARS

The St. Louis Car Company has recently completed a number of fine interurban cars for the Rockford & Freeport Electric Railway Company, of Rockford, Ill., which operates an interurban line 29 miles long. Three views of one of these cars are shown in the accompanying illustrations.



CAR FOR ROCKFORD & FREEPORT RAILWAY COMPANY



SMOKING COMPARTMENT OF ROCKFORD & FREEPORT CAR

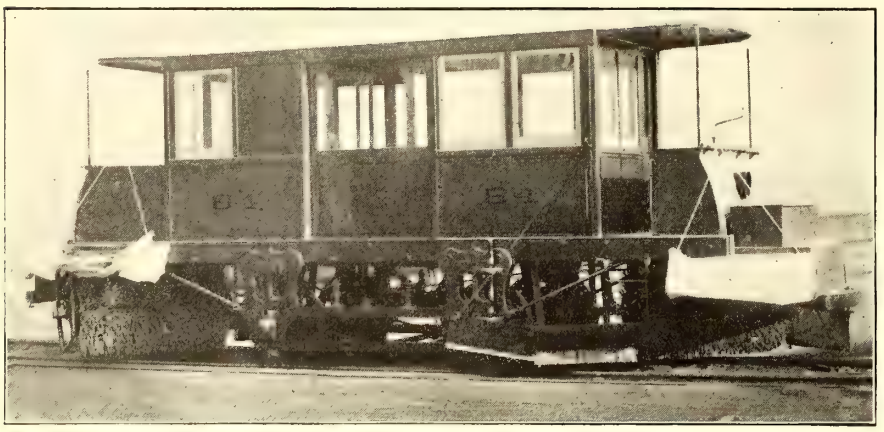
Each car is 34 ft. long over the corner posts, and has two compartments—passenger and smoking. Both sections are furnished with reversible cross seats. The interior finish is of veneered mahogany and is very elegant in appearance. As these cars have very large windows they can be considered semi-convertible. The hot-water heaters are placed in the passenger compartment next to the partition. The main compartment is fitted with bundle racks.

All the cars are built in accordance with the St. Louis Car Company's standard steel-bottom construction, and are mounted on the company's No. 23-B trucks. They are also equipped with the builder's sand-boxes and vertical wheel hand brakes in addition to air brakes.

A recent change in the operation of cars of the St. Louis & Suburban Railway Company has resulted in a division but two blocks long. On this short road one car is operated, one man being employed in the double capacity of motorman and conductor during the day and one at night. Although the operator is motorman-conductor, he collects no money, his duties being to operate the car. It requires only 5 minutes to make the trip.

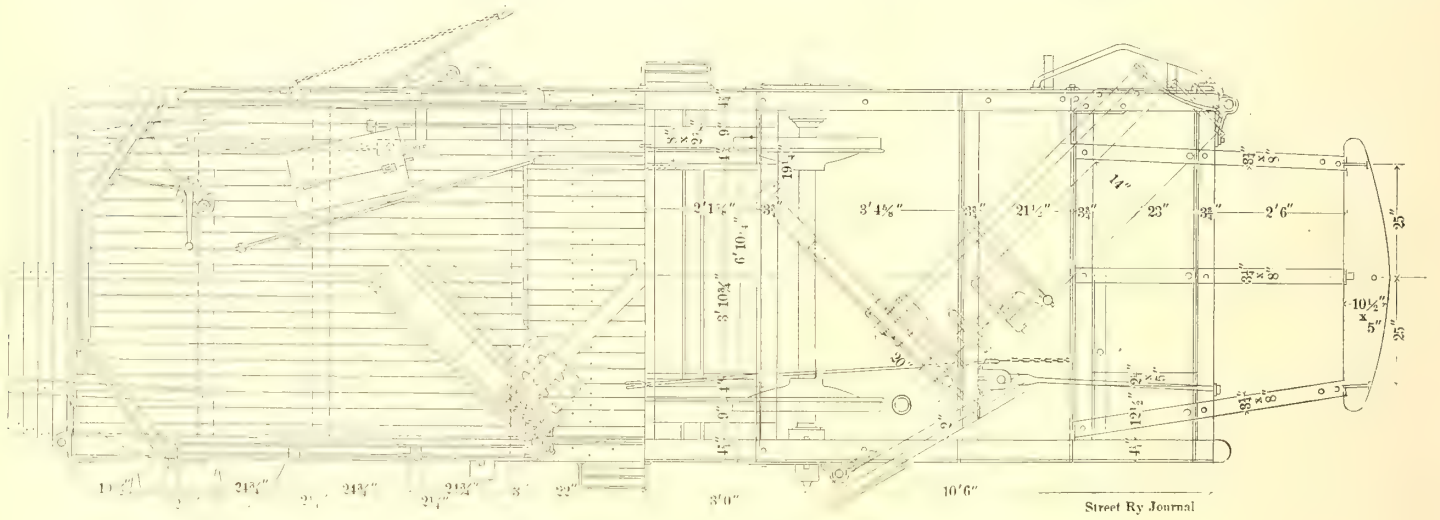
BRILL SWEEPERS FOR THE METROPOLITAN STREET RAILWAY

The Metropolitan Street Railway Company, of New York City, has recently received from the J. G. Brill Company ten



SWEEPER USED BY METROPOLITAN STREET RAILWAY COMPANY

snow-sweepers of the type shown in the accompanying illustration and detail drawing. This is the fourth lot of sweepers built for the company, making in all thirty-three sweepers.



CONSTRUCTION DETAILS OF METROPOLITAN SWEEPER

The plan follows the general practice of the builders, modified in certain details to suit the requirements of the railway company. The Brill sweepers are constructed with short brooms, set at an angle of 45 degs. The brush board and wing, as shown in the cut, extend the clearing area in front of the right forward wheel, and whatever snow may be left by these extensions is thoroughly cleared away by the rear revolving broom. It is claimed that with short brooms set at a more acute angle than long brooms, the snow is thrown clear of the rails instead of ahead, and that they conform better to the curvature of the pavement between the tracks. Open platforms are used because of the crowded condition of New York streets, making it necessary that the motorman should have an unobstructed view of all that is going on about him.

The cabs are 14 ft. 10⅛ ins. over the ends and 2 ft. over platforms. The total length is 28 ft. 8 ins.; width over sheathing, 6 ft. 10¼ ins.; height from track over roof, 11 ft. 4 ins. The side sills are 4¼ ins. x 8¾ ins., plated on the outside with 8-in. x ½-in. steel. Sliding doors with 40-in. opening are provided on either side and single swinging doors at the ends. The window sashes in the sides are stationary, and the sashes in the ends are arranged to drop into pockets. The brooms have a clear sweep of 14 ins. outside the gage line. The diameter of the brooms is 36 ins.; from track to center of draw-bar, 17 ins. A tool box is placed on the extension in front of the dash at one end. The brooms are raised and lowered by convenient levers, and both brooms are operated by a motor situated in the cab. The cars are equipped with Brill brake handles, sand-boxes, alarm gongs, etc. The cars are mounted on gear trucks with 33-in. wheels, 7-in. wheel base, and are equipped with 35-hp motors.

CONVERTIBLE CARS WITH DETROIT PLATFORMS

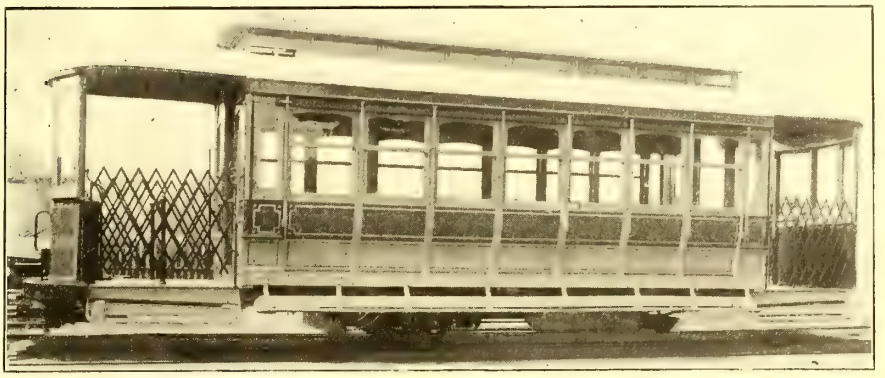
The Springfield Consolidated Railway Company, of Springfield, Ill., has received two convertible cars which are remarkable as being the first convertible cars to be built with Detroit platforms, and one of the few instances of using this type of platform with cars mounted on single trucks. One of these cars is shown in the accompanying illustrations—open and closed. The platforms are equipped with portable vestibules. The entrances have folding gates, which close against the corner posts. The cars are seated for twenty-eight passengers, and are handsomely furnished in ash with ceilings of decorated



OPEN CONVERTIBLE CAR, WITH DETROIT PLATFORM

birch. These cars, which are of the Brill convertible type, were built by the American Car Company, of St. Louis. Their length over end panels is 20 ft. 7 ins., and over crown pieces 32 ft. 7 ins.; from end panels over crown pieces, 6 ft.; width over

sills, 6 ft. 11¼ ins., and over posts at belt, 7 ft. 9 ins.; from center to center of posts, 2 ft. 7 ins.; thickness of corner post, 3¾ ins., and the side posts, 3⅜ ins.; sweep of post, 5 ins. The seats are 31½ ins. long, and the aisles 20 ins. wide. Height of platform steps from rail, 15½ ins.; from step to platform, 12 ins.; from platform to car floor, 8 ins. The running board is 17⅛ ins. from the rail head, and from board to platform is 14¼ ins. Cars are mounted on Brill 21-E trucks, with 7-ft. 6-in. wheel base and 33-in. wheels. They are equipped with two 25-hp motors each. The angle-iron bumpers, platform gongs, brake handles, gates and other specialties are of Brill manufacture.

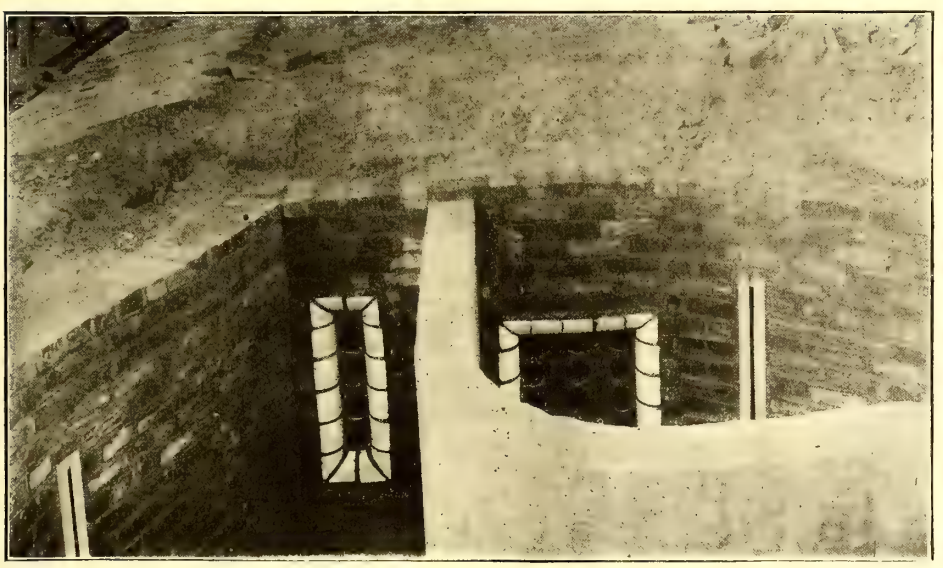


CLOSED CONVERTIBLE CAR, WITH DETROIT PLATFORM

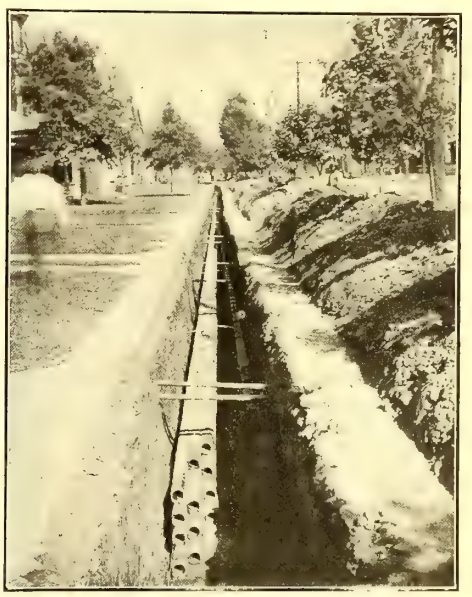
CONDUIT LAYING IN LOUISVILLE

The Louisville Traction Company has lately had installed an extensive conduit system, the contract for which was given to G. M. Gest, of New York, Boston and Cincinnati. This installation was for high-tension and low-tension cables, required over 500,000 ft. of duct, and was completed within ninety days after work commenced. It was equipped throughout with the most modern improvements, including Gest cable hanging racks and terminals.

In one of the accompanying illustrations is shown an uncovered section of the system as laid in one of Louisville's principal streets. The other illustration shows a Gest terminal of the same system. The concrete dividing wall which separates the two series of conduit is shown in relief, one of the conduit series running into a terminal duct and the other ready for continuation. To the right and left of the illustration are the cable hanging slots, one of Mr. Gest's recent improvements for conduit work.



TERMINAL OF CONDUIT SYSTEM, WITH DIVIDING WALL



EXPOSED SECTION OF CONDUIT SYSTEM

CHICAGO CITY RAILWAY FRANCHISE MATTERS

In connection with the publication of the proposed ordinance granting a new franchise to the Chicago City Railway Company for twenty years, the Council sub-committee has made public a letter, addressed by President D. G. Hamilton, of the Chicago City Railway Company, to the Council sub-committee, regarding the matter of compensation, which is left blank in the ordinance. He says in part:

It is proposed to require of the company the best service that money and skill can supply, to keep and maintain the property in the best condition during the entire period, to carry passengers from any one point to any other required, to make transfers with another company to effect this, to operate its cars by methods and in such manner as required by the city, to comply with requirements not only as to the operation but also as to the construction and maintenance; to build and operate, on order of the Council, its tracks into new territory, which may amount to 60 miles of double track; to waive valuable vested rights, and in addition to these requirements to pay compensation estimated at from 3 per cent to 20 per cent of its gross receipts.

Strikes will add largely to the item; increase in insurance premiums and damages to persons and property all tend to maintain, if not to increase the rate.

The company is asked to invest from fifteen millions to eighteen millions in new construction to meet the demands of this ordinance, to stand the depreciation, and to provide for it out of the risks of the future, all out of its present income which is known.

All this the company stands willing to do, to furnish the best of service, new equipment, modern appliances, and insists that these should be considered as compensation.

The estimate which the company submits for the whole period of twenty years is as follows:

Passenger receipts	$197,000,000
Operating expenses	126,987,000
Extensions	6,000,000
Taxes	9,008,000
Reserve	1,090,000
Interest on bonds	14,250,000
Sinking fund	11,347,740
Dividends	21,600,000
Balance for compensation and contingencies	6,716,760

LEGAL DEPARTMENT

CONDUCTED BY WILBUR LARREMORE, OF THE NEW YORK BAR

BOARDING MOVING CARS

The New York Supreme Court, Appellate Division, First Department, rendered a decision in May, 1903, in Fremont vs. Metropolitan Street Railway Company (83 App. Div., 414), which lays down some very wise and just principles. It appeared that the plaintiff's intestate was injured by an accident upon a car of defendant's railway company in Church Street, in the city of New York, during what was known as the "rush hour;" that is, at half-past five in the afternoon; that for twenty minutes previous to the accident the defendant's northbound cars had been blockaded; that, as the second car which passed north, after the raising of the blockade, was crossing Cortlandt Street, or when it had reached a point a few feet north of that street, the intestate attempted to board it. He succeeded in grasping one of the stanchions, but, as the plaintiff's evidence tended to show, the speed of the car was suddenly accelerated at this time, and the intestate slipped or fell from the car, sustaining injuries which resulted in his death.

There was evidence to show that the intestate signaled the motorman of the car to stop by holding up his hand, but it did not appear that the motorman saw him or acknowledged the signal. Several other men had rushed for and succeeded in boarding the car just before the intestate attempted to board it. It did not appear, however, that either the motorman or the conductor saw that the intestate was attempting to board the car. The car was traveling at a speed of 5 miles or 6 miles an hour at the time of the accident, and the motorman testified that when a blockade occurred during the "rush hour" he had orders to pass streets without taking passengers in order to equalize the traffic; that he did not slow up or stop for passengers at Cortlandt Street, and was not aware that any one attempted to board the car there. It was held that, although in view of the fact that other persons were boarding the car at the time the intestate attempted to do so, it could not be said that he was guilty of contributory negligence as matter of law, there was no evidence of any negligence on the part of the defendant, and that the court should have dismissed the complaint. It was further held that in view of the conditions existing at the time of the accident, the defendant could not be held to have been negligent because of the failure of the motorman to stop and take on passengers at Cortlandt Street; and that the fact that the motorman slackened the speed of the car as it was crossing Cortlandt Street did not constitute an invitation to persons to board it while it was still moving, particularly as it appeared that the speed was slackened at a time when people were crossing the tracks. The opinion of the court contains the following language:

"There was no invitation to the decedent to board the car, and there is no evidence that the motorman or conductor knew that he was attempting to board the car at the time the speed was accelerated. The company cannot be held negligent merely because the motorman did not stop to take on passengers at this crossing. It is evident that if, after cars have been delayed, every car in the vicinity of the blockade stopped to take on all passengers, the cars would become overcrowded, and unable to take on passengers at other crossings, and frequent and long stops by the first cars out of the blockade would tend to prolong the effects of the blockade, and not relieve and equalize the traffic over the entire line. It is, therefore, necessary in some circumstances for the cars to pass streets without taking on passengers. The company should not be chargeable with negligence from the mere fact that the speed of the car passing over a crossing at the rate of 4 or more miles per hour is somewhat accelerated at the usual point of stopping to take on passengers, when the circumstances were such that it was not intended to stop at that point. Those who attempt to board a car under such circumstances going at a speed of 4, 5 or 6 miles an hour, in the absence of an invitation by signal or otherwise from the conductor or motorman, assumed the risk of the change of speed and of their ability to get on in safety."

Note.—Communications to this department should be addressed to Mr. Larremore, 32 Nassau Street, New York.

This language is significant, because, among other things, it recognizes the necessity and the privilege of passing streets without stopping to take on passengers. The conductor was inside the car collecting fares at the time of the accident, and the company, therefore, was in a fortunate position so far as the application to take the case from the jury was concerned. Quite frequently in cases of boarding moving cars, a question of fact may be raised sufficient to carry the case to the jury whether there was or was not a sufficient invitation to the passenger to enter.

The intimation of the court that the attempt to board a moving car is not necessarily contributory negligence as matter of law, is unquestionably sound. In Distler vs. Long Island R. R. Co. (151 N. Y., 424), it was held that it is not negligence *per se* for an embarking passenger to step, by direction of the conductor, from a station platform upon a railroad train moving at the rate of 2 miles or 3 miles an hour, when there is nothing to indicate any unusual or peculiar danger. This decision by the New York Court of Appeals involved a sharp controversy on the subject of boarding moving trains, the court distinguishing certain of its previous decisions. The spirit of the reasoning in the Distler case, which applies *a fortiori* to street railroads, is summed up in the following language from the opinion:

"It is a matter of common knowledge that it is of daily occurrence that ordinarily prudent persons safely board a train or car moving at 2 miles or 3 miles an hour. We are not prepared to hold that it is negligence *per se* to step upon a train moving at that rate of speed. To do so would encroach upon the proper province of a jury."

Ordinary observation shows that it is not an uncommon thing for passengers safely to board street cars moving at a low rate of speed, and that conductors not infrequently do not discourage male passengers from making the attempt. Frequently there is danger of a plaintiff being able to testify, or procure testimony, to alleged facts sufficient to require a submission to the jury of the question whether there was direct invitation or practical connivance of the motorman or conductor when an effort to enter a moving car was made. The situation calls for rigid enforcement of the rule that passengers shall not be received until a car has been brought to a full stop. If such rule were strictly enforced, and conductors were able to testify that in practice it never was violated, cases of boarding moving cars might be more uniformly disposed of in favor of street railway companies, as was the Fremont case first above cited.

LIABILITY FOR NEGLIGENCE.

GEORGIA.—New Trial—Newly Discovered Evidence—Diligence.

1. On an application for a new trial on the ground of newly discovered evidence, the movant must exclude any idea of laches, and show affirmatively that by the exercise of ordinary diligence the newly discovered evidence could not have been procured in time for use on the trial.

2. Ordinary diligence is all that is required, by the Code, of a movant for a new trial in the ascertainment of "newly discovered" evidence. The opinion of the majority of the court requires extraordinary diligence. Under the facts disclosed by the record, the movant showed ordinary diligence. The newly discovered evidence would certainly change the result and prevent a robbery under the forms of law, and the trial judge should have granted a new trial.—(Atlanta Rapid Transit Co. vs. Young, 43 S. E. Rep., 861.)

GEORGIA.—Appeal—Harmless Error.

1. When in the trial of an action against a railway company for negligence in damaging property the evidence demands a finding that the defendant was not negligent, an error in the admission of evidence relating to the ownership of the property damaged will not authorize the granting of a new trial.—(Marchman vs. City Electric Ry. Co., 44 S. E. Rep., 992.)

ILLINOIS.—Elevated Railroads—Injuries to Passengers—Negligence—Question for Jury—Evidence—Declaration—Motion in Arrest.

1. Where a passenger on a dark night stepped into an unguarded hole between two cars and the platform of an elevated railroad station, believing it to be the platform of the car she was about to board, and it was shown that the space between the cars was usually protected by a trellis gate, which at the time of the accident

had been removed, the question of the carrier's negligence was for the jury.

2. Where plaintiff boarded a shuttle car on a city street, which connected with an elevated railroad, and plaintiff was carried to a platform station erected between two elevated tracks, where she waited for the elevated train, on which she intended to continue her journey, and she was injured by falling between two cars as she attempted to board the train, she was a passenger, and entitled to the exercise of more than ordinary care by the carrier.

3. In an action for injuries to a passenger, it was not error to permit a pencil drawing of the cars, showing the space where the injury occurred, to be used for the purpose of aiding the jury in understanding the testimony, though such drawing was not strictly accurate, where it was neither introduced in evidence, nor taken by the jury to its room.

4. Where a declaration set forth the relation of passenger and carrier, and averred that it was defendant's duty to use due care in providing suitable gates or other safeguards to prevent persons from falling between the cars, and that defendant failed to do so, by reason of which plaintiff was injured, the declaration was sufficient to support a verdict for plaintiff, as against a motion in arrest of judgment.—(Lake Street El. Ry. Co. vs. Burgess, 66 N. E. Rep., 215.)

ILLINOIS.—Negligence—Street Cars—Warning at Street Crossing—Evidence—Appeal.

1. In reviewing the refusal of the trial court to instruct the jury, at the close of all the evidence, to find a verdict for the defendant, the Supreme Court will not review the evidence to determine its weight, but only examine to determine whether there was any evidence fairly tending to support the plaintiff's cause of action.

2. Where plaintiff, while crossing a street at a regular crossing, was struck and injured by defendant's street car, and she testified that she heard no warning given of the approaching car, and she could have heard it if one had been given, and other witnesses heard no warning given, a finding that defendant was negligent, affirmed by the Appelate Court, will not be disturbed.—(Chicago City Ry. Co. vs. Loomis, 66 N. E. Rep., 348.)

ILLINOIS.—Street Railroads—Injuries to Passengers—Pleading—Evidence—Instructions—Negligence—Contributory Negligence—Boarding Moving Car—Signaling to Stop—Intoxication—Harmless Error.

1. A count for personal injuries, alleging that defendant did not stop the car after plaintiff had given notice of his intention to take passage, in consequence of which, while he was attempting to take passage, he was thrown to the ground, did not state a cause of action, as the refusal to stop and accept plaintiff as a passenger was not the proximate cause of the injury alleged.

2. In an action for injuries received by being thrown from a street car, evidence examined, and held sufficient to warrant the submission of the question of defendant's negligence to the jury.

3. On an issue of the negligence of a street railway in allowing plaintiff to board a car while slowly passing over the tracks of a steam railroad, the admission of evidence that it was customary for people to get on the cars at the crossing while in motion, though error, was not prejudicial to defendant; such evidence merely showing that people got in the cars while in motion, where there was no stopping place and no reasonable man would expect them to stop, and such fact not having been made the basis of any instruction as to the law.

4. It is not negligence, as a matter of law, for a passenger to get on a street car when it is in motion; but the question is one of fact, depending on the rate of speed of the car and all the circumstances.

5. In an action for injuries received by being thrown from a street car, which plaintiff had boarded while it was in motion, an instruction that if plaintiff did not signal to stop, and the motorman did not slacken the speed or stop, to invite plaintiff to get on, the jury must find for the defendant, was properly refused, where the evidence showed that a large number of people approached the cars and got on with the knowledge of the conductor and motorman, as, plaintiff being the last one to get on, they had notice of his intention.

6. An improper instruction as to the effect of intoxication as bearing on the question of contributory negligence was harmless, where the evidence would not justify a finding that plaintiff was intoxicated at the time of the accident.—(South Chicago City Ry. Co. vs. Dufresne, 65 N. E. Rep., 1075.)

ILLINOIS.—Carriers—Injuries to Passengers—Negligence—Pleading—Variance—Negligence Not Alleged—Damages—Evidence—Hearsay—Trial—Misconduct of Counsel.

1. In an action against an electric railway company for personal injuries, plaintiff's evidence that she was injured, in stepping from the car to the platform, by a lurch in the train, tended to support the declaration, alleging that the train was suddenly started, and plaintiff thereby thrown from the train onto the platform.

2. A party cannot recover upon a cause of action not alleged in the declaration.

3. A declaration in an action against an electric railway company for injuries, alleging negligence in defendant in violently starting its train while plaintiff was about to alight therefrom, is not supported by proof that the train was started slowly and smoothly, while the gates were open, and before plaintiff had time to alight.

4. In an action for personal injuries, where there was a conflict as to the character and extent of the injury sustained, it was error to permit a servant of plaintiff to testify that plaintiff "complained of pain in her right hip."

5. In an action for personal injuries, where there was a conflict as to whether the injury sustained extended to the right hip, it was error to permit plaintiff's counsel to intentionally misquote a deposition of a physician, so as to include the words "the right hip," in his recital of plaintiff's statements regarding her injuries. —(Lake Street Elevated Ry. Co. vs. Shaw, 67 N. E. Rep., 374.)

ILLINOIS.—Street Railroads—Injury to Cyclist—Evidence—Questions for Jury—Instructions—Use of Street—Presumption of Care—Damages.

1. A street car company had two tracks on a street. All northbound cars carrying passengers ran on the east track, and all southbound cars on the west track. About midnight each night two cars used on another line were run north on the west track to the car house. The tracks were 4 ft. 10 ins. apart. Decedent, about 11:40 p. m., was riding a bicycle, going north between the tracks, when a car on the west track, going in the same direction, overtook him. The car was running at from 12 miles to sixteen miles an hour. When within 25 ft. or 35 ft. of the man the motorman rang his bell, when the man turned toward the west track, evidently supposing the car was on the east track, and was killed. The street outside the car tracks was impassible for a bicycle on account of snow. Held, that the questions of negligence of the motorman and contributory negligence of the deceased were for the jury.

2. Evidence of the custom of running all northbound cars on the east track and all southbound cars on the west track was admissible, though there was no allegation that running the car northward on the west track was negligence.

3. An instruction that "one who uses the public streets has a right to expect from others using the same highway ordinary prudence and care to avoid accidents, and to rely upon that presumption in determining their own manner of using such street," gave the impression that decedent had a right to rely on the continued observance by the street car company of the custom of running all northbound cars on the east track, and that in doing so he exercised ordinary care as matter of law, and invaded the province of the jury.

4. Where, in an action to recover for negligence resulting in the death of a husband and father, there was no evidence relating to his services in the care of his family, or in the education of his children or fitness for such purpose, an instruction that, in assessing the damages, the jury should take into consideration the value of his services and attention in the care of his family and education of his children, was error.—(North Chicago Street Ry. Co. vs. Irwin, 66 N. E. Rep., 1077.)

ILLINOIS.—Street Railways—Driving on Tracks—Injuries—Negligence — Evidence — Sufficiency — Instructions — Inferences.

1. Plaintiff was driving on defendant's street railway tracks in a covered wagon. A car, approaching from the rear, sounded its gong when within about 25 ft. of him, whereupon he at once attempted to turn to one side, but was struck by the car, which had not slackened its speed, before he succeeded in getting off the tracks. Held, that the question of defendant's negligence was for the jury.

2. An instruction that the jury might "find any fact to be proved which they think may be rightfully and reasonably inferred from the evidence" did not give the jury too much latitude in drawing inferences, or authorize them to draw illogical inferences.—(North Chicago Street Ry. Co. vs. Rodert, 67 N. E. Rep., 812.)

ILLINOIS.—Carriers—Street Railroads—Injuries to Passengers—Position — Negligence—Care Required—Instructions—Refusal of Requests.

1. Where, in an action for death of a passenger while riding on the running board of a street car by his coming in contact with the sides of a tunnel, the declaration contained five counts, and there was no evidence in support of at least one of them, it was error to give a general instruction authorizing the jury to find for plaintiff, if they found he had made out his case as set forth in his declaration, and to refuse proper instructions, asked by defendant, explaining the issues, and that if the jury believed there was no negligence in the management of the train as alleged, or

that the negligence alleged in the other counts had not been proved, their verdict should be for the defendant.

2. In an action for the death of a passenger while riding on the running board of a street car by being struck by the sides of a tunnel, the carrier was not guilty of negligence as a matter of law in permitting deceased to ride in such position.

3. An instruction that a carrier of passengers is bound to exercise the utmost and highest degree of care, skill, and diligence for the safety of passengers that is consistent with the mode of conveyance employed, was erroneous for failure to limit the care required to such as was consistent with the practical operation of the railroad.—(North Chicago Street Ry. Co. vs. Polkey, 67 N. E. Rep., 793.)

ILLINOIS.—Servant—Injuries—Fellow Servant—Question for Jury—Incompetency—Manner of Proving—Assumption of Risk—Appeal—Review of Evidence.

1. The judgment of the Appellate Court is final as to the facts where there is any evidence tending to support it.

2. Whether servants are fellow servants is, as a general rule, a question for the jury.

3. A servant does not assume the risk resulting from the employment of an incompetent fellow servant unless he has notice of such incompetency.

4. Incompetency of a motorman may be shown by proof of his general reputation as to prudence in running motor cars, and by evidence that he had run past signals, had jerked the train he was pulling, and had been laid off and reprimanded by the master for carelessness in the performance of his duties.—(Metropolitan West Side Elevated Ry. Co vs. Fortin, 67 N. E. Rep., 977.)

INDIANA.—Carriers—Street Railroads—Injury to Passengers—Contributory Negligence—Presumption—Time to Alight—Continuance — Admissions — Evidence—Conclusions—Complaints of Pain—Instructions—Issues—Special Verdict—Judgment Notwithstanding General Verdict—Harmless Error.

1. An application for judgment on special interrogatories notwithstanding a general verdict cannot be sustained unless the facts found by the special verdict are so repugnant to the general verdict that both cannot be true under any conceivable state of facts provable under the issues.

2. Nothing but the pleadings, the general verdict, and the answers to special interrogatories can be considered in determining the force of such special interrogatories on a motion for judgment notwithstanding the general verdict.

3. Where plaintiff was injured by the premature starting of a street car while he was attempting to alight, and the jury specially found there was no evidence that plaintiff could have released his hold on the car and have avoided being dragged, the court could not presume, on a motion for judgment notwithstanding a general verdict in plaintiff's favor, that he could have released his hold by the exercise of ordinary care, and therefore was guilty of contributory negligence.

4. Where an old and infirm passenger was thrown down by the premature starting of a street car, and in the fall caught hold of the running board of the car, and was dragged a considerable distance, his act in so doing, having been under an impulse created by a sudden danger, did not constitute contributory negligence.

5. Where plaintiff, in order to prevent a continuance, admitted that certain witnesses, if present, would testify to the material facts set forth in defendant's affidavit, such admission did not preclude plaintiff from objecting that statements of conclusions of the witnesses, contained in the affidavits, should not be read to the jury.

6. Where plaintiff testified through an interpreter, the overruling of an objection to a question asking the witness to state whether or not his foot was twisted or wrenched at the time of the injury, on the ground that it was leading, was not reversible error.

7. In an action for injuries, evidence that plaintiff complained of pain to his wife is admissible, though the complaints were not made at the time or shortly after the accident.

8. Where the sole allegation of negligence in an action for injuries was the untimely starting of a street car before plaintiff had time to alight, an instruction that, if defendant's employees failed to assist plaintiff in leaving the car, defendant would be guilty of negligence, was error, though evidence on such issue was received at the trial without objection.—(Indiana Ry. Co. vs. Mauier, 66 N. E. Rep., 156.)

INDIANA.—Street Railways — Cyclist—Injuries—Contributory Negligence—Evidence.

1. One riding a bicycle so near a street car track as to be in danger from passing cars failed, for a distance of 300 ft., to look behind him, though he knew that the cars came frequently from such direction. There was nothing to prevent him from riding further from the track, except a roughness in the asphalt pavement. He was in full possession of his senses, and had control of his bicycle. He was struck by a car running at full speed, which had given no special warning of its approach, but which, had he looked or listened, he could have seen or heard at a distance of 300 ft. It was not shown what indications he gave that he could not or would not turn aside to avoid the car. Held, that he was guilty of contributory negligence.—(Robards vs. Indianapolis Street Ry. Co., 66 N. E. Rep., 66.)

INDIANA.—Carriers—Street Car Company—Injury to Passenger—Instructions—Proximate Cause—Theories of Action—Harmless Error—Right to Alight From Moving Car—Preservation of Exceptions.

1. In an action for injury to a street car passenger, the court instructed that the defendant would be responsible for "the slightest neglect resulting in an injury," etc. Held, that, in view of the following instructions that there could be no recovery unless the injury was shown to be the direct and proximate result of defendant's negligence, the first instruction was not erroneous for failing to limit defendant's liability to such neglect as was the proximate cause of the injury.

2. In an action for injury to a street car passenger, the court instructed that the gist of the action was an injury by the company's negligently starting the car while the passenger was alighting; that, to warrant a recovery, it must be shown that the passenger was injured as the proximate result of the negligent starting of the car; that it was for the jury to determine whether the defendant was negligent in the alleged starting of the car, and whether the injuries were caused thereby; and that they might consider whether the car was fully stopped, and whether there was a sufficient length of time for the passenger to safely alight, and whether the car was so crowded as to make it difficult for her to depart; that it was the company's duty to stop its cars long enough, and to provide facilities, for a safe alighting; and that, if the car did not start while the passenger was getting off, but that she fell from some other cause, plaintiff could not recover. Held, that the instruction was not objectionable, as confused and contradictory, in that it included two theories of plaintiff's cause of action.

3. The court instructed that, if the car had stopped for her to alight, but started again before she could do so, and while she was still in a position of safety, and the car had attained a dangerous rate of speed, as she knew, or might have known, it was her duty to remain on board until the car was again stopped; and, if she attempted to alight while the car was moving at such dangerous rate of speed, plaintiff could not recover because the car had been prematurely started. This instruction was given in view of testimony that the passenger left her seat after the car had started, and stepped off while it was running at its usual rate of speed; but the jury found that she was within one step of the ground, and not in a place of safety, when the car started. Held, that, in view of the finding, any error in the instruction as to the passenger's obligation to know the movement of the car was harmless.

4. Defendant's requested instruction that the mere fact that the car started before the passenger had time to alight "would not give her the right to jump from the car while it was in motion" was modified by substituting, "would not give her the right to alight while the car was going at a rate of speed which would make it dangerous to do so." Held, that the modification was proper, as it is not true that a passenger has no right under any circumstances to attempt to get off a moving car.

5. Any error in the court's interrogation of a party's witnesses cannot be reviewed where no objection was made or exception saved.—(Indianapolis Street Ry. Co. vs. Hockett, 66 N. E. Rep., 39.)

INDIANA.—Street Railway—Injury to Passenger—Contributory Negligence—Question for Jury—Pleading—General Denial—Issues—Bill of Exceptions—Signature—Designation of Court—Judge—Judicial Notice.

1. Where a passenger on a street car was about to alight, but was still in a safe position when the car suddenly started, and in getting off while the car was moving was injured, the question whether she exercised reasonable care in continuing her attempt to alight was for the jury.

2. Where, in an action against a street railway for injuries, defendant answered by general denial, and there was no evidence, positive or circumstantial, that defendant owned or operated the road or car on which plaintiff was a passenger, a judgment in her favor was error.

3. Burns' Rev. St. section 638a, provides that, to make the evidence a part of the record on appeal, it shall be sufficient if the transcript contains the bill of exceptions embracing all such evidence, provided it shall appear that such bill was presented to and signed by the proper trial judge and filed within the time

allowed by law. Section 1395 provides for the creation, in certain counties, of a "superior court," and section 1396 that the seal of such court shall contain the words "Superior Court of ——— County." The record shows that M. presided at the trial, and that the bill of exceptions containing all the evidence was duly presented to and signed by him. The caption of the bill of exceptions was: "State of Indiana, Marion County—ss. In the Superior Court," and it was signed, "M., Judge of Marion Superior Court." It bore the file mark of the clerk, and was included in the transcript under the certificate of the clerk attested by the seal of the "Superior Court of Marion County." Held, that the name of the court appeared with sufficient accuracy; hence the evidence was properly in the record.

4. The court will take judicial notice that a certain person was one of the judges of the superior court of a certain county at the date of the signing of a bill of exceptions.—(Indianapolis St. Ry. Co. vs. Lawn, 66 N. E: Rep., 508.)

INDIANA.—Street Railways—Injury to Passenger—Negligence—Instruction — Relevancy—Evidence—Res Gestæ—Declaration of Bystander.

1. Where, in an action against a street railway company, the only negligence complained of was the violent starting of the car without warning while plaintiff was on the running board, getting off, a requested instruction that the plaintiff assumed all the risk of stepping or walking over the street in the condition it was then in was properly refused as not germane.

2. In an action against a street railway company for injuries to a passenger owing to the sudden starting of the car while she was getting off, it was error to permit a witness who had witnessed the accident to testify that she stated to the conductor, just after the passenger fell, that, if the car had stopped and let her off, it would not have occurred; such declaration not being res gestæ.

3. Where, in an action against a street railway company for injuries to a passenger, the chief question was whether the car stopped until after the plaintiff had alighted, and she stumbled in the street, or whether the sudden movement of the car threw her to the ground, there were a greater number of witness for defendant than for plaintiff, but a witness of the accident was erroneously permitted to testify that immediately after the accident the witness stated to the conductor that if the car had stopped it would not have happened, it was prejudicial error.—(Indianapolis St. Ry. Co. vs. Whitaker, 66 N. E. Rep., 433.)

INDIANA. — Carriers — Expulsion of Passenger — Defective Transfer Ticket—Justification—Evidence—Sufficiency.

1. Where a passenger is aboard a street car without the proper transfer ticket, which is due to the mistake or fault of the conductor of the car from which he was transferred, and not to the fault of the passenger, the conductor in charge of the car must accept the reasonable explanations of the passenger in regard to the transfer in dispute.

2. In an action against a street railway company for the forcible expulsion of a passenger from one of its cars because of defects in transfer ticket, evidence considered, and held to show that the expulsion was unjustifiable.—(Indianapolis St. Ry. Co. vs. Wilson, 66 N. E. Rep.)

INDIANA.—Street Railways—Negligence—Newsboys Riding on Cars—License—Ordering Boy Off Car—Injuries—General Verdict—Special Findings—Inconsistency.

1. In an action against a street railway the complaint alleged that plaintiff, an infant, went upon the running board of one of defendant's open cars to sell a newspaper, when the conductor commanded him to jump off, and approached him threateningly, so that plaintiff slipped from the running board, and was injured; that the car was running at considerable speed at the time; and that it was a custom of the railway company to permit boys to go upon the cars to supply passengers with newspapers. There was a general verdict for the plaintiff, but the jury found specially that the conductor had ordered plaintiff to get off the car before it started and again just after it started. Held, that such findings were not inconsistent with the general verdict, since they did not find that the boy heard or could have heard the command.

2. Where, according to general custom, newsboys are permitted to go on street railway cars to sell and deliver papers, a boy is not a trespasser while on a car selling a paper, unless his right to remain on the car has been terminated by reasonable notice.

3. A command given by a conductor to a newsboy on the car to get off, which he did not hear, would not operate to terminate his right to be on the car.

4. Where, after a car had started, the conductor ordered a boy to leave the car while it was running at a hazardous speed, and under the influence of fear, while attempting to comply with the order, the boy was injured without fault on his part, the railroad was liable.

5. The question whether it was safe for a boy to alight from a car at the command of the conductor while it was running at a speed of some 4 miles to 5 miles an hour was a question of fact for the jury.

6. Where a conductor orders a boy to leave a moving street car, and, being frightened at the threatening manner of the conductor, he sustains injuries while attempting to alight, the expulsion from the car is the proximate cause of the injury.

7. It appearing that the conductor did not intend to injure the boy, his conduct was negligent, but not wrongful.—(Indianapolis St. Ry. Co. vs. Hockett, 66 N. E. Rep., 106.)

INDIANA.—Street Railways—Defect in Street—Injury to Pedestrian—Special Interrogatories—Consistency with General Verdict—Evidence—Harmless Error—Service of Summons—Presumption as to Party Served.

1. In the absence of a showing to the contrary, it is presumed that summons was served on the defendant named in the complaint.

2. Where a street railway company, after tearing up a brick paved street to lay its tracks, replaces the paving, a pedestrian has a right to presume that the street is safe, and, in the exercise of due care, to act upon such presumption.

3. In an action by a pedestrian against a street railway company for injuries from a defect in a street, the jury found a general verdict for plaintiff, and by its answers to interrogatories found that the company had relaid the brick paving after constructing its tracks, but had not set the bricks as close together as practicable, nor tamped down the gravel solidly enough; that the street was lighted, and near the crossing where the plaintiff was injured a red lantern was burning; that plaintiff lived in the neighborhood, and knew the nature of the work being done, and had seen the red lights, and understood their significance; that she crossed the street without heeding the conditions surrounding her, or looking to see where she was walking. There was no signal light on the street crossing itself, and nothing to warn plaintiff that the crossing was dangerous. There was evidence that plaintiff could not see the loose bricks which caused her injury. Held, that the answers to the interrogatories were not so inconsistent with the general verdict as to necessitate a reversal.

4. Where a street railway company is sued by a pedestrian for injuries occasioned by a defect in a street, and the jury find that red signal lights were burning at the place of accident, the exclusion of a witness' testimony that he had not observed their absence is harmless error.

5. Inasmuch as a street railway company, which tears up a paved street to lay its tracks, and replaces the paving, is bound to know whether it has restored it as nearly as practicable to its former condition, any error in the admission of evidence offered by a pedestrian, suing the company for injuries from a defect in the street, to show that the company was notified of its condition, is harmless.—(Union Traction Co. of Indiana vs. Barnett, 67 N. E. Rep., 205.)

INDIANA.—Street Railroads—Injury to Cyclist—Contributory Negligence.

1. Where plaintiff, riding a bicycle near a street car track, was struck by a car, and, if he had looked and listened, would have known of its approach, and could have put himself out of danger up to the instant of the injury, the rule that a plaintiff's conduct is not contributory negligence, if, notwithstanding his negligence, the injury could have been avoided by defendant's ordinary care, does not prevail, as his negligence continued up to the moment of the injury, and was the contributing cause.—(Robards vs. Indianapolis St. Ry. Co., 67 N. E. Rep., 953.)

INDIANA.—Street Railroads—Personal Injuries—Defect in Street—Negligent Repairing of Track—Complaint—Sufficiency—Bill of Exceptions—Leave to File—When Obtained.

1. A complaint alleging, in substance, that defendant street railway, in replacing a broken rail, performed the work so negligently as to leave the street in a dangerous and unsafe condition, owing to the use of loose dirt, which settled, leaving a dangerous hole, so as to permit vehicles to drop into said hole, and that plaintiff, while driving along the street, in the exercise of due care, drove into the hole and was injured, and that the accident occurred wholly by reason of the negligence of defendant, etc., was not objectionable as failing to show negligence.

2. The street railway was liable, though it had no notice of the defective condition alleged.

3. The complaint was not objectionable as failing to show that the negligence of the street railway was the proximate cause of the injury.

4. Burns' Rev. St. 1901, section 638, provides that the party objecting to the decision must except at the time the decision is made, but time may be given to reduce the exception to writing, but not beyond the term, unless by special leave of the court, provided that, if a motion for a new trial shall be filed in a cause

in which such decision so excepted to is assigned as a reason for a new trial, such motion shall carry the decision and exception forward to the time of ruling on such motion, and time may be given by the court within which to reduce such exception to writing. Held, that leave to file a bill of exceptions, not given until several days after a motion for a new trial has been overruled, is without authority.—(Citizens' St. Ry. Co. et al. vs. Marvil, 67 N. E. Rep., 921.)

INDIANA.—Carriers — Injuries to Passengers—Negligence—Contributory Negligence—Pleading—Statutes—Constitutionality—Assumption of Risk—Burden of Proof—Sufficiency of Complaint—Demurrer—Trial—Instruction—Curing Error—Special Verdict—Interrogatories.

1. A general allegation of negligence in a complaint is sufficient to withstand a demurrer for insufficiency of facts to show negligence.

2. A complaint in an action against a carrier which alleged that plaintiff's injuries were caused "solely by the fault, carelessness, and negligence of the defendant and its servants" sufficiently averred negligence to withstand attack by demurrer.

3. The mere fact that the car on which a person attempted to take passage was crowded when he was injured by the sudden starting thereof does not render such person guilty of contributory negligence per se.

4. Plaintiff attempted to take passage on a crowded car, which had stopped at a place where cars usually received passengers, but, owing to the crowd, did not secure a firm footing before the car was started with such force as to throw him to the ground. Defendant's servants did not warn plaintiff not to take passage. Held, that the question of contributory negligence was for the jury.

5. The complaint in an action against a street railroad for injuries alleged that plaintiff was in waiting at a point where defendant's cars usually stopped for passengers, with the intention of taking passage; that a car stopped to take on passengers; that plaintiff stepped on the step of the rear platform, and endeavored to get on the car, which was crowded, when he was thrown to the ground and injured by the starting of the car. Held, that the complaint, prima facie, showed plaintiff to have been a passenger.

6. Act Feb. 17, 1899 (Acts 1899, p. 58), providing that it shall not be necessary for a plaintiff in an action for negligent personal injuries or negligent death to allege and prove want of contributory negligence, is not in conflict with Const. art. 4, section 22, prohibiting the passing of special laws regulating the practice in courts of justice.

7. In an action by a passenger against a carrier for negligent injuries, defendant has the burden of proving assumption of risk.

8. Where a requested instruction was substantially contained in instructions given, the error, if any, in refusing it, was harmless.

9. While a street railway is required to exercise the highest degree of care, skill, and diligence for the safety of its passengers in operating its cars and in constructing and maintaining its tracks, roadway, and machinery, it is only liable for negligence, and cannot be considered as an insurer of the safety of its passengers.

10. Where the complaint in an action by a passenger against a street railroad for negligent injuries alleged that plaintiff was thrown off the car and injured by reason of a severe jolt or jerk of the car, caused by its going over a switch or a frog which was old and worn, it was error to instruct the jury that they might inquire not only whether the jolt of the car was caused by the old and worn frog or switch, but also whether the jolt was due to "any other cause, which the defendant could have guarded against by the exercise of the highest degree of skill and foresight."

11. Though the instructions in a suit may appear fair and correct when considered as a whole, an error in a particular part thereof will not be considered harmless unless the Appellate Court be satisfied that the jury was not misled to the prejudice of the complaining party.

12. Act of March 4, 1897 (Acts 1897, p. 128), repealing Civ. Code 1881, section 389, as amended by Acts 1895, p. 248, which provides for special verdicts, and authorizes the submission of special interrogatories, enables each party in a cause triable by jury to have submitted to and determined by the jury every essential fact in the case, and in no manner abridges the right of parties to a trial by jury as authorized by the Constitution.—(Citizens' St. Ry. Co. vs. Jolly, 67 N. E. Rep., 935.)

INDIANA.—Negligence—Personal Injuries—Willful Injury—Complaint—Allegations—Sufficiency.

1. A complaint in an action for injuries sustained by plaintiff while a passenger on defendant's street car, which alleges that the starting of the car with a sudden and violent jerk, without warning, was the proximate cause of the injuries, and that because of his condition his injuries were the natural and probable consequences of defendant's act of starting the car without warning; that defendant, with full knowledge of plaintiff's condition, and without warning, intentionally, purposely, and willfully so started the car, utterly regardless of the safety of plaintiff, and with knowledge of the fact that the natural and probable consequences of so starting it would be injury to him—does not state a cause of action for willful injury.

2. The recital of evidence in a complaint for personal injuries willfully inflicted, which tends to prove that defendant acted with a reckless disregard of the safety of plaintiff, and with a willingness to inflict the injuries complained of, does not help the complaint, or make it state a cause of action for willful injury, though such evidence on the trial is competent to support the allegation of willfulness.

3. The complaint in an action for personal injuries willfully inflicted, being quasi criminal in its nature, and involving an intent to inflict the injuries complained of, must be strictly construed.—(Union Traction Co. of Indiana vs. Lowe, 67 N. E. Rep., 1021.)

INDIANA.—Street Railroads—Injury to Pedestrian—Contributory Negligence—Failure to Look and Listen—General and Special Verdict.

1. Where a special verdict is antagonistic to and in irreconcilable conflict with the general verdict, the general verdict must give way.

2. Where a special verdict does not disclose any facts going to the negligence or want of negligence on defendant's part, the general verdict that defendant was guilty of actionable negligence must stand.

3. One alighting from a street car on which he was a passenger became at once a traveler on the public street, charged with the duty of exercising due care.

4. A person who alighted from a street car and passed back of it, and upon the track on which cars traveled in the opposite direction, without looking and listening for the approach of cars, was guilty of contributory negligence as a matter of law, where he was familiar with the manner of operating the cars on the two tracks.—(Indianapolis St. Ry. Co. vs. Tenner, 67 N. E. Rep., 1044.)

IOWA.—Street Railways—Collision with Pedestrian—Negligence After Danger Is Apparent—Evidence.

1. Though one is negligent in getting struck by a street car, yet if the motorman sees his danger long enough before the accident to prevent it, and negligently fails to do so, the railway company is liable.

2. A finding that the motorman of an electric street car saw a person who was struck by the car in time to have avoided accident to him (it being possible to stop the car within from 5 ft. to 12 ft.) is authorized by evidence that from the front platform, where he was, he could easily see the surface of the street immediately in front; that it was his duty, not only under the rules of the railway company, but also under the general requirement of the exercise of care in operating the car, to be on the lookout to avoid injuring persons in the street; and that deceased was carried 20 ft., while clinging to the dashboard, before he was run over.—(Barry vs. Burlington Ry. & Light Co., 93 N. W. Rep., 68.)

IOWA.—Street Railways—Injuries—Contributory Negligence—Duty to Look and Listen—Ordinary Care—Ringing of Gong—Presumption—Speed of Car—Damages—Future Loss—Pleadings—Instructions—Credibility of Witnesses—Harmless Error.

1. Where in an action for injuries some of the grounds of negligence stated in the petition were withdrawn from the jury, an instruction, requiring the jury to confine itself to the acts of negligence "set out in plaintiff's petition," and that the plaintiff must prove negligence "as set forth in his petition," was properly refused.

2. A requested instruction that the jury was "at liberty" to consider the opportunity of the witnesses for seeing, their interest, their demeanor, etc., was not strictly correct, since, if the instruction was required, it should have made such consideration the "duty" of the jury.

3. Where a jury is instructed that a preponderance of the evidence is not necessarily established by the greater number of witnesses, and that it is the jury's duty to disregard testimony which does not seem reasonably worthy of credence, it is not an abuse of the court's discretion in the matter to refuse to charge that they should consider the opportunity of the witnesses for seeing, their interest in the case, and demeanor on the stand.

4. In an action against a street railway for injuries sustained in a collision between plaintiff's carriage and a car, a requested instruction that plaintiff was guilty of contributory negligence if he could have seen or heard the car by looking or listening in time to have avoided the accident was erroneous, as imputing negli-

gence in case by any possibility plaintiff might have so discovered the car.

5. Ordinary care to discover an approaching street car by looking or listening is all that is required of a driver.

6. Where the only issues to be submitted to a jury were as to the negligence of a street car company in running its car at an excessive speed, and in failing to sound its gong, and as to the contributory negligence of plaintiff, an instruction relating to the right of the motorman to assume that plaintiff would get out of the way was properly refused.

7. In an action by a driver for injuries sustained in a collision with a street car, a requested instruction that plaintiff could not recover if the accident occurred as the result of his failure to exercise ordinary care in driving on the track was covered by instructions that the driver was bound to take reasonable precaution to avoid collision with the car, and that a failure to exercise reasonable care, resulting in the accident, would defeat his recovery.

8. Where witnesses who deny the ringing of a street car gong were in as good position to hear as those who affirm it, no presumption arises in favor of the ringing of the gong.

9. In an action for injuries sustained in a collision with a street car, caused by its alleged excessive speed, the rate of speed, in the absence of municipal regulations, was for the jury to consider in connection with surrounding circumstances, in order to determine whether it was negligent, and an instruction which, as a matter of law, eliminated the question of speed, was properly refused, unless it was so great as to imply a disregard for the safety of those approaching the track in an ordinarily careful manner.

10. In an action by a driver for injuries sustained in a collision with a street car, an instruction that if the jury find "that by reason" of running the car at an unreasonable rate of speed it collided with plaintiff's vehicle, so as to injure him, then, etc., sufficiently instructs that the rate of speed must have been the proximate cause of the injury.

11. Another instruction read that if the jury "found plaintiff's injuries, if any, were directly and proximately caused by the negligence, if any, of the defendant's," then, etc. Held, that any omission in the first instruction was cured when taken in connection with the second.

12. Future pain and suffering and loss of time constitute a proper element of damage for injuries received in a street car accident.

13. In an action by a driver for injuries received in a collision with a street car, an instruction authorizing damages in such sum as will reasonably compensate him for the pain, loss of time, etc., sustained by reason of the accident, is not erroneous for failing to specify that the jury's findings on such matters must be based on the evidence.

14. One driving at a slow trot on a busy city street, as he approached a cross street on which ran a street car line, listened for the ear, but heard nothing. It was raining, and other rapidly driven vehicles were close beside him. As he reached a point at the corner where the buildings permitted him to look up the cross street 50 ft. or 60 ft., he did so, and, seeing no car, looked down the street for cars in that direction. On turning again to look up street, just as the horse got on the track, he saw a car only about 10 ft. away, and tried to whip up his horse so as to escape, but was injured. Held, that the facts negatived contributory negligence.—(Stanley vs. Cedar Rapids & M. C. Ry. Co., 93 N. W. Rep., 489.)

IOWA.—Street Railroads—Collisions with Vehicles—Injuries to Persons on Track—Negligence of Driver—Persons on Vehicle—Failure to Signal—Contributory Negligence—Issues for Jury.

1. While a hook and ladder truck, weighing 9000 lbs. and carrying ten men or twelve men, was crossing a street, it was struck by a car going south on the cross street, and plaintiff was injured. A seven-story building on the corner obstructed the driver's view up the cross street on approaching it. The distance from his seat to the horses' heads was over 14 ft., and he testified that he did not notice the car coming from the north 50 ft. or more feet away, though he both looked and listened until the horses were about to go on the track, and that he urged them, but could not get across in time to avoid the collision. Held, that whether the driver was at fault was for the jury.

2. While crossing a street a hook and ladder truck was struck by a street car coming from the north. Plaintiff, a fireman, was riding on the footboard on the north side of the truck, and, as customary, looking across it. Other employees were on the opposite side, looking to the north. There was evidence that the gong on the car was not rung, and the first warning plaintiff had of the car's approach was the signal of a woman on the sidewalk. He immediately jumped, but was caught by the car and injured. Held, that plaintiff was not negligent, as a matter of law, in not turning around and observing the car in time to leave the truck in safety.—(Quinn vs. Dubuque St. Ry. Co., 94 N. W. Rep., 476.)

IOWA.—Servant's Injuries—Assumption of Risk—Contributory Negligence—Question for Jury.

1. An ordinary laborer for a railroad, working with other laborers of the same class, who had never had any occasion to make a coupling, nor any reason to suppose that he would be required to do so, did not assume the risk of defects in a car or a drawhead of which he had no reason to know and had never observed, when suddenly called by a foreman to make such coupling.

2. In an action for servant's injuries caused by a defective coupling, where the evidence was conflicting as to whether the usual safe method of making such couplings was by going between the cars or not, the question as to what was the usual safe method was for the jury.—(Branz vs. Omaha & C. B. Ry. & Bridge Co., 94 N. W. Rep., 906.)

IOWA.—Street Railroads—Injury to Pedestrian—Contributory Negligence—Presumptions—Direction of Verdict.

1. Five or six covered wagons were following one another southward along a street close to a street railway track. Decedent stepped from behind the last of these wagons toward the track, and was struck by a street car coming from the south. There was evidence that the car was running faster than allowed by law. There was no evidence that any care was exercised by deceased to avoid collision with the car. Held, that a verdict for defendant was properly directed.

2. Where there is direct evidence as to the circumstances surrounding an accident resulting in the death of the person injured, the presumption that, prompted by the instinct of self-preservation, he was in the exercise of due care, does not obtain.—(Ames vs. Waterloo & C. F. Rapid Transit Co., 95 N. W. Rep., 161.)

KANSAS.—Negligence—Question of Law—Street Railways—Care to Protect Passengers.

1. In an action to recover damages for personal injuries resulting from the alleged negligence of another, if the facts are admitted or undisputed and but one conclusion can be drawn therefrom, the question of whether negligence existed is one of law.

2. A street railway company in the transportation of passengers must use the utmost degree of care and skill, for the protection of passengers, in the preparation and management of the means of conveyance.—(Metropolitan St. Ry. Co. vs Hanson et al., 72 Pacific Rep., 773.)

KENTUCKY.—Street Railways—Collision with Pedestrian—Pleading and Evidence—Negligence—Instruction.

1. Under a complaint alleging that, while plaintiff was going along an avenue, and crossing a street, a street car struck him, there may be a recovery, though the collision did not occur exactly at the footwalk, but within the intersection of the street and avenue.

2. Though the collision of a street car with a pedestrian is not exactly at the footwalk, still, it being at the intersection of streets, it is proper to charge that it was the motorman's duty to decrease the car's speed as it approached the intersection, and to give notice of its approach by the usual signals, and to have it under control, and to keep a lookout to avoid injuring one there using the street or crossing.—(Louisville Ry. Co. vs. French et al., 71 S. W. Rep., 486.)

KENTUCKY.—Electricity—Protection of Wires—Negligence—Contributory Negligence—Questions for Jury—Instructions.

1. An electric company, which permitted a pulley wire used in lowering and hoisting an arc lamp to remain without proper or any insulation, and to come in contact with the feed wires, and become so charged with electricity that a boy passing along the sidewalk and taking hold of the wire where it passed around the reel on the pole at a point 4½ ft. above the ground was killed by the current, was guilty of negligence.

2. The question whether the boy was guilty of contributory negligence in taking hold of the wire was for the jury.

3. Under the evidence, held, that the question whether the boy jerked the wire, so that it came in contact with the feed wire, or was jerked about by the electric current, was for the jury.

4. It is the duty of an electric company to know the condition of its wires, and to use the utmost care to keep them safely protected by proper insulation, so that those exposed to likelihood of contact with them may escape injury; and an instruction that the company is only required to use such means as would prevent the escape of the current is too favorable to it.

5. An instruction that if the boy "purposely took hold of said pulley wire, and by so doing caused it or any wire to come in contact with another wire charged with an electric current, this was negligence on the part of" such boy, was as favorable to the company as the law authorized.—(Lexington Ry. Co. vs. Fain's Adm'r., 71 S. W. Rep., 628.)

LONDON LETTER

(From Our Own Correspondent.)

The Sunderland District Electric Tramways Company, Limited, has been formed to operate electric tramways through the large and populous colliery district in the neighborhood of Sunderland, Durham County, lying between the southern terminus of the Sunderland Corporation tramway system and the parish of Easington. The tramways authorized comprise a length of 19¼ route miles, and will be 4 ft. 8½ in. gage, being uniform with the Sunderland Corporation lines. The capital is £270,000, divided into 100,000 6 per cent cumulative preferred shares of £1 each and 170,000 common shares of £1 each.

Glyn Mills Currie & Company, on behalf of the Metropolitan District Railway Company, recently invited subscriptions for £500,000 4 per cent perpetual debenture stock. The prospectus stated that the work of converting the District Railway from steam to electricity was steadily progressing, and that the engineers anticipated that the whole system would be equipped and ready for working by the end of 1904. Provision is being made for a largely increased train service, and it is intended to provide eventually on the main line a service of forty trains per hour, as against eighteen trains now running, and on each of the five suburban western branch railways a ten-minute service. During the year ended June 30 last, the passengers numbered 43,203,584. When the system is electrically equipped and in full working order, the company expects to carry at least 100,000,000 passengers per annum, and to meet this it is providing a seating capacity for 143,548,000 persons per annum.

At a recent meeting the tramways committee of the Erdington Urban District Council considered and approved the detailed specification and drawings for the construction of the first portion (about 6 miles long) of a complete scheme of electric tramways for the district, prepared by Robert Green and H. H. Humphries, the joint engineers, who were instructed to forthwith obtain the approval of the Board of Trade to them and to advertise for tenders.

A further extension of the electric tramway system in Aberdeen has been inaugurated with the opening of a line to Torry, which has now become a thickly-populated suburb of the city. The new line passes along South Market Street from Guild Street, and crosses Victoria Bridge, which spans the River Dee.

In the projected scheme of the extension of the Newcastle Tramway system, which has already cost over £800,000, nearly £250,000 will be spent, and the urban areas which are chiefly included in the proposed extension of boundaries will all be knit together by a network of rails. The chief difficulty experienced in connecting the great eastern suburb of Byker and Heaton has been that traffic has been carried over one bridge—the Byker Bridge—which was two years ago doubled in width for this purpose. To complete the circle of rails it is essential to run the tramways over the bridge built over Jesmond Dene by Lord Armstrong, and presented to the city. But it is not considered feasible to make a double line of rails, and to lay only a single line would spoil the completeness of the system which is double throughout. The tramways committee has inspected the bridge with a view to devising some scheme which shall enable the laying of a double line, and will report to the City Council shortly.

Fifty-three candidates applied for the post of chief officer of tramways to the London County Council, vacated by Mr. Baker, who has gone to Birmingham. A. L. C. Fell, J. B. Hamilton, and C. J. Nicholson were selected by the general purposes committee to appear before the Council, and they have now appointed Mr. Fell at a salary of £1,500 a year, he to give all his time to the duties. Mr. Fell, as is well known, has been for many years the successful electrical engineer and manager of the Sheffield Corporation Tramways.

The Birmingham Corporation has entered upon the first stage of reconstruction of tramways in the city, and workmen are engaged in pulling up the wood paving in Steelhouse Lane, preparatory to laying down the tramlines from the corner of Snow Hill to form a junction with the existing lines at Lancaster Street and Aston Street. This portion will be electrified in conjunction with the Aston route. When complete the Aston and Gravelly Hill trams will run to the new terminus, while the Perry Barr and Saltley steam trams will continue to traverse the old route to the Old Square until the leases terminate. Until the Corporation has laid down other lines the whole of the electric supply for the route from Aston to Snow Hill will be provided by Aston.

A representative meeting of Flintshire gentlemen was held recently at Chester to consider an application to be made to Parliament during the coming session for powers to construct an electric tramway in Flintshire. It is proposed to connect the districts of Bagilt, Greenfield, Holywell, Flint, Halkyn, Northop, Mold, Buckley, Sandycroft, Queen's Ferry, Shotton and Connah's Quay. The distance is about 30 miles, and the population about 34,000. A generating station will be erected in the area if electrical power cannot be obtained from the North Western Electricity & Power Gas Company, incorporated during the last session of Parliament. It is proposed to have fifteen-minute service of trams, and in addition to the ordinary passenger traffic it is expected that a considerable business will be done in the carriage of goods from various points in the district to the Dee ports, and from point to point.

The city of Manchester has provided on more than one occasion a number of interesting surprises in connection with its electrical committees and their officials, and it has again brought itself to the notice of the electrical public and received a good deal of adverse criticism by the resignation of their city electrical engineer, G. F. Metzger, which has been brought about by a misunderstanding between himself and the electricity committee. Mr. Metzger has been the electrical engineer of the city of Manchester for some years, and during his appointment enormous improvements and extensions have been promulgated. The resignation was evidently brought about by the fact of some misunderstanding between Mr. Metzger and the electrical committee as to whether he had the right or not to do outside work for other corporations or companies. There seems to be a good deal of bitterness on both sides, but in any case Mr. Metzger has handed in his resignation, which has been accepted, and he will most likely leave his present work about the end of the year.

The city of Glasgow is now taking up the matter of experimenting with the welding its rails instead of the ordinary joints with fish-plates. It is now making a most important experiment with the Lorain Steel Company's process of electrical welding of rails, a process which has been utilized in America to considerable extent, in Buffalo, Rochester, Worcester and other cities, but it has not hitherto been used in Great Britain. The work is in charge of Mr. Kleinschmidt, of the Lorain Steel Company. An order has also been placed in Glasgow for 1000 joints to be welded by the Goldschmidt Thermit process.

At the last general meeting of the Underground Electric Railway Company, of London, Mr. Yerkes made some interesting statements. It may be remembered that this company controls not only the Metropolitan District Railway, but practically all of the new tubes which are being constructed at present and which are to be put into service within the next year or two. These tubes, according to Mr. Yerkes, are being pushed on as rapidly as possible, but work of this kind can only be completed at a certain speed. The Chelsea power house, which will furnish current for all of Mr. Yerkes' schemes, is not proceeding so rapidly as had been expected, but still the work is going on successfully and satisfactorily. The work of conversion in the tunnels of the Metropolitan District Railway is also proceeding satisfactorily, and every night large gangs of men are hard at work after the train service is discontinued. It is not expected that the electrical service of the District Railway will be commenced before 1905, when it is expected that the Baker Street and Waterloo tube will also be ready to be put into service at the same time. This tube is practically complete so far as it was originally intended to extend, viz., between Baker Street and Waterloo, the work now going on being extensions to the Elephant & Castle on the south side and to Paddington on the northwest.

At the annual meeting of Willans & Robinson, Ltd., Mr. Robinson made some interesting statements entirely outside the financial condition of the company. Mr. Robinson considered that the big steam engine as manufactured to-day is going out of fashion, and it is rapidly becoming the fashion to order either steam turbines or gas engines instead. Though Willans & Robinson have not said much about their gas engines or steam turbines, their chairman stated at the meeting that they are already in receipt of orders for several large steam turbines, and that they are now perfectly prepared to go into the manufacture of steam turbines up to the largest sizes. It is also a matter of great interest that they have received a number of orders for their gas engines which are being built entirely on their own design. Mr. Robinson also stated that they were preparing an even greater novelty than either the steam turbine or the gas engine, in the shape of an auxiliary waste-heat engine, although the development of this will probably be quite slow, and finally the interesting statement was also made that they were now manufacturing for automobile manufacturers a large number of petrol engines.

The Torquay Town Council has been considering the subject of tramways for some time, and it was confidently expected that some decision would soon be arrived at, especially as the Dolter Electric Traction Company had made a proposition to them which it was expected would be accepted. The latest information, however, from Torquay states that the Dolter Company has now abandoned its proposition, so that the whole subject has for the time being fallen through. It will be remembered that the Dolter

Electric Traction Company is the promoter of a surface contact system which is at present in use in parts of Paris.

One of the most important contracts in connection with electric traction that has been placed for some time has just been decided by the London County Council, and an order has accordingly been placed with Messrs. John Musgrave & Sons, of Bolton, for four engines, nominally of 5000-hp each. The price of these will aggregate £96,713. It is interesting to know that Messrs. Musgrave's tender was very far from being the lowest tender and that the whole matter was thoroughly discussed at meetings of the committee, who arrived finally at the result that they were completely justified in accepting Messrs. Musgrave's tender, as they considered that this firm had had larger and greater experience in the manufacture of large engines for similar purposes than any other firm. The engines will be of a design different from anything that has been previously seen in Great Britain, having both vertical and horizontal cylinders. The specifications for these engines provide that with superheated steam at 500 deg. F., and 180 lbs. pressure and with 26 ins. vacuum these engines shall operate at approximately full load on 11½ lbs. of steam and at approximately half load on 13 lbs. With saturated steam, under the same conditions, the figures to be reached are 12¾ lbs. and 14½ lbs.

The tramways committee of the London County Council has asked for power to initiate the conversion of about 52 miles of tramways in north London from the horse to the underground system of electric traction. The following lines will be dealt with in the first instance: Theobalds Road to London Dock, Norton Foldgate to Stamford Hill, and Aldgate to Poplar. Other lines shortly to be taken in hand are Moorgate Street to Old Street, Holborn to Theobalds Road and along Old Street. The length of the tramways to be dealt with immediately is about 22 miles of single line, and it will be practicable for the whole of these to be worked from the Greenwich electricity generating station.

A. C. S.

REDUCED FARES IN PHILADELPHIA

It is reported that the Philadelphia Rapid Transit Company, as a convenient method of getting the free use of several million dollars a year, has under consideration the plan of selling tickets for rides on its cars at the rate of six for 25 cents or twenty-five for $1. It is said that the money the company expects will be advanced by the adoption of this plan would be considerable, and that it would be particularly acceptable just at this time when so much money is needed for the construction of the Market Street subway and the elevated roads.

In this connection it is interesting to note the scheme of fares and transfers now in vogue in that city. It seems that many years ago, when there was a large number of independent operating companies, they commenced by joint agreement issuing exchange tickets between connecting lines, for which a charge of 3 cents was made. This plan enables passengers to ride over connecting lines for 8 cents instead of paying 10 cents, and the idea became so popular that the number of points connecting lines where exchanges were sold was increased.

At the time of the consolidation of the independent lines as the Union Traction Company, the question of transfers was gone into very thoroughly, and the present system of issuing almost universal transfers for 3 cents in addition to the regular fare was adopted. The exchange ticket, for which 8 cents is paid, when issued by the conductor, is punched for the day and hour of issue, but is accepted for passage at any time. The effect of the practice of issuing these exchange tickets amounts practically to a reduction of fare to a 4-cent basis for a considerable number of the company's patrons, and this reduction the public seems to consider of more consequence than a limited free transfer privilege. In addition to the exchange tickets sold, the company issues a considerable number of free transfers. This is done at some points to fill charter requirements where it is not found practicable to run through cars via the original routes.

BOILER CONTRACT FOR THE NEW YORK CENTRAL POWER STATION

The Babcock & Wilcox Company has been awarded by the New York Central & Hudson River Railroad Company a contract for forty-eight 625-hp forged steel construction boilers, designed for 200 lbs. working pressure.

These boilers are intended for the new power stations of the company, mentioned in the last issue. The boilers will be equipped with Babcock & Wilcox patent superheaters, proportioned to give a superheat of 200 degs. above the temperature due to the pressure carried.

TERMS OF SETTLEMENT OF THE CHICAGO CITY RAILWAY STRIKE

As briefly announced in these columns last week, the great strike of trainmen on the Chicago City Railway was ended by mutual agreement Nov. 25, having lasted two weeks. The agreement was reached after a conference of many hours, at which the representatives of the men and the representatives of the company appeared before the mayor and a special committee of the Council. Following is the text of the agreement, which was ratified by the vote taken at a mass-meeting of the striking employees a few hours after its acceptance by their representatives:

Memorandum of agreement executed in duplicate this 24th day of November, 1903, between the Chicago City Railway Company, party of the first part, and the Amalgamated Association of Street and Electrical Railway Employees of America, Division 260, Chicago, Ill., party of the second part, witnesseth:

It is hereby agreed that the question of wages between the parties hereto shall be submitted within the next ten days to a board of arbitration, the board of arbitration to be composed of three persons, one to be chosen by the party of the first part, one to be chosen by the party of the second part, and the two thus selected shall choose a third. As soon as the third member of the board is selected, they shall organize by the selection of one of their number as chairman, and then decide upon the times and places of meetings.

The board of arbitration shall settle the wages of all the trainmen and other employees of said company for the period of this contract. This question shall be determined upon the fair value of the services to be rendered by said employees, as shown by such evidence as would be legally competent to fix said wages if the various men had performed the service without a specific contract and were suing to recover the value of such services, with the exception that inasmuch as the company claims that the present wages paid to its employees are above the market value, the present scale or rate of wages paid by the company to its employees shall be ignored in determining the wages hereafter to be paid by the company.

The expense of said board shall be borne equally by the parties hereto.

The rate of wages fixed by the board shall date from the signing of this agreement, it being understood that the present rate of wages shall be paid regularly until the decision has been reached.

2. The company shall meet with the committee of trainmen from the organization, and will make the hours of service as nearly as possible to suit them on the basis of a maximum of eleven hours and a minimum of eight hour within fifteen consecutive hours, or will establish a nine-hour day within fifteen consecutive hours if preferred, but the company shall have the right to fix the number of cars running at all hours, and the length of the time they shall be on the streets, endeavoring always to make the work as agreeable to the men as will be consistent with the performance of its duty to the public.

3. There shall be no opposition by the party of the first part to the employees becoming members of the union, neither shall there be any discrimination or distinction by either party for or against men who belong to a union or who do not belong to a union. No attempt shall be made to prevent employees from becoming members of the union and employees who are not members of the union shall not be annoyed or subjected to pressure to compel them to join the union. But reasonable and peaceable association shall not be considered annoyance or pressure. A disregard of this provision of the contract shall be construed a repudiation of this contract. Nothing herein contained shall be construed as in any way interfering with or limiting the right of the company to absolutely exercise its own judgment and discretion in employing, discharging or disciplining its employees, except for membership in the union.

4. The properly accredited officers of the company agree to meet and treat with any committees of the organization on all questions and grievances that may arise in the future.

5. The company agrees that any employee who has been unjustly suspended or discharged shall, upon reinstatement, be reimbursed for all time lost.

6. The company agrees that officers of the organization shall be granted leave of absence on organization business when so requested. It further agrees that any member of this organization who now holds office or who shall be elected to any office in said association which requires his absence from the company's employ, shall, upon his retirement from said office, be placed in his former position, provided such officer during his absence from the company's employ shall not have been guilty of acts which would justify his discharge if he had continued in the employ of the company.

7. The company shall endeavor at all times to maintain an adequate and proper extra list.

8. The company shall place in the office of each car house of the respective lines an open book, in which the men can register the particular day or days on which they want to get off, and the men so registered first for any particular day or days shall have first preference. It is agreed, however, that members of the executive board of the executive organization shall be entitled to get off in preference to others. Said book shall be dated seven days ahead.

9. All car repairers, motor repairers, grip repairers, inspectors, dopers, car pushers and car cleaners shall be absent from duty every other Sunday.

10. This agreement to be binding and in force beginning this 25th day of November, 1903, and continuing until the 25th day of November, 1904, with this understanding: That this agreement will not be ratified until all employees shall return to work in the positions they occupied prior to the 12th day of November, 1803, provided that the company shall have the right to refuse to take back any employee who shall have been guilty of acts of violence or intimidation on or since Nov. 12, 1903, which would justify his dismissal from the service of the company.

It is difficult to see of what benefit this strike was to the men, but it is very plain to all that it meant a loss to them, a loss to the company and a great inconvenience to the Chicago public. Not one of the main points at issue was yielded by the company. There is a possibility under the new agreement that there will be a reduction of the wages of some of the men. The clause providing for arbitration of the wages without regard to the present scale, and with consideration only for the value of such services in other cities, would naturally result in a lowering of the pay of the cable trainmen, who now receive wages much higher than the trainmen on electric cars and higher than is paid in any other large city of the United States. These cable wages are the outgrowth of an agreement made many years ago. Practically, the only concession made by the company in the peace negotiations previous to the ending of the strike was that it agreed to take back engineers and firemen who went on a sympathetic strike in violation of an agreement. The company has gained one important point under the new agreement which did not prevail under the old agreement which expired Oct. 1, 1903. The company is now free to hire, discharge and discipline men as it chooses, without regard to the grievance committees and arbitration boards, which have taken so much time during the past year in connection with ordinary routine discipline, the principal results of which have been to take time and energy which might better have been spent otherwise. There is a general feeling of relief by all parties concerned that this senseless affair has been ended. The terms of the settlement were enthusiastically accepted at the meeting of the men, the majority of whom are very glad to be at work in their former places again. The operation of cars began Thanksgiving Day, Nov. 26, just two weeks from the time the strike began.

RESUMING SERVICE IN CHICAGO

The operation of cars was resumed by the Chicago City Railway Company on Thursday, Nov. 26, and that night cars were run for the first time after dark since the strike was called on Thursday, Nov. 12. When the struggle was on, the service operated under police protection was abandoned each day shortly after 4 o'clock, in order to avoid any attack that might be made by strike sympathizers under cover of darkness. On Thursday the only remaining evidence of the recent struggle was that the service was not on regular schedule. On Friday, however, cars ran practically on regular time. When the strikers reported for duty on Thursday morning, all of them, with the exception of fifty-nine, were given their old positions. Of those whom the company refused to reinstate, fifty-three were trainmen and six were members of the Cable Splicers' Union. These men, the company claims, were guilty of misconduct during the strike, and according to the terms of the settlement were not entitled to reinstatement. The men, however, deny that they took part in any acts of violence, and it is said that they will appeal their case to Mayor Harrison and the Aldermanic mediation committee, which pledged itself during the negotiations for a settlement to demand from the company an adequate reason and proof of violence before any of the strikers should be refused employment.

CONFERENCE ON TRAFFIC CONDITIONS IN CLEVELAND

A special meeting of the board of public service of Cleveland was held last week to consider complaints made against the service of the Cleveland Electric Railway. Mayor Tom L. Johnson acted as chairman of the meeting. The company was represented by President Andrews and General Manager Stanley. The meeting was pleasant and harmonious throughout, and instead of making excuses for poor service, or any contest against the demands of the citizens who appeared to make the complaints, the railway officials appeared willing to meet the complaints more than half way.

The burden of complaints was that cars are crowded at all times and that during rush hours they are packed. It was claimed that since the consolidation of the Cleveland Electric and Cleveland City companies the headway on many lines has been made less frequent. A strong complaint was that certain lines do not traverse the Public Square and Superior Street as they formerly did.

Mr. Andrews expressed himself in strong terms on this point. He stated that Cleveland people had been humored in years past by being taken direct to the Public Square and down Superior Street by every car in the city. He said that in no other large city the size of Cleveland is such a rule in practice. This practice, he said, has had much to do with the fact that cars are crowded and the downtown district congested, and he stated that instead of putting cars back on the Public Square and Superior Street route, it was the intention to diverge other lines from this route. He thought the fact that universal transfers are now given ought to compensate for this change.

In this connection he gave some very interesting figures showing the increased service consequent with the six tickets for a quarter and universal transfer rules now in force. He stated that 74 per cent of the people are now buying tickets instead of 40 per cent, the average under the eleven tickets for 50 cents rule. The proportion of passengers asking for transfers is now 40 per cent instead of 28 per cent as in years past. Lower fares and universal transfers have increased the traffic 25 per cent, and Mr. Andrews said that the company is making less money. He claimed that as a matter of fact the company is operating more cars than formerly and that the number of trippers had been increased. He also pointed out that it was practically impossible to maintain regular headway on many of the Cleveland lines because of numerous grade crossings and draw-bridges.

There are about fifty grade crossings in the city and four draw-bridges. Two of these draw-bridges are on the Central and Superior Street viaducts, the main arteries of the city, and crossed by over half the car lines. On a line having a two-minute headway, a ten-minute blockade means that five cars each way are held up. It is conservative to estimate that four blockades on each of the fifty grade crossings are experienced daily. With 200 blockades of this nature, each of ten minutes' duration, it will be seen that 2000 minutes are taken off the schedules. Where the cars are on five-minute headway it means that the traveling public has been hindered to the extent of 400 cars. The draw-bridges are even worse than the grade crossings, as it usually takes from ten to twenty minutes to swing the large draws. During rush hours the approaches to the bridges are sometimes completely filled with cars waiting to cross, hindering incoming as well as outgoing cars. Cleveland at one time had an ordinance prohibiting the opening of draw-bridges between certain hours morning and evening, but if it is now in force the street railway officials are not aware of it. The city has an ordinance requiring a freight train to be cut in two after it has blockaded a street five minutes, but practically no attention is paid to this ordinance and the police apparently make no attempt to enforce it.

The railway officials invited citizens to call at their office with complaints as to service, but requested that they deal in facts and specify the exact time, the number of cars, etc., regarding which they desired to make complaint. The board of public service took no action and decided to wait and see the results of the changes promised by Mr. Andrews. The position of the company has been rendered more uncomfortable still through the loss of seventy-five cars in the recent fire.

NEW TRANSFER SCHEME IN BROOKLYN

Announcement has been made by the Brooklyn Rapid Transit Company of a number of changes in its transfer system to go into effect Dec. 1. On and after that date conductors will issue transfer tickets only to passengers presenting continuous trip tickets or paying cash fares. In order to avoid confusion, passengers will have to ask for transfers upon payment of fares. In other words, conductors will not thereafter issue transfers upon transfers. In the official circular outlining the new scheme the names are given of the lines to which continuing trip tickets, which entitle the holder to a transfer, will be given, and the points at which transfer agents will issue such tickets are also given. A number of new transfer points will be established, and these are specified. According to General Manager Calderwood, the company has increased the transfer privileges between the lines since July 1, 1902, from 262 to 292, and he says that the new arrangement will make an increase of 7, or a grand total of 299. The purpose of the company in adopting the new system is to make it possible for a passenger, by the use of a transfer, to go from one point to another by the shortest route and in the quickest time for one fare, and to stop, if possible, the flagrant misuse of transfers. It is pointed out by Mr. Calderwood that in adopting the new system the practice of the companies in all the large cities of the United States has been followed, and that the new arrangement will in no way work to the detriment of those who heretofore used transfers legitimately.

In accordance with the general policy of Mr. Huntington, the Los Angeles Traction Company will issue no more pass books, save those provided for in the franchises.

CENSUS REPORT ON CENTRAL ELECTRIC LIGHT AND POWER STATIONS

Bulletin No. 5 of the Census Bureau, devoted to electric light and power stations, has just been issued by the Department of Commerce and Labor, of the government. The history of central electric light and power stations in the United States is briefly enumerated. Statistics for the year ending June 30, 1902, which is the period covered by the report, shows that there are 3620 central stations of this kind in operation. The cost of construction and equipment amounted to $504,740,352; the gross income is reported as $85,700,605, and the total expenses as $68,081,375. The power plant equipment consisted of 5930 steam engines, with 1,379,941 ihp, and 1390 water wheels, with a stated hp of 438,472. Of the total number of stations, 815 were operated under control of municipalities. The total output in kw-hours for the year was 2,453,502,652; the total number of arc lamps was 385,698; the total number of incandescent lamps 18,194,044. During the year 252 electric railway companies reported the generation of electric current for sale for light and power; of this number, 118 reported the generation of electric current for this purpose was of sufficient importance to enable them to give the number of lamps in use and the amount of income from the sale of current. Adding these stations to those already enumerated, the number would be increased to 3738; the total income from the sale of current to $90,458,420.

The report states that 75 per cent of the central electric stations are in towns of less than 5000 inhabitants. Illinois contains the greatest number of stations operated under private ownership, and Ohio the greatest number under municipal ownership. Of the private stations in the country, 157 furnish electric current to railway companies for the operation of their cars, but only two municipal stations, one at Riverside, Cal., and one at Hannibal, Mo., reported current as sold for this purpose. The capitalization of the central stations is represented by $372,951,952 stock and paid on either common or preferred stock. A more complete report is to be issued later, and is being compiled by T. C. Martin, special expert agent for the bureau.

APPLICATION FOR RIGHT TO BUILD OVERHEAD TROLLEY IN NEW YORK

The Metropolitan Street Railway Company, of New York, has taken the first steps toward securing the necessary authority to convert its West Street horse car line into an overhead trolley system. West Street is devoted to commence, and parallels the river front on the west side of the city, and for most of its length is so low that the conduits which would have to be laid for the underground trolley would be frequently flooded by high tide. Probably the best understanding of the conditions to be met in a change of motive power on this line can be obtained from the official circular of the company sent out to property-owners along the street by President Vreeland, of the Interurban Street Railway Company. The circular says:

For several years there has been an urgent and constantly growing demand for better street car facilities on West Street than can be furnished by horse cars. The Metropolitan Street Railway Company has expended a large amount of time and money in an effort to develop some system of mechanical or electrical traction which would enable it to meet this demand. It has been recognized from the outset that the underground electric system, which has been generally adopted for the Metropolitan lines on Manhattan Island, cannot be used upon West Street, because for most of its length the street is so low that the conduits which contain the underground electric conductors would be so frequently flooded by high tides as to prevent the successful use of the underground trolley. Storage-battery cars and compressed-air cars have both been tried at great cost, but without success. Many other systems have been examined. The company even offered a reward of $50,000 for a successful system, and, although numerous systems were offered in response to this invitation, none proved successful.

It has finally come to be generally recognized that the only systems of electric propulsion of surface cars which successfully meet the requirements of the traffic on Manhattan Island are the underground electric system and the overhead electric system.

Accordingly, the conclusion has been reached that if the street cars upon West Street are to be operated otherwise than by horses, the overhead electric system must be used. This system can be installed on West Street in such a manner as not to obstruct traffic or detract from the appearance of the street. The same cars can be fitted with both overhead and underground trolley, so that the West Street line, if equipped with the overhead electric system, could be operated as part of the general Metropolitan system.

Now that almost all of the surface lines upon Manhattan Island are operated by electricity, the co-operation of the owners and occupants of property on West Street is asked in securing the necessary authority for the installation of the only system of electric propulsion which is available under the conditions which exist on West Street.

ECLIPSE LIFE-GUARDS ADOPTED IN BROOKLYN

The Eclipse Car Fender Company, of Cleveland, has received an order for fifty Eclipse life-guards to be placed on new cars for the Brooklyn Rapid Transit Company being built by the G. C. Kuhlman Car Company. The fenders are a departure from the now well-known Eclipse life-guard, being designed to meet special requirements met with on the Brooklyn system. In that city the cars are double-enders, and it is the practice to carry the fender from one end to the other. The framework for the new fender is made of tubing instead of angle iron, and the table is detachable so that it can be carried from one end to the other. The use of tubing makes the fender much lighter than heretofore and renders it easy to handle. It is also claimed the tubular frame is much stronger than the angle iron frame. The Eclipse Car Fender Company is supplying seventy-five equipments to the Cleveland Electric Railway Company, making 225 for that company, and it has received an order for forty-five additional equipments for the new cars just ordered to replace those recently destroyed by fire. General Manager Stanley, of the Cleveland Electric Railway, states that his company expects to equip every car on its system with the Eclipse life-guard, as he regards it as a great life-saver and a profitable investment. It is reported that within the past thirty days no less than seven persons have been picked up and their lives probably saved by Eclipse life-guards in Cleveland.

REPORT OF NORTHWESTERN ELEVATED, CHICAGO

The report of the Northwestern Elevated Railroad Company, of Chicago, for the year ending June 30, 1903, has been made to the Railroad & Warehouse Commission of Illinois as follows:

INCOME ACCOUNT

Earnings—	
Northwestern, main line	$1,215,071
Loop division	387,232
Total	$1,602,303
Rents and miscellaneous	40,153
Gross	$1,642,456
Operating expenses—	
Maintenance way	19,698
Maintenance equipment	66,754
Reserve for maintenance	36,000
Transportation	343,243
General and legal	51,746
Total	$517,441
Net earnings	1,125,015
Charges—	
Bond interest	779,350
Other interest	6,155
Taxes	156,100
Total	$941,605
Surplus	183,410

BALANCE SHEET

ASSETS

Cost road and equipment	$28,589,089
Stocks and bonds owned	4,307
Cash and bills receivable	108,520
Accounts receivable	579,056
Materials	17,912
Land and buildings	456,000
Sundry	199,588
Total	$29,954,472

LIABILITIES

Capital stock	$10,000,000
Bonds outstanding	18,387,000
Real estate mortgages	119,000
Interest accrued	241,504
Taxes accrued	90,164
Accounts payable	424,294
Reserves	72,925
Sundry	14,062
Profit and loss	600,523
Total	$29,954,472

GRANT FOR TUNNEL BETWEEN NEW YORK AND NEW JERSEY

The Rapid Transit Commission of New York has granted a franchise to the Hudson & Manhattan Railroad Company to run a tunnel under the North River from Exchange Place, Jersey City, to Cortlandt Street, Manhattan. William G. McAdoo is the president of the company and also is president of the New York & New Jersey Railroad Company, which has received a franchise to run a tunnel under the North River, entering Manhattan at the foot of Christopher Street.

The tunnel which will enter New York at Cortlandt Street will run to Church Street and then will form a loop, running back through Fulton Street to the place where the tunnel strikes Manhattan. There will be a spur from the station in Church Street, and this spur will connect at Broadway and Dey Street with the lower Broadway spur of the rapid transit subway.

The franchise gives to the company a twenty-five year grant with the privilege of two renewals, one at ten and the other at fifteen years, at varying rates of compensation, equivalent to the city of 3 per cent of the capital involved and of the earnings of the company as estimated.

REPORT OF THE WEST END COMPANY OF BOSTON

At the annual meeting of the stockholders of the West End Street Railway Company, held Nov. 24, the following directors were re-elected: Edwin F. Atkins, Samuel Spencer, Charles H. Baker, C. Minot Weld, Parkman Dexter, Stephen H. Weld, John Parkinson, Chas. A. Williams, Joseph B. Russell, Moses Williams and Alfred Winsor. The report of President Russell showed the total assets to be $31,800,000. The liabilities, including common and preferred stock, aggregate $15,900,000, and there is a surplus of $650,000. The bonded indebtedness has been increased by an issue at 4 per cent amounting to $3,915,000, and bonds to the value of $3,362,000 have been paid. The total bonded indebtedness of the company is $15,219,000. The capital stock has been increased by the issue and sale of 9085 shares of the common stock of the par value of $454,250. The balance sheet shows:

ASSETS

	1903	1902
Road and construction	$10,871,119	$10,581,397
Equipment	8,256,387	8,080,812
Land and buildings	11,169,063	10,734,953
Subway equipment	275,739	296,942
Cash and cash accounts receivable	1,240,551	1,231,778
Total	$31,812,860	$30,925,883

LIABILITIES

Common stock	$9,539,250	$9,085,000
Preferred stock	6,400,000	6,400,000
Bonds	15,219,000	14,666,000
Surplus	654,610	215,213
Current and unfunded debt	.....	559,670
Total	$31,812,860	$30,925,883

Since the last annual report two accounts for additions and improvements made to the property of this company by the Boston Elevated Railroad Company, covering the year ended March 31, 1902, under terms of lease to that company and amounting to $873,203, have been presented and approved by the board. Two accounts for similar work done by the Boston Elevated Railroad Company covering the year ended March 31, 1903, have also been presented, but have not yet been adjusted.

TRUCKS AT BRIGHTON, ENGLAND

The tramways committee of Brighton, one of the most popular South of England seaside resorts, which have from time to time placed contracts for various American equipment, recently disqualified a tender of the British Brush Engineering Company, on the ground that the company had not complied with the specifications regarding the trucks to be used.

The Brighton municipal electrical engineer specified for trucks built either by the J. G. Brill Company or the Peckham Manufacturing Company. The Brush people, being publicly invited to bid, offered to supply trucks constructed at its own works at Loughborough, one of the southeast suburbs of the British metropolis. Not being in accordance with the specification, the Brush tender was thrown out. The action of the Brighton committee, according to advice received from the other side, has created no little stir in the British electrical trade. The employees of the electric traction department of the Brush Company passed the following resolutions at a special meeting:

1. That this meeting, having heard that in several towns it is the custom to exclude British firms from putting in tenders for trucks in competition with foreign makers, respectfully appeals to members of tramway committees and other buyers of cars to give fair play to an industry on which the welfare of so many of their countrymen, not only ourselves and our families, but other workers concerned in the preparation of the material is absolutely dependent.

2. That, while having no right or wish to interfere with the actual placing of orders, we urge that in our own country it is unjust that British truck makers should be barred from opportunities of selling goods which are the product of British labor.

3. That we protest against any suggestion that foreigners can claim superiority, or even equality in any branch of steel work, and we are confident that, with fair and open competition, foreign-made electric traction trucks would soon fail to find any market whatever in this country, and that employment would then be provided for a large number of additional men in this industry.

MR. DUFFY RETURNS TO CHICAGO

C. Nesbitt Duffy has resigned his position as comptroller of the Interurban Street Railway Company, of New York, and has returned to the Chicago City Railway Company, resuming his former position of secretary and auditor of the company. During his short stay in New York Mr. Duffy made an excellent record as comptroller of the Interurban Street Railway Company, and his resignation from that company was accepted only with great regret by the officials of that system. But the fact that he has been closely identified with the policy of the Chicago City Railway Company during the last three or four years, that during this time he had made a very careful study of the traffic conditions of the company, and that recently he had taken an active part in negotiations with the city authorities looking to the company's franchise extensions, made his presence in Chicago almost indispensable to the owners of that road. All who are acquainted with Mr. Duffy realize that it must have been a considerable sacrifice on his part to relinquish the important work in New York upon which he had just entered, but his feeling of loyalty to the principal stockholders of the company with whom he had been connected for a long time in Chicago and previously in St. Louis, induced him to return to Chicago when it was found that his services were necessary.

TORONTO RADIAL ELECTRIC RAILWAY

An agreement has at last been reached between the Council of Toronto, Ont., the Toronto Railway Company, and Solicitor Walter Barwick, K. C., representing the Metropolitan Electric Railway, whereby the different radial railways will gain admission to the city. The line from the north will enter the city at or near Christie Street, and will proceed mostly by private right of way through the unimproved tract that extends to College Street and on to Stanley Park, thence mostly by Front Street to St. Lawrence Market. The lines from the west will cross the Grand Trunk Railroad tracks at Sunnyside and extend along the south side of these tracks to Bathurst Street, recross the steam railroad tracks by a bridge and take the radial Front Street line to the St. Lawrence Market. The Toronto & Hamilton Railway will also use this road. The companies are to carry over that right of way passengers, light or package freight and express traffic. Only during limited night hours are other classes of freight, mostly coal, to be carried, and this subject to the supervision and direction of the city engineer. The tracks of this radial right of way are to be the standard gage, which is 4 ins. smaller than the gage of the Toronto Company. The radial companies are not to pick up city passengers. They are to pay for the privilege of entering the city a percentage on the cost of the right to the city, such percentage to include a compensation at the rate of 5 per cent for the use of the streets traversed. This will enable the city to pay the interest on the cost and provide a sinking fund that will pay off the principal in forty years. The city can borrow at 3½ per cent, and the other 1½ per cent will provide the required sinking fund. The radial railways are also to pay to the city a percentage on the rate of fare for every passenger brought into the city. The Metropolitan Electric Railway promises to build within four years at least 150 miles more of track. It now has 150 miles, and the total of radial lines entering Toronto will be 300 miles. Only the Metropolitan tracks are standard gage, so the tracks of the three other radials will have to be changed.

CONTEMPLATED IMPROVEMENTS BY THE BROOKLYN RAPID TRANSIT COMPANY

The Brooklyn Rapid Transit Company has been planning a number of important changes and improvements which it expects to carry out within the next year or two. Among these are complete trackage arrangements to ensure adequate passenger transportation over the new Williamsburg Bridge, which is to be opened to wagon and pedestrian traffic on Dec. 19. The railway company is at present negotiating with the city for a franchise which will enable it to run cars over the new bridge and along one or two streets in New York leading from the bridge. As soon as practicable the company will build a third track on all its elevated lines, so that an express service can be given such as is now enjoyed by passengers on the Manhattan division of the Interborough Rapid Transit Company. This will involve much rebuilding, as on most of the lines "island" stations are in use, and on one of the lines where such stations are not used the structure is so narrow that it will have to be widened to accommodate a third track. It is also planned to enlarge the Culver terminal at Coney Island so that 1000 passengers a minute can be comfortably handled there. While the winter traffic at this terminal is of little importance, the enlargement will be made to accommodate the immense passenger business which is handled during the summer months, Coney Island being the most popular seashore resort near New York. The tracks of the Brighton Beach division, which run through some very fine suburban districts, are to be depressed in some places and raised in others to comply with the wishes of property-owners along the route.

As has been previously stated in these columns, the Brooklyn Rapid Transit Company is building a large addition to its Kent Avenue power station. Owing to the labor troubles in the building trade in New York and Brooklyn the completion of this station has been greatly delayed, and as a result the company has been unable to abolish the use of steam locomotives as quickly as it desires, but hopes to do this during the coming year. The new loops which were recently built by the company at the New York end of the Brooklyn Bridge have given satisfaction, and the company expects that it will be able to transport 20,000 passengers more per hour as soon as its patrons have become thoroughly familiar with the new arrangement.

It is reported that a contract has been made by the American Railway Traffic Company for removing the city's ashes on cars over the lines of the Brooklyn Rapid Transit Company to the low lands of Coney Island. This work is to be done at night so that it will not interfere with the regular passenger business.

The company also expects to construct a new seven-story office building sometime during the coming spring. This structure will be an annex to the present office building of the company, the new building being directly behind the present quarters.

IMPROVEMENT BY THE PUBLIC SERVICE CORPORATION

President Thomas N. McCarter, of the Public Service Corporation, of New Jersey, has just outlined plans for the reconstruction of the street railway system of that company that will call for the expenditure of $7,000,000 in the next five years. In addition to this there will also be important and extensive improvements to the gas and electric lighting system controlled by the company, but the expenditure for this latter work will be small compared with that which will be spent upon the street railway system, due to the relative conditions in which the properties were found when taken over. During the summer a complete examination was made by experts of the street railway system and the result of that examination has recently been submitted to the company. It is substantially that the large expenditure just referred to must be made without reference to the future development of power, which is separately considered, and without reference to a single extension.

Some of the improvements to the street railway system are already under way. Deliveries are being made on the first lot of 150 new cars ordered almost immediately after the consolidation, and the last of the cars on this order, it is expected, will be delivered within the next month or two. Additional orders are to be placed which will result in an increase in the rolling stock of 600 more cars during the next five years.

Most of the money for improvements will be expended in what is known now as Greater Newark. If the right of the company to build on Central Avenue through East Orange is sustained, a line will be built through the Oranges as far as the company is permitted to go on Central Avenue, thus furnishing direct communication to all that part of the community south of Main Street, and if the company receives the permission of the authorities of East Orange, it will build a similar line on Springfield Avenue, about equidistant to the north, so that two more lines radiating from the Oranges will come into Newark.

The plan is to proceed at once with the extension to Elizabeth, via Lyons Farms Road, and as soon as this work is completed the Plainfield cars will run directly into the city of Newark. Simultaneously with the completion of the improvements just outlined, it is planned to run a new line from Hoboken Ferry, Hoboken, direct to Newark. Negotiations are now pending for a through line from Hackensack over the line of the Newark & Hackensack Traction Company, an independent line, into the city of Newark. The company also expects soon to complete negotiations so that cars can be run direct from Perth Amboy into the city of Newark, and approval has just been given by the company to a contract drawn to provide for a through car service, commencing Jan. 1, approximately, from Jersey City to Trenton.

If the commissioners approve of the abandonment of the Morris Canal, and if the Legislature sanctions the plan, Mr. McCarter says that the company will immediately enter into negotiations for the use of the canal bed for street railway purposes, so as to increase the transit facilities of the city of Newark and the county of Essex. The whole project of canal abandonment is in its primary stages at present, but the possibilities of the use of the waterway for high-speed work are important. It is pointed out that the canal bed could be used for a high-speed line in one direction to Paterson and in the other to the Passaic River, and that after the Passaic is crossed it would be possible to continue in the canal bed or else on present right of way which the company owns, abutting the plank road, across the Hackensack River. Then by building a short new line from the Hackensack to the elevated line which the company owns in Jersey City, passengers could be taken not only from Newark, but from the Oranges and all the outlying territory on a high-speed line to the Hoboken Ferry. When the new tunnel under the Hudson River is completed, if the negotiations that are now under way are successful, the terminal of the Public Service Company's lines will not be at Hoboken, but New York, to which place through cars will be run.

PERSONAL MENTION

MR. A. N. CONNETT, of J. G. White & Co., Ltd., of London, has been making a short visit to the United States.

MR. H. L. SHIPPEY, New York manager of John A. Roebling's Sons Company, of Trenton, N. J., has been dangerously sick with appendicitis, but is now convalescent, having recovered without the necessity for an operation.

COL. GILES S. ALLISON has returned to New York hale and hearty after a long and serious illness. On Aug. 22 he underwent a difficult operation at the medical college of Johns Hopkins University, Baltimore. Subsequently he was confined at his St. Louis home by pneumonia. His many railway friends will no doubt be glad to learn of his return.

MR. EDWARD H. CHAPIN, of Rochester, has just been appointed Eastern sales agent of the National Car Wheel Company, and will establish headquarters about Dec. 1 at 556 West Thirty-Fourth Street. Mr. Chapin, who has long been known in the railway trade through his connection with the Rochester Car Wheel Works, has recently recovered from an attack of appendicitis.

MR. CLARK YERRICK, assistant superintendent of the San Francisco, Oakland & San Jose Railroad, of San Francisco, Cal., known as the Key route, was instantly killed on the evening of Nov. 21, near his home in Oakland, by coming in contact with an old telephone wire, which had broken and fallen across a 2000-volt lighting main. Mr. Yerrick was an old steam railroad man, but had been in the employ of the Oakland Transit Company in various capacities since 1894. When the new electric ferry line between Oakland and San Francisco was opened up by interests identical with the Oakland Transit, he was made assistant superintendent of the system, and in that capacity had charge of the movements of the electric trains and ferryboats from the new pier. Mr. Yerrick was a very competent official, was possessed of an even temper and was extremely well liked by employees and associates. His death removes the second official of the new Key route within a few days, the first being Mr. George Spink, master mechanic, whose accidental death was noted in last week's issue.

TABLE OF OPERATING STATISTICS

Notice.—These statistics will be carefully revised from month to month, upon information received from the companies direct, or from official sources. The table should be used in connection with our Financial Supplement "American Street Railway Investments," which contains the annual operating reports to the ends of the various financial years. Similar statistics in regard to roads not reporting are solicited by the editors. * Including taxes. † Deficit. *a* Including all lines operated.

Company	Period	Total Gross Earnings	Operating Expenses	Net Earnings	Deductions From Income	Net Income, Amount Available for Dividends
AKRON, O.						
Northern Ohio Tr. & Light Co	1 m., Oct. '03	75,272	41,314	33,958	22,447	11,511
	1 " " '02	65,627	36,333	29 294	16,769	12,525
	10 " " '03	741 574	403,264	338,310	222,112	116,198
	10 " " '02	617,526	340,471	277,055	170,067	106,988
ALBANY, N. Y.						
United Traction Co	3 m., Sept. '03	449,306	279,727	169,579	76,147	93,432
	3 " " '02	414,635	251,738	162,897	71,597	91,300
AURORA, ILL.						
Elgin, Aurora & Southern Traction Co	1 m., Oct. '03	37 011	22 869	14,142	9.172	4,970
	1 " " '02	33,648	20,494	13.154	9,050	4,104
	10 " " '03	383,181	219,446	163,735	85,010	78,725
	10 " " '02	341,888	196,233	145,655	84,765	60,890
BINGHAMTON, N. Y.						
Binghamton Ry. Co.	1 m., Oct. '03	18 613	10,586	8,028	------	------
	1 " " '02	17,107	10,693	6,414	------	------
	4 " " '03	92,120	44,584	47,537	------	------
	4 " " '02	82,360	44,675	37,685	------	------
BROOKLYN, N. Y.						
Coney Island & Brooklyn R. R. Co	3 m., Sept. '03	516,757	293,705	223,052	67.628	155,424
	3 " " '02	525,955	282,109	243,846	68,842	175,004
CHICAGO, ILL.						
Aurora, Elgin & Chicago Ry. Co	1 m., Oct. '03	38,878	20,079	18 799	------	------
	4 " " '03	191,314	82,159	109,155	------	------
Chicago & Milwaukee Elec. Ry. Co.	1 m., Oct. '03	43 307	10,746	32,561	------	------
	1 " " '02	15,731	6,548	9 183	------	------
	10 " " '03	237,943	77 682	160,261	------	------
	10 " " '02	163,139	66,395	96,743	------	------
CINCINNATI, O.						
Cincinnati, Newport & Covington Light & Traction Co	1 m., Sept. '03	110,719	*60,716	50,003	22,664	27,339
	1 " " '02	99,147	*49,698	49,44	20,862	28.587
	9 " " '03	905,686	*521,206	384,48	203 123	181,357
	9 " " '02	806,583	*451,492	355,091	189,636	165,455
CLEVELAND, O.						
Cleveland & Southwestern Traction Co	1 m., Oct. '03	43,656	24,875	18,782	------	------
	1 " " '02	28,243	16,342	11,900	------	------
	10 " " '03	373,889	219,614	154 275	------	------
	10 " " '02	248,211	137,462	110,748	------	------
Cleveland, Painesville & Eastern R. R. Co	1 m., Oct. '03	18 333	11 696	6,637	6,568	68
	1 " " '02	16,980	10,422	6,558	6.180	378
	10 " " '03	183,219	105,704	77,515	64.871	12,644
	10 " " '02	168,875	94,818	74,057	61,955	12,102
DETROIT, MICH.						
Detroit United Ry *a*	1 m., Oct. '03	387,340	234,239	153,101	85,119	67,982
	1 " " '02	345,589	199,222	146,367	81,078	65 289
	10 " " '03	3,720,963	2,181,717	1,539,246	828,882	710,364
	10 " " '02	3,331,709	1,867,239	1,464,470	784,297	680,173
DULUTH, MINN.						
Duluth Superior Traction Co	1 m., Oct. '03	53,634	29,010	24,622	15,838	8,784
	1 " " '02	48,587	28,204	20 333	14,590	5,743
	10 " " '03	518,893	286,051	232,842	154,923	77,919
	10 " " 02	442,845	233,248	209,597	146,409	63,188
FORT WORTH, TEX.						
Northern Texas Traction Co	1 m., Oct. '03	47,569	27,459	20,110	9,723	10,387
	1 " " '02	38,127	15,856	22,271	474	21,797
	10 " " '03	382,866	205,627	177,239	92,212	85,027
	10 " " '02	177,239	------	------	------	------
GLENS FALLS, N. Y.						
Hudson Valley Ry. Co.	3 m., Sept. '03	181,389	103,823	77,566	64,123	13,442
	3 " " '02	121,125	83,183	37,942	55,272	†17,330
HAMILTON, O.						
The Cincinnati, Dayton & Toledo Trac. Co	1 m., Oct. '03	46.617	24,246	22,421	15 931	6,490
	1 " " '02	41,747	22,648	19 099	16,512	2,587
	5 " " '03	251,328	123,832	127,496	80,221	47,274
	5 " " '02	226,249	113,854	112,395	81,753	30,642
HANCOCK, MICH.						
The Houghton County St Ry. Co	1 m., Sept. '03	16,479	9,376	7,103	3,852	3,251
	1 " " '02	13,581	8,827	4,754	2,604	2,150
	12 " " '03	185,001	121,144	63,857	35,097	28,760
	12 " " '02	170,302	105,247	65,055	31,632	33,423
HARRISBURG, PA.						
Central Pennsylvania Traction Co	1 m., Oct. '03	41,896	38,975	2,921	------	------
	1 " " '02	37,447	22,355	15,092	------	------
	10 " " '03	433,039	313,108	119,931	------	------
	10 " " '02	381,956	228,285	153,701	------	------
HAZLETON, PA.						
Lehigh Traction Co	1 m., Oct. '03	12,277	5,356	6,921	------	------
	1 " " '02	6,419	3 316	3 103	------	------
	10 " " '03	117,799	64,369	53,430	------	------
	10 " " '02	81,137	49,894	31,243	------	------
HOUSTON, TEX.						
Houston Electric Co.	1 m., Sept. '03	38,599	23,389	15,210	6,306	8,904
	1 " " '02	32,282	17,804	14,478	6,250	8,228
	12 " " '03	421,018	261,368	159,650	79,107	80,543
	12 " " '02	339.728	196,112	143,616	------	------
ITHACA, N. Y.						
Ithaca Street Ry. Co.	3 m., Sept. '03	29,067	17,270	11,797	4,920	6,877
	3 " " '02	30,396	18,588	11,808	5,736	6,072
JACKSONVILLE, FLA.						
Jacksonville Electric Co	1 m., Sept. '03	21,813	14,149	7,664	3,100	4,564
	1 " " '02	16,575	10,947	5,628	2,875	2,753
	12 " " '03	237,024	158,530	78,494	35,363	43,131
LONDON, ONT.						
London St. Ry. Co	1 m., Oct. '03	13.772	8,656	5,116	2,289	2,827
	1 " " '02	11,645	7,408	4,237	1,911	2 326
	5 " " '03	146,289	92,412	53,877	22,161	31 716
	5 " " '02	127,307	78,220	49,086	22,195	26,891
LONG ISL'D CITY, N.Y.						
New York & North Shore Ry. Co	3 m., Sept. '03	48,611	24,555	24,056	9,186	14,870
	3 " " '02	42,237	22,621	19,616	9,130	10,486
MILWAUKEE, WIS.						
Milwaukee El. Ry. & Lt. Co	1 m., Oct. '03	264,513	137,890	126,623	73,949	52,674
	1 " " '02	239,853	111,902	124,951	67,814	57,137
	10 " " '03	2,509,950	1,266 371	1,243 579	723,504	520 074
	10 " " '02	2,254,794	1,061,410	1,193,383	664,625	528,758
MINNEAPOLIS, MINN.						
Twin City R. T. Co	1 m., Oct. '03	348,646	161,451	187,195	60,944	126 251
	1 " " '02	304,317	140,226	164,091	60,233	103,857
	10 " " '03	3,369,489	1,560,338	1,809,151	609,074	1,200,076
	10 " " '02	2,971,411	1,331,546	1,639,865	590,967	1,048,899
MONTREAL, QUE.						
Montreal St. Ry. Co	1 m., Oct. '03	206,601	110,709	95,892	18,922	76,970
	1 " " '02	181,406	96,419	84,987	15,992	68,995
OAKLAND, CAL.						
Oakland Transit Consolidated Co	1 m., Oct. '03	93,624	49,868	49.756	24,311	25,445
	1 " " '02	81,955	45,344	36,611	21,865	14,745
	10 " " '03	937,635	478,919	458,716	------	------
	10 " " '02	777,672	460,155	317,517	------	------
PHILADELPHIA, PA.						
American Railways	1 m. Oct. '03	116,953	------	------	------	------
	1 " " '02	96,266	------	------	------	------
	4 " " '03	539,186	------	------	------	------
	4 " " '02	449,459	------	------	------	------
RICHMOND, VA.						
Virginia Passenger & Power Co	1 m. Oct. '03	124,355	79,132	45,203	------	------
ROCHESTER, N. Y.						
Rochester Railway Co.	1 m., Oct. '03	107,887	56,510	51,378	25,933	25,445
	1 " " '02	92,211	47,104	45,107	24,836	20,271
	4 " " '03	446,208	224,186	222,022	------	------
	4 " " '02	387,123	195,271	191,852	------	------
SAO PAULO, BRAZIL.						
Sao Paulo Tramway, Light & Power Co., Ltd	1 m., Oct. '03	109,200	32,200	77,000	------	------
	1 " " '02	92,721	35,692	57,029	------	------
	10 " " '03	1,071,500	327,300	744,200	------	------
	10 " " '02	914,741	350 629	564,112	------	------
SAVANNAH, GA.						
Savannah Electric Co	1 m., Sept. '03	45,606	26,505	19,101	10,583	8,517
	1 " " '02	42,883	22,803	20,080	9,583	10,497
	3 " " '03	146.674	80,558	66,116	30,219	35,896
	3 " " '02	135,630	71,435	64,194	28,749	35,444
SCHENECTADY, N. Y.						
Schenectady Ry. Co	3 m., Sept. '03	231,648	122,084	109,564	43,436	66,128
	3 " " '02	140,476	76,300	64,176	32,844	31,332
SEATTLE, WASH.						
Seattle Electric Co	1 m., Sept. '03	175,678	122,200	53,479	22.917	30,562
	1 " " '02	163,685	107,888	55,797	21,878	33,919
	12 " " '03	2,067,418	1,470,964	596.454	287,976	308,479
	12 " " '02	1,772,330	1,215,916	556,414	255,708	300,706
SYRACUSE, N. Y.						
Syracuse Rapid Transit Co	1 m., Oct. '03	70,015	39,685	30,330	20,323	10,006
	1 " " '02	59,585	32,644	26,941	19 025	7,916
	4 " " '03	282 608	157,145	125,463	81,206	44,258
	4 " " '02	243,900	133,868	110,032	76,100	33,932
TERRE HAUTE, IND.						
Terre Haute Elec. Co.	1 m., Sept. '03	46,713	25,309	21,404	8,523	12,881
	1 " " '02	32,717	19,944	12,773	6,451	6,322
	3 " " '03	135,012	77,384	57,629	21,726	35,902
	3 " " '02	94,975	63,012	31,963	19,342	12,622
TOLEDO, O.						
Toledo Rys. & Lt. Co.	1 m., Oct. '03	142.651	74,805	67,846	41,245	26,601
	1 " " '02	124,487	60,483	64,004	38,832	25 172
	10 " " '03	1,368,580	705,979	662,601	408,096	254,505
	10 " " '02	1,193,546	607,072	586,474	381,541	204,933
Toledo, Bowling Green & Southern Trac. Co.	1 m., Oct. '03	26,240	16,955	9,285	------	------
	1 " " '02	21,195	11,642	9,553	------	------
	10 " " '03	243,633	150,104	93,529	------	------

Street Railway Journal

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EDITORIAL NOTICE

Street railway news, and all information regarding changes of officers, new equipments, extensions, financial changes and new enterprises will be greatly appreciated for use in these columns.

All matter intended for publication must be received at our office not later than Tuesday morning of each week, in order to secure insertion in the current issue.

Address all communications to

THE STREET RAILWAY JOURNAL,
114 Liberty Street, New York.

Chicago Elevated Traffic During the Strike

The figures on daily traffic on the South Side Elevated Railroad, of Chicago, during the two weeks' strike on the surface lines of the Chicago City Railway, which serves the same territory, are interesting as showing what proportion of daily traffic within reach of the elevated line ordinarily patronizes the surface lines, and also the capacity of the elevated road to handle large traffic. It is true that the elevated road was taxed to its utmost to take care of the business which came to it as a result of the strike, yet it met the emergency when it was presented. The daily average in November, 1902, was 83,299 passengers, and during the strike, from Nov. 12 to Nov. 25, 1903, the average daily traffic was increased to 206,000. This exceeded by 10 per cent any like period during 1893, which was the World's Fair year, when the traffic was very heavy toward the close of the exposition season. On Nov. 14, 1903, which was the date of the heaviest traffic, 229,535 passengers were carried. During the rush hours all trains were not run the full length of the line, but some were turned at Thirty-Ninth Street, Forty-Seventh Street and Sixty-First Street. The possibility of doing this without delaying the traffic and without special terminal facilities at these points calls attention to the flexibility of the multiple-unit system, which enables trains to be switched over to the opposite track at any cross-over without delay. The management was, of course, elated over the splendid showing made, and President Leslie Carter expressed their sentiment correctly when he said: "The figures demonstrate the capacity of the road to do a big passenger business in an emergency, and show, also, what can be done later when we have the additional tracks and power now proposed. The November strike crowd was carried with little complaint, and there would have been less if it had been possible to lengthen the loop platforms." With better station and loop facilities and additional power the South Side "L" will be able to contribute materially to the solution of the transportation problem of Chicago.

Restricting Controller Movement

In another column a synopsis is given of some tests recently made at Madison, Wis., to determine the economies introduced by the use of a certain new but tolerably well-known device for restricting the rate of turning on current at the controller. While these tests were made with the avowed object of determining the advantages to be derived from the use of this one particular device, and for the manufacturing company which is introducing it, the results throw some light on the general question of limiting the attempted rate of acceleration by means of devices connected with the controlling mechanism. That there is value in such devices in the minds of others than those directly interested in their manufacture is shown by the introduction of the automatic throttle or limiting coils in connection with several of the most important multiple-unit systems of control.

The original Sprague multiple-unit system had an automatic throttle which limited the acceleration current to a predetermined value for which value the throttle was set. The controller would not advance from one point to another until the current in one motor fell below the current for which the throttle was adjusted. In the first train control system of the General Electric Company no provision was made for limiting the accelerating current, but a device for this purpose has been introduced for the controllers that company is furnishing for the subway cars in New York, and apparatus having a similar object in view is employed in the Westinghouse electro-pneumatic train control system.

The automotoneer, which is the trade name of the device upon which the Madison tests were made, is a purely mechanical device. The rate of advancement of the controller naturally is independent of the current that may be flowing, and depends entirely upon the rapidity of action of an air dash pot which must release the controller after each advancement of one notch. Although depending simply upon a time element and not upon current flowing, the latter device, in most cases, probably accomplishes about the same results as the former, and its simplicity makes it available for use on many cars where a train control system would not be thought of. The matter of restrictions on the acceleration is, therefore, one of immediate interest to the great majority of electric roads, because the apparatus for that purpose now available covers practically the entire electric railway field.

There is undoubtedly much misconception among electric railway men who have not studied the subject as to the real objects for which such devices should be used on a car, some believing that they have many virtues which they have not, and others failing to appreciate some of the real benefits which

they accomplish. This confusion is, perhaps, only natural when we consider the literature which has appeared on the subject of acceleration in the last few years. In the first place, we have the technical society papers of any number of eminent electric railway engineers demonstrating that in any kind of a rapid transit schedule where frequent stops are necessary, the greatest economy in the consumption of electrical energy is secured by accelerating the car or train as rapidly as possible and shutting off current as soon as possible, letting the car drift until it is necessary to apply the brakes. The retardation or rate of braking should be also very rapid. It is not necessary to go into an extended discussion on this principle, which is now well recognized, but it is perhaps somewhat confusing at first when it is learned that the same eminent engineers who expound this principle are responsible in part for the introduction in the controlling mechanism of means for restricting the rate of turning on current. Some will ask why any such restrictions should be introduced when it is desirable to have very rapid acceleration, and this question brings us to the fundamental reasons for the introduction of such devices in any class of electric railway service where the stops are frequent. The simple practical fact is that some such limiting devices as those under discussion are an aid in securing rapid acceleration by acting as a guide to the careful motorman and a check on the careless motorman. A careful motorman of good judgment can, it is true, accelerate a car or train very rapidly and smoothly without any such restricting devices, but their use relieves a careful motorman of responsibility in this direction, and also prevents the careless motorman from spinning the wheels, jerking the passengers and straining the entire equipment by too rapid turning on of current. The spinning of wheels during acceleration, of course, defeats the desired end of rapid acceleration by reducing the available tractive effort of the driving wheels. That the jerking of passengers by careless controller handling is a common evil in most large cities is too well known to need repetition.

There is another field for devices of this kind which is entirely distinct from their use on lines where stops are frequent as they are on city surface and elevated lines. This is in interurban service where it is desired to limit the maximum starting current that can be drawn from a power house or sub-station by a car, and to limit the heating of motor equipments by heavy starting current. In this case the rate of turning on current should be determined not by the amount of current that can be turned into the motors without slipping the wheels, as in city service, but by the maximum current which it is desired to allow any one car to take from the power house. In service where stops are infrequent and the number of cars are few, the matter of rapid acceleration is of comparatively little importance, and frequently the matter of maximum demand on power house or sub-station and heating of motors is of great importance. These two uses for controller electric devices should not be confused with each other, as they are entirely distinct from each other, as said before.

There have been none too many tests made on the economies possible at the controller handle. While full details as to the methods employed in the tests at Madison are not given, they appear to have been entirely fair, and, if anything, have erred in the direction of comparing test runs under conditions least favorable to the restricting device. None but those who have tried it can appreciate the difficulties to be found at every hand when an attempt is made to make a fair test of the economy to be secured by any device of this kind. Special tests lasting only a short period of time are open to many errors that creep into any test where conditions vary so widely from hour to hour as they do in the operation of an electric car. On the other hand, comparison of the commercial performance of a large number of cars with and without such devices on a given road is also very difficult, because on most roads conditions are changing from month to month and from year to year. The only way to determine these points is to test and keep testing, and the results in the aggregate will show where the correct practice lies. Taken altogether, the Madison tests confirm previous results that have been obtained.

One question upon which these tests throw some light is that of the value of reversal for emergency stops in city service. The curve obtained in the tests, which shows the result obtained by the speed recorder on an emergency stop made by reversing, shows that a stop was made from 20 m. p. h. in 88 ft. This is as good, if not better, than the majority of emergency stops that can be secured with the aid of the brake-shoes, as shown in the braking tests published within the last few years. For example, in the tests recorded by J. D. Keiley, in the transactions of the American Institute Electrical Engineers, Dec. 19, 1902 (see Street Railway Journal, Dec. 27, 1902), a greater distance than this was usually required to make a stop from about 15 m. p. h. It should be remembered, however, that the emergency stop curve shown in connection with the Madison tests represents favorable conditions, and that a too rapid application of the reverse current by the motorman materially increased the distance required to stop. On the other hand, it can be said that too strong an application of an air brake would skid the wheels and so increase the distance required to stop a car by means of the brake-shoes.

Alternating-Current Traction Motors

For some years past we have persistently harped upon the necessity of alternating-current motors for traction if serious railway work was to be attempted in the future. For large distributions high voltage upon the working conductors is little less than a necessity, and no amount of ingenuity can evade the issue. And to work this high-voltage system effectively, alternating-current motors are highly desirable. Upon this theme we have consistently executed a sort of "vox-clamantis-in-deserto" solo, and it looks now as though time were swiftly bringing us vindication. The account of the Finzi motor, and the still more important announcement of the Westinghouse Electric & Manufacturing Company, which we print elsewhere in this issue, that it is now prepared to take contracts for the equipment of electric railways with the new single-phase system, show that this form of motor meets, at least fairly well, the dynamical requirements of electric traction, and that it must be reckoned with as a competitor at least within certain limitations. Adding to this the really remarkable claims made for the motor of the Union Elektricitäts-Gesellschaft, which has already been described in our columns, and the work of Latour, Schüler and others in Europe and Arnold in America, and one has a mass of evidence in favor of single-phase traction that cannot safely be disregarded.

The interesting feature of all this recent work is that the tendency is toward the adoption of types other than the pure induction motor. In its polyphase form this motor leaves little to be desired in the way of good qualities for ordinary purposes, and the recent success at Zossen shows plainly that it is not to be despised for certain classes of railway work. But, as we have often pointed out, the working conductors of a polyphase

line form an exceedingly troublesome system save in special cases, and in ordinary tramway work the polyphase motor is handicapped by troublesome regulation and inability to make up time conveniently. The pure monophase induction motor is in a far worse case in these latter particulars, and has in addition a bad power factor. Hence, this curious simultaneous recurrence to alternating motors with commutators—either series motors with laminated poles and extra low inductance, or repulsion motors of the form devised by Thomson, or some combination of these forms. The series form has been long known and was worked upon a decade since by the late Rudolf Eickemeyer with somewhat promising results. But in spite of careful design and high-resistance commutator leads, such motors have hitherto been afflicted with serious sparking, and both they and the repulsion motors have shown bad power factors, save when running at a fair speed. That these serious objections have been overcome, or at least materially reduced, in the motors now before us, seems beyond question.

In point of efficiency the alternating motors cannot be fairly expected to surpass the present types, or to equal them while retaining the same general constants of design, but it is altogether probable that the difference in practice will be vanishingly small. When, however, the rheostatic control losses with the direct-current motor are taken into consideration, any difference in motor efficiency disappears in the cases of short runs; and when we consider the total losses on the system the advantages of the single-phase motor become still more apparent. Mr. Lincoln, in discussing the Westinghouse single-phase motor, places the point at which the car efficiency of the two systems coincides as being in runs of about a mile in length. Where the average run is shorter, the alternating-current car equipment is more efficient, owing to the practical elimination of controller losses. Where the runs are longer, the direct-current equipment is more efficient. In comparing the total loss, however, in the two systems, the alternating-current efficiency stands out in striking contrast. In the example selected by Mr. Lincoln, it is 81.6 per cent as against 61.5 per cent in the direct-current system.

We are not disposed to get excited over the matter and to predict that the new motors will shortly drive both direct-current and polyphase motors into oblivion, but the time is certainly here when the alternating-current traction motor must be reckoned with as a real competitor, and cannot longer be put aside with contempt. At the time of the Inner Circle litigation, we took occasion to make some predictions on the possibilities of alternating-current motors, which were criticised in some quarters, but the developments of the last year have proved the truth of our contention. We do not mean to claim now, nor did we then, that the alternating-current motor, when developed, will do all that the direct-current motor can do and more, but we do believe that the field which it will fill will be commensurate in size with that of its direct-current counterpart. It is possible that none of the motors now being exploited will take a prominent place in the art, but it is equally certain that the larger requirements of electric traction demand a more rational system of distribution than can be provided by the rotary converter. The latter should be looked upon merely as a useful makeshift. In the very near future there will be hot competition as to what form of alternating-current motor can be used under different conditions, and in some cases what form will best replace the direct-current motor, and the wise thing for American engineers and manufacturers to do is to realize this fact.

Relieving Congestion on Brooklyn Bridge

The opening of the Williamsburg Bridge will be hailed by all who have occasion to cross the East River daily, especially during the rush hours, as this will greatly relieve Brooklyn Bridge. The new bridge connects with a large and important manufacturing district, it has much greater capacity than the present structure, and the arrangements for transportation lines are on a much larger scale than could ever be provided by the first structure. It is 118 ft. in width, as compared with 85 ft., the width of the Brooklyn Bridge. It also has two decks instead of one, two foot walks, each 10½ ft. in width, two bicycle paths, each 7 ft. wide, four trolley tracks, two elevated railway tracks and two roadways, each 20 ft. in width. The old bridge has one promenade 15 ft. wide, two roadways, each 18 ft. wide, and each giving half of its space to the trolley tracks, and two elevated railway lines.

The trolley lines on the new bridge will greatly increase present facilities, as there will be four tracks running in a space especially devoted to their use, thus providing facilities for operating 350 cars an hour, and handling 70,000 persons traveling in both directions, as against 40,000 an hour on the old structure. Moreover, there will be no interference from trucks, wagons or carriages, and the elevated railroad will provide for the carrying of at least 29,000 persons in one direction every hour, or 58,000 persons going and coming across the bridge, thus raising the maximum to 128,000 an hour.

Mr. Wheatley contributed a valuable series of articles on "The Passenger Traffic Problem of Greater New York," to the STREET RAILWAY JOURNAL early this year, in which he pointed out the great advantages that would accrue to the city from these added facilities and the relief that would be afforded the increasing congestion of the transportation service of Manhattan, as well as the present facilities of Brooklyn Bridge. His concluding article, which appeared on Feb. 7, 1903, was an able exposition of the relations between Manhattan, Brooklyn and Queens, and the influence which improved transportation facilities would have in building up the boroughs across the East River. It may be read again now with interest.

American Railway Mechanical and Electrical Association Work

The executive committee of the American Railway Mechanical and Electrical Association met at Cleveland this week to lay out general lines of work for the next convention and take such steps as naturally fall on such an organization.

Leaving to another time a fuller consideration of the timeliness and usefulness of the subjects chosen, it can be said that the executive committee has acted wisely in its method of handling the programme. It is a plan that has been followed with much success in similar organizations with which we are acquainted. Various members of the executive committee and other prominent members are each assigned the responsibility for the securing of papers and discussions on a certain subject. It will materially benefit everyone concerned and be very acceptable to the executive committee if those interested will communicate with the members having charge of the various subjects as to men who are especially fitted to discuss the subjects of which they have charge. This new Association certainly has a great work before it, and the earnest manner in which it is going at it shows that its officers and members are equal to the task. Although being new the Association is not, perhaps, as well known and recognized as it will be another year, and the membership and support it is receiving from every quarter assures its continued success and usefulness.

THE METHODS OF HANDLING THE MEN ON THE CAMDEN & SUBURBAN RAILWAY

It is the intention, in the present article, to give in detail the methods followed by the Camden & Suburban Railway Company not only in engaging, instructing and managing the force of men which operates its cars, but also the system followed in preparing the time-tables, assigning the runs, disciplining the men and discharging them if inefficient. In handling its men the company has followed, in many respects, quite novel lines, being the only one, so far as the editors of this paper are aware, which has adopted a regular system of demotion with its employees. This plan has been in use on the Camden & Suburban Railway for two years and a half, with most successful results, being satisfactory to both the officers and to the men themselves.

ENGAGING EMPLOYEES

The company exercises the greatest care in the selection and engagement of its employees. When a man applies for a position he is obliged to fill out the usual blank, in regard to his physical condition, past history and reasons for wishing employment. He is then obliged to give at least three references as to his character. Letters are not sent to the parties whose names are given as reference unless they are some distance away. If they are in Philadelphia or Camden, a representative of the company is sent to them, as experience has shown that a former employer will often give a man a very good testimonial in writing, but if he is interviewed personally he will mention faults in the man's character which he would hesitate to express in black and white. These reports are filed with the application for employment. One question which is always asked every prospective employee and which is not found in the question blank of many roads is whether he has a job at the time of making application for employment, and also his average wages per week during the previous three years. Every employee is also asked personally by the general manager whether he agrees to keep the rules of the company, especially the rule forbidding men to smoke while on duty or while riding as a passenger on the cars, and also the one forbidding them entering saloons while in uniform, and is required to sign a promise to obey these particular rules, as they have been found to be the ones most frequently broken.

EXAMINING APPLICANTS

The prospective employee, if satisfactory to the company up to this point, is then obliged to pass a physical examination. If up to the standard required he is given a note to the chief despatcher, who assigns him to some particular inspector for instruction.

After having served without pay the necessary length of time to become competent on a car in the suburbs and then on a city car with an instructor, the motorman or conductor is given an examination on the rules before being placed in entire control of a car. This examination is conducted by the chief despatcher. If the man passes it successfully his standing is indicated on Form 143, reproduced herewith, which is signed by the employee, by the chief despatcher and by the general manager. The object of having the different topics printed on the examination form is to have all the subjects directly before the examiner and man during the examination, so that the former may not neglect any of them, and the latter will not claim, at a later date, that any portion of the rules was passed over. If the man "passes" he is assigned to work as an "extra."

THE DEMOTION SYSTEM

The discipline of the company is based entirely upon what is known as the "demotion" system, which was originated on this line, and which was adopted on April 1, 1901. Some particulars of the system were given by Mr. Harrington in an article in the Street Railway Journal for Sept. 6, 1902, but it may be well to rehearse its principal features.

Demotion points are applied for tardiness and other petty irregularities and violations of the rules. For instance, for the first failure to report for duty in a month, a regular conductor or motorman is demoted one point; for the second time in the same month, two points; for the third time, three points. For permitting smoking on his car or for starting his car without receiving a signal from the conductor he may be demoted five points. Other violations are punished by demotions of various

Form 143 500-5-22-03 19612

Application No._____

EXAMINATION

—OF—

CONDUCTORS AND MOTORMEN

Date_____

Name _____ { Conductor / Motorman

Date of Examination_____ Examination Average _____

Sent out for Instructions_____ Approved_____ Chief Dis

Date Passed_____ Approved_____ Gen. Mgr.

CONDUCTOR AND MOTORMEN'S EXAMINATION	MOTORMAN'S EXAMINATION
1. Accidents 2. Bell Signals 3. Broadway and Vanhook 4. Broken Trolley wire 5. Car spacing on street 6. City Hall Stop 7. Duty at Ferry Terminal 8. Fenders 9. Freight 10. Fog 11. Gates, Sidebars and steps 12. Haddonfield Terminal 13. Last trips to Barn 14. Light circuit on car. 15. Position at Ferry 16. Power off 17. Passengers on platform 18. Railroad Crossing. 19. Right of way 20. Signs. 21. Street Crossings 22. Smoking on duty 23. Saloons, with uniform 24. Speed by School Houses and Churches	40. Brakes 41. Controller, use of 42. Circuit breakers 43. Gong 44. Headlights 45. Motorman's Cards 46. Passing other cars. 47. Switches and Curves 48. Water
CONDUCTOR'S EXAMINATION	
24. Assistance to Passengers. 25. Bicycles 26. Dogs 27. Direction of Trips 28. Division of Fares 29. Delay cards 30. Fares and Tickets 31. Glass 32. Haddon Avenue and Kaigh Avenue 33. Intoxicated and disorderly passengers 34. Lost articles 35. Position of Conductor 36. Passengers, Danger 37. Register strips 38. Spitting on the floor 39. Trolley rope	

I have carefully read, and understand all the rules and regulations of the Camden and Suburban Railway Co., and will work in strict accordance with same.

Remarks—

EXAMINATION SHEET

amounts, but the principal cause of demotion is failure to respond at roll call.

The desirable runs are assigned to the conductors and motormen, not on the basis of seniority of service, but on their standing as determined by the demotion system. The result is that any employee by good conscientious service can advance to the better runs at the sacrifice of the less capable men. It has been found that the men appreciate this reward for faithful service.

RACK FOR INDICATING STANDING OF MEN

The company has the following runs, and they are mentioned in the order in which they are considered as most desirable:

Twenty-three straight day runs.
Twenty straight-from-noon runs.
Nineteen swing runs.
Three night runs.
Sixteen tripper runs.

The standing of the men as regards the assignment of these runs is indicated by the position of a series of cards kept in the chief despatcher's office at the car house in two special racks, one for the motormen and the other for the conductors. One of these racks is illustrated herewith. Each rack has about fourteen horizontal rows of fourteen hooks each. There is a small tag corresponding to each motorman and each conductor, upon which is written his name and badge number. The upper

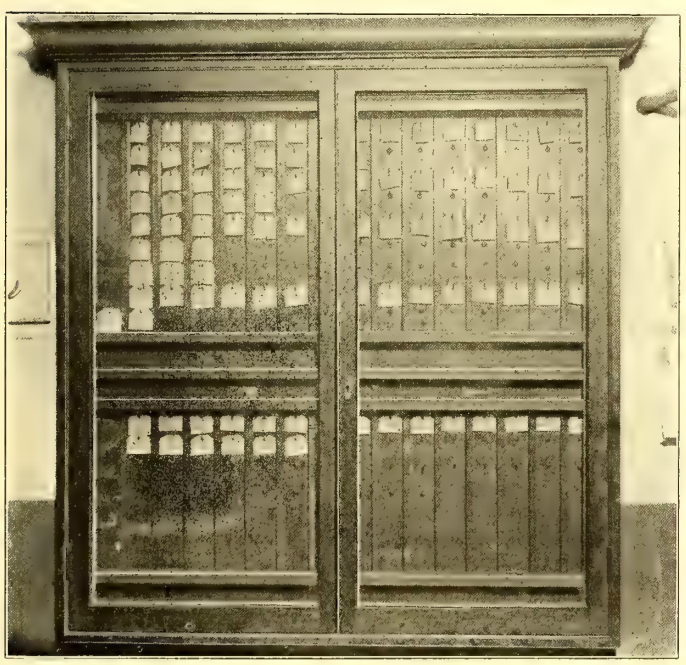
two rows in each rack are reserved for the tags of the men holding the "straight-day" runs, the second two rows for those holding the "straight-from-noon" runs, and so on down the scale. The lowest row, that in the lower half of the rack, as shown in the illustration, is for the "extra" men.

When a demotion is decided upon the chief despatcher transfers the tags as called for by the penalty. Thus, if Conductor Doe is to be demoted five points, his tag is taken from its hook and placed on the fifth hook, lower down in the scale, and each of the four intervening tags is moved up one hook. In this way if a man is toward the end of any one of each different kind of run he may be moved back to a run of a less desirable kind, but, of course, always has the chance of regaining his place by conscientious work and attention to duty.

The position of the cards in the rack is changed only by the chief despatcher himself, and a written memorandum is made of it at the time, so that a man will not be demoted twice for the same offense. The rack has glass doors and is kept under lock and key. The chief despatcher holds the only key to it, so that there can be absolutely no tampering with the order of the cards. The order of the cards, however, can be seen through the glass doors, and, as it is open at all times to the inspection of the conductors and motormen, they often consult it as to their standing and that of their comrades.

NOTICES ANNOUNCING THE MEN'S STANDING

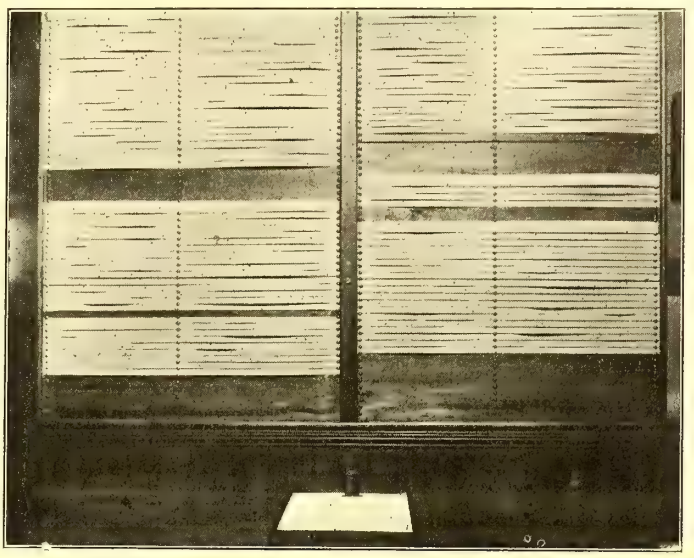
Notice of all demotions made is sent within twenty-four hours to the men interested and also to the general manager. In addition, once a month, a sheet is made up for the general manager showing the standing of all the men, their seniority in service and the runs upon which they are engaged. The seniority is indicated by the order in which these names appear, their standing by the length of a straight line drawn after the name of each man, and the class of run by the color of the line. There is also a numeral at the end of each line showing the relative standing of each man. This record will be referred to



RACK FOR HOLDING CARDS, SHOWING DEMOTION RANK OF MOTORMEN

more particularly in the article next week devoted to the reports made to the general manager by the different heads of departments.

In addition a notice is posted up monthly in the car house, giving the names of the men in alphabetical order, number of days excused, sick, etc., points demoted, and days and hours worked. The latter has been found to be of especial interest to the men, as it encourages the good workers and stimulates others to follow their example. This notice is posted in the



BULLETIN BOARD, SHOWING METHOD OF POSTING RUN NUMBERS AND BLOCK NUMBERS FOR GUIDANCE OF MEN

following form, the names of the regular men being written in black, and those of the extras in red ink:

SUMMARY, AUG., 1903

NAME	Excused	Sick	Times Missed	Points Demoted	Days Not Worked	Days Worked	Hours Worked
Andres, J.....	2	..	1	1	3	28	329½
Apgar, F.....	4	3	..	..	7	24	288¼
Andrews, J.....	..	10	..	..	10	21	246¼
Appleback, C.....	2	10	..	..	12	19	229½
Abbott, W.....	4	2	..	..	6	25	319¾
Anderson, W. ...	2		1	1	2	29	342
Arthur, C.....	..	1	1	1	2	29	302¾
Adams, A.....	.	..	..	..	1	30	333¾
Andrews, F.....	..	..	2	2	6	25	263½

A copy of this list is also sent monthly to the manager, who finds the record of the number of hours worked by each man, a point on which knowledge is of convenience.

WAGES

The wages paid for motormen and conductors are 17 cents per hour, which is an advance of 2 cents an hour over those paid prior to March, 1902. The runs are arranged for an average day of twelve hours and twenty-five minutes for meals.

PREMIUMS

In addition to the wages a premium of 10 per cent is paid monthly to all conductors and motormen who have gone through the month with a clear record, as far as accidents, good deportment and other parts of their duties are concerned. Tardiness is not punished by a loss of this premium unless a man has been tardy four or more times during the month. This premium is paid on the fifteenth of the following month. The system has been in force for about a year and a half, and the average number of men who participate each month in the division is 55 per cent of the total.

The list of men to whom the premiums are to be paid is made up monthly, in the main office, from the demotion record referred to above, which is sent to the general manager by the chief despatcher. This list contains the names of all the men, but opposite those not entitled to the premium a memorandum appears like this:

Jones—Accidents Nos. 582 and 583.

MOORESTOWN AND MERCHANTVILLE SUNDAY

101		
FERRY AR LV	M'VILLE AR LV	MOORSTN AR LV
		5 29
	6 14 15	
7 12 18	49 51	
8 22 28	59 9,	
9 32 38		10 35 45
11 42 48	12 19 21	
12 52 58	1 29 42	
2 13 18	49 3 2	
3 33 38	4 9 22	
4 53 58	5 29 42	
6 13 18	49 7 2	
7 35 38	8 9 22	
8 53 58	9 29 42	
10 13 18	49 51	
11 22 28	59 12,	
	12.25 ≠	

102		
FERRY AR LV	M'VILLE AR LV	MOORSTN AR LV
	5 35	
	5 50 +	
6 12 18	49 51	
7 22 28	59 8,	
8 32 38		9 35 45
10 42 48	11 19 21	
11 52 58	12 29 31	
1 3 8		2 4 7
3 3 8		4 4 7
5 3 8		6 4 7
7 3 8		8 4 7
9 3 8		10 4 15
11 12 18	49 51	
12 22 24		
12.35 ≠		

103		
FERRY AR LV	M'VILLE AR LV	MOORSTN AR LV
7 29		
		7 5 15
7 38 38		
9 42 48	10 19 21	
10 52 58	11 29 31	
12 2 8		1 5 7
2 3 8		3 4 7
4 3 8		5 4 7
6 3 8		7 4 7
8 3 8		9 4 7
10 3 8		11 5 15
12 12 14		
12.25 ≠		

104		
FERRY AR LV	M'VILLE AR LV	MOORSTN AR LV
5 50		
6 6 8		7 5 15
8 12 18	49 51	
9 22 29	59 10,	
10 32 38		11 35 45
12 42 48		1 44 47
2 43 48		3 44 47
4 43 48		5 44 47
6 43 48		7 44 47
8 43 48		9 44 47
10 43 48	11 19 21	
11 52 58	12 29 30	
	12.55 ≠	

105		
FERRY AR LV	M'VILLE AR LV	MOORSTN AR LV
		5 55
		6 44 45
7 42 48	8 19 21	
8 52 58	9 29 31	
10 2 8		11 5 15
12 12 18	49 51	
1 22 28		2 24 27
3 23 28		4 24 27
5 23 28		6 24 27
7 23 28		8 24 27
9 23 28	59 10,	
10 33 38		11 35 45
12 42 44		
1 ≠		

106		
FERRY AR LV	M'VILLE AR LV	MOORSTN AR LV
	5 55	
	6 20 21	
6 52 58	7 29 31	
8 2 8		9 5 15
10 12 18	49 51	
11 22 28	59 12,	
1 32 38	1 9 21	
3 13 18	49 4 2	
4 33 38	5 9 22	
5 53 58	6 29 42	
7 13 18	49 8 2	
8 33 38	9 9 22	
9 53 58	10 29 32	
11 3 8		12 5 7
1 4 8		
NIGHT-CAR-1012		

TIME-POINTS-TO-FERRY-	70 MIN	120 MIN 30	120 MIN 20
MOORESTOWN -		0	0
MERCHANTVILLE	0	26	25
ROSEDALE T-GATE	8	34	33
BRIDGE	19	45	44
BROAD & MARKET	26	52	51
FERRY -	31	57	56
LAY-OVER-AS-SCH			

TIME-POINTS-TO-M'VILLE & MOORSTN	70 MIN	120 M-30	120 M-20
FERRY -	0	0	0
BROAD & MARKET	5	5	5
BRIDGE	12	12	12
ROSEDALE-T-GATE	23	23	23
MERCHANTVILLE	31	31	31
MOORESTOWN		56	57
LAY-OVER-AS-SCH			

SCHEDULE

BLK	LV. FERRY M'VILLE	MOORSTN
104		6.8
102	6.18	
103	6.28	
107		6.38
109	6.48	
106	6.58	
108		7 8
101	7.18	
102	7.28	
103		7.38
105	7.48	
109	7.58	
106		8.8
104	8.18	
101	8.28	
102		8.38
107	8.48	
105	8.58	
109		9.8
108	9.18	
104	9.28	
101		9.38
103	9.48	
107	9.58	
105		10.8
106	10.18	
108	10.28	
104		10.38
102	10.48	
103	10.58	
107		11.8
109	11.18	
106	11.28	
108		11.38
101	11.48	
102	11.58	
103		12.8
105	12.18	
109		12.28
106	12.38	
104		12.48
101	12.58	
102		1.8
107	1.18	
105		1.28
1010	1.38	
108		1.48
106	1.58	
103		2.8
101	2.18	
109		2.28
107	2.38	
104		2.48
1010	2.58	
102		3.8
106	3.18	
105		3.28
101	3.38	
108		3.48
107	3.58	
103		4.8
1010	4.18	
109		4.28
106	4.38	
104		4.48
101	4.58	
102		5.8
107	5.18	
105		5.28
1010	5.38	
108		5.48
106	5.58	
103		6.8

BLK	LV. FERRY M'VILLE	MOORSTN
101	6.18	
109		6.28
107	6.38	
104		6.48
1010	6.58	
102		7.8
106	7.18	
103		7.28
108		7.48
107	7.58	
103		8.8
1010	8.18	
109		8.28
106	8.38	
104		8.48
101	8.58	
102		9.8
107	9.18	
105	9.28	
1010		9.38
108	9.48	
106	9.58	
103		10.8
101	10.18	
109	10.28	
105		10.38
104	10.48	
106	10.58	
102	11.18	
101	11.28	
109		11.38
1010	11.48	
104	11.58	
108		12.8

107		
FERRY AR LV	M'VILLE AR LV	MOORSTN AR LV
	5 55	
	6 ,6	
6 32 38		7 35 45
8 42 48	9 19 21	
9 52 58	10 29 31	
11 2 8		12 5 15
1 12 18	49 2 2	
2 33 38	3 9 22	
3 53 58	4 29 42	
5 13 18	49 6 2	
6 33 38	7 9 22	
7 53 58	8 29 42	
9 13 18	49 52	
	10.15 ≠	

108		
FERRY AR LV	M'VILLE AR LV	MOORSTN AR LV
6 50		
7 2 8		8 5 15
9 12 18	49 51	
10 22 28	59 11,	
11 32 38		12 35 45
1 42 48		2 44 47
3 43 48		4 44 47
5 43 48		6 44 47
7 43 48		8 44 47
9 43 48	10 19 22	
10 53 58	11 29 31	
12 2 8		
NIGHT-CAR-1011		

109		
FERRY AR LV	M'VILLE AR LV	MOORSTN AR LV
7 40		
7 52 58	8 29 31	
9 2 8		10 5 15
11 12 18	49 51	
12 22 28		1 24 27
2 23 28		3 24 27
4 23 28		5 24 27
6 23 28		7 24 27
8 23 28		9 24 27
10 23 28	59 11,	
11 32 38		12 35 37
		1.25 ≠

1010		
FERRY AR LV	M'VILLE AR LV	MOORSTN AR LV
	12 30	
1 32 38	2 9 22	
2 53 58	3 29 42	
4 13 18	49 5 2	
5 33 38	6 9 22	
6 53 58	7 29 42	
8 13 18	49 9 2	
9 33 38		10 35 45
11 42 48	12 19 20	
	12.45 ≠	

- MILEAGE -

BLOCK	M'VILLE	MOORESTOWN	TOTAL
101	112.13	39.30	151.43
102	53.79	123.60	177.39
103	33.60	145.55	179.15
104	36.77	145.55	182.32
105	37.68	134.65	172.33
106	108.33	30.90	139.23
107	89.21	41.20	130.41
108	46.19	123.60	169.79
109	43.02	143.30	186.32
1010	73.54	20.60	94.14
N-CARS		104.35	104.35
TOTAL	634.26	1052.60	1686.86

BARN-TO-FERRY-	1.35 M
" " ROSEDALE	2.33 "
" " M'VILLE	3.80 "
" " MOORESTOWN	9.40 "
FERRY " ROSEDALE	3.11 "
" " M'VILLE	4.71 "
" " MOORESTOWN	10.30 "

TIME-OF-RELEIF

BLK	NOON	NIGHT
101	11.42	6.13
102	11.52	7.03
103	12.02	6.03
104	12.42	6.43
105	12.12	5.23
106	11.22	5.53
107	11.02	5.13
108	11.32	5.43
109	11.12	6.23
1010		5.33

CREWS.

	A.M.	NOON	NIGHT
A	101		107
B	102		103
C	103		1010
D	104		109
E	105	104	
F	106	102	
G	107	108	
H	108	103	
I	109	101	
J		1010	
K		107	103
L		109	102
M		106	104
N		105	101
O		N. CAR	106
P		" "	108

NIGHT-CAR-SCHEDULE-

BLOCK	LV. FERRY FOR MOORESTOWN	LV. MOORSTN FOR FERRY	LV. M'VILLE FOR FERRY -
1011		1.7	1.31
1012	1.8	2.2	2.26
1011	2.8	3.2	3.26
1012	3.8	4.2	4.26
1011	4.8	5.2	5.26

CHARGE-DOUBLE-FARE-ON-ALL-TRIPS EXCEPT-5.2 AM-FROM-MOORESTOWN

SCHEDULE

L.V BLK	MOORSTN TO-FERRY
101	6.15
105	6.45
104	7.15
107	7.45
108	8.15
103	8.48
106	9.15
102	9.45
109	10.15
101	10.45
105	11.15
104	11.45
107	12.15
108	12.45
103	1.7
109	1.27
104	1.47
102	2.7
105	2.27
106	2.47
103	3.7
109	3.27
104	3.47
102	4.7
105	4.27
108	4.47
103	5.7
109	5.27
104	5.47
102	6.7
105	6.27
108	6.47
103	7.7
109	7.27
104	7.47
102	8.7
105	8.27
108	8.47
103	9.7
109	9.27
104	9.47
102	10.13
1010	10.45
105	11.15
106	11.45
103	12.7

NOTES.

= LEAVING-TIME-AT-BARN + ARRIVING-TIME-AT-BARN-
+ " " " ROSEDALE -
U.P.-TRIP-TO-M'VILLE AND MOORESTOWN-
DOWN " " FERRY
RECORD-REGISTER-ON-EACH-COLLECTION- TURN-REGISTER-BACK-
FIRST-AM-TRIPS-BLOCKS-102-103-107-109 GO-TO-ROSEDALE-FROM-BARN
" " " " 101-105- " " MOORESTOWN " "
" " " " 104 " " FERRY " "
" " " " 106-108-1010 " " MERCHANTVILLE "

10

F. A. Hewitt
10-27-01

C.B.W.

SAMPLE TIME TABLE, SHOWING RUN AND BLOCK NUMBERS, TIMES ON AND OFF, AND OF RELIEF, RUNNING TIMES, ETC.

At the top of the premium list sheet is a digest of the accidents occurring the month in question and prepared in the following form:

Accidents Nos. 500 to 604, inclusive.
Accidents reported.....104
Accidents deducted..... 71

*Accidents not deducted..... 33

*These are unavoidable or trifling accidents for which the employees are not penalized.

One object of keeping a record of the number of the accidents in this way on the premium list is so as easily to refer to the documents relating to the accident in case an employee should call at the general manager's office to see why he did not get his premium. If he should claim that he did not know about any accident during the month, as is sometimes done, the files are looked up, and if it is found that the employee was in an accident which he did not report he is asked to explain, as the rules call for full reports of all accidents by the employees in charge of the car involved.

OTHER PREMIUMS

In addition, other rewards are given for long service with the company. Thus, at the end of five years he is given one suit of uniform a year and is entitled to wear a stripe of green on his sleeve. A man who has been connected with the company for ten years is given two suits of uniform a year, and is entitled to wear two stripes on his sleeve; and those who have been with the company fifteen years or more are given two suits and an overcoat each year, and are entitled to wear one stripe for each five years which they have been connected with the company.

TIME TABLES

The standard time-table of the company is made out on rather a novel plan, and a reproduction of one of the time-tables is given on the opposite page.

The time-tables are first laid out theoretically, in the usual way, by diagonal lines with the hours of the day as the ordinates and the length of the line as the abscissæ. After the proper spacing of the cars has been determined in this way, the time-table, as shown on the opposite page, is drawn up on a tracing with the proper run numbers and block numbers for the different crews. Blue prints are taken from this tracing and are posted up in the various car houses.

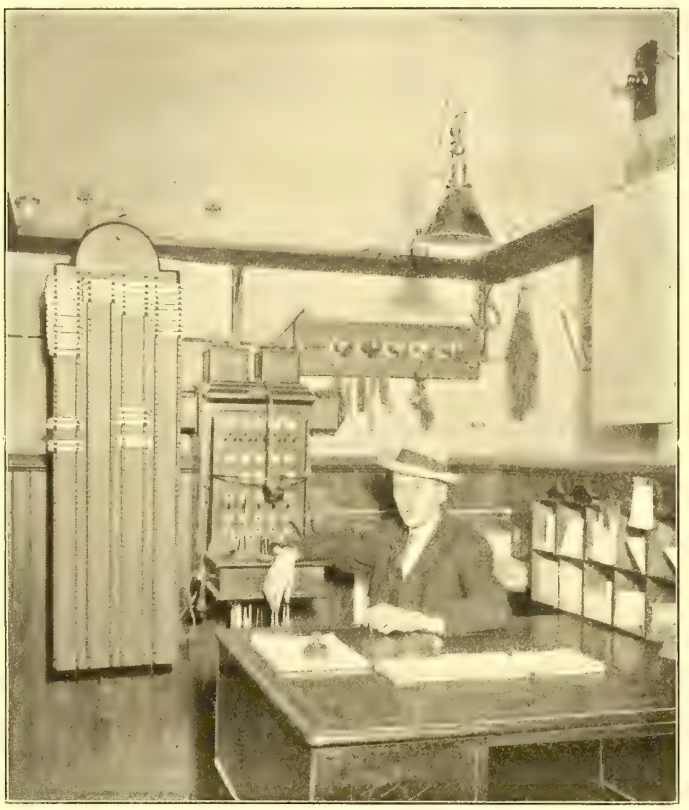
The time-table reproduced is that of the Moorestown & Merchantville line, for a Sunday. The first block number is 101, called 10-1, because the Moorestown line is Division 10. It shows that the first car leaves the car house at 5:20 a. m., arrives at Moorestown 6:14, leaves Moorestown 6:15, arrives at the ferry 7:12, and so on up to one minute past midnight, when it leaves Merchantville to go to the car house, where it arrives at 12:25 a. m. The total mileage of block No. 10-1, as well as that of every other block, is shown in a separate table.

Another table on the tracing shows the times of relief, from which it will be seen that the relief for Block 10-1 at noon is at 11:42 a. m., and at night is at 6:13 p. m. These times are also indicated by the heavy lines in the body of the time-table. Directly under the table showing the times of relief is another, giving the crews; thus, crew A (which has a swing run) takes Block 10-1 from 5:20 a. m. to 11:42 a. m., and Block 10-7 from 5:13 p. m. to 10:15 p. m. On this particular time-table sixteen crews are required; viz., four crews (A to D) who have swing runs, five crews (E to I) who have straight day runs, four crews (K to N) who have straight-from-noon runs, one crew (J) which has a tripper run and is usually combined with a run on another division, and two crews (O and P) who have night runs. The other information given on the time-table is self-explanatory.

It will be noticed that while, as a rule, a crew works on two cars during the day, the block numbers, 10-1, 10-2, etc., remain throughout the day on the same cars. The block numbers are indicated on small wooden signs, which are carried on the hood of the car, and when a crew is assigned to any particular block number the men find the car by this sign. It is, therefore, necessary only to assign the men their proper run numbers, and from the time-table they can find their proper block numbers.

ASSIGNMENT OF RUNS

The assignment of desirable runs, as stated earlier in this article, is dependent on the standing of the men on the demotion system. The assignment must necessarily be posted up daily on the bulletin board, because if a man is excused from working the order may be changed. A regular man who wishes to be excused from duty is obliged to ask the day before, and if he is excused his run is taken by the man at the top of the extra list.



INTERIOR OF DESPATCHER'S ROOM, SHOWING RACK FOR CARDS OF EXTRA MOTORMEN AND CONDUCTORS

The notice showing the names of the men and their run numbers is made up of strips, one for each run, and is tacked up on the bulletin board in the car house, as shown in the upper cut on page 1011. This strip shows for a straight run, the "run number," which is the same throughout the day for the same crew, the "block numbers," "time on and off" and "total hours." This notice is always posted by 4 p. m., to cover the runs of the following day. A duplicate notice is posted at the Market Street terminal, where certain crews take their cars. Owing to this system there is, or should be, no confusion in the crews taking their cars in the morning or at any other time of the day.

EXTRAS

The "extras" who are to take regular runs the following day are also notified on the bulletin board of the time at which they are expected to report. A limited number of "extra" men are also required to report at 4:30 a. m., 5 a. m., 5:20 a. m. and 5:35 a. m., and others at other hours of the day. The noon roll call is at 10:40 a. m., and the night roll call at 4:40 p. m. Upon arrival at the car house all extras report to the car despatcher and the time at which they report is recorded.

The extra men are governed like the regular men, by a demotion system, but the rule for tardiness is not quite so strict as with the regular men. For instance, if an "extra" has a clear record as regards tardiness for two previous months he is relieved from demotion for the first failure to report in the following month.

The chief despatcher has a simple device for keeping track of the order of the extra men and of the names of those who are assigned during the day to runs. This device consists of a rack, shown in the engraving of the despatcher's office on page 1013. This rack has eight upright pieces, with slots, in which the cards containing the names of the different extra men are placed in the order of their standing. There are four rows of cards, the motormen's cards being on the first and the conductors' on the third.

When an extra man has to be assigned to a run, the man whose name is on the top card is given the run, and his card is lifted out of its place and set in the second or fourth row, depending upon whether he is a motorman or a conductor. In this way the despatcher can see at a glance the proper man to assign to any vacant run and the men who have been so assigned. The system, as will be seen, is very simple, and requires no writing.

The morning runs are taken from the car house, while the afternoon runs are taken from the Delaware Avenue ferry to Philadelphia, where there is also a despatcher. At both places the notices as to the runs for each day are posted up by 4 p. m. of the previous day. When this notice is posted the regular men who have asked to be excused for the following day know whether their request has been granted, while the extra men know what runs they are to take.

Form No. 50—16038—5000—6-16-02.

C. & S. RY. CO.

CONDUCTOR'S AND MOTORMAN'S TIME REPORT

Place..... Date.....

CONDUCTOR	MOTORMAN	SIGNED TO GO OUT				SIGNED COMING IN				REMARKS
		Block	Car	A. M.	P. M.	Block	Car	A. M.	P. M.	

MOTORMAN'S SIGNING IN AND OUT SHEET

CREW RECORDS

If a man is late, a record is made of the time he actually reports for duty, and notice of it is sent by the assistant despatcher , by whom it is reported to the main despatcher.

The chief despatcher keeps six different records of the men besides those which are kept at the main office. The first is a sheet made out by the day despatcher, showing the extras who take the place of regular men. The day despatcher gets this from the bulletin board at the car house and sends it to the chief despatcher.

The second record is that showing whether each man worked on each day. This is kept in simple form, the men's names being arranged in a book in a vertical column, and the rest of the page being ruled off for the different days of the month. This page is made up from the record first mentioned, received from the day despatcher, and the only symbols used are E, for excused; S, for sick; W. for worked. It was started in 1899 and takes only a very little time to keep up, and shows at a glance the number of days worked and off for each man.

The third record is called the "motormen and conductors' signing in and out sheet." This is a sheet which is kept at the car house, and is signed by the men themselves, as they come in and go out. The headings across the page are given in the reproduction of this sheet, published herewith.

A carbon copy of this record is sent to the office and filed. If this "signing in and out" sheet is not signed by the man ten minutes before his car is ready to go out the man looses his run.

The fourth record kept is a list of the men who miss their runs, and from this the demotions for tardiness are made.

The chief despatcher also has what he calls his motorman's and conductor's record book, which is very similar to that kept on all roads and gives the name of the man, badge number, date of engagement, memorandum of all accidents, suspensions, etc. A page is given to each man. He also keeps a card catalogue of the names of the men, badge numbers and home address. The conductors' cards also bear their punch marks.

The complete record of the relations of the company with each man employed on the system is kept at the main office on a card catalogue. These records are made up from the reports of the secret service department, as described below, which are

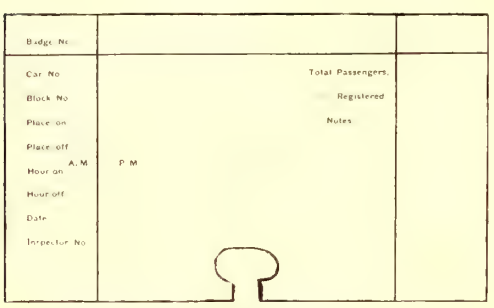
Inspector's No. ____ CAMDEN & SUBURBAN RAILWAY CO. Report No. ____

Total Hours Worked ____

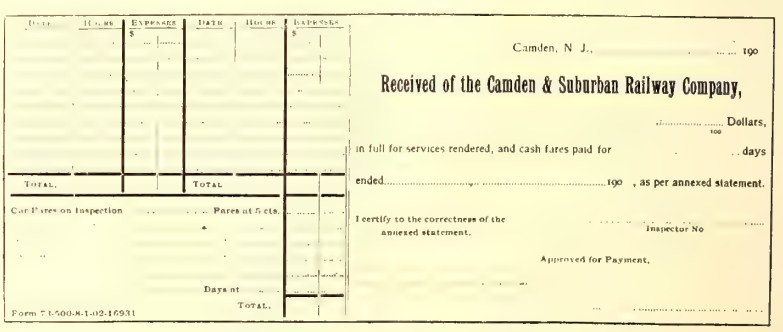
Total Expenses ____ ____ day ____ 190

Block No.	Badge No.	Car No.	Time On	Street On	Time Off	Street Off	Division	Total Reg'st before Fin'ng	Pas'gers before Entering	Passes	Transfers	Total Regist.	Total Pass'gers	Difference	Conductor's Returns	Conductor's Name	Note No.	Run No.
																		1
																		2
																		3
																		4

FORM USED BY INSPECTOR IN MAKING DAILY REPORT



CARD TRIP RECORD OF INSPECTOR



EXPENSE FORM USED BY INSPECTOR

put in digested form on the card, the original report being filed away for future reference. The cards also show the date of appointment, the number under which the application is filed, record of accidents, demotion, etc. If a man is discharged the date of discharge is entered on his card and they are filed away. If there are several cards relating to one man, as is usually the case, they are kept together by a holder.

INSPECTION SYSTEM

The inspectors belonging to the secret service system work twelve hours a day and make their reports by mail. The inspectators are provided with a pad, shown in form No. 94, on which they make their memoranda of each trip, using a separate sheet for each car taken. This blank contains a place on which the inspector enters the block number, car number and conductor's badge number for each ride which he takes, points at which he got on and off, condition of the register, number of passengers carried, etc. From this memoranda he fills out his regular trip reports, which are of two kinds, one for each trip, as shown in the card herewith marked Inspector's Trip Report, and Form 32, which is simply a summary of the information contained on the individual cards without the remarks, and represents the inspector's work for the day.

Form 94—9-26-02—17312—5000

BLOCK..... BADGE..... CAR.....
TIME ON..... ST. ON.....
TIME OFF..... ST. OFF .....
DIVISION.....
REG. BEFORE ENTERING.....
PASSENGERS.....
PASSES..... TRANSFERS.....
TOTAL PASS..... TOTAL REG.....
REMARKS:.....

PAD USED BY INSPECTOR ON EACH TRIP

When the inspector's reports are received in the main office a clerk first takes each of the cards and compares the block number, badge number and car number, as given on each of the cards with the conductors' records of the previous day, to check up the inspector. After these reports have been checked up in this way the clerk makes a digest of each trip report on a card, under the name of the conductor or motorman referred to, and files it in the card catalogue relating to the employees. The inspector's reports are then filed. At the end of the week or month the inspector sends in a statement on Form 73, showing the number of hours worked, expenses, etc.

The company has found as a result of inspections extending over a number of years that the number of fares collected but not registered has varied all the way from sixty to three and three-fourths for each 1000 passengers carried. The average for some time has been about fourteen fares for each 1000 passengers carried.

EMPLOYEES' RECORDS

A record showing the standing and other particulars about each employee is made up for the use of the general manager. This gives under the name of each employee the following: Application number, date of engagement, how long out of work before coming with the company, trade or business before coming with the company, reasons for leaving former occupation, time lost during the preceding year, maximum wages received per week during the preceding year, average wages received during the year, average wages since his employment by the Camden & Suburban Railway Company. This is made out only for recent employees, and the first part of the information is taken from the application blank.

The general manager also keeps a record of the times each man turns in a car for any fault. This is kept in the following form:

NAME	1902		1903		
	Nov.	Dec.	Jan.	Feb.	Mar.
Smith.....	.....	.....	.....	.....	.....

A record is also kept of each man, by months, of the number of fares collected but not registered, as written up from the inspectors' reports described above. This is based on the number per 1000 passengers and is made up as follows:

Name,
Number of cars inspected,
Fares not registered,
Number of passengers, total,
Total, Fares not registered at 5 cents per
passengers, Fares not registered per 1000 passengers.

BLANKS AND FORMS

In the next article the system of blanks and forms used by the Camden & Suburban Railway Company in keeping its records and accounts, outside of those directly relating to the car crews, will be described.

THE HEATING OF RAILWAY MOTORS

Youngstown, Ohio, Nov. 30, 1903.

EDITORS STREET RAILWAY JOURNAL:

The article of Messrs. Dodd and Canfield, in your issue of Nov. 21, and your previous editorial on the subject of railway motor ventilation are a pleasant new light on a subject discredited in many quarters, particularly by certain manufacturers' engineers who have been and are in the habit of answering any suggestion of ventilation of motors by a wise look and a pitying smile for the ignorance of the inquirer.

A type of ventilated electrical apparatus is in daily use to the extent of several hundred thousand kilowatts, and if one wants to ascertain the true economical value of artificial cooling let him ask a manufacturer to make a guarantee on air-blast transformers used without the air. The answer will throw an interesting side light on the value of ventilation. The comparison between transformers and railway motors is not as far fetched as one might suppose at first glance. Theoretically, of course, we blow only pure, dry air through transformer windings, but practically, however, we blow air charged with atmospheric moisture, engine room sweepings, escaping steam and sulphurous language. Once in a while a transformer burns out, but, on the whole, the arrangement has worked fairly satisfactory for a number of years and at potentials as high as 30,000 volts and above. Now, we are assured that the difficulties of insulation increase very nearly as the square of the voltage, and since 30,000 volts is sixty times the potential used on railway motors it would appear that an air-blast transformer will present a problem of insulation 60^2, or 3600 times as difficult as a railway motor, or vice versa, a railway motor should be 3600 times easier to insulate, provided the same factor of safety is used in both cases. There is something incongruous about a situation like that. It is not to be argued that this represents actually commercial conditions as they exist to-day, but the comparison may help to illustrate the point at issue.

In direct-current motor work we must protect the commutator and bearings against dust and dirt, and it is this feature rather than the protection of windings, which, no doubt, is responsible for the hermetically sealed motor casings of to-day. There must be ways and means to ventilate the interior of railway motors without opening the door for commutator and bearing troubles. Transformer casings are often cast with ribs, both inside and outside, to dissipate the heat, and the same construction is resorted to in almost numberless examples of mechanical appliances. There seems to be no valid reason why a motor casing should not be a ribbed casting, and with the air blast, which is conveniently furnished by the speed of the car, this simple expedient should increase the working capacity of a motor under service conditions very considerably, and this with few, if any, openings in the casing. There are other external means for cooling the motors, such as spoke wheels,

which allow a better radiation, and help air circulation by having more or less of a blower effect on the motor casings. There are also one or two patented remedies on the market, which promise to reduce the heating of motors by forcing air from various sources through the casings. It is evident that the subject is a live one and of great economic importance to railways, especially interurban roads, where heating is of greater importance than commutation.

The entire problem is one which should be solved by the operating railway companies rather than by manufacturers, whose interests certainly do not warrant them in making any experiments, the success of which can only result to their commercial disadvantage. On the other hand, it is to be remembered that the average electric railway cannot afford any experiments. It is, therefore, gratifying to learn that at least one manufacturing concern has done something, as indicated by Mr. Dodd and Mr. Canfield, toward reducing the size and cost of railway equipment by introducing ventilated motors. Unfortunately, our railway engineering practice of to-day is very largely canal-bank made, cut and dried and done up in packages, and it seems that once in a while a package contains a nice, shining, gilded brick. There is, therefore, every reason to believe that a thorough and independent investigation of this subject is sure to be of profit to manufacturers and of incalculable benefit to their customers.

Ernest Gonzenbach.

EMERGENCY STOPS AND BRAKING

Boston, Nov. 30, 1903.

Editors Street Railway Journal:

I am much pleased to see in your last issue a note on emergency stops by M. C. Richards. I fear that he did not quite catch the purport of my comment in the issue of Oct. 31. The thing to which I wished especially to direct attention was the fact that in the instance cited the two cars did not have sufficient braking capacity, considering the topography of the road. If an interurban line is to be operated at such speeds that two cars being in sight of each other cannot avert a head-end collision, it seems to me that it is clearly up to the road to furnish better brakes, or so to modify its grades and curves that two cars cannot come into dangerous proximity without seeing each other or to reduce its speed.

The long and short of the matter is that interurban cars are frequently so run that the cars are not under proper control, considering the brakes, schedule and track, and it is small wonder that accidents result. Of course, a block system can be arranged to prevent cars getting into dangerous proximity, but such a system is a rather costly and troublesome safeguard, and most roads try to get along without it. They run as steam railroads ran on single track years ago, trusting in the care of the train despatcher and the presence of mind of the engineer, and they are reaping just the harvest of accidents that long experience on railroads has shown to be likely when trains are not kept under proper control. I have nothing to say against cutting off the current as a safety measure, but it is an expedient which does not relieve the roads of the responsibility of keeping the cars under control at all times.

As to emergency stops by reversal with the trolley current, its effectiveness is merely a qestion of fact, as to which data ought to be gathered. Skidding with the wheels in reversal is by no means the same thing as skidding with them fixed, either in theory or in practice, particularly on slippery tracks, and its characteristics ought to be determined. Apparently Mr. Richards regards it as between hand brakes and air brakes in efficiency, but does anybody really know the facts? As to "plugging" the motors, I should hardly expect it to give results equal to air brakes, and I hope, as Mr. Richards suggests, that some interurban road will start experiments on the subject.

A. P. Johnson.

AN INTERURBAN MAP OF INDIANA

The map of Indiana interurban railways changes so rapidly these days, because of the great amount of construction going on in that State, that although an interurban map of Indiana was published in these columns Aug. 30, 1902, a revised map is here presented, which contains many lines not given on the previous map, and affords an opportunity for comparison of the district and the progress that has been made in this work. The map is in the main self explanatory. Roads in operation are indicated by heavy solid lines; those under construction by heavy crossed lines, and those projected by light dotted lines. It is not claimed that this map shows all the projected lines. If it did the network of such lines would cover the entire State.

Only the more important projected lines have been included, such as those for which the right of way is being actively secured by strong companies already in the field, or which are far enough along so that there seems to be a reasonable prospect that they will be built soon.

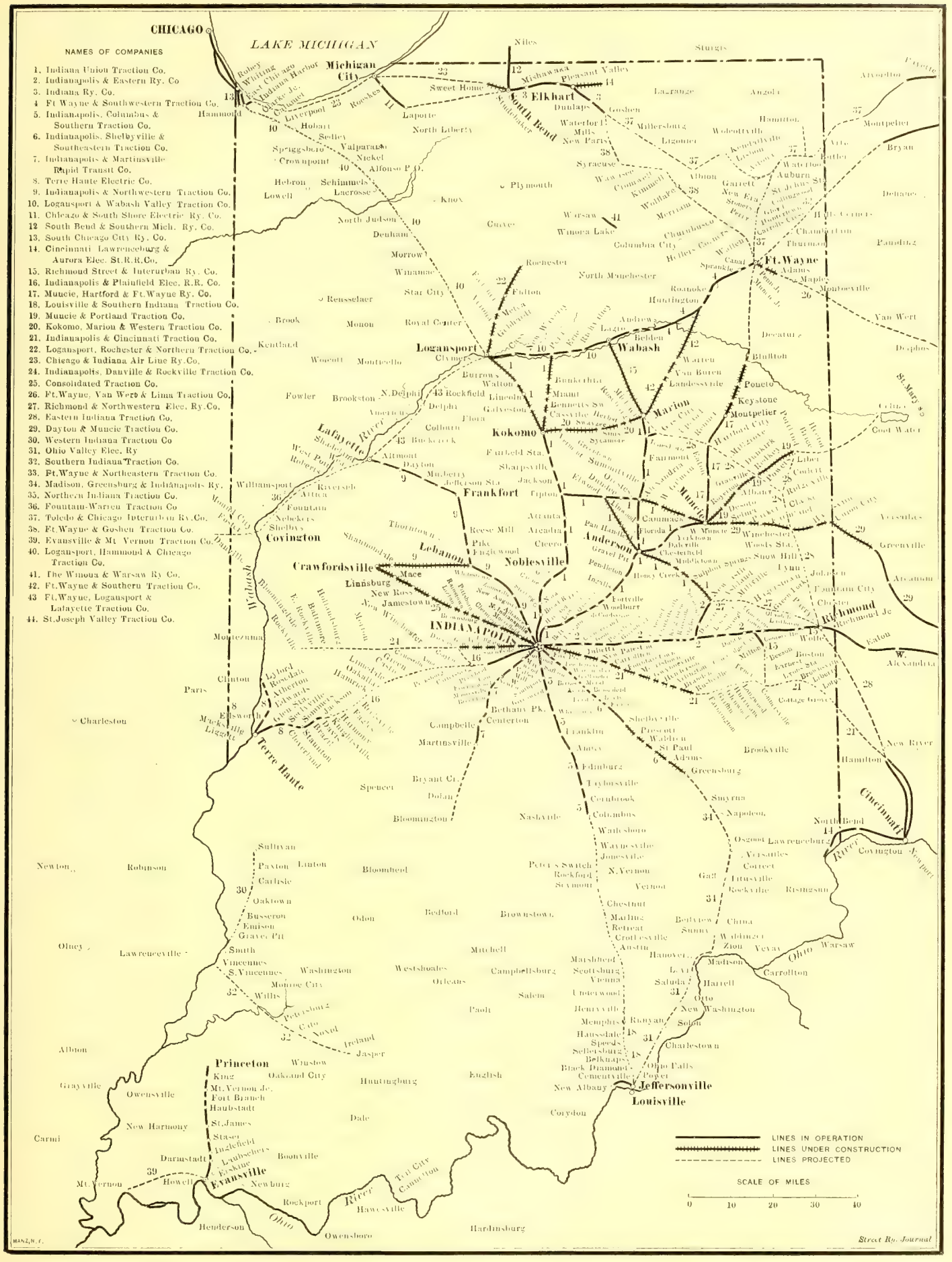
The most important company in Indiana is, of course, the Indiana Union Traction Company, which operates by far the greatest mileage of any interurban system in the State. Besides the mileage indicated as belonging to the Indiana Union Traction Company there is a considerable mileage in addition to this which is owned by companies closely allied with that company. All the lines between Fort Wayne and Logansport and the lines indicated as running north and west from Logansport are controlled by these allied companies, and include the Fort Wayne & Southwestern Traction Company, the Fort Wayne & Southern Traction Company, the Logansport & Wabash Valley Traction Company, the Logansport, Rochester & Northern Traction Company, the Logansport, Hammond & Chicago Traction Company, and the Fort Wayne, Logansport & Lafayette Traction Company.

The Indianapolis & Eastern Railway, running almost due east from Indianapolis, forms part of the through line between Indianapolis and Columbus, Ohio. Those interested in the Indianapolis & Eastern are also actively at work on a line due west from Indianapolis, called the Indianapolis, Danville & Rockville Traction Company, which is said to aim at a Terre Haute connection.

Several companies have projected through lines from Indianapolis to Cincinnati. The Indianapolis, Shelbyville & Southeastern was at one time thought to be the most likely link in the Indianapolis-Cincinnati chain. At the present time, however, it seems almost certain that the Indianapolis & Cincinnati Traction Company, which expects to reach Cincinnati by way of Rushville, Connersville and Hamilton, Ohio, will be the through line, as the Indianapolis, Shelbyville & Southeastern has been purchased by those interested in the Indianapolis & Cincinnati Traction Company, and it is thus no longer a possible competitor of the Rushville route to Cincinnati.

An important system now rapidly nearing completion is that of the Indianapolis & Northwestern Traction Company, which will soon be giving service from Indianapolis to Lafayette. It is now completed as far as Frankfort.

Across the northern end of the State there has been very little building, but a great deal of "projecting." The Indiana Railway Company has operated with success the interurban system between Goshen and South Bend for a number of years, and is completing an extension to Niles, Mich., under the name of the South Bend & Southern Michigan Railway Company. At least four companies have been working on various routes between South Bend and Hammond. The Chicago & Indiana Air Line Railway Company has constructed some track and secured a number of franchises, hence it is a line put down on the map, although other companies have done strong work in the same territory over somewhat different routes.



MAP OF INTERURBAN ELECTRIC LINES IN INDIANA

EUROPEAN SINGLE-PHASE RAILWAY MOTOR

BY GUIDO SEMENZA

The writer had an opportunity to assist at some experiments with a single-phase railway motor, which he feels are of sufficient importance and interest to warrant him in presenting

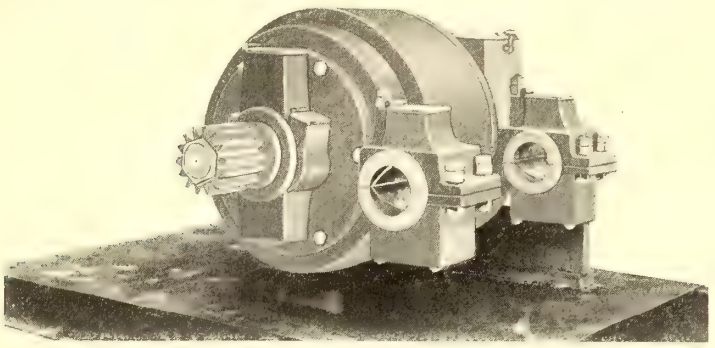


FIG. 1.—FINZI SINGLE-PHASE MOTOR FOR RAILWAY SERVICE

a somewhat extensive account at this time. The motor was designed by Dr. Giorgio Finzi, of Milan, Italy, and is simply a modification of the series direct-current motor having a laminated multipolar field core with longtudinally divided poles, a

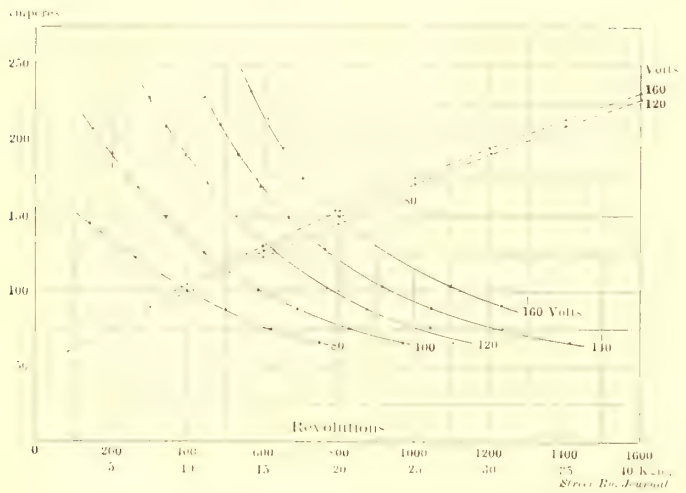


FIG. 2.—CURRENT SPEED CURVES IN FULL LINES, AND CURRENT TORQUE CURVES IN DOTTED LINES.

small air gap, low speed and a set of resistances connecting the armature coils to the commutator sections.

The longitudinal division of the poles, often suggested and sometimes adopted for continuous-current dynamos, is quite as important for alternating current as the laminating of the field core, and it is the simplest method of destroying the reaction flux of the armature. Other and less satisfactory means of accomplishing this result depend upon highly saturating the portion of the poles which is near the air gap, as in the Lamme single-phase motor, where a number of holes are made in the poles, or by short-circuited windings in the poles, as developed by Steinmetz, Stanley and Lamme, or by the use of a symmetrically distributed field winding, supplied from opposite points, and short-circuited at 90 degs. from the points of supply, as advocated by Latour. But these are all subsidiary means, which dissipate energy, and, through leakage, are prevented from completely attaining their end.

Although the transverse flux is prevented there is still a greater difficulty in the sparking, due to the short-circuiting (under the brushes) of the armature sections, acting as secondaries of a transformer under the influence of field poles supplied by alternating current. The german silver resistances, connecting the coils to the commutator, are introduced in the circuit one at a time, and bring down the maximum short-circuit current to a much lower figure. These resistances do not appreciably lower the efficiency. By adopting a design, giving a low reactance voltage in the armature sections, and with an appropriate shape of the poles, Dr. Finzi secured a series motor well adapted to traction use for frequencies of 15 to 20 and more and for 100 volts to 300 volts.

The appearance of one of these motors is shown in Fig. 1, which closely resembles an ordinary railway motor. Its weight is 1760 lbs., and it is designed to run at a frequency of 18 cycles.

This motor was thoroughly tested at the Gadda-Brioschi-Finzi works in Milan, and from this study produced the characteristic curves recorded. Fig. 2 shows, for each voltage applied, the amperes and the angular speed in full lines and the torque in dotted lines. It may be observed that the current is slightly higher with a higher voltage for the same torque, and this is more clearly shown when the torque is greater.

Fig. 3 shows the efficiency and the power factor for this particular motor for various voltages in function of the speed. It is interesting to note that in the efficiency curves the higher segment corresponds to lower speeds when the voltage is lower, consequently the motor tends always to work under favorable conditions, its speed being generally lower when the voltage is kept low.

This motor was then geared to one of the ordinary cars of

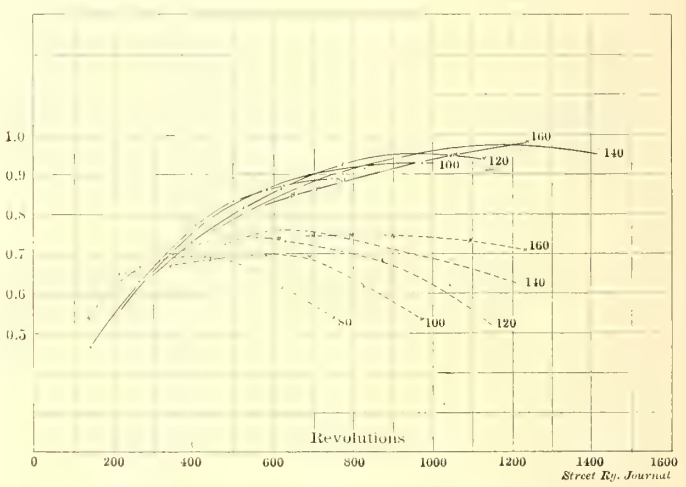


FIG. 3.—EFFICIENCY AND POWER FACTOR

the Edison Company, used for the service on the Milan lines, thus replacing the continuous-current motor. The controller and the rheostats were also taken off and replaced with the controlling transformer. The weight of the car so equipped was slightly above 7 tons.

The circuits on the car are shown in Fig. 4. The line from

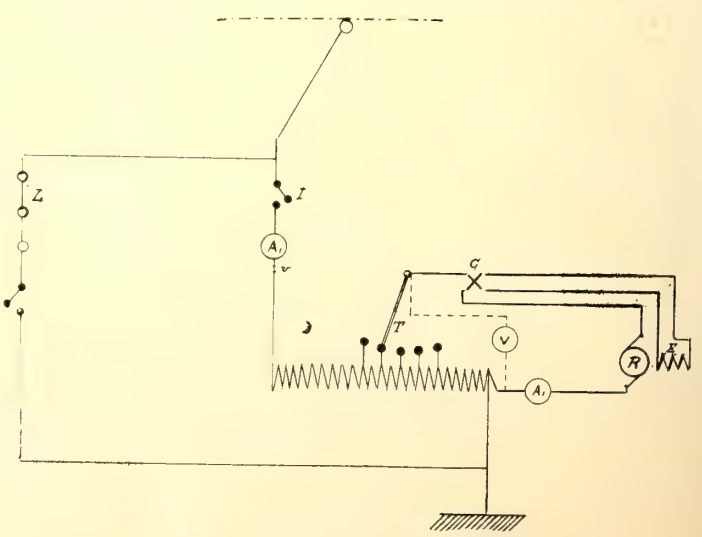


FIG. 4.—CAR WIRING DIAGRAM

the trolley has a switch I on one platform, it passes to the other platform where the controller is placed, then to the ammeter, the snap-fuse V, and finally to the auto-transformer; the other end of this is grounded, and so is one brush of the motor. The other brush goes to the field E'', and then to the handle of the controller, which takes current from different points of the transformer windings. These points go to five sections, corresponding to 80-100-120-140 volts. With a 500-volt supply the passing of the five points was made absolutely non-sparking. As can be seen, the five points were running points, and the stoppage was performed by opening switch I. This was a temporary arrangement. Through a commutator, C, the fields were inverted, to change the direction; an ammeter, A'', showed the current going through the motor, and a voltmeter the voltage.

The usual method of gearing the motor was adopted. A

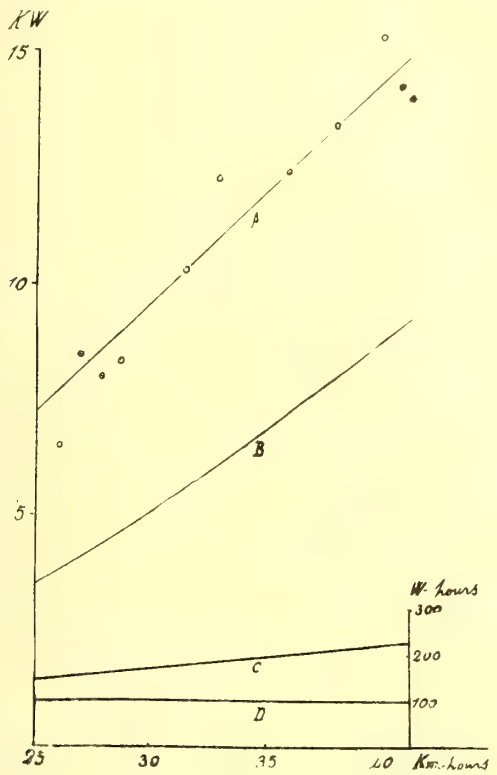


FIG. 5.—ENERGY CURVES

standard pinion of fourteen teeth was geared to a wheel of sixty-seven teeth (1 to 4.78 ratio). The diameter of the car wheels was 77 cm, or 30 1-16 in. A Kapp accelerimeter was fastened to the car; for measuring the speed several methods were used, but that ultimately adopted as the most exact was to deduct it indirectly from current and voltage through the curves of the motor itself.

The generating station was near the laboratory of the Edison Company in the works at Porta Volta, and it contained a 60-hp, 3600-volt, three-phase induction motor, belted to an old eight-pole alternator, with rotating armature, giving a frequency of 18 at 270 r. p. m.

The exciter was an old Edison dynamo, with thin upright fields, kept as an historical object in the Edison laboratory.

The voltage in the alternator was raised from 90 volts to about 550 volts by an auto-transformer, feeding the trolley line, the other wire being connected to the rails. The instruments in the station were: a hot-wire ammeter, a Thomson integrating wattmeter and an Olivetti's recording wattmeter, specially arranged for the tests. A voltmeter showed the line voltage, which varied from 575 volts with open circuit to about 520 volts when the car was running.

The greatest number of runs was made during the night, on the municipal line connecting the Milan Monumental Cemetery with the new Musocco Cemetery. The track had Vignole rails over the whole length, of about 5 km, with a considerable number of switches and several curves of small radius. At a crossing over a railway there was an average grade of 25 per cent on each side for a length of 225 m. The grade of the whole line from Musocco to the Monumental Cemetery is 2 per cent.

The test runs were begun on June 29, 1903, and continued for ten nights, the two last nights being made through the whole town of Milan over the tramcar lines of Phœnix rails with a trailer.

The first tests showed very smooth speeding up and absence of sparking at the commutator, and the writer, who has followed some of the runs very closely, can testify that the satisfactory commutation was chiefly remarkable in starting, the motor behaving better than the corresponding continuous-current motor. Some little sparking was observed now and then when the full voltage was delivered, but not more than is usually noticed with a good standard railway motor. These sparks did not show the color or the light of an arc, resembling mere carbon particles from the brushes. As a matter of fact,

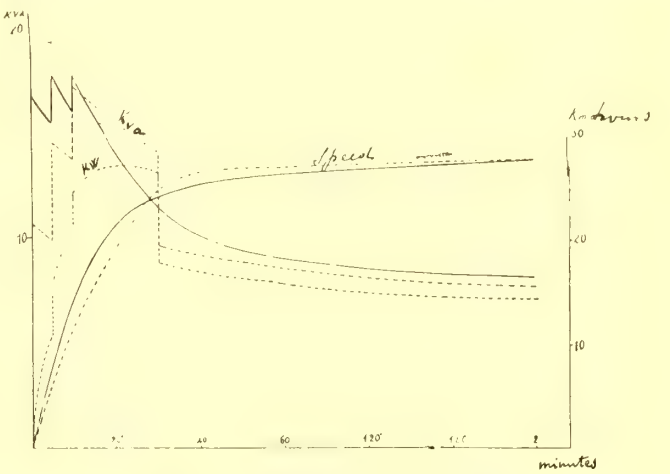


FIG. 6.—ACCELERATION CURVES

after a run of 200 km the commutator was as clean and smooth as when the runs were started, and the brushes suffered no measurable wear.

The objects of the tests were: first, to determine the general working of the motor in respect to its specific qualities for traction use; and, secondly, to measure how much power the startings and runnings absorbed, compared with standard continuous-current equipments. With these two objects in view two different classes of runs were made. During the first, instantaneous readings of the instruments were taken, besides records from Olivetti's wattmeters, by which the power necessary to keep up the various speeds, when once attained, was determined. The startings in this case were very few, in fact, only those which were necessary. Other runs were full of successive speeding up and stopping, thus it was possible to form a correct idea of what a standard starting was, while the figures of the integrating wattmeter, at the end of the run, showed the difference due to a given number of startings compared with the energy absorbed by a run without startings. The same course was carefully followed, using another car equipped with a standard General Electric 52-motor.

In Fig. 5 the line A shows the power at the generating station necessary for a 10-ton single-phase car, running on a level, straight track, at speeds from 25 km to 40 km per hour. This curve represents the average curves of all the experiments. The B curve shows the power delivered by the motor, and it is obtained from line A, taking into account the line and transformer losses and the efficiency of the motor (voltage and speed given). The line C gives the energy in watt-hours per car-kilometer given by the motor. The line D gives the energy dissipated per car-kilometer in mechanical friction; that is,

after deducting the air resistance, which was computed by considering the shape of the car and taking advantage of the coefficients found in some recent experiments by Finzi and Soldati on air resistance.

Thus we find that mechanical friction absorbs 10 watt-hours per ton-kilometer, of which about 1.5 is gear-friction. This leads to a traction coefficient of 3.48 kg per ton; a very normal figure for a level, straight track and for Vignole rails.

Fig. 6 institutes a comparison between single-phase motor acceleration and continuous current. The data here given does not depend upon one individual acceleration, but is the average of several experiments. The speed reached was 22 km per hour, with an average acceleration of 0.25 m per second per second with the single-phase motor, and of 0.28 m per second per second with the General Electric 52. The full lines in Fig. 6 refer to the latter, the dotted lines to the former; while the power absorbed and the speeds are represented in function of the time. For the single-phase motor the higher line indicates the kilometer-volt-amperes at the motor while the lower line indicates the actual kilowatts. Even after starting we find the single-phase motor absorbing less power (its efficiency though being a trifle lower), on account of the resistances the General Electric 52 had still in series.

Integrating the power curves for each motor to a 22-km speed we find, for the single-phase motor, 9.4 watt-hours per ton, and for the General Electric motor, 12.35 watt-hours per ton. If we integrate at a speed of 23.5 km, which both motors reached in the same time, but at a little greater distance in the case of the General Electric 52, we have, for the single-phase motor, 10.6 watt-hours per ton, and for the General Electric 52, 14.85 watt-hours per ton; while, if we calculate from these figures down to 22-km speed, we find for the single-phase motor 9.35 watt-hours per ton, and for the General Electric 13.10 watt-hours per ton. The theoretical amount of energy for starting at a 22-km speed would be 6.6 watt-hours per ton.

These figures show 25 per cent economy in favor of the single-phase motor, which is a matter of great importance when we consider that the power absorbed in starting on a city thoroughfare is 50 per cent, and sometime as much as 65 per cent of the whole consumption of current.

Figs. 7 and 8 are reproductions of the registering kilowatt-meter records at the generating station. They must be read from right to left, and they all refer to one 10-km run between Milan and Musocco and back, on the same track, at the same average speed of 17.3 km to 17.8 km per hour, and the same number of starts, about 2.25 per kilometers. Note should be made that the scale of ordinates is different in the two diagrams.

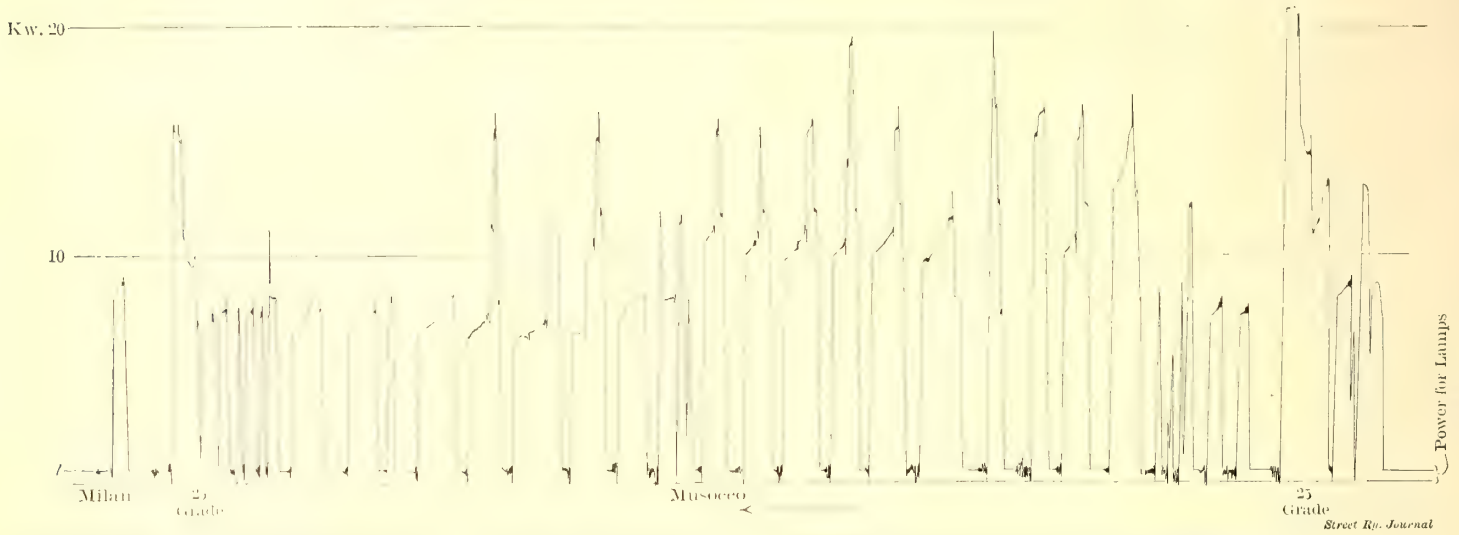


FIG. 7.—KILOWATT-METER RECORDS AT GENERATING STATION FOR FINZI SINGLE-PHASE MOTOR; WEIGHT OF CAR 9.45 TONS

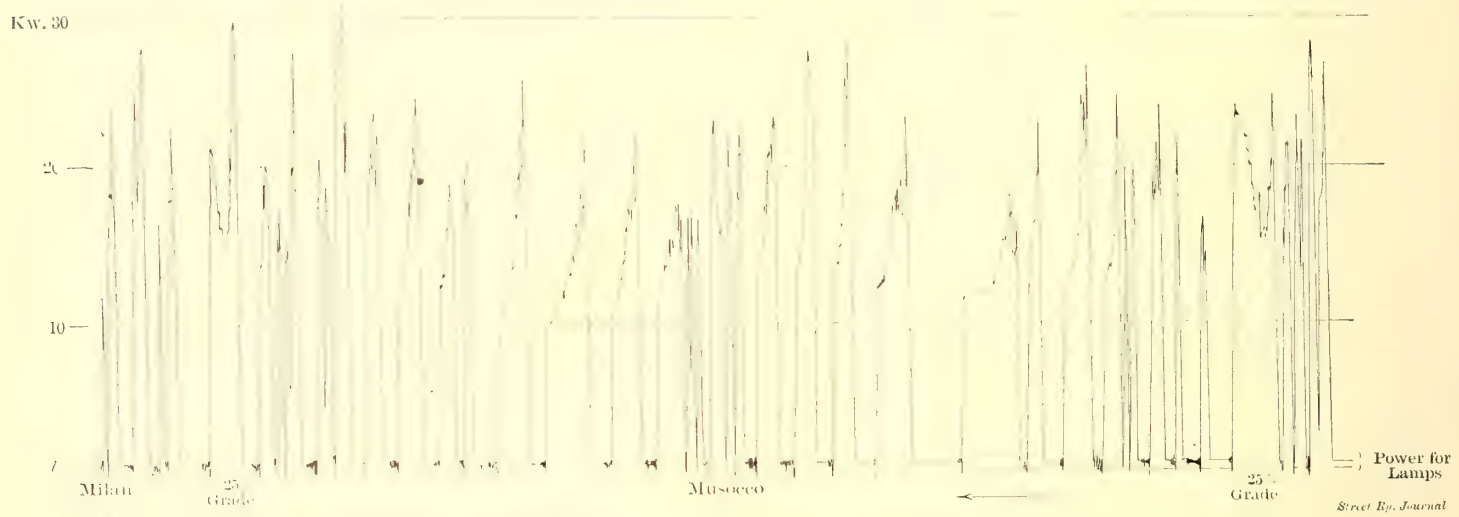


FIG. 8.—KILOWATT-METER RECORDS AT GENERATING STATION FOR G. E. 52 MOTOR; WEIGHT OF CAR 9.65 TONS

The integration of the diagrams gives: (Fig. 7), single-phase, 9.45 tons, 425 watt-hours, 45 per ton-kilometer; (Fig. 8), General Electric 52, 9.65 tons, 775 watt-hours, 70 per ton-kilometer.

It should be observed that this difference is due, partially, to the fact that in order to remain within the limits which were established to correspond to those of a city traffic, the continuous-current motor had to work almost all the time with resistances in series. But even this shows the advantage, in similar conditions, presented by the single-phase motor, which

would allow a very wide range of velocities without lowering the efficiency at normal speed.

As to the power factor, it varies between rather wide limits, according to speed and voltage, which is shown by the characteristic curves of the motor. These curves, computed in the case of Fig. 6 for acceleration, give, during starting, an average power factor of 0.7. On the other hand, if we compare the wattmeter diagrams with the instantaneous current and voltage figures, at the station during the run, we find an average power factor, including line, transformer and motor, of 0.8.

Some of the most important objections made to the single-phase motor are the following:

(1) The commutation is unsatisfactory.

(2) The wattless current is always pretty high.

(3) The power is developed in that element of the machine, on which a commutator is attached, making direct high-tension working impossible.

(4) The heating of the stator is different in different points.

On the first point the writer can attest that commutation was satisfactory at all speeds, that runs on the same conditions, with continuous current on a General Electric 52-motor, did not show better behavior at the brushes, and that the commutator did not require the smallest care throughout all the experiments.

Moreover, it is a remarkable fact that such results have been attained with the simplest means and without having recourse to any roundabout devices. They are entirely due to proper design, to suitable shape of the magnetic circuit, to the resistances between the windings and commutator, to the suppressed transverse reaction, accomplished by simply dividing the magnetic circuit, and not through special windings or by short-circuiting two symmetrical points of the main stator's windings. This does away with an ohmic loss and any non-symmetrical heating, which was one of the points criticised by Mr. Latour about series motors.

As to the wattless current, the curves of Dr. Finzi's motor are the best answer to any such objection. A motor which shows a power factor of 0.85 to 0.98 through a range of speeds and voltages from 550 revolutions to 1400 revolutions, and from 80 volts to 160 volts, cannot be condemned on account of the low power factor.

The third objection touches a point which is yet under discussion. The supporters of low-tension motors contend that where even the high-voltage central station generator itself is on many sides objected to, because of the small margin of safety, the same feeling is *a fortiori* justified, when it is the question of a motor working under a car on the road, and they conclude that the best railway practice is to allow, with the simplest controlling mechanism, the use of the highest voltage on the line together with a low-tension motor. This position is constantly winning adherents.

Summing up, Dr. Finzi's single-phase motor, at a constant voltage, automatically regulates its speed according to the load, the speed being at high load inversely proportional to it; besides, it allows a voltage control with negligible losses and the widest speed limit. As against these advantages it cannot use high voltage directly, and it is for the present restricted to comparatively low frequencies.

The writer's impression is that Dr. Finzi has solved the problem of single-phase traction motor, and that it is now only a question of how such motors will work on the every-day service and fulfill the conditions and requirements of an inter-urban or a heavy railway traffic, and to compare, for different conditions of traffic, line and speeds, their advantages and disadvantages, with those of other systems which are already working to be exploited. The tests here described are significant, and the work accomplished is of great practical value.

ECONOMIES INTRODUCED BY THE USE OF THE AUTOMOTONEER

A report has recently been submitted to the Garton-Daniels Company by D. C. & W. B. Jackson, of Madison, Wis., on the results of tests carried on by that firm of consulting engineers on the lines of the Madison Traction Company to determine some of the economies introduced by the use of the automotoneer on the car controllers. The automotoneer, as is probably well known, is a device for limiting the rate at which current can be turned on at the controller. A description of the latest form of the device appeared in the STREET RAILWAY JOURNAL of Aug. 23, 1902, page 262. It is a purely mechanical device, the time element, or interval between notches being determined by the rapidity of action of a piston in an air dash pot. It thus accomplishes mechanically about the same results as are secured electrically by the electric throttles and limiting coils on the most recent types of multiple-unit controllers for elevated and heavy rapid transit work. The results of these tests, as they apply broadly to the question of limiting the attempted rate of acceleration, should be of general interest to the electric railway engineer at the present time, and a tolerably complete abstract of the report is, therefore, given here.

The tests were carried out on the lines of the Madison Traction Company on a run of a little over 6 miles in length, including many sharp curves, grades and switches. The schedule requires an average running time of approximately 9 m. p. h. The car used is one of the single-truck open cars in the regular service of the Madison Traction Company. It is 30 ft. over all, weighs about 8 tons, and was equipped with two General Electric 800-motors and K-2 controllers. The car was on its regular service runs during the time that the tests were being made. These tests were carried on during two successive days. The track was dry and clean during the tests. The car was fitted with the following instruments: Weston indicating ammeter, Weston indicating voltmeter, Thomson integrating wattmeter, all mounted for car testing, special Boyer speed recorder and a special device for indicating distances. The indicating instruments were read at 5-second intervals throughout the test runs, and the current curves were plotted from the results of these readings. The integrating wattmeter was read at the terminii of the line, and the record of the speed recorded was used in checking the distance record and in comparing the maximum speeds attained.

Tests were first made of the performance of the car without automotoneers attached to the controllers, and tests of the same car on the same run were made on the succeeding day with the automotoneers applied.

The motormen on this road are closely supervised and exhibit unusual care in handling the controllers, and the road men knew that a test was under way. It may, therefore, be accepted that the data of the tests show the improvement in the performance of the equipment produced by the effect of the automotoneer as compared with the performance of the same equipment when handled in an unusually careful manner.

Observations of the handling of the controller by the motorman during the test before the automotoneers were applied entirely confirmed the above view. Only at one interval was the controller handled in the manner of the usual raw motorman, and this was done to test the effect.

The automotoneer was adjusted throughout these tests to permit the movement of the controller from the "off position" to the full "current on" position in 4½ seconds. This permitted more rapid acceleration than is necessary for the service, and reduced the relative economy produced by the "automotoneers."

Several diagrams are presented with the report, showing the current consumption at various parts of the line, with the object of showing the effect of the automotoneer in reducing

the starting current peaks. One set of curves shows the current from 5-second readings on a car equipped with the automotoneer, and the other set shows the current taken by the same car over the same portions of the route without the automotoneer but with careful handling of the controller. These curves are not reproduced here because of the great number that would be required to make an intelligent comparison, but the peak currents are generally lower with the automotoneers in service, and the ampere-hours are stated to be 28 per cent lower. Fig. 1, however, is given to show a comparison of the conditions with the automotoneer in use and with a careless handling of the controller. In this latter case the highest peak currents are respectively 160 amps. and 110 amps. The former is over 45 per cent larger than the latter, and the advantage thus resulting from the use of the automotoneer is gained without interfering with the car's operating schedule. The ampere-hours represented by those two curves are respectively 0.4 amp.-hour and slightly over 1 amp.-hour, and the automotoneer, therefore, reduced the power consumption for this

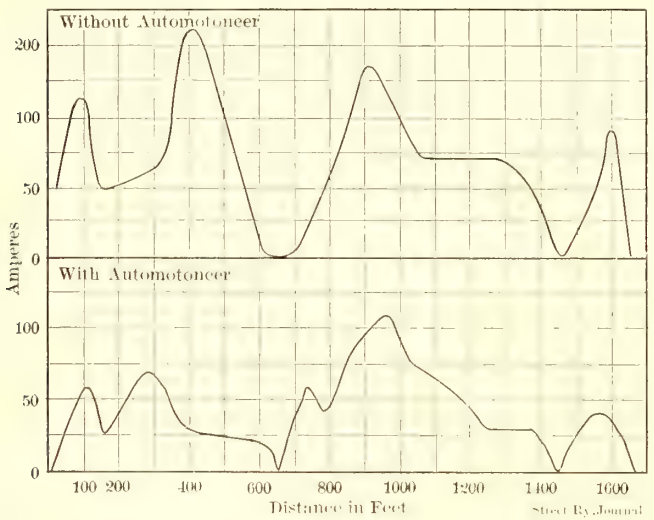


FIG. 1.—CURRENT CONSUMPTION WITH CARELESS HANDLING OF CONTROLLER, AND WITH AUTOMOTONEER

particular 1600 ft. of track by more than 60 per cent. This portion of the track was on somewhat of an adverse grade, and the number of stops was the same in the two runs. The time consumed in the two cases is not stated in the report. The records made by the Thomson integrating wattmeter differ for the different runs as might be expected, but the average power consumed by the car with and without the automotoneers shows an advantage of a little over 7½ per cent for the automotoneer. Without the automotoneer, and while in charge of an unusually careful motorman, as explained before, the car equipment absorbed almost exactly 1000 watts per car-mile. After the automotoneers were applied the power consumption averaged approximately 925 watts per car-mile. This shows a difference of slightly over 7.5 per cent in favor of the automotoneer. In one of the runs the difference was as high as 10 per cent. These results make the comparison with the plain controllers handled with unusual care. The margin in favor of the automotoneer by the recording wattmeter records, in that portion of the run shown in Fig. 1, is over 60 per cent. Messrs. Jackson believe that this latter represents the condition existing on many electric railroads, and also believe that a more retarded adjustment in the automotoneer would increase the saving in power, and that 15 per cent or more saving in power may be effected on a large proportion of roads by the employment of the automotoneer.

Special tests were made of the effect of the automotoneer on the time required for accelerating the car and upon emergency stops made by reversing the motors. With the automotoneers adjusted to 4½ seconds as a minimum time in passing the controller from the "off" to the full "on" position it may ordinarily be expected that between 5 seconds and 6 seconds will be consumed by the motorman in starting. This time is divided fairly uniformly between the several points of the controller, and the result conduces to a smooth acceleration and an economical start. The tests indicate that the car gets under way so promptly and so quickly comes to a full speed, that the automotoneers cause no loss of schedule-keeping power. A materially slower operation of the automotoneers would still give satisfaction in this respect under the traffic conditions in Madison.

Fig. 2 exhibits a curve showing a start and emergency stop with automotoneers in use. It is to be noted that the car came to a speed of over 15 m. p. h. in the space of 100 ft., or a little over three car lengths. The car came to a speed of 20 m. p. h. in 16 seconds in a distance of 290 ft., and to 18¾ m. p. h. in 12 seconds and 170 ft. This was effected with a smooth acceleration and minimum peak current.

While making emergency stop tests by reversing the motors, it was clearly seen that the maximum braking effect was obtained by allowing the controller to rest upon the first and second notches. The automotoneer is here of service in pre-

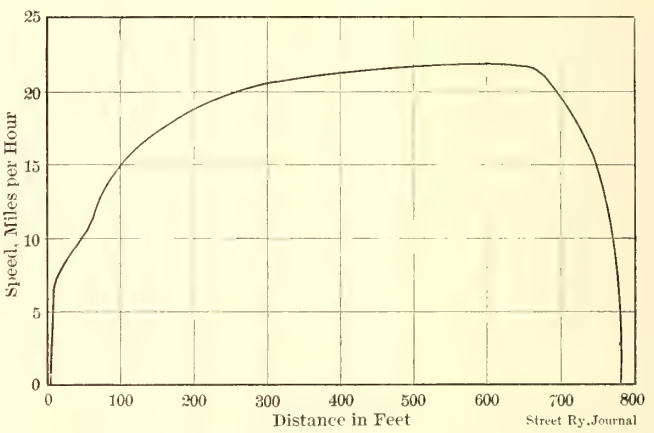


FIG. 2.—ACCELERATION AND EMERGENCY STOP BY REVERSAL

venting the controller from being carried around quickly to the last notch by an excited motorman, which slips the wheels and reduces the retarding effect, besides causing serious danger of opening the safety devices or injuring the motors.

Fig. 2 also illustrates an emergency stop, the reverse switch being thrown and the controller then being operated as rapidly as the automotoneer would permit. It was found that a stop could be made from a speed of 20 m. p. h. to standstill in 88 ft., or two and one-half car lengths. When an effort was made to stop by throwing the motors at once into parallel, as would be done by an excited motorman unchecked by the automotoneer, the distance required for the stop was considerably longer and sometimes exceeding five car lengths.

The adjustment of the automotoneers, as used on this test, is considered a trifle fast for the best results, and in small cities, such as Madison, a slower rate is permissible, and a 5-second adjustment would probably not interfere with schedule keeping even in dense thoroughfares with crowded crossings, after motormen became accustomed to the most effective way of handling the controllers.

The saving in operating expense which these tests show may be brought about by using the automotoneers, relate to: Repairs on the equipment, which are reduced through the reduction of starting currents. Cost of power for propelling the cars, which is reduced through the reduction in the amount of power consumed. Increase of operating capacity of the plant through reduction in the maximum of current which is required.

Besides this, the report shows that the automotoneer, when properly adjusted, imposes upon the motorman a reasonable

rate for accelerating the car, and thereby conduces to the comfort and safety of the passengers and the safety of the motors. The tests also show that it is perfectly easy to maintain the schedule of the Madison Traction Company, with the automotoneers set for 4½ seconds or longer, leaving a proper margin for making up time if the car becomes delayed for any reason. The automotoneers, however, will not permit the motorman to throw the controller on with a "jump," and thus impair the equipment, reduce the efficiency of operation, and produce discomfort for the passengers. The tests also indicate that the device will not interfere with picking a way in dense traffic and at crowded crossings.

It is clearly proved by the tests that the automotoneer is of value in emergency stops where reversing the motor is resorted to, by preventing the motorman from too quickly operating the controller.

A NEW FARE REGISTER

Will I. Ohmer, of Dayton, Ohio, is the inventor of a device for registering and recording fares which comprises many new ideas. The invention is the outgrowth of about twelve years experience in designing and manufacturing automatic recording and registering machines of various kinds.

The new device will be known as the Dayton Fare Recorder, and will be manufactured and placed on the market by the Ohmer Automatic Recorder Company, of Dayton, Ohio. The company already has its factory fully equipped and will have the recorders ready for the market at an early date. The invention comprises a fare indicator, fare register and recorder, a cash and fare computer and total adder. With all it is surprising simple, and is operated by one operation of a rod.

Fig. 1 is a front and side view of the recorder. The upper openings show the direction and trip passengers independent of the amount paid. The trip passenger register is reset at the end of each trip by a knurled hand grip, which also sets the direction indicator.

Through the lower group of sight openings in the case are seen the fare indicators, which show at each operation of the recorder the kind or amount of fare that has been registered. The automatic display of one of these fare indicators every time the recorder is operated is a check on every fare registered. The register can be operated in two ways, either by several independent rods or by one rod. In both cases the rope or cord is dispensed with. Where the fares are limited there is, possibly, a slight advantage gained by using independent rods, each rod providing means for registering two classes of fares. Thus, in practice, when the conductor has collected a fare, say a 5-cent cash fare, he registers the fare by a forward or rearward movement of the operating lever or handle. The fare indicator exhibited remains in full view of the passengers until another fare is registered, when it is released and another indicator is brought to view. At the extreme end of the movement, which is necessary to make the registration, a bell rings within the recorder as a signal that the registration has been complete.

The most important feature of the invention is the very complete and fully itemized record which is produced within the recorder. For this purpose two groups of duplicate record printing counters have been provided, also automatic mechanism for recording the various classifications of the fares. The recorder is also provided with a roll of blank paper and suitable mechanism for taking a printed impression of the record made by the record printing counters.

In operation when the car leaves the car house on the first trip out the recorder is locked and cannot be operated until the conductor who is in charge of the car inserts a key into the mechanism and unlocks it, the key remaining in the mechanism as long as the conductor has charge of the car. Engraved on the key is the conductor's name or number, which will be printed upon that part of the record for which he is responsible. At the end of each trip the conductor operates the printing mechanism of the recorder and prints a record from the group of record printing counters which pertains to the record of the fare collections on that trip. The record will show the direction the car was running on the trip, the consecutive number of the trip, the total amount of cash collected, the number of each class of fares collected, the total number of passengers carried, the number of the car and the name or number of the conductor. The conductor then resets the group of record

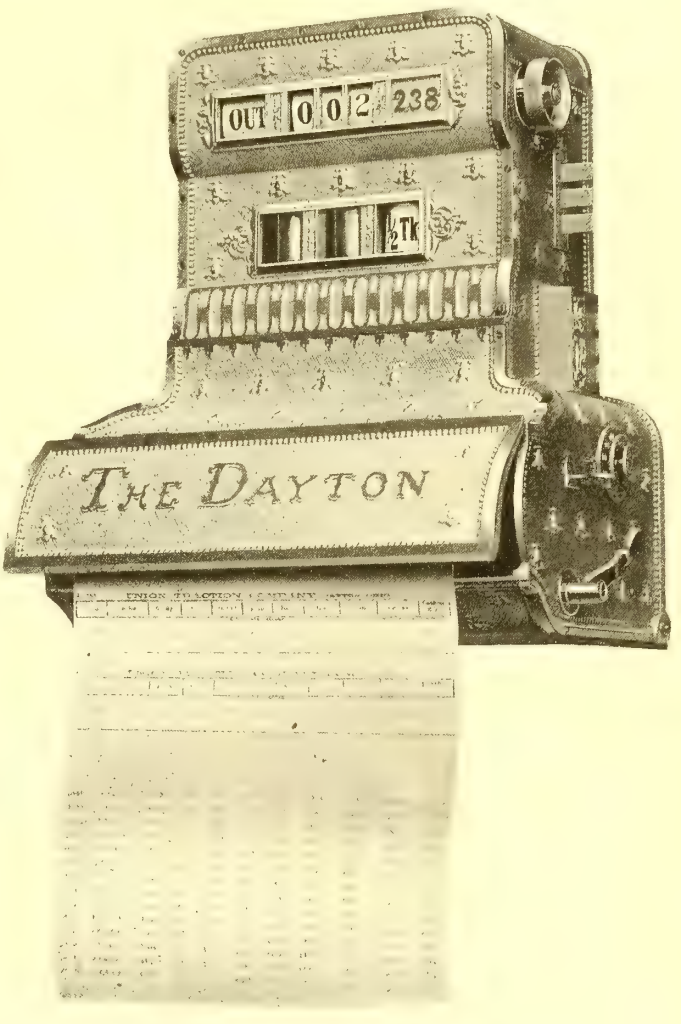


FIG. 1.—FARE RECORDER OPEN, WITH DAILY RECORD AS IT ISSUES FROM MACHINE

printing counters from which a record has been taken with the same movement and simultaneously with the trip passenger register. The operation described is repeated at the end of each trip; the record of the fare collections for each trip showing separate and complete in itself. The conductor in no case removes the record from the recorder, and has no means of knowing the result of the registrations, except when sight openings in the recorder are provided, which is optional with the company as well as with the conductors.

When the car is returned to the car houses at the end of the day's work the conductor removes the key from the mechanism, and the recorder again locks automatically and becomes inoperative as before. A duly authorized person, such as an inspector or cashier, then inserts another key into the mechanism and unlocks that part of the printing mechanism which permits of a record being printed from that group of record printing counters which pertain to the daily total record. In this case the key used to unlock the mechanism bears the name or number of the inspector or cashier, and identifies him

with that part of the record for which he is responsible. The mechanism pertaining to the registering of fares, however, remains locked and cannot be operated. The printing mechanism is then operated and a printed record is produced from the last-named group of record printing counters, which is a record showing the result of the fare collections and operations of the car for the entire day, viz., total number of trips made by the car, total amount of cash collected, total number of each class of fares collected, total number of passengers carried during the day, total number of passengers carried since the beginning of the car run or month or year, the month and date, name or number of the inspector or cashier, name of the company, place of operation, number of the recorder, etc. Suitable headings are also printed to the respective cassifications of the record.

Fig. 2 is a fac simile copy of a record taken from the recorder. It will be noted that the record is fully computed and that it shows complete information in every respect. Not a single mathematical calculation is required to show the result of the fare collections on any trip made during the day, nor to arrive at the total classified result of the fare collections and operations of the car for the entire day. The work is all done mechanically, which insures its accuracy.

The result of the fare collections on the first trip made by the car is shown in the bottom line of figures beginning with "Out 1," which shows the direction of the car for that run and the consecutive number of the trip. The record for the trip shows the following result of the fare collections: One dollar and seventy-five cents in cash, 26 5-cent fares, 15 3-cent fares, 14 half tickets, 10 full tickets, 28 transfers and 2 passes. The total number of passengers carried was 95. The record also shows that the trip was made with car No. 356, and that conductor No. 165 was in charge. The record of each trip made during the day shows the same fully itemized results. A change of conductors took place at the end of the sixth trip. This is indicated on the record by the change in the conductor's number. Conductor No. 165 is responsible for that part of the record which bears his number. Before leaving the car he removed his key from the recorder and the mechanism locked automatically against further operations until the relief conductor inserted his key which made him responsible for that part of the record identified with the number "C-142."

No. 238 **UNION TRACTION COMPANY, DAYTON, OHIO.**

Trip No.	Cash Total	5c. Fares	3c. Fares	Half Ticket	Full Ticket	Transfers	Passes	Trip Total	Grand Total	Cashier #126
DAILY TOTAL RECORD. The Ohmer Automatic Recorder Company, Dayton, Ohio, U. S. A.										
12	065.98	0908	0686	0492	0326	0734	0026	3172	232654	June-12
CONSECUTIVE TRIP RECORD.										
In 12	011.09	0145	0128	0086	0067	0095	0002	0523	Car 356	C-142
Out 11	005.22	0072	0064	0045	0024	0068	0004	0267	Car 356	C-142
In 10	006.98	0094	0076	0053	0037	0078	0006	0344	Car 356	C-142
Out 9	007.83	0105	0086	0074	0043	0092	0002	0402	Car 356	C-142
In 8	006.10	0086	0060	0042	0026	0058	0000	0272	Car 356	C-142
Out 7	005.09	0070	0053	0027	0018	0042	0001	0211	Car 356	C-142
In 6	004.40	0064	0040	0021	0018	0038	0003	0184	Car 356	C-165
Out 5	005.91	0081	0062	0049	0028	0073	0000	0293	Car 356	C-165
In 4	003.58	0050	0036	0027	0016	0062	0002	0193	Car 356	C-165
Out 3	005.28	0075	0051	0032	0026	0055	0003	0242	Car 356	C-165
In 2	002.76	0040	0026	0022	0013	0045	0001	0146	Car 356	C-165
Out 1	001.75	0026	0015	0014	0010	0028	0002	0095	Car 356	C-165

COPY OF RECORD (HALF SIZE) TAKEN FROM RECORDER

As has already been stated the conductor has no means of knowing the result of the registrations he has made, except where special provision is made for that purpose. He simply turns into the office what he has collected, and his returns are then checked from the record by the cashier or clerk assigned to that duty. Thus, referring again to the record shown in Fig. 2, when the twelve trips had been made and the car was returned to the car house at the end of the day's work, conductor C-142, who was then in charge of the car, removed his key from the recorder, leaving it locked against the further registering of fares or manipulation of any kind. Cashier No. 126 then went to the recorder and inserted a key bearing his number and unlocked that part of the printing mechanism which governs the printing of the daily total record, but did not unlock that part of the mechanism which pertains to the registering of fares by the conductors. He then printed the part of the record which shows the result of the fare collections and operations of the car for the entire day, making as many duplicate copies as may have been required, and at the same time printed the headings to the respective classifications of the record and other matter, such as the name of the company, place of operation, number of the recorder, etc., and his own number, which identified him with the record. He then unlocked and opened the lid, as shown in Fig. 1, and removed the record by tearing off the strip of paper along a straight-edge knife provided for the purpose. The cashier then reset the group of record printing counters pertaining to the daily total record by means of a resetting key, shown in Fig. 1. This left the record in its normal condition and ready for the next day's operations.

The result of the fare collections for the day, as shown in the line of figures under the heading, "Daily Total Record," is as follows: Sixty-five dollars and ninety-eight cents in cash, 908 5-cent fares, 686 3-cent fares, 492 half tickets, 326 full tickets, 754 transfers and 26 passes. The record also shows that twelve trips were made in all, and that 3172 passengers were carried during the day, and that a total number of 232,654 passengers had been carried since the beginning of the year. The date of the record is June 12.

The returns made by the two conductors in charge of car No. 356 for that day are then checked from the record. If found correct the record is then filed for possible future reference. If any discrepancy exists between the returns and the record sufficient to warrant an investigation, the company will, of course, be governed by its own rules and regulations in such cases. However, when conductors use due care when registering the fares their returns will invariably be found to tally with the record. The duplicate records are sent to such departments or heads of departments as may require them. The record may also be printed in two colors of ink so that the totals will be prominently distinguished.

The advantages to be derived from this register will be apparent. The conductor is relieved of all clerical work while in charge of his car. He has more time to attend to the collecting of the fares and to look after the welfare of his passengers. The record produced by the recorder is indisputable evidence that places every conductor upon his own merits. The advantages to the office from the fully itemized record of the fare collections will also be appreciated by those who are familiar with the rather complex system of counting and checking the fares which is now a part of the office work.

A number of sizes of the recorders will be manufactured. For city use two sizes will be made. One having capacity for four different classes of fares, and the other for from six to

eight different classes of fares. In each case the recorder will have all the features that have been described. Slight changes, of course, in the record will be necessary in order that it may conform with the fares in use.

For interurban lines the recorder is modified so as to have greater capacity as to the number of the different kinds of fares that may be independently recorded. At least two sizes will be made. These will accommodate from ten to twenty different classes of fares, permitting of each class to be recorded separately. However, instead of showing a consecutive trip record an independent station record showing the number of passengers taken aboard at each station and the amount of fare paid by each will be shown. The time when each stop was made will also be shown when desired. The independent station record corresponds to the consecutive trip record described in this article. At the end of a trip another record is made, corresponding to the "Daily Total Record" described, which shows the result of the fares collected and the operations of the car for the entire trip. At the end of the day's work a final record is made, which shows the result for the entire day. Instead of the direction-indicating wheel, shown and described in connection with Fig. 1, a station-indicating wheel, which shows the name of the approaching station, is used. The station-indicating wheel works automatically with the operations of the recorder. The fares are classified and registered with a single rod method.

ELECTRICAL HEATING OF THIRD RAILS FOR SLEET REMOVAL

The plan of melting sleet from a third rail by means of electricity has been proposed a number of times, and a patent covering special apparatus for accomplishing this result was issued about a month ago to E. E. Ries, the well-known electrical inventor. The favorable execution of this plan depends upon the theory that when sleet forms upon the rail the latter is seldom more than 1 deg. or 2 degs. below the freezing point, that only a slight increase in its temperature is necessary to melt the sleet, and that a comparatively small amount of power is required to maintain the rail, when once heated, at a temperature at which no sleet will form upon it.

Mr. Ries has estimated that the electrical energy required, in still air, to heat 1000 ft. of 100-lb. rail, such as used on the Manhattan Elevated Railway, and which has a cross-section of 9.8 sq. ins. and perimeter of about 25 ins., would amount to 1.5 hp per 1 deg. F. This figure is based upon a loss from radiation and convection of 1.33 B. T. U. per hour, per degree Fahrenheit

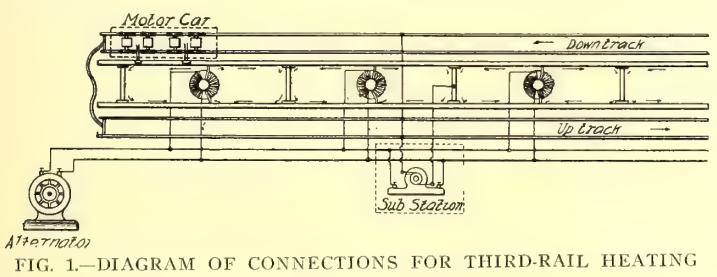


FIG. 1.—DIAGRAM OF CONNECTIONS FOR THIRD-RAIL HEATING

per square foot of surface, divided into 0.64 B. T. U. loss due to radiation and 0.69 B. T. U. due to convection. A high wind against a bare rail would abstract heat perhaps twice as rapidly, but this condition does not usually exist with a wet rail surface, which is a requisite to the formation of sleet.

It obviously requires considerably less energy to maintain the rail at a given temperature elevation in still air than is needed initially to bring it up to this temperature. For initial heating purposes a current strength of not less than 500 amps. per square inch of section is considered necessary, whereas, less than one-tenth of this amount will be required to maintain it at, say, 34 degs or 35 degs. in a surrounding temperature of 4 degs to 5 degs. lower.

According to the plan proposed, the most important sections, which are at the same time the shortest, such as at stations, on curves and cross-overs, are heated first. After the sleet on these sections has been removed the current is cut down and the sections on ascending grades are cleared. Finally, the level sections and those on descending grades are supplied with current. The term "section" is not used in this connection in

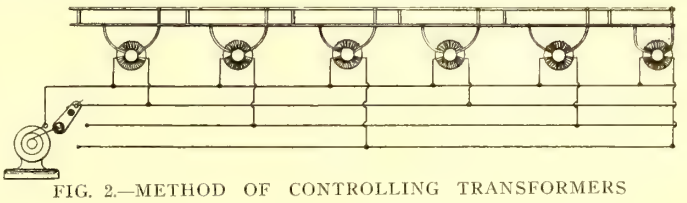


FIG. 2.—METHOD OF CONTROLLING TRANSFORMERS

its electrical sense, as in the system of heating proposed it is not necessary to divide the rail electrically into sections. Direct or alternating current can be used for heating, but alternating current is preferred, as it is not only much more convenient of application but the skin effect produced is useful. The effect of skin heating is that the heat is first developed on the surface of the rail where it is most needed, and a portion of it is then conducted into the body of the rail. This makes it unnecessary to heat the entire mass before melting can commence. Twenty-five-cycle current has been found very suitable to produce the requisite skin heating.

The apparatus and connections proposed are shown in Fig. 1, which illustrates a double-track third-rail road with the third rails between the tracks, as is the practice in New York. Heavy bonds connecting the third rails are placed every 500 ft., and midway between them is a transformer, whose secondary is designed to give a maximum of 5000 amps. at 25 volts. These transformers are located permanently between the ties, but as they are to be used only a few days during the year they can be of the cheapest construction. Owing to the low voltage the secondary need not be insulated except by air, which will allow the transformer to run at considerably over its rated capacity or to develop for the initial heating 20 kw from a 10-kw transformer. Owing to their simple construction it is thought that these transformers can be easily manufactured for $5 per kilowatt, making the cost of the transformers about $1,000 a mile. The circuits of the heating currents would be, as shown in the diagram, through each third rail and cross connection back to the transformer. As will also be seen, the plan does not make it necessary to sectionalize the third rail or to discontinue its use for car movement while it is being heated, as the alternating-current circuit is entirely distinct from the car circuit and the latter will assist in heating.

The primary winding of the transformer is preferably in two parts, capable of multiple or series connection, and is fed from an intermediate tension cable extending from the various sub-stations along that portion of the line supplied by them. The transformers are controlled from the sub-stations, according to the prearranged schedule already referred to, in which the third rail of the important sections of the road are first heated up, after which the series connection is used to maintain the rails at the requisite temperature. Assuming the additional cost of feeder cables, switches, etc., at $1,500 a mile, the entire cost of equipping a third-rail road with this system is estimated at not to exceed $2,500 a mile. As opposed to this, there will be no wear on the third rail from scrapers as in the present system.

The Canton-Akron Railway Company has issued a ruling requiring passengers to purchase round-trip ticket at offices, instead of selling such tickets on the cars as heretofore. The policy of selling round-trip tickets only at ticket offices is becoming the general rule with Ohio interurban roads.

INTERURBAN ELECTRIC TRACTION SYSTEMS—ALTERNATING CURRENT VS. DIRECT CURRENT*

BY P. M. LINCOLN

Electric traction is peculiarly an American institution; that is, it has found its widest application in American communities and has been developed chiefly by American engineers. In America practically every town of over 5000 inhabitants is provided with an electric traction system. In other parts of the world it is only larger centers of population that are so provided.

Practically, all the traction work in America has been done by direct current. The alternating-current traction system, although it has received considerable attention from American engineers, has not until recently been favorably considered by them. In Europe, on the other hand, the alternating-current traction problem has received a large amount of attention. The polyphase induction motor has been developed by European engineers for traction purposes, and a number of installations have been made in Europe with apparatus of this character. American engineers have consistently refused to adopt the polyphase induction motor for traction purposes, on the ground that it is not suitable for that purpose. The principal reasons for this stand are two in number.

(1) That the polyphase induction motor is inherently a constant speed motor, and, therefore, not adapted to traction purposes. Continual change of speed is one of the characteristics of traction work. The direct-current series motor is peculiarly adapted to this class of work, because it is inherently a variable speed motor. At one definite speed the polyphase motor is an efficient machine, while at all other speeds the efficiency cannot be greater than the ratio of the actual speed to the synchronous speed. For instance, if the actual speed at which a given induction motor is working is 10 per cent of its synchronous speed, the power utilized is at most only 10 per cent of the power put in. In traction work a large part of the work done is necessarily at speeds below the maximum attained, and at these lower speeds the maximum economy that can be obtained from induction motors is necessarily small.

One expedient used by European engineers to reduce this source of loss is the use of motors in concatenation or in tandem; that is, the secondary of one motor is fed into the primary of another on the same car. If both motors thus concatenated are wound for the same number of poles this expedient has the effect of making the synchronous speed of each of the pair of concatenated motors one-half that which it is when not in concatenation. It is equivalent in direct-current practice to throwing two shunt motors in series. Up to the half-speed point, therefore, there is a gain of economy by this arrangement. By winding the two concatenated motors for different numbers of poles, more than one point of maximum economy can be secured between zero speed and full speed, but this arrangement has the disadvantage of being able to use but one-half the total motor capacity above half speed, while the greatest expenditure of energy takes place above half speed. In order to secure the advantages of concatenation, however, it is necessary to add largely to the weight of the electrical apparatus. European practice has been to equip cars with four motors, two main motors and the other two being used only while the car is below half speed. Above half speed the motors are running idle and are doing no useful work. The energy required to take care of the additional weight is an offset against the energy which is saved by concatenating the motors. For long runs this expedient would probably be detrimental, since the energy taken up to transport the extra weight would be more than equivalent to the energy saved at the start.

*Read before the electrical section of the Canadian Engineers' Society, Montreal, Nov. 19, 1903.

(2) The second reason against the use of polyphase induction motors for traction purposes is the necessity for providing at least two overhead conductors. If the track is not used as one of the conductors, then the necessity arises of using at least three overhead conductors. Maintenance of insulation on such overhead conductors when they are at high voltage is naturally a difficult problem, much more difficult than to maintain the insulation between a single conductor and ground, as would be the case in the single-phase system.

American engineers, instead of endeavoring to adapt the unsuitable induction motor to traction purposes, have devoted their energies to the development of a suitable alternating-current motor. The idea of using a series motor operated by alternating current is not new. The only alternating-current single-phase motors which have a characteristic suitable for electric traction purposes are those of the commutator type. In no other type of motor are the speed and torque characteristics such as to be suitable for traction purposes. In the commutator-type alternating-current motor the speed and torque characteristics are practically identical with these characteristics in the direct-current series motor. As early as 1893 extensive experiments were made by the Westinghouse Electric & Manufacturing Company on this class of motors. In fact, the experiments went so far as to equip a car with two motors of this type, and the car was put into actual operation. Moreover, the frequency and voltage for which the motors were designed was practically the same as those for which the more recent motors were designed. These early motors were considerably smaller in capacity, however, and the trolley voltage was less. Further, the method of controlling the speed was by control of voltage. Although the early motors were successful as motors, the alternating-current system, as a system, was not thought at the time of sufficient importance to continue the developments along this line. In other words, the time was not yet ripe for the development of this system. Interurban electric traction work, such as exists to-day, was not at that time thought of, and this is, in my opinion, the peculiar field for the alternating-current traction system.

In considering the general problem of electric traction, the question naturally arises—what is gained by the use of alternating current over direct current? and the converse of this question also naturally arises—what is it necessary to sacrifice in order to obtain the benefit of alternating-current traction? An analysis of the advantages and disadvantages of these two systems may be of interest. Although many of the following points have been treated in previous papers, particularly that of Mr. Lamme, before the American Institute of Electrical Engineers, in September, 1902, it is hoped the reader will bear with a repetition of some of the points mentioned.

The principal advantages of the alternating-current electric traction over the direct current are as follows:

(1) Limits to trolley voltage are removed.

(2) Avoidance of rheostatic losses.

(3) The necessity for rotary converter sub-stations abolished.

(4) Manual attendance at the sub-stations done away with.

(5) Danger of electrolysis by return current avoided.

To take up these points more in detail:

(1) VOLTAGE LIMIT REMOVED

The greatest item of cost in the electrical equipment of interurban traction systems, as they exist to-day, is that of secondary distribution. This item of cost usually carries somewhere between 25 per cent and 50 per cent of the total for electrical equipment, and is usually much nearer the latter figure than the former. Six hundred volts at the motor in a direct-current traction system is practically the limit at which present designers and manufacturers are willing to guarantee their operation except in some special cases. This necessarily limits the voltage fed into the secondary distribution system to, say,

700 as a maximum. The consequence of this comparatively low voltage is naturally a high cost for conductors of this secondary distribution. The alternating-current system, providing, as it does, the possibility of greatly increasing the voltage of the distributing system, thus cuts down largely the cost of this distributing system.

Another point which militates against the use of direct current is the fact that when large units are used it is difficult to collect the large amount of current for their operation. For this reason, as well as an advantage in cost, trolley construction has been largely replaced by the third rail for interurban work. By raising the voltage of the secondary system the current taken by a locomotive may be reduced, and consequently the difficulty with collecting devices may be made to disappear.

(2) RHEOSTATIC LOSSES AVOIDED

In the direct-current system the voltage at the car is practically constant, and while the counter e. m. f. of the motors is building up, the excessive voltage must be taken up by resistance. At the start, therefore, a comparatively large rheostatic loss occurs. With the alternating-current system, on the other hand, the voltage at the car may be controlled by suitable means and the rheostatic loss thus avoided. When stops are few, and, consequently, runs are long, the rheostatic loss in the direct-current system is a small proportion of the total, and, therefore, under these conditions this advantage of the alternating-current system is not so greatly marked. With short runs, on the other hand, and consequently frequent starts, the rheostatic loss with the direct-current system amounts to a considerably greater proportion of the total loss, and the alternating-current system, therefore, can have the greater advantage.

Figs. 1 and 2 show kilowatt curves for a car equipped in one case with direct-current motors and in the other with alternating-current motors. The weight of the direct-current car is 35 tons, and of the alternating-current car about 18 per cent greater. The length of run is 2 miles in each case, and the schedule speed 30 m. p. h. Were it not for the saving of rheostatic loss, one would expect that the alternating-current equipment, being 18 per cent heavier, would take 18 per cent more power. The actual difference in the areas under the curves, however, shows about 10 per cent more power in the alternating current than the direct current on account of avoiding rheostatic loss in the alternating-current equipment. If the run were for about 1 mile instead of 2 miles the consumption of power would be about equal, and for runs of less than 1 mile the alternating-current power consumption would be less.

(3) NECESSITY FOR ROTARY CONVERTERS AVOIDED

The cost of sub-station equipment constitutes one of the large items in the cost of the electrical equipment of an interurban road. In this sub-station equipment by far the largest item of cost is the rotary converters. In the alternating-current equipment the rotary converter has no place, thus avoiding not only a large item of cost but also one of the largest items of the loss of power.

(4) ATTENDANCE AT SUB-STATIONS DONE AWAY WITH

The direct-current rotary being a piece of revolving machinery, of course, requires manual attendance at the various sub-stations. Alternating-current sub-stations consist of static transformers only, and, therefore, require attendance only for the purpose of operating the switches. Making the switching devices entirely automatic in their operation avoids the necessity of attendance for this purpose. A still further refinement is the use of distant-controlled switches operated from a central point, say the main power house. Electrically-operated switches have already been developed to be operated from a distance of several hundred feet, and no reason exists why this distance of operation cannot be extended to 20 miles to 30 miles by proper design. By including in such a switch operating mechanism, also a signaling device, by which the position of the switch is made known at the central point, the switch-operating system becomes complete and no necessity exists for attendance at the alternating-current sub-stations for any purpose except occasional inspection. There is, of course, an expense in connection with installing such a system of operating switches electrically, but it bears no comparison to the expense of manual attendance.

(5) ELECTROLYSIS

Electrolysis of parallel conducting systems is generally recognized as one of the most serious dangers in connection with present direct-current trolley systems, and the fact that an alternating-current system avoids this danger entirely need only be mentioned in order to be recognized as a marked advantage.

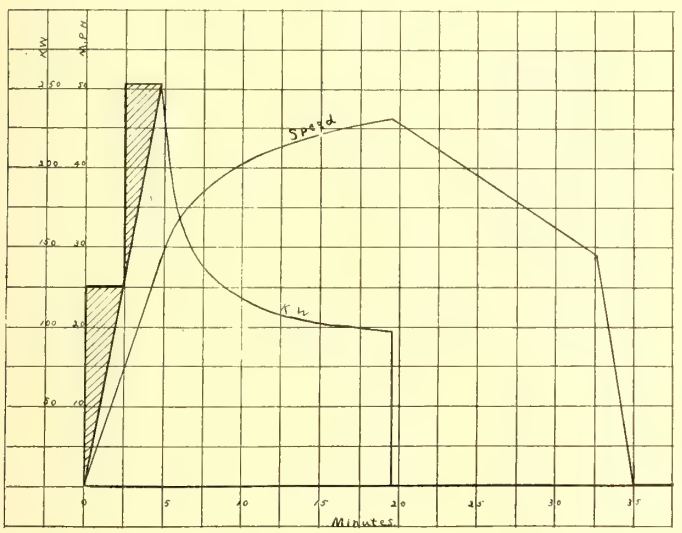


FIG. 1.—TYPICAL RUN CURVE WITH DIRECT-CURRENT MOTORS

Weight of car, 35 tons.
Equipment, two No. 50-C Ry. motors.
Schedule speed, 30 m. p. h.
Average volts at motors, 550
Braking accel., 2 m. p. h. p. s.
Average kw., 67.2.
√Mean² curent per motor, 105 amp.
Accel., 1.0 m. p. h. p. s.
Gear ratio, 21:50.
Wheels, 36 in.
Run, 2 miles.
Stop, 30 seconds.

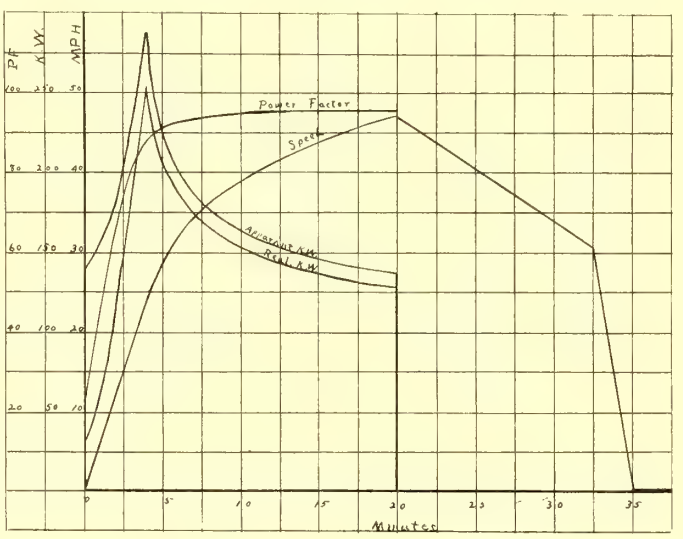


FIG. 2.—TYPICAL RUN CURVE WITH ALTERNATING-CURRENT MOTORS

Weight of car, 41.3 tons.
Equipment, two 175-hp ac. motors.
Gear ratio, 17:53.
Schedule speed, 30 m. p. h.
Stop, 30 seconds.
Braking accel., 2 m. p. h. p. s.
Average kw, 73.9 real; 84.7 apparent.
Accel., 1.0 m. p. h. p. s.
Wheels, 36 ins.
Run, 2 miles.
Average volts at motor, 200.

So much for the advantages which accrue to the alternating-current system. Now the question arises—what points must be sacrificed in order to obtain these advantages. The disadvantages which necessarily accompany the use of the alternating-current traction system are as follows:

(1) Additional weight.
(2) Difficulty of operating on existing lines.
(3) Increased rail loss.
(4) The fact that an active e. m. f. exists between field turns.
(5) Possible interference with telephones.

Now suppose we take up the above points in detail.

(1) ADDITIONAL WEIGHT

An alternating-current motor of a given capacity is necessarily somewhat heavier and somewhat more expensive than a direct-current motor for the same capacity. This difference in the motor, however, does not constitute the total difference in weights of equipment. In order to make use of the advantages of high trolley voltage the alternating-current equipment should preferably be provided with a step-down transformer on the car. Also, in order to obtain the advantages of avoiding the rheostatic losses some provision must be made for controlling the voltage on the car. The transformer, the voltage control apparatus, and the greater weight of motors make the alternating-current equipment necessarily heavier than the direct current. Although this difference need not, and in many cases will not, be as great, the example cited later in this paper (18 per cent), still a difference in weight will always exist detrimental to the alternating-current equipment. This greater weight of the alternating-current equipment is one of the items on the debit side of the ledger.

One of the most attractive methods for controlling the voltage on the motors is the use of an induction regulator. The principal advantage over other forms is that it does not require the interruption of the current, and is, therefore, of particular advantage in large equipments. It is this problem of breaking the current that forms not only the greatest difficulty with direct-current equipments of large capacity but also one of the largest items in the deterioration account. The induction regulator has the disadvantage of adding considerably to the weight, and in equipments of comparatively small size where the difficulty of current interruption is not great will probably be replaced by some other method of voltage control, such as loops or commutated coils on the step-down car transformers.

(2) DIFFICULTY OF OPERATING ON EXISTING LINES

Practically all interurban roads run in and through cities on existing tracks, and, therefore, must use the existing sources of direct-current power. In order to meet this condition the equipment for an alternating-current interurban road must be so arranged as to operate an alternating current outside the city and on direct current inside. Although this is entirely possible, it must necessarily prove to be a matter of considerable complication. It means, in the first place, the use of motors which can be operated from both direct current and alternating current. This is entirely possible with the series alternating-current motor. It means in the second place that another system of control must be added to the car. This objection might, in part, be avoided by using rheostatic control for both the alternating-current and direct-current conditions, but the objection obtains that this method will deprive the alternating-current system of its advantage of saving rheostatic losses. Further means will have to be provided for disconnecting all transformers when running from direct-current system and reconnecting them when running from alternating-current system. All these matters, although they mean a considerable amount of complication, are entirely possible. The most important part of the equipment—the motors—can be operated from direct current as well as alternating current.

(3) INCREASED RAIL LOSS

Experiments have shown that with alternating current from 2000 alternations to 3000 alternations the actual loss which takes place with a given current through the iron rails is from three to five times that which the same direct current would give. The higher ratio of loss holds for the higher frequencies. At first thought this seems to be an important objection to the alternating-current system. But when it is considered that in order to utilize the main benefit of the alternating current a higher trolley voltage is used, and, therefore, smaller currents in the return conductor, the element of rail loss in an alternating current proposition may be made even a smaller proportion of the total than in the direct current, in spite of this apparently large handicap. The rail loss with direct current is usually a small proportion of the total, and this, with alternating current at the trolley voltages, which are usually considered, viz.: 2000 to 5000, becomes a much smaller proportion.

(4) ACTIVE E. M. F. BETWEEN FIELD TURNS

The space that can be assigned to the motor for operating a car is necessarily limited. It is this limitation of space, in fact, which often forces the use of a four-motor equipment instead of a two-motor equipment, the available space not being large enough to allow the installation of motors, two of which are sufficient for the work. When we consider the alternating current motor, the question of space available becomes still more exacting; first, because the alternating-current motor is necessarily heavier, and, therefore, occupies more space than an equivalent direct-current motor; and, secondly, because of the active e. m. f. that exists between the field turns in the alternating-current motor, and which, other things being equal, again requires additional space for installation. In the matter of e. m. f. between field turns, the alternating-current and direct-current motors are quite different. The e. m. f. between the field turns of a direct-current motor is due simply to ohmic resistance, and a short circuit between turns simply throws out of action the turns so short circuited, and if not too severe, does not interfere seriously with the motor's operation. Between field turns of the alternating-current motor, on the other hand, there is an active e. m. f. similar to that between the turns of a transformer winding. A short circuit between field turns in an alternating-current motor, therefore, means a destructive short circuit and an immediate interruption of service from that motor. In other words, the effect of a short circuit between field turns in an alternating-current motor has the same effect that short circuit between armature turns would have in either the alternating-current or direct-current motors. Roasting out of field coils is one of the most frequent causes of trouble in direct-current motor equipments, and it is readily realized that this matter of active e. m. f. between field turns in the alternating-current motor is a serious one. As an offset against this disadvantage of an active e. m. f. between field turns, the alternating-current motor possesses the advantage of being capable of operation at low voltage, thereby reducing the number of turns on the series field and increasing the proportionate space for insulation. The use of a step-down transformer on the car makes available any desired voltage at the motor. This existence of an active e. m. f. between field turns is the most serious obstacle to the use of high voltage on the motor. Even with low voltage the alternating-current motor is laboring against the handicap of occupying more space than an equivalent direct-current motor, and the use of high voltage still further increases this handicap. The limitations of space do not apply to the transformer in anything like the same degree that they do to the motor, and no particular difficulty is anticipated in building a transformer for this work.

This limitation of available space for the motor and the ex-

istence of an active e. m. f. between field turns makes it seem probable to the writer that the alternating-current railway motor of the future will be operated at low voltage, and will receive its current from a transformer carried on the car.

(5) INTERFERENCE WITH TELEPHONES

It is a question whether alternating current in the rails will interfere with telephones and similar instruments more than the direct current, which they have to contend with at present. In any event, the amount of current in the rails can be reduced by the use of higher voltages, so that this source of interference can be made less than it is with the present direct-current system. Further means have been proposed whereby the current can be confined entirely to separate conductors provided for the purpose and not allowed to wander at will through any return circuit that may exist, as is the case with the direct-current system. This can be done, of course, only at the expense of erecting a separate system for the return currents and a system of series transformers whereby these currents can be confined to this return system. The alternating-current system, therefore, possesses the advantage of being able to use the rails for contact and still not allowing the alternating currents to escape at will through the earth. As a matter of fact, interference with other circuits by the alternating-current system is expected to be less than with the present direct-current system.

COMPARISON OF ALTERNATING AND DIRECT-CURRENT SYSTEMS

The engineer has been defined as a man who could do for $1.00 what any fool could do for $2.00. The engineer, in other words, stands for efficiency. It is he who accomplishes a given result with a minimum expenditure of effort and money. Suppose we apply this criterion to the comparison between the alternating-current and direct-current systems. By which of these systems can a given service be rendered most economically? In order to answer this question we shall assume a certain typical interurban road, ascertain the first cost by both systems and the cost of operating by both systems and compare the results. Suppose the typical road which we will assume to be as follows:

Length, 60 miles.

Schedule speed, 30 m. p. h.

Cars running half-hour apart.

Number of stops thirty, that is, typical run, 2 miles long.

Weight of direct-current car, complete, 35 tons.

Weight of alternating-current car, complete, 41.3 tons.

It may be noted here that the difference in weight is not the minimum that can be obtained. A large part of the difference in weight comes, as previously mentioned, in the induction regulator, with which it is assumed the alternating-current car is equipped. Other methods of voltage control can be applied which would be considerably lighter, but the induction regulator is selected on account of the advantages previously mentioned. The alternating-current system is, therefore, working under a handicap which is greater than would be the case if some other method of control were assumed.

Fig. 1 shows the speed-time and kilowatt-hours curve of a direct-current car of 35 tons over the typical run. The equipment, gear ratio, acceleration, etc., are given on the curve.

Fig. 2 shows the same for an alternating current typical run, and in addition gives also the apparent kilowatt and power factor. It will be noted that the difference in power at the car is only 10 per cent in favor of the direct-current equipment, in spite of the fact that the difference in weight is 18 per cent in favor of the direct current.

The location of the power house is assumed in both cases to be on the line of the road midway between the termini, therefore, 30 miles from each terminus.

In each case, also, one of the sub-stations is located in the power house. In the alternating-current proposition the generators are wound for trolley voltage (3000 volts) and feed directly into the trolley.

In each case, also, there are supposed to be four feeding points beside the power house, thus making the sub-stations 12 miles apart in both cases.

Further, in both cases the secondary system is a single network, thus gaining the advantage of two feeding points except beyond the end sub-stations. In neither system are secondary feeders figured on, the alternating-current being simply a No. 0000 trolley wire throughout, and the direct current a 60-lb. conductor rail. In the direct-current system the high-tension line is supposed to be along the right of way of the road, and the high-tension poles are utilized for supporting the trolley wire with a bracket construction.

Recognition of the fact that the alternating-current car is the heavier and requires more energy is made, and larger motors than on the direct-current car estimated on.

In the direct-current proposition the generators, transmission line, etc., are supposed to be three-phase, naturally making necessary smaller transformers than in the single-phase system.

The following parallel columns give complete comparison of the power consumption, the losses in the various transmissions and transformations, the first cost of the apparatus used and an estimate of the operating expenses. The conditions are taken as nearly as possible to those in the typical road. Location will, of course, make differences in many of the items considered, but especial care has been used in estimating those items in which the two systems present a difference:

DIRECT-CURRENT RAILWAY SYSTEM POWER REQUIREMENTS		ALTERNATING-CURRENT RAILWAY SYSTEM POWER REQUIREMENTS	
Average kilowatt at car in typical 2-mile run (Fig. 1)	67.2	Average real kilowatt at car in typical 2-mile run (Fig. 2)	73.9
Number of cars running at one time	8	Number cars running at one time	8
Number sub-stations	5	Number sub-stations	5
Average number cars per sub-station	1.6	Average number cars per sub-station	1.6
		$\sqrt{\text{Mean}^2}$ apparent kilowatt per car	129.0
$\sqrt{\text{Mean}^2}$ amps. per car.	185.3	$\sqrt{\text{Mean}^2}$ amps. per car (3000 volts)	43.0
$\sqrt{\text{Mean}^2}$ amps. per sub-station = m	279.0	$\sqrt{\text{Mean}^2}$ amps. per sub-station = m	68.8
With sub-stations 12 miles apart, 80-lb. track rail and 60-lb. third rail, resistance between adjacent sub-stations is = r	.0.9 ohms	With sub-stations 12 miles apart, 80-lb. track rail and No. 0000 trolley, resistance between sub-stations, allowing for increased rail resistance	4.2 ohms
Direct-current line loss per sub-station $r\,m^2$ =	16.1 kw	Trolley and rail loss per sub-station = $r\,m^2$ =	3.32 kw
6		6	
Average kilowatt per sub-station at cars = 67.2 × 1.6 =	107.5	Average real kilowatt per sub-station at cars = 73.9 × 1.6 =	118.0
Average kilowatt per sub-station at sub-station	123.6	Average real kilowatt per sub-station at sub-station	121.32
		Per cent loss in regulator and car transformer	5.0
Per cent loss in third rail	15.5	Per cent loss in trolley and rails	2.8
Per cent loss in step-down transformers	3.5	Per cent loss in step-down transformers	3.5
Per cent loss in rotaries	10.0		
Per cent loss in high-tension line	2.5	Per cent loss in high-tension line	2.5
Per cent loss in step-up transformers	3.5	Per cent loss in step-up transformers	3.5
Total per cent loss from cars to P. H.	39.5	Total per cent loss	18.4
Average kilowatt consumed by eight cars at the cars	537	Average real kilowatt consumed by eight cars at the cars	591
Average kilowatt at power house for eight cars	750	Average real kilowatt at power house for eight cars	700

Max. load per sub-station—worst condition, two cars starting....	560
One 400-kw rotary will take care of this 40 per cent over load.	
Average load on rotary	30%
Rotary sub-stations are of sufficient size so that one can be cut out temporarily.	
Max. load on P. H.,say	1200 kw
Can be taken care of with three 400-kw generators—one for spare.	

STEP-UP TRANSFORMERS

Seven 150-kw transformers—1 for spare.	

HIGH-TENSION LINE

One No. 6 B. & S. gage line each way from P. H., 20,000 volt, three-phase.	
Max. loss, about.....	8.25%
Average loss, about...	2.50%

SUB-STATION EQUIPMENT

Five sub-stations in all—one in P. H.	
Each of four sub-stations to contain:	
Three 135-kw step-down transformers.	
One 400-kw rotary converter.	
Switchboard.	
Step-down transformers omitted in power house sub-station.	

LOW-TENSION DISTRIBUTING SYSTEM

Entire length of track equipped with 60-lb. conductor rail.	

CAR EQUIPMENTS

Each car equipped with two 150-hp direct-connected railway motors and multiple conrol arparatus complete.	

ESTIMATED FIRST COSTS OF ELECTRICAL EQUIPMENT

POWER STATION

Three 400-kw, 25-cycle, 360-volt, three-phase, A. C. generators, at $6,500 each	$19,500
Seven 150-kw, 350-volt to 20,000-volt, self-cooling, oil-insulated trans., 25-cycle, at $1,225	8,575
Switchboard	4,500
	$32,575

HIGH-TENSION LINE

48 miles of 20,000-volt, three-phase transmission line—No. 6 B. & S. gage conductors, at $900 per mile.....	$43,200
Lightning protection...	2,500
	$45,700

Average apparent kilowatt at power house, about	825
Max. load per sub-station—worst condition, two cars starting (say 275 apparent kw each).....	550
One 350-kw transformer will take care of this with 50 per cent overload.	
Average load on sub-station, about	40%
These transformers are sufficiently large to take care of road if one is cut out.	
Max. load on P. H. in apparent kilowatt, say	1400 kw
Can be taken care of with three 450-kw generators—one for spare.	

STEP-UP TRANSFORMERS

Three 400-kw transformers—load can be carried by two in case of emergency.	

HIGH-TENSION LINE

One No. 3 B. & S. gage line each way from P. H., 20,000-volt, one-phase.	
Max. loss, about.....	8.2%
Average loss, about ...	2.7%

SUB-STATION EQUIPMENT

Four sub-stations—P. H. feeds directly into 3000-volt trolley.	
Each sub-station to contain:	
One 350-kw transformer.	
Switchboard.	

LOW-TENSION DISTRIBUTING SYSTEM

Entire length equipped with No. 0000 B. & S. gage trolley.	

CAR EQUIPMENTS

Each car equipped with two 165-hp alternating-current railway motors, with multiple-control apparatus complete.	

ESTIMATED FIRST COSTS OF ELECTRICAL EQUIPMENT

POWER STATION

Three 450-kw, 25-cycle, 3,000-volt, one-phase, 2,000 alt. generators, $7000 each	$21,000
Three 400-kw, 17-cycle, 3000 to 20,000-volt, O. I. S. C., trans., at $2,500	7,500
Switchboard	3,800
	$32,300

HIGH-TENSION LINE

48 miles of 20,000-volt, one-phase transmission line—No. 3 B. & S. gage conductors, at $1200 per mile	$57,600
Lightning protection...	2,000
	$59,600

SUB-STATIONS

Twelve 135-kw, 20,000 and 360-volt, 25-cycle, O. I. S. C. transformers, at $1,175 each..	$14,100
Five 400-kw, 600-volt, 25-cycle rotary converters, at $5,200 each	26,000
Five switchboards, at $2.800 each	14,000
	$54,100

LOW-TENSION DISTRIBUTION SYSTEM

63 miles of 60-lb. conducting rail, at $2,500 per mile, installed...$157,500	
Bonding main track—63 miles, at $400 per mile	25,200
	$182,700

CAR EQUIPMENT

Twelve D. C. car equipments complete, consisting of two No. 50-C motors, with multiple-control outfit, heaters and contact shoes, at $5,217 each.	$62,604
Total first cost electrical equipment...$377,179	

ESTIMATE OF YEARLY OPERATING EXPENSES

DIRECT-CURRENT SYSTEM

Five men, at P. H., two shifts, average wage $900 per year.....	$9,000
One man at each of four sub-stations, two shifts, at $900 per year each	7,200
Fuel, water, oil, etc., at one-half cent per kw-hour—4,890,000 kw-hours	24,450
Repairs and maintenance of P. H. (3 per cent of cost per year)	971
Repairs and maintenance of H. T. line (5 per cent of cost per year)	2,285
Repairs and maintenance of sub-stations (4 per cent of cost per year)	2,064
Repairs and maintenance of third rail (1 per cent of cost per year)	1,822
Repairs and maintenance of car equipments (12 per cent of cost per year).....	7,512
Total yearly operating expenses	55,404

SUB-STATIONS

Four 350-kw, 2000-alt., 2000-volt to 3000-volt, O. I. S. C. transformers, at $2200 each....	$8,800
Five switchboards, at $1,500 each	7,500
Auxiliary signaling lines for operating sub-station switches..	7,500
	$23,800

LOW-TENSION DISTRIBUTION SYSTEM

63 miles of No. 0000 trolley wire in place, at $900 per mile....	$56,700
Bonding main track 63 miles, at $400 per mile	25,200
15 miles of pole construction not included in H. P. lines, at $630 per mile	9,400
	$71,300

CAR EQUIPMENT

Twelve A. C. car equipments complete, consisting of two 165-hp motors, with multiple-control outfit, heaters and trolley, at $8,482 each $101,774	
Total first cost electrical equipment....$308,774	

ESTIMATE OF YEARLY OPERATING EXPENSES

ALTERNATING CURRENT SYSTEM

Five men at P. H., two shifts, average wage $900 per year each...	$9,000
Fuel, water, oil, etc., at one-half cent per kw-hour	23,050
Repairs and maintenance of P. H. (3 per cent of cost)	969
Repairs and maintenance of H. T. lines (5 per cent per year)	2,980
Repairs, maintenance and inspection of sub-stations (6 per cent)	1,428
Repairs and maintenance of trolley (4 cent per year)	3,652
Repairs and maintenance of car equipments (10 per cent).	10,177
Total yearly operating expenses	51,256

NOTES ON THE FOREGOING COMPARISON

In the first cost of the two systems thus compared no allowance is made for the fact that the alternating-current system requires less energy at the power house, and, therefore, will economize to a considerable extent in both engines and boilers. On account of the greater apparent kilowatts for the alternating-current system, generators and transformers will be larger in capacity, but the engines and boilers need not be so great in capacity. So far as transformers are concerned, the alternating-current system has the advantage, because it allows the use of considerably larger units than the direct-current, where three-phase transmission is necessary instead of single-phase, as is the case in alternating-current system. The alter-

nating-current switchboards also have the advantage in that two switches per panel are required instead of three.

To render a given service over high-tension line, more copper is required for a single-phase line than for a three-phase line, and this makes the copper for the alternating-current system somewhat more expensive than for the direct-current system. The largest difference, however, in the high-tension line items comes from the fact that the poles of the high-tension line are spaced sufficiently close to allow the trolley brackets to be supported from the same poles. In the direct-current system, the spacing need be only sufficient for the requirements of the high-tension line alone.

So far as sub-station transformers are concerned the alternating-current system has the advantage of single-phase over three-phase in that larger units are used. By far the largest item of saving in sub-station equipment between the two systems is, of course, in the omission of rotary converters in the alternating-current system.

The greatest difference in first cost of the two systems is, of course, the great difference in the cost of the secondary network. A glance at the comparative values will show that this difference in the case we have considered amounts to nearly $100,000, and is, therefore, nearly 30 per cent of the total cost of the direct-current system.

In first cost the alternating-current car equipments are, of course, considerably higher than the direct current. I would call attention to the fact, however, that the costs of the alternating-current car equipment include an induction regulator. If some other style of regulator, such as, for instance, loops on the car transformers, has been figured upon, the cost of the alternating-current car equipments might be diminished by something like 6 per cent; that is, something over $6,000. The saving in weight by the same change and the consequent saving of power in the alternating-current system would amount to nearly 4 per cent of that which have been figured upon. In the item of maintenance of the control apparatus, however, it is believed that the induction regulator has the advantage, in that it is not necessary to break the current in going from step to step.

The alternating-current system throughout is figured on the basis of using a frequency of 2000 alternations per minute. This frequency could be increased to, say, 3000 alternations per minute at the expense of, first, a considerably decreased power factor, and, consequently, increased apparent kilowatts; second, increased generator and transformer capacity; third, increased line and rail loss; and, fourth, increased cost of motors. This difference might run the cost of the alternating-current car equipment some 5 per cent higher than figured on. It will be noted that the great saving comes in changing from direct current to alternating current, and that a change in frequency within moderate limits affects a change by no means comparable with that which is effected by going to alternating current.

Operating Expenses.—In the labor item it will be noted that the main saving comes in that sub-station attendance is avoided by the use of the alternating-current system. In other respects the labor items will be the same.

The fuel item for the alternating-current system is somewhat smaller than for the direct-current system, as the actual energy at the power house is less in the former case than in the latter.

Besides labor and power the main operating expense for any interurban railway system comes in the items of repairs and maintenance. It will be noted that this item of repairs and maintenance has been included in the above comparison by assuming that it is a certain percentage of the first cost in each case. There may be some difference of opinion as to the percentage that should be assumed in the various cases of this item of repairs and maintenance, but I have endeavored to make the comparison between the two systems as fair as possible. It is not intended to include any item of depreciation in these repairs and maintenance figures. It will be noted that a marked difference is made between the maintenance of a third rail and trolley by allowing 1 per cent in the one case and 4 per cent in the other. The apparent discrepancy in allowing 5 per cent for the maintenance and repairs on the high-tension line and only 4 per cent for that of the trolley is explained by the fact that the 5 per cent on the high-tension line includes the repairs and maintenance and the supporting structure for the trolleys.

The matter of inspection of the alternating-current sub-stations is taken care of by allowing 6 per cent in the case of the alternating-current sub-stations instead of 4 per cent, as in the direct-current sub-stations.

In the matter of repairs and maintenance of the car equipments it will be noted that 12 per cent is allowed in the direct-current system and only 10 per cent in the alternating-current system. Even this difference in percentage allows $10,000 per year for the maintenance of the alternating-current equipments in the place of $7,500 for the direct current, or 25 per cent more for the alternating current than for the direct current. The alternating-current motors being lower in voltage and being protected by direct lightning discharges by the intervention of a transformer, ought to have at least a no higher maintenance bill than the direct-current motors. The number of motors in each case is the same. The alternating-current system, however, will require a certain amount of attention for the transformers and regulators. This item, though necessarily not based on experience, is estimated to represent the comparative conditions as closely as is possible at this time.

EXECUTIVE COMMITTEE MEETING OF THE AMERICAN RAILWAY MECHANICAL AND ELECTRICAL ASSOCIATION

A meeting of the executive committee of the American Railway Mechanical and Electrical Association was held at the Hollenden Hotel, Cleveland, on Dec. 7, to make preliminary arrangements for the next convention of that Association, which will be held two days in advance of the next American Street Railway Association convention and at the same place. Those present at this executive committee meeting were President E. W. Olds, of the Milwaukee Electric Railway & Light Company; Secretary Walter Mower, of the Detroit United Railway; W. O. Mundy, of the St. Louis Transit Company; Alfred Green, of the Rochester Railway; H. H. Adams, of the United Railways & Electric Company, of Baltimore, and T. J. Mullen, of the Scranton Railway Company. It was decided to have papers on a number of subjects, and in order to facilitate the work of securing the best men from the various members of the Association to discuss these subjects, one member of the executive committee was assigned the task of securing an author and men to lead in the discussion of each subject.

As one very important subject that was suggested to the committee was the keeping of shop records, mileage of parts, etc., in some uniform method so that records of various companies could be compared to advantage, H. H. Adams, of Baltimore, was appointed a committee chairman, with power to appoint assistants, if he sees fit, to insure the proper presentation of this subject at the next convention.

Wheels and wheel mileage is another topic which drew out considerable informal discussion at the committee meeting, and Alfred Green, of Rochester, is the committee chairman to look after the papers and discussion on that subject.

Maintenance of electrical equipments was another subject decided upon, T. J. Mullen, of Scranton, being given charge of this topic.

A paper and discussion on power stations is planned, and Ex-

President Thomas Farmer, of Cleveland, was requested to secure an author for this topic and look after the discussion, Mr. Farmer being present at one of the committee sessions.

As it was felt that a discussion of shop design and centralizing of repairs should have considerable attention, as suggested in a communication from Mr. Beggs, of Milwaukee, President Olds was appointed a committee to see that some one present the designs of a number of modern shops, with an analysis of their strong and weak points.

It was brought to the attention of the committee that there are many unnecessary and unreasonable variations in the specifications of car bodies, and that it should be the work of the Association to collect the car specifications of various companies with reasons for all changes from the most usual practice. By weeding out unnecessary clauses in these specifications a comparatively standard practice could be brought about by the Association in certain respects. W. W. Annable, of the Grand Rapids (Mich.) Railway Company, was appointed to start such a work, which it was felt would probably last many years.

It was decided to have a question box at the next convention for the benefit of members wishing light on certain troublesome points. This question box will be in charge of the secretary. In appointing these various gentlemen, each to look after a certain topic, it is not to be understood that they will, themselves, prepare the papers, but that they will see that their subjects are properly discussed by the best available members, and, hence, will act as chairmen of committees. Suggestions addressed to any of these committee chairmen as to men desirable for papers and discussions on their respective topics will, therefore, be in order and welcome.

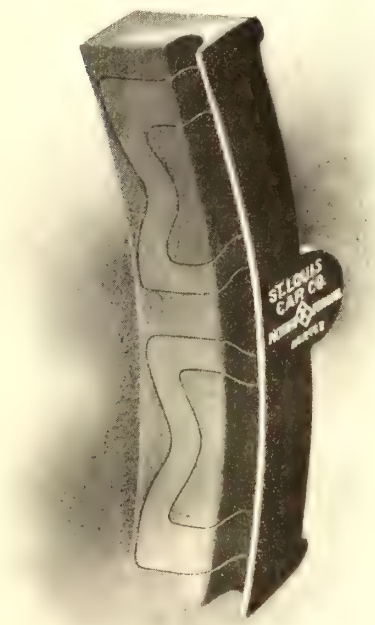
The membership in this new association is steadily increasing, and its work certainly is so important that no company and its staff can afford to be without the proceedings to which membership entitles it, to say nothing of the benefit derived from attendance at the conventions.

The Association has issued a little book, which will be sent upon application to the secretary. It gives information about the Association and the endorsement its work is receiving.

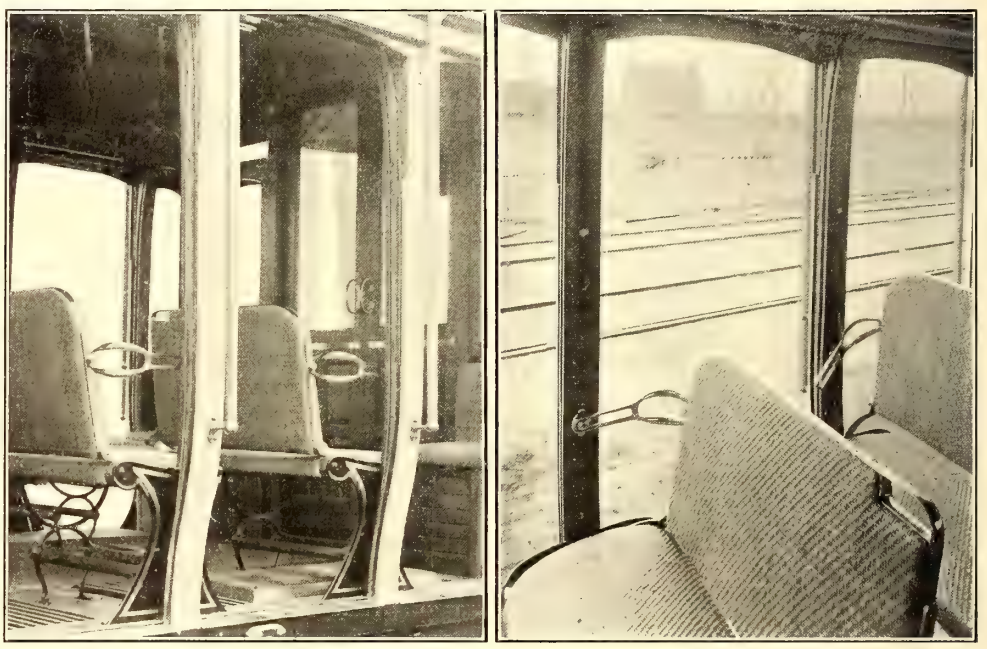
After the committee adjourned a dinner was given at the Hollenden to the members, by H. N. Ransom, Cleveland representative of the National Electric Company.

NEW FORM OF SEAT ARM

The J. G. Brill Company has recently added a small but important attachment to the seats of its convertible cars, consisting of a metal arm pivoted to the back of the seat and connected with the side post by a button, on which the arm slides and makes part of a revolution. The operation of this arm is shown in the illustration taken from the interior of the car. The back of the rear seat, it will be noticed, is raised, showing the position of the arm during reversal. The arm has three purposes; one being the strengthening of the back. This is necessary on account of having the back supported at unusually low points by the reversing levers. A pair of levers is used at the aisle end of the seat and a single lever at the post end. The double levers are amply strong for any weight that may be brought against the back of the seat at that end, but the lever at the post end is single and curved, and although strong enough for persons of average weight, requires extra support for heavy passengers, and this is met by the arm. At the same time the arm is useful for filling the gap between the back and the post. The arm is also to be used as a handle for passengers getting in and out, and is well situated for that purpose, especially for passengers leaving the car, inasmuch as it prompts them to face in the right direction when stepping down. The J. G. Brill Company owns the patents now pending on this device, has installed seats with this arrangement in a number of convertible cars, and intends using it regularly hereafter. This device is equally applicable to various types of seats now in use other than those of the Brill Company.



NON-CHILLED BRAKE-SHOE



SEAT ARM AS SEEN FROM EXTERIOR AND INTERIOR OF CAR

NON-CHILLED BRAKE-SHOE

Among the numerous other supplies now being manufactured by the St. Louis Car Company, in addition to its car and truck building business, is the Diamond "K" brake-shoe. This shoe, which is illustrated herewith, has a hard iron insert around which is cast the body of the shoe in gray iron. The gray iron is not permitted to chill, which is claimed to be a peculiarity of this shoe as compared to others of the kind. The hard iron is made of very high-grade malleable iron. The secret processes of casting gray iron about the insert without chilling are said to give toughness to the body of the shoe and a better friction coefficient than a chilled shoe.

FINANCIAL INTELLIGENCE

WALL STREET, Dec. 9, 1903

The Money Market

An extremely low rate for sterling exchange persisting in face of heavy gold exports continues to be the most striking phenomenon in the money market. We have now taken, all told, upwards of $15,000,000 gold from London, and yet demand sterling bills have sold during the past week not only at the lowest figures of the season, but below any previous record for the last ten years. In fact, the recent quotations have been lower than anything ever known, except in times of great financial disturbance. With the explanation for this extraordinary situation the average observer of current financial events is quite familiar. The enormous exports of cotton at almost unprecedented prices are chiefly responsible for the great pressure to which the exchange market has been subjected during the last month and a half. Nor are there any signs that this pressure is about to diminish. European spinners, having so entirely underestimated the size of this autumn's cotton crop, find themselves in a position where they must pay whatever prices the American speculator demands. So long as this necessity continues the present influences in favor of low exchange rates will remain, and gold will continue to be shipped across the ocean in settlement of international credit balances. This is the strongest assurance that conditions now afford that money will gradually work easier. Shipments of currency for our own interior needs have not yet ceased, but the movement to the South in connection with the financing of the cotton harvest has begun to be offset by return of funds sent out earlier in the autumn to the grain country. During the next few weeks we shall undoubtedly witness the customary turn of the interior exchanges in favor of New York, which will be followed, after the first of the year, by a rapid accumulation of local bank cash holdings. Already the money market has begun to discount these events. The high call money rates of the latter part of November are no longer present, and the tendency in the time money market is distinctly toward relaxation. As high as 7 per cent is occasionally paid even now for the use of call loans, but 5 and 5½ per cent are the ordinary quotations on all renewals. Time money is quoted at 5½ per cent for all periods both long and short.

The Stock Market

Wall Street has witnessed, during the last two weeks, something very like a return to a genuine bull market. Prices have advanced sharply all along the line and dealings have very often aggregated upwards of a million shares a day. Examining the causes of this movement, the main thing that must be concluded is that the majority of the standard securities were driven down far below their real values during last summer's forced liquidation. This being the case, a sharp recoil was bound to occur as soon as it was clearly established that the selling pressure had ceased. There are certainly no great incentives to investment or speculation in the present situation. The decline in general business may have proceeded as far as it is going to for the time being, but it is still a question in men's minds whether the wave will not recede farther at a later period. At all events, the resumption of the forward movement is quite out of the question. Railroad earnings, if they succeed in holding their own during the next twelve months, will be doing as much as may reasonably be expected. Any further increase in dividends is highly improbable. Consequently, the great motives which are usually found at the beginning of an extensive rise in prices are not present now. The upward movement of the past month seems plainly to be a recovery rather than a fresh advance. The distinction is an important one, because a recovery under the present circumstances can scarcely be anything but limited both in extent and duration. It must simply proceed on the theory that the recent decline was excessive and that a rebound was necessary in order to restore a normal level of prices. The fact that railroad stocks of the better grade have been selling on a basis where they yield 5 per cent and over to the investor, while the money interest rate is working toward a 4½ per cent level, has undoubtedly been a powerful inducement to the buying of securities. Besides this, the conviction has now become general that too much has been made of the argument of industrial reaction, and that so long as railroad earnings hold up as well as they are now doing this argument has no great practical force. In well informed quarters the prevailing view seems to be that the upward movement is likely to continue for a while longer, at least, subject to the normal reactions of a speculative market. The stage has not been reached, however, where the public has found courage to take a hand in the proceedings.

A 10-point advance in Brooklyn Rapid Transit has been the spectacular incident in the local traction group. A variety of explanations—new and old—have attached to the movement. But so far the truth seems to be nothing more startling than that the supply of the stock in the market is extremely narrow, that a short interest has been outstanding, and that two or three pools have been using this favorable technical condition to make a good turn for themselves on the long side. The advance in Manhattan and Metropolitan has been more or less sympathetic with the strength of the Brooklyn stock. Insiders appear to have been doing nothing in Manhattan, the rise in the price being quite evidently the work of professional speculators. People who bought Metropolitan Securities low down, on good information, have been taking their profits during the past week.

Philadelphia

All the active street railway specialties on the Philadelphia Exchange have taken part in the general market advance of the last two weeks. Philadelphia Electric is up a quarter point from 5 15/16 to 6 3/16, Union Traction has gained a point and a half from 44 to 45⅝, and Philadelphia Traction a half point from 95 to 95½. American Railways has been particularly strong. The stock sold ex-dividend a week ago, and rising to 43 has more than regained the whole amount of the dividend. Consolidated Traction of New Jersey has been another feature, advancing to 64 on sales of about 1000 shares. This is 5 points higher than the low figure for the stock two months ago. Fairmount Park Transportation advanced from 19 to 20, then reacted to 19¾. Philadelphia Rapid Transit, on the report that another assessment call will be made by the end of January, declined from 11¾ to 11. Philadelphia Company common rather hung behind the rest of the list, advancing only a point to 37½. The preferred was a trifle higher at 43¼. Thirty shares of Reading Traction changed hands at 30.

Chicago

The interesting episode recently in Chicago traction matters is the effort made by the receivers of the Union Traction Company for permission to substitute trolley lines where the cable is now in use. Judge Grosscup has announced that he will postpone action in answer to the petition of the company made for the purpose of effecting this change in motive power. The city will make a vigorous fight against the application of the company, and it may be that while this matter is before the courts, opportunity will be taken to test the whole question of the constitutionality of the ninety-nine year franchise grant. Many people believe that this is the real end that Union Traction officials have in view. Dealings in the common shares have been light, most of the sales occurring around 6. City Railway, on the settlement of the strike, advanced from 170 to 171, but later 10 shares of the stock sold at 167½. South Side Elevated has been strong at an advance to 95 on the excellent showing made by the company during November. The large increase in the earnings of this period was directly due to the diversion of traffic from the surface roads on account of the strike. The Northwestern Elevated reported a gain of over 6 per cent in the earnings for the month. This road is suffering much less than the Metropolitan from the effect of the recent adoption of the transfer system on the West and North Side surface lines. A few sales were reported in Metropolitan common at 17 and the preferred at 54. Lake Street sold at a new low record of 1¾, rallying later to 2. North Chicago made a new low record at 89, but later recovered to 90.

Other Traction Securities

The publication of the annual statement of the Massachusetts Electric Company showed, as expected, a very large increase in operating expenses for the year, due principally, as was explained, to the higher cost of fuel. Altogether the showing was not a flattering one, but the speculative market took the view that the

heavy decline in the stocks had discounted the unfavorable news. The common, on active trading, moved up from 19 to 21⅞ and later eased off to 20. The preferred gained 3 points, from 77 to 80, and then fell back to 79. In both instances the improvement in the general market had obviously more connection with the rise than any special considerations in regard to the property. The other Boston stocks underwent no particular change during the fortnight. Boston Elevated sold as high as 141½ at one time but later reacted to 140¾. West End common sold at 89⅞ and 90 and the preferred at 110 and 110½. In Baltimore the general mortgage bonds of the United Railways Company were the feature of that group, selling up to 92, which is the highest price reached for a considerable while. The income bonds, ex-interest of 2 per cent, rose as high as 57½ then declined to 57. The stock was dull and featureless around 9. Atlanta Street Railways 5s were in good demand, advancing from 105¾ to 106½; later sales were made at 106. Norfolk Street Railway 5s sold at 108. On the New York Curb sales of the traction securities have been as usual rather limited during the last two weeks. Following the advance in the street railway group on the Stock Exhange, Interborough Rapid Transit rose 3 points, from 90 to 93, but sales amounted to less than 1000 shares. New Orleans securities were rather notably strong, the preferred stock gaining a point and a half to 29¾, 300 shares changing hands, and the common selling up to 11. The 4½ per cent bonds were firm at 80, but only a few lots sold at that figure. Brooklyn Rapid Transit 4s were bought and sold at 76½ to 76¾, Washington Traction 4s at 71¼, odd lots of St. Louis Transit at 14, and Brooklyn City Railroad at 232½.

Toledo Railways & Light featured in Cincinnati last week as well as in Toledo, where there seems to be a strong local demand. Over 600 shares changed hands in Cincinnati, starting at 24⅜ and advancing steadily to 26. Detroit United was very active and about 385 shares sold; all in lots of less than 50 shares. The price was almost stationary at 68½, although one lot brought 70. Cincinnati, Newport & Covington preferred was active, the range being from 81¼ to 82¼. Cincinnati Street Railway was inactive, a few shares selling at 132. Cincinnati, Dayton & Toledo 5s sold at 81½.

About 500 shares of Cleveland Electric sold in Cleveland, a considerable portion of this being at a premium over ruling market prices for 90-day delivery. The range during the week was from 68¾ to 70¾, the latter being the price paid for the future delivery. Northern Ohio Traction was firm at 12½ to 12⅝, with sales of 200 shares. Toledo Railways & Light attracted some attention, caused by the activity in Cincinnati, and 200 shares sold at 24⅞ to 25.

The new Columbus Railway & Light was very active in Columbus and the price advanced from 25 to 30 during the week. The old Columbus Railway common advanced from 82 to 85 on several sales.

Security Quotations

The following table shows the present bid quotations for the leading traction stock, and the active bonds, as compared with two weeks ago:

	Closing Bid Nov. 24	Dec. 8
American Railways	41	42
Aurora, Elgin & Chicago (preferred)	a68	a57½
Boston Elevated	140	140
Brooklyn Rapid Transit	38⅝	46⅞
Chicago City	164	160
Chicago Union Traction (common)	5	5½
Chicago Union Traction (preferred)	27	28
Cleveland Electric	67½	68
Consolidated Traction of New Jersey	60	63½
Consolidated Traction of New Jersey 5s	106½	105½
Detroit United	64	69
Elgin, Aurora & Southern	—	—
Lake Shore Electric	a14⅞	—
Lake Street Elevated	1½	1½
Manhattan Railway	138⅞	141¼
Massachusetts Electric Cos. (common)	17¼	20
Massachusetts Electric Cos. (preferred)	76	75
Metropolitan Elevated, Chicago (common)	17	17
Metropolitan Elevated, Chicago (preferred)	50	51
Metropolitan Street	115⅝	120½
New Orleans Railways (common)	8¼	10½
New Orleans Railways (preferred)	28¼	30¼
North American	71½	75
Northern Ohio Traction & Light	12⅛	12⅝
Philadelphia Rapid Transit	11½	11
Philadelphia Traction	95	95½
St. Louis Transit (common)	13½	13
South Side Elevated (Chicago)	95	93¼
Third Avenue	107	115
Twin City, Minneapolis (common)	89¼	94
Union Traction (Philadelphia)	43⅞	45⅝
United Railways, St. Louis (preferred)	57½	59

a Asked.

Iron and Steel

Although a decidedly better feeling is evinced in the iron market, and although there has unquestionably been some real improvement during the last few weeks, there is still a great deal of uncertainty regarding the immediate position. In the case of pig iron, while it is known that output has been greatly reduced and that the reduction is still in progress, it is by no means clear that the process has been carried far enough to suit the full decrease in consumptive requirements. In view of this uncertainty, purchasers of pig iron are confining themselves to buying from hand to mouth and are covering only such contracts as are due in the immediate future. It is reported that Southern makers, who have all along taken the lead in the price cutting, have at length been encouraged to advance their schedules a trifle. In the finished branches of the trade the situation is that the recent concessions on the part of sellers have brought in enough new orders to render any further lowering of prices unnecessary for the time being. Nevertheless, opinion is divided as to whether further reduction will not be necessary later on. Quotations are as follows: Bessemer pig iron, $14.85; Bessemer steel, $23, and steel rails, $28.

Metals

Quotations for the leading metals are as follows: Copper, 12 to 12¼ cents; tin, 26 cents; lead, 4⅛ cents, and spelter, 4½ cents.

ANNUAL REPORT OF THE ALLGEMEINE ELEKTRICITATS GESELLSCHAFT

The statement of the Allgemeine Elektricitäts-Gesellschaft which has just been issued for the fiscal period July 1, 1902, to June 30, 1903, shows that despite the industrial depression which has for some time existed in Germany, this company has more than held its own, the net profits for the year being 5,624,385 marks ($1,338,603.63), and the dividend proposed by the directors 8 per cent.

One of the noteworthy features of this report is the approval with which the directors look upon the recent consolidations of German electrical companies, not only because such action has tended to eliminate ruinous competition but is also helping to standardize apparatus. It is interesting to note that the company has made arrangements to build steam turbines on a large scale for both stationary and marine service.

On July 1, 1903, the Allgemeine Elektricitäts-Gesellschaft was consolidated with the Union Elektricitäts-Gesellschaft. The Allgemeine Elektricitäts-Gesellschaft is developing the Slaby-Arco and Braun wireless telegraph systems in conjunction with the Siemens & Halske Company, and is also co-operating with the latter company in the construction of a complete lighting, power and railway system for Valparaiso, Chile.

The directors report a slight improvement in electric railway business, the most important foreign contracts being the reconstruction of the Metropolitan Tramways of Buenos Ayres and Valparaiso tramways in South America. The consolidation with the Union Elektricitäts-Gesellschaft has relieved the works of the Allgemeine Company to such an extent that the latter company will hereafter manufacture railway signals, using the Köslin patents. Brief reference is also made to the Marienfelde-Zossen tests, reports of which have been published in these columns.

STORAGE AIR BRAKES FOR DETROIT UNITED SYSTEM

The cars of the Detroit United Railway Company are all to be equipped with storage air-brakes. The National Electric Company has the contract. This is the second large system to adopt storage air-brakes for its entire equipment within the past year, the St. Louis Transit Company having decided upon the National Company's system last spring.

PRIVATE RIGHT OF WAY AND COMPETITION IN STREET RAILWAYS DENIED IN MASSACHUSETTS

An important order has just been issued by the Board of Railroad Commissioners upon the petition of the Suburban Street Railway Company, of Springfield, for approval of locations in the city of Springfield, and the towns of Ludlow and Wilbraham. The order is as follows:

"The agreement of association published by the Springfield Suburban Street Railway Company refers to the 'provisions of chapter 113 of the Public Statutes and all general laws in addition thereto or amendment thereof' as the body of laws under which the company is to be organized. The Public Statutes had then been repealed and the Revised Laws were in force in their stead. We are asked to rule that this mistake in naming the statutes has rendered all subsequent proceedings void. We decline to make this ruling. It was not necessary that the agreement of association should name the statutes under which the company was to be organized. The provision of law to which reference was made were actually in force, though under a different title, and there is no proof or likelihood that the misnomer misled anybody who had any interest in the matter.

"The Springfield location provides that a violation of any one of the many conditions imposed upon the company shall work the immediate forfeiture of all rights in the street. This is contrary to the general law, which provides an effective and at the same time a just method for revoking street railway locations whenever the public good requires it. No location which controverts a State policy wisely established by the Legislature for the protection of public rights can be said to be consistent with the public interests.

"Again, the plan for constructing so large a part of the railway upon private lands raises a serious legal question. The company has no special statute authority to construct its railway upon private lands such as was given, for instance, to the Boston & Worcester Street Railway Company. It is, therefore, subject to section 9, chapter 112, Revised Laws. However unrestricted the right to build and operate street railways apart from the highway may have been prior to the passage of the above statute, street railways organized under the general law can now be constructed over private lands only for the purpose of avoiding grades and curves, or for other purposes 'incidental to the use of the highway.'

"The proposed railway passes for 2½ miles over private lands in Springfield, admittedly not to avoid grades or curves, but to secure a direct route for quick service and high speed. It takes to the highway only as it approaches populous centers. This departure for long distances from the highway would seem to be for railroad rather than street railway purposes. Apparently the highway and private lands have been used in furthering this enterprise whenever either best served the purposes of the promoters, the use of neither being 'incidental' to the use of the other.

"We do not intimate that railways ought not to be built over private lands between town and city centers and upon the streets when such centers are reached. On the contrary, much is to be said in favor of such construction. High speed is surely more appropriate over private lands than upon the highway. We only suggest that there is as yet no general law for such construction, and that therefore the petitioner, having no authority by special statute, cannot lawfully construct its railway as proposed.

"The foregoing views dispose of the location in Springfield, but we deem it only fair to interested parties to call attention to certain general principles which, under other circumstances, might have played an important part in the discussion of the facts here presented.

"There is no doubt about the need of additional street railway accommodations for those now without them, nor about the need of improvement in the accommodations now furnished certain patrons of existing lines.

"The Springfield Company was asked to extend its railway across the bridge into Ludlow. If it did not refuse to do this, it certainly pursued a short-sighted policy in paying scant attention to the needs of the community which desired the extension. There is also abundant evidence that passengers who desire to leave Springfield for Palmer and towns beyond have had difficulty in obtaining seats in the cars that go through to these points; and it would further appear that there is frequent annoyance from poor connections made between the Springfield and the Springfield & Eastern Railways.

"The new company seeks to furnish the needful additional facilities for Ludlow and to provide a remedy for the other grievances named, while the old company offers to do the same by extending its lines and improving its service.

"In Springfield we have a long established company with a railway reaching into almost every part of the city, well equipped, and, notwithstanding the exception noted, efficiently managed, affording convenient transportation in all directions and for long distances for a single five-cent fare; a company to which prosperity has brought financial strength and abundant resources. Can it be said upon business principles that the public interests would not be best served by giving this company an opportunity to build and equip an extension of its railway to Ludlow? A grant which secures economy in capitalization, and efficacy in operation, is certainly desirable.

"It is urged that the competition which would result from admitting another company into the city would be a public benefit. This is a theory which, in spite of the multiplied lessons of experience, is still more or less popular. History has repeatedly proved that such competition, after a fitful existence, always gives way under the compelling force of business principles to the consolidation of competing companies, leaving behind evils which are lasting in their effect. A monopoly in local street railway service under proper supervision would give the public a better service than the efforts of contending companies, not infrequently struggling to keep alive enterprises which ought never to have been undertaken. Under our laws such a monopoly is founded upon statutes which protect the public interests by making street railway locations not only subject to supervision, but subject to revocation for cause; practically, therefore, dependent upon the good behavior of the company receiving them. To deny recognition and protection to a company which renders good service kills ambition to please and accommodate and encourages rather a disposition to thwart the public. It weakens confidence in the stability of the tenure by which the company holds its property, and so impairs its credit and consequent ability to comply with the public demands.

"The operation of street railways in the larger municipalities has shown that the traffic within city limits can be handled with greater success and greater safety by one than by several companies. It will not do, however, for a company which receives the privileges of a monopoly to forget the obligations which go with them. The public in such case can look to the one company only for needful extensions and additional accommodations. In response such company should be quick to meet all reasonable demands. When it undertakes to perform the entire public service it must carry out the task.

"The petitioner contends that the question of the public convenience and necessity is not open in a proceeding of this sort. In our opinion it would be impossible to issue a certificate that locations are consistent with the public interests without full consideration of all matters affecting capitalization and safety and convenience in operation. We deem these questions of more than mere local concern.

"In declining to certify that the Springfield location is consistent with the public interests, we indirectly pass upon the locations of the Suburban Company in Ludlow and Wilbraham, as those grants were obviously made in connection with the Springfield location and are dependent upon it. The Selectmen of these towns very naturally and properly availed themselves of the opportunity to obtain street railway facilities at the hands of the Suburban Company. Their failure to obtain them in this way need not prevent the ultimate realization of the desires of these communities in respect to street railway accommodation."

OUTLAY OF $5,000,000 FOR TEMPORARY WORK IN CHICAGO

If the receivers of the Chicago Union Traction Company secure the right from the court to make improvements which they think are needful at once, the sum of $5,000,000 will be spent before the extension ordinances have been considered by the Council. The plans for the new work to be done include the construction of a number of underground lines, the relaying of rails, the purchase of new cars and the readjustment of loops. In addition to the 100 new cars which are expected to be delivered early next year, an order will soon be placed for 500 cars. The money for these improvements is to be raised by issuing receivers' certificates or bonds. The hearing on the application to make the expenditure just referred was begun by Judge Grosscup on Tuesday, Dec. 8, in the Federal Court, and it is understood that if the court rulings are favorable to the receivers, application will be made to expend even more than the original $5,000,000.

THE JOLIET, PLAINFIELD & AURORA RAILWAY

The Joliet, Plainfield & Aurora Railroad has recently been placed in regular operation between Joliet and Plainfield, 10 miles, with a forty-five minute headway, and the reports of the earnings for the first few days show that the receipts are exceeding the estimates made by the promoters. The road is a connecting link between the Chicago & Joliet Electric Railway, extending from Chicago to Joliet, a distance of 35 miles, and the Aurora, Elgin & Chicago Railway, extending from Chicago to Aurora, a distance of about 35 miles. The distance from Joliet to Aurora, between which points the road is built, is about 20 miles, and the populations of the terminal towns are 40,000 for Joliet and 35,000 for Aurora. Plainfield, to which the road is now in operation from Joliet, is about midway between Aurora and Joliet, and has a population of 1500. The average population per mile of line is 4000, and from the standpoint usually adopted in figuring tributary population the road will enjoy the proud distinction of 200,000 population to the mile, since the completion of the triangle above described makes Chicago directly tributary. The road is being built by the Fisher Construction Company, of Joliet. The standard specifications of the American Railways Company, which owns the Chicago & Joliet Electric Railway, are being followed. Use of the terminals of the Chicago & Joliet Company, at Joliet, have been secured under a long-time contract, and arrangements have also been made with this company for power. At Aurora the road will enter the city over the tracks of the Aurora, Elgin & Chicago Company.

FOURTH ANNUAL REPORT OF THE MASSACHUSETTS ELECTRIC COMPANIES

The fourth annual report of the Massachusetts Electric Companies, covering the year ending Sept. 30, 1903, has just been issued. During the year the policy of consolidating the constituent companies has been continued until there are to-day but two operating companies, not including the Hyde Park Electric Light Company, which cannot, under existing laws, be consolidated with the Old Colony Street Railway Company, to which it furnishes a large amount of power.

As a result of the considerable amount of new construction done in 1902 for the purpose of connecting various existing lines, little work of that kind has been done during the past year, but very important improvements have been carried out both to the equipment and to the power houses. Thus during the fiscal year the following amounts have been expended:

Cars and electrical equipment	$906,000
Reconstruction of track	468,000
Power stations (including Newport and transmission lines)	910,000
Reconstruction of cars	93,000
Land, building and engineering	193,000
Total	$2,570,000
While for new roadway and new tracks there was spent only	$460,000

With the above outlay 164 new cars were purchased, of which 132 were equipped, 25.552 miles of track were reconstructed with new and heavy rail, 44.858 miles of new feed-wire, and 2½ miles of underground feeder were built, and 8500 hp in new machinery installed. Besides this, the new station at Newport, with 2100 hp of turbo-generators, was practically completed, and the new station at Quincy Point, with room for 15,000 hp of turbo-generators, with a sub-station at Brockton, was pushed forward rapidly, so that it may be expected to be ready for its electrical equipment by Feb. 1. In addition to this, advantageous sites have been secured for new stations at Fall River and Danversport, although work on the buildings has not yet been begun.

The records show that during the period of four and one-half years the properties have been in charge of the trustee, and leaving out of account all new construction, 75 miles of track have been reconstructed with either 75-lb T or 90-lb girder rails; that 267 miles of new feeder-wire have been strung; that 123 cars have been reconstructed and increased in size; that 621 new cars and snow-plows have been added, and that 1064 new motors and equipments have been purchased.

The general increase in price of all supplies and the increase in wages all combined to swell expenses, while the gross earnings showed a serious falling off in the best months of the year, owing to the cold, wet summer. Gross earnings increased only 5 per cent for the year, but, compared with the results of other suburban companies, these figures show a very great stability of business, and it is interesting to note that in July and September (the only pleasant months of the summer) the gross increased 11 per cent, While October of the new fiscal year shows an average gain of 6 per cent in gross over the same month of last year, when much of the new mileage was in operation.

The operating expenses were very materially swelled during the year, owing to an increase of substantially 12½ per cent in rate of wages of conductors and motormen.

The consolidated income account shows earnings as follows:

FOR THE YEAR ENDING SEPT. 30, 1903

Earnings	$6,333,910
Expenses	4,155,908
Net earnings	$2,178,002
Interest, rentals and taxes	1,331,147
Net divisible income	$846,855
Dividends	840,233
Surplus for the year	$6,622

The profit and loss statement for the year ending Sept. 30, 1903, follows:

INCOME		
Dividends on stocks owned	$840,738	
Interest on notes and bank balances	85,371	
Total income		$926,109
EXPENSES		
Salaries—general officers	$9,000	
Printing and stationery	1,123	
Legal expenses	775	
Miscellaneous expense	3,988	
Total expense		$14,887
Net income for the year		$911,222
CHARGES AND DIVIDENDS		
Interest on coupon notes		$121,500
Net divisible income		$789,722
Dividends (4 per cent on preferred shares)	$809,646	
Less accrued on preferred shares sold	27,430	
		782,215
Surplus for the year		$7,507
Surplus Sept. 30, 1902		204,160
Surplus Sept. 30, 1903		$211,667

The consolidated balance sheet as of Sept. 30 shows:

ASSETS		
Property, Sept. 30, 1902	$31,152,269	
Net additions to Sept. 30, 1903	2,658,366	
Property, Sept. 30, 1903		$33,810,635
Cash		815,965
Accounts receivable and open accounts		338,843
Newport & Fall River and Nashua Street Railway lease accounts		222,480
Coupon deposits		86,542
Sinking and redemption funds		50,883
Prepaid taxes, insurance and rentals		134,730
Material and supplies		933,157
Total assets		$36,393,235
LIABILITIES		
Capital stock		$16,760,100
Capital stock subscription		400,000
Funded debt		13,174,500
Notes payable		2,014,500
Notes and accounts with the Massachusetts Electric Companies and Massachusetts Street Railway Accident Association		1,683,638
Vouchers and accounts payable		580,261
State, local and excise taxes		367,064
Coupons outstanding		86,543
Dividends declared, unpaid		429,118
Accrued interest and rentals		185,795
Renewal funds		10,000
Surplus		701,716
Total liabilities		$36,393,235

CHICAGO ELEVATED TRAFFIC FIGURES

The most interesting feature of the passenger traffic reports of the South Side, Metropolitan and Northwestern Elevated Railroads, of Chicago, for the month of November, is the increase in passengers carried by the South Side Company, due to the strike of the employees of the Chicago City Company. The South Side Company during the month broke all records for the number of passengers carried by the Chicago elevated railroad in a single month since the World's Fair. The daily average number of passengers carried was 143,398, compared with 83,299 in November, 1902, an increase of 72.15 per cent. From Nov. 2 to Nov. 25, inclusive, the average traffic was 206,000 passengers per day. This exceeded by 10 per cent any like period during the World's Fair in 1893. The largest day's traffic was 229,535, on Nov. 14. President Leslie Carter of the company said:

"The capacity of the road to carry passengers in an emergency was amply demonstrated, as well as what can be done when we have the additional tracks, cars, and power now proposed. The passengers were very good humored and kindly gave us credit for doing our best. If the loop platforms had been lengthened, as we desire, much of the crowding and discomfort on the Union loop would have been avoided. We went to the limit of the present power of our power house in our effort to accommodate the public."

Northwestern Elevated and Metropolitan Elevated had fair months. Following is the record of elevated traffic this year:

	1903	1902	Gain	Per cent gain
SOUTH SIDE				
January	86,637	79,154	7,483	9.45
February	88,516	79,386	9,130	11.50
March	87,989	80,318	7,671	9.56
April	87,553	81,009	6,544	8.07
May	82,884	76,063	6,821	8.96
June	85,262	76,449	8,813	11.52
July	76,236	70,767	5,469	7.72
August	72,646	68,334	4,312	6.31
September	81,887	76,572	5,315	6.94
October	85,788	83,112	2,676	3.02
November	143,398	83,299	60,299	72.15
METROPOLITAN				
January	112,771	98,029	14,742	15.03
February	116,090	100,466	15,624	15.55
March	116,716	105,512	11,204	10.61
April	117,597	109,246	8,351	7.64
May	109,330	105,798	3,531	3.34
June	111,613	101,743	9,870	9.70
July	102,057	97,929	4,128	4.21
August	102,971	100,099	2,872	2.87
September	112,993	109,751	3,242	2.95
October	117,387	115,980	1,407	1.21
November	114,148	110,289	3,859	3.50
NORTHWESTERN				
January	68,266	62,010	6,256	10.80
February	69,885	64,760	5,125	7.91
March	70,070	65,362	4,708	7.22
April	71,340	65,430	5,910	9.03
May	66,990	63,199	3,781	5.98
June	66,571	60,813	5,758	9.46
July	59,393	56,110	3,283	5.85
August	60,693	57,911	2,182	3.76
September	68,107	63,950	4,157	6.50
October	71,617	69,562	2,055	2.96
November	71,422	67,236	4,186	6.23

UNION BUTTONS CAUSE TROUBLE IN CHICAGO

An official button has been issued by the Cook County division of the Amalgamated Association of Street & Electric Railway Employees of America. "Union Principles and Immediate Municipal Ownership" is the slogan it carries. The wearing of these buttons brands at once a man as non-union or union. As a result of this the non-union employees remaining in the employ of the Chicago City Railway Company after the strike have been abused in a number of instances. On Dec. 5 three non-union conductors of the company were attacked by passengers who refused to pay their fares to non-union men. A fracas followed, in which two non-union conductors were injured and a union man shot in the leg. On Wednesday, Dec. 9, a most serious riot was precipitated by union sympathizers. Cars manned by non-union crews were stoned, windows were broken and several passengers hurt at the hands of mobs that congregated at Root Street and Wentworth Avenue to make a demonstration against the non-union employees. Police from the Stock Yards Station arrived shortly after the demonstration, but no arrests were made. A new book of rules which has just been issued by the company prohibits the employees from wearing any badge or sign other than that provided by the company.

CHICAGO UNION TRACTION MATTERS

The hearing of arguments on the validity of the claims of the Chicago Union Traction Company under the ninety-nine year act, which was to have been held before Judge Grosscup Dec. 3, was postponed one week. In his response to the petition for permits to install the overhead trolley and make other extensive improvements, Corporation Counsel Tolman makes a sweeping denial of the constitutionality of the ninety-nine year act and declines to admit the jurisdiction of the Federal Court over any of the important questions at issue. He puts aside as irrelevant all questions as to whether the improvements will be of benefit to the public or value to the estate in the custody of the court. He claims the only question properly involved in the matter is whether, under existing and valid ordinances, the receivers are entitled to the privilege asked for.

There seems at present no likelihood that the Chicago Union Traction Company will obtain any franchises or attempt to obtain any from the City Council until the litigation that has been started has been decided.

W. K. Vanderbilt, Jr., was in Chicago inspecting the Union Traction lines Dec. 4. It was rumored that his mission had something to do with the financing of the Chicago Railways Company which was recently organized, with the idea of taking over the properties now operated by the Chicago Union Traction Company.

CHICAGO CITY RAILWAY FRANCHISE MATTERS

The ordinance proposed to extend the Chicago City Railway Company's franchises twenty years, recently outlined in these columns, is being discussed at a series of public readings held by the local transportation committee in Chicago.

The Council has extended the franchises of this company ninety days from Nov. 30, as a temporary measure to provide for time in which to get action on the twenty-year ordinance.

THE DEVELOPMENT OF TRAFFORD CITY, PA.

Those who have visited the works of the Westinghouse interests near Pittsburg know that they extend along the line of the Pennsylvania Railroad for several miles, and that, with the exception of the works of the Union Switch & Signal Company, they are connected by a private railroad known as the Westinghouse Inter-Works Railway. Of the shops on the line of this road, those of the Westinghouse Machine Company and of the Westinghouse Electrical & Manufacturing Company are at East Pittsburg, those of the Westinghouse Air-Brake Company are at Wilmerding, and the new foundry is at Trafford City. The property at the latter point available for industrial development comprises some 130 acres, on which have been erected a large foundry, pattern shop, power house, machine shop, brass foundry and sand house. The foundry is 184 ft. x 612 ft., and is served by three Sellers cranes of 80-ft. span, one of 100 tons capacity and two of 60 tons. Also running below them are four traveling cranes, two on each side. The cranes and most of the machinery used in the foundry and department buildings are operated by induction motors supplied with current from the power station, which contains both steam and gas engines of Westinghouse make.

One of the most interesting features of the installation at Trafford City is the provision made for residences for the employees. For this purpose some 470 acres have been acquired by the company and set aside for the erection of model buildings. The individual residences are on a hill above the foundry, and are of brick with slate roofs, and contain five rooms and a bath, besides an attic and a cement cellar. Employees are encouraged to rent these houses or purchase property on easy terms. The streets are laid out in a generous manner, and are paved, with flagstone sidewalks, while the entire town has a water supply and gas for illuminating and heating.

In addition to these individual houses, the Westinghouse interests have erected a block of flat houses two stories in height. These rent for somewhat less than the individual houses, and each apartment contains four rooms and a bath, and has separate entrances. For unmarried men a well-appointed hotel has also been erected. It is tastefully furnished, and is planned to give accommodations at cost.

CHICAGO CAR HOUSE HOLD-UP SOLVED

The mystery surrounding the hold-up of the receiver at one of the car houses of the Chicago City Railway last August, during which two of the employees were shot and killed without warning, has been cleared up by the confession of one Gustave Marks, under arrest for the murder of a detective. Marks has named two accomplices in the car house murders. He says that he and the other two men went to the office of the company for the purpose of robbery, and that when he ordered the men to throw up their hands they obeyed. One of his accomplices, he says, burst in the window of the office and commenced shooting. The door was then broken down with a sledge hammer and the office was rifled. In all, $2,250 was secured, and Marks says the money was evenly divided among the three men. The next day Marks and his companions went to Denver, where they remained but a short time. From Denver they went to Cripple Creek, and in a week they came back to Chicago.

FENDERS ADOPTED IN LINCOLN, NEB.

The Lincoln Traction Company recently made an extended test of a number of car fenders, to determine the type to be adopted on its cars. The tests were conducted before the members of the City Council and the officers of the company, and resulted in the selection of the Providence fender. In consequence, the order has been placed with the Consolidated Car Fender Company to equip all of the electric cars in Lincoln with this fender.

PLANS FOR THE CRUSADE AGAINST NEW YORK TRANSPORTATION COMPANIES

According to the officers of the Committee of One Hundred and the Merchants' Association, the crusade against the surface and elevated roads throughout New York is to be resumed at once, and a plan of preventing overcrowding, which has been tried abroad, is now under consideration. The London authorities, finding the arrest and fining of conductors insufficient, have now resorted to the arrest of passengers, whom the magistrates fine for "aiding and abetting" conductors in contravening the anti-crowding law. An officer of the Merchants' Association, who is supposed to know all about transportation matters, although he never owned any vehicle other than a truck, delivered himself of the following profound thoughts:

"This London plan is an indirect means of getting at the officials of the companies. After a certain number of passengers have been arrested and fined, a public sentiment will be aroused, sufficiently strong to force the companies to better their carrying facilities. The plan is a good one, but is decidedly English; and, while it could be used successfully in clearing the open cars in summer of standing passengers, it is not the most practicable way of gaining the desired end in this country."

A strict enforcement of such a regulation, if it were possible, would require the entire police force of the city, and while it would doubtless put an end to overcrowding, or at least greatly modify the evil as it exists to-day, it would at the same time effectually cripple the transportation business of the city, and by restricting the carrying capacity of the city lines practically bring all business to a standstill.

Another suggestion, made by an eminent reformer, is to the effect that if an association were formed by the indignant passengers of any particular road, and action were brought by individuals against the conductors of cars, that the companies would soon be brought to time. "Certain police rights are vested in transit companies and their servants, and if they do not perform certain duties they may be haled before the nearest magistrate and fined. At present the weapons to combat the evils complained of lie in the hands of the public and need only be used to be made effective. There is power in numbers. If several such organizations are formed and the individuals of each carry overcrowding and other grievances into the city courts, the result will be immediate and satisfactory. Rather than be compelled to send half a dozen lawyers to the different municipal courts every day, and ultimately pay fines, the companies will do exactly what we want them to do. These cases must be brought before the city courts, for the higher courts are too slow and cumbersome to suit the purposes of this attack. It must be quick, rapid and constant."

THE QUESTION OF A STRIKE AT PITTSBURG

At a conference at Pittsburg on Monday, Dec. 7, of the special committee of organized motormen and conductors, with J. D. Callery, president of the Pittsburg Railways Company, it was planned to settle the difference between the company and its employees. Meantime the company is conducting an investigation of its schedules, with an idea of making changes that will benefit the workingmen, and not interfere with a satisfactory operation of cars, and the employees are expressing their sentiment by ballot regarding their course if the peace conference fails of result.

TROLLEY COMPETITION HURTS—RATE WAR

Numerous changes in running time are being made by the steam railways entering Indianapolis. The schedules show that a number of accommodation trains have recently been dispensed with, and the announcement is made that further reductions in train service are to go into effect Jan. 1. While no cause is given for the taking off of trains other than that "business does not warrant their continuance," it is known that the reduced service is due to the competition of the electric railways. In the future the steam roads will pay more attention to through traffic, having, it is believed, fully realized how futile it is to try to compete with the electrics. What purport to be authentic figures show that railway stations that sold about $250 or $300 worth of tickets per week to Indianapolis before the electrics entered the field now sell about $50 or $75 worth a week.

In this connection it is interesting to note the announcement that the Monon, the Lake Erie & Western and the Big Four Railroads are to establish a one-cent a mile rate for passengers between Lafayette, Frankfort, Lebanon and Indianapolis. This, of course, means a cut in the regular rates on these lines. The establishment of the new rate is ascribed to the competition of the Indianapolis & Northwestern Traction Company, which company even charges higher rates of fare than most of the other interurban companies. Between certain points the average fare amounts to more than 2 cents per mile. The regular mileage rate is 1¼ cents per mile. There has been no announcement by the Indianapolis & Western Company as to whether it will attempt to meet the cut of the steam companies.

QUARTERLY REPORT OF THE INTERURBAN COMPANY

The consolidated statement of earnings and expenses for the quarter ended Sept. 30, 1903, of the Interurban Street Railway Company (including Third Avenue Railroad and all leased and controlled lines) compares as follows:

	1903	1902
Gross receipts	$5,570,212	$5,371,690
Operating expenses	2,761,600	2,736,022
Net earnings	$2,808,612	$2,635,668
Other income	370,224	425,926
Total income	$3,178,836	$3,061,594
Deductions	3,015,459	2,915,224
Surplus	$163,377	$146,370

THE BACKERS OF THE ELEVATED AND SUBWAY ORDINANCES IN ST. LOUIS

Official confirmation is received of the statement made in the Street Railway Journal of Oct. 31, 1903, that the Western Electrical Supply Company, of St. Louis, is behind the applicants for combined subway and elevated railway franchises in that city. As previously stated, the road will run from Third Avenue and Washington Avenue, underground to a point between Seventeenth and Nineteenth Streets, where it will come to the surface and then proceed by an elevated line west to the city limits, terminating on the Watson Road. The route of the present franchise asked, will be from Third Avenue and Washington Avenue under St. Charles Street, to a point between Seventeenth Street and Nineteenth Street, to St. Charles Street, Bell Avenue, Fairfax Avenue, west to Taylor Avenue and south over Taylor Avenue to Manchester Avenue, thence west over Manchester, Clayton, Berthold, Billon and McCausland Avenues to the city limits on the Watson Road.

TRACTION DEVELOPMENTS IN PITTSBURG

Interests identified with a number of companies incorporated at Harrisburg during the year have just applied to the Common Council of Pittsburg for franchises to build street railway lines which will be approximately 40 miles long and in the construction of which about $10,000,000 will be spent, if the franchises are granted. The lines will be built mostly in the east end of Oakland, Lawrenceville, Hazlewood and in the lower section of the city. Provision is made for a downtown loop connecting with lines that run through Bloomfield and Garfield Parks to Highland Park, with a branch to East Liberty, Homestead and Brushton. The applications for franchises have been made in the names of seven different companies, namely, Pittsburg Rapid Transit Company, Ferry Street Railway Company, Iron City Street Railway Company, Bankers Street Railway Company, Squirrel Hill & Wilkinsburg Street Railway Company, Webster Avenue Street Railway Company and Atlantic Street Railway Company. The routes as detailed in the ordinance are of interest only to residents of the city. In an official announcement made immediately after the application had been filed it was stated that the financial stringency of the past summer has somewhat delayed the plans of the company, and that the original intention was to apply for franchises immediately after the charter had been granted at Harrisburg. At one time the names of T. S. Bigelow, E. M. Bigelow and Murry A. Verner were connected with the enterprise. Mr. Bigelow, for himself and the other two gentlemen, has denied any connection with the company. An announcement of the company that is official gives the following organization: R. C. Hall, president; S. S. Leslie, secretary; James W. Clark, treasurer; R. C. Hall, James W. Clark, John Sloan, William Kaufmann and S. S. Leslie, Jr., directors. The engineers will be Harry Mulholland, former City Engineer W. M. Brown, and Lippincott & McNeil.

BETTER SERVICE PROMISED IN MANHATTAN

The Board of Railroad Commissioners had a conference last week with E. P. Bryan, vice-president and general manager of the Interborough system, and made a critical examination of the measures adopted by the company to provide accommodations for the great increase in traffic that must be expected during the holiday shopping season. The phenomenal increase that has been experienced during the last few months over the corresponding periods of last year has taxed the facilities of the company to the utmost, and the management fully appreciates the problem it must now face in handling the crowds of the shopping district during the next few weeks. The Commissioners, it is said, are satisfied with the improvement that has been made thus far, and they realize that the management will do all in its power to relieve the crush and give satisfactory service during the holidays. It was suggested that the company run extra trains in the rush hours on Sixth Avenue by using a switch at Waverley Place, and keeping the cars of those trains empty as far as Fourteenth Street. Mr. Bryan submitted a statement to the Commissioners, containing the following interesting data:

Contracts were made with four different car companies for 500 cars for the subway. The contracts provided that these cars be delivered by November, 1903. Realizing in the summer that there would be no need for these cars in the subway, owing to the delays occasioned by the numerous strikes, it was planned to use them on the Manhattan division, supplying the entire equipment of Second Avenue—about 250 cars—from subway equipment. This would relieve the Second Avenue cars for distribution on other lines of the Manhattan division. It was fully expected that these 250 cars would be delivered in ample time for service as indicated. Up to the present date we have received about 175, of which 160 are now in use on the Second Avenue line. All the cars from the Second Avenue line have been put in service on the other lines, a large part of them on Sixth Avenue. In addition to this we have taken all of the cars, some sixty, out of the shop which were there for painting, and put them into service, necessitating the closing of the paint shops.

A cable or tie has been laid between the Fifty-Ninth Street power house and the Manhattan power house, at Seventy-Fourth Street, at a cost of $125,000, in order to be ready to make use of any power which may be generated in the Fifty-Ninth Street power house on the Manhattan division.

It has been planned to run from Franklin Street certain trains, making first stop at Fourteenth Street, and we had hoped before now to have increased our Franklin Street service, but as before stated, we have not been able to do so on account of lack of rolling stock. The cars are being wired at the rate of three a day, and we will by Monday next be in a position to run at least four trains from Franklin Street, making no stops until they reach Fourteenth Street. It is not practicable to operate trains from the switch below Eighth Street during the rush hours.

The increase in passengers carried in the month of October was 3,000,000 over October, 1902, and the car mileage increase was 1,146,716. For November the increase in passengers was 2,972,000, and the increase in car mileage was 1,052,470.

NEW CARS FOR BROOKLYN SURFACE LINES

The State Board of Railroad Commissioners has recommended to the Brooklyn Heights Railroad Company that it add fifty cars to those at present in use, to be operated between the hours of 9 o'clock in the morning and 4 o'clock in the afternoon and 7 o'clock and midnight and to be run on the lines on which there is the greatest overloading of cars at present. This recommendation is based upon a thorough examination of the transportation conditions of the company's system. The board in its recommendation to the company says:

"As a result of our investigation the conclusion has been reached that little, if any, improvement can be made at present in existing conditions during the rush hours of the morning and evening. This statement is made after a careful consideration of all the conditions as they exist, including the amount of power which the company has available for operation. Under the present conditions the company is unable to operate more cars than are now in use during the rush hours and is only able to partly heat them with all of the power apparatus working on overload. Any injury to or breakdown of the power units will compel the company to reduce the number of cars or lessen the amount of heat furnished. Because of this the consideration of the improvement in the transportation facilities was confined to other than the rush hours."

The board conducted a systematic investigation and formulated a series of tables showing the necessities of certain days of the week, which demonstrate that the average number of additional cars required on these lines for Sunday is 104; Monday, 52; Tuesday, 96, and Saturday, 82. The conclusion is reached: "If they were added to the present operation, while they would not furnish seats for all passengers, it would greatly relieve the overcrowded conditions on the lines mentioned."

The recommendations conclude: "The maximum number of cars which will be operated during the rush hours the coming winter on the surface lines, including surface cars, will be about 1200. The average number of cars operated during the non-rush hours will be about 545. The natural query is, 'If the company can operate 1200 cars during the rush hours, why can it not operate more than an average of 545 during the non-rush hours?'

"The reason for this large difference in the number of cars operated during different portions of the day is that in order as nearly as possible to accommodate the traffic during rush hours the power apparatus is worked to a point far beyond its normal capacity. In the case of electric generating apparatus this can be done for short consecutive intervals, but after the rush hours the load must be reduced and the machines allowed to regain their normal temperature, and during the non-rush hours some of the units must be shut down each day for repairs, hence the necessity for reducing the number of cars operated during these hours.

"The board, after a careful consideration of all the existing conditions and the danger involved in any impairment of the service during the rush hours, whether in the number of cars operated or the heating of them, has arrived at the conclusion that the company can at present safely operate fifty more cars during the non-rush hours, and makes that recommendation, with which it expects the company to comply immediately, and the board will take the proper means to inform itself as to such compliance."

J. F. Calderwood, vice-president and general manager of the Brooklyn Rapid Transit Company, when notified of the State Railroad Commission's recommendations, is reported to have said: "If the State Railroad Commission makes such a recommendation we shall most assuredly comply with it. We have fifty new trolley cars, and they were to have been put out within a few days anyway."

The Harlan & Hollingsworth Company, of Wilmington, Del., has completed the electric sleeping car, Theodor, and it has been shipped to Indianapolis. The car was built for the Holland Palace Car Company, of Indianapolis, and was described in the STREET RAILWAY JOURNAL of Aug. 15, 1903.

PROPOSED MIXED SYSTEM FOR NEW YORK

Elias E. Ries, of New York City, has addressed a letter to Dock Commissioner Hawkes recommending a modified mixed system of storage battery and direct supply for the proposed electric line on West Street, which, he claims, will obviate the necessity for overhead wires on that route. According to Mr. Ries, the plan differs from the mixed storage battery and direct supply system which has been tried extensively and abandoned in Germany, from the fact that current would be taken from the storage batteries for only very short periods of time, hence the battery, which receives its charge from the channel rails while the car is traveling over the regular underground trolley route, would have to be of only one-eighth to one-quarter the weight and capacity heretofore found necessary for regular storage battery operation. The plan is to build an underground conduit of the usual type and which would be used in the ordinary way except in times of high water. Even then the higher portions of the conduit would be available. The conductors in this conduit would be divided into sections and those in the flooded sections would be automatically cut out by the action of the rising water itself when the same reaches a predetermined travel. This Mr. Ries accomplishes in one of several ways, preferably by causing the water to establish electrical connection between a pair of terminal plates in the lower part of the conduit, or in a side chamber connected therewith, which action operates a suitable electromagnetic cut-out to break the circuit to the channel rails, which latter thereupon become temporarily "dead." By a corresponding automatic apparatus within the car the motor connections, at the same time, would be switched from the plow to the storage battery carried on the car. When the water receded the current would be automatically restored to the conduit conductors and the batteries would be automatically cut out. In this manner, it is claimed the necessity for equipping the cars with removable or folding plows would be avoided.

An additional advantage claimed is that cars equipped in this way would be independent of a direct source of supply, and in case of blockades or short circuit they could run for a short distance over another line by their batteries, also that there would be no flickering or going out of the lights, or danger of stalling of the motors, as at present, when the cars pass over a crossing.

AN OMNIBUS LINE IN ST. LOUIS

The Imperial Transit Company, of St. Louis, recently organized, announces that by April 1, 1904, an automobile omnibus service will be in operation between the downtown district in St. Louis and the Louisiana Purchase Exposition grounds. Contracts for the coaches have already been placed by the company with the American Car Company, of St. Louis, and for the electrical equipment with the Western Electric Company, of Chicago. The cars will be double-deck affairs, and will vary in capacity from twenty-four to forty persons. While the service will be inaugurated as a feature of the exposition, it will not strictly be an exposition venture, as the plan is to continue the operation of the cars permanently. When the regular carrying capacity is reached by a car, it is planned to display a red flag and to stop only to discharge passengers. The schedule of fares has not been decided for the exposition period, but the statement is made that a straight 5-cent fare will prevail over the regular routes after the exposition period. Thomas M. Jenkins, formerly general manager of the St. Louis & Suburban Railway Company, has been elected president and general manager of the company. Among those associated with Mr. Jenkins in the new enterprise are: Ernst Kastor, Edward Weston, John D. Johnson, who will be the legal counselor for the company; J. L. Williams, president of the Commercial National Bank, of Detroit, and John D. Baker.

STREET RAILWAY MEN PROMOTE BASE-BALL LEAGUE

Indiana is to have an interurban baseball league. Representatives of the eight interurban roads centering in Indianapolis held a meeting a few days ago and formed an organization. The cities composing the league and where baseball will be played are: Greenfield, Rushville, Shelbyville, Richmond, Frankfort, New Castle, Connersville and Indianapolis. W. R. McKown, of Greenfield, is president of the league and Harry Sielken, secretary. The season will begin May 1, and end Sept. 15. The organization will seek protection of the national association of minor leagues. The electric railways will give the league loyal support for the increased patronage they will get.

BOSTON ELEVATED REPORT FOR THE YEAR

The income account of the Boston Elevated Railway Company for the year ended Sept. 30 is issued. A comparison with 1902 follows:

	1903	1902
Gross	$11,959,511	$11,321,030
Operating expenses	8,259,860	7,862,571
Net earnings	$3,699,654	$3,458,458
Other income	59,856	.....
Gross income	$3,759,510	$3,458,458
All charges	2,932,556	2,836,560
Balance	$826,954	$621,898
Dividends	798,000	600,000
Surplus	$28,954	$21,898

The balance sheet as of date Sept. 30 compares as follows:

ASSETS

	1903	1902
Cost of roadway	$6,747,692	$6,047,089
Cost of land	5,104,898	4,679,548
Cash	4,019,431	2,112,974
Bills receivable	855,963	963,409
Current assets	208,010	212,010
Deposited with State	500,000	500,000
Material and supplies	1,045,011	748,451
Somerville Railroad	102,851	102,851
West End property account	1,613,856	2,609,866
Subway	160,343	158,268
Total	$20,358,058	$18,134,470

LIABILITIES

Capital stock	$13,300,000	$12,383,310
Vouchers and account	293,784	332,904
Salaries and wages	124,051	125,615
Dividends not called for	7,697	9,481
Matured coupons	31,337	39,550
Rent due	333,873	317,975
Outstanding tickets	24,407	21,041
Notes payable	.....	500,000
Accrued interest	113,651	150,051
Accrued taxes	904,351	840,909
Accrued rentals	131,825	131,825
West End ls account	1,207,201	1,227,207
West End bond account	171	12,849
Damage fund	598,015	598,015
Insurance fund	360,000	360,000
Depreciation fund	600,000	600,000
Surplus	2,327,687	483,733
Total	$20,358,058	$18,134,470

PASSENGER TRAFFIC STATISTICS COMPARE

	1902-3	1901-2
Revenue miles	47,476,702	45,772,836
Revenue passengers	233,563,578	222,484,811

THE THREE-CENT FARE SITUATION AT CLEVELAND

The fight between the Cleveland Electric Railway and the People's Street Railway, the so-called 3-cent fare line, has assumed a very peculiar phase. The old company has secured an injunction against the 3-cent fare line, temporarily restraining it from building on Denison Avenue on the ground that the consents of some of the property owners are invalid because they are not given by the true owners of the property. Heretofore, in obtaining consents, it has been considered necessary only to secure the consents of the parties paying taxes on a piece of property. The attorneys for the Cleveland Electric Railway Company have delved into the records and developed a number of flaws in the titles of the present owners, and they claim that these parties are not competent to grant consents. The 3-cent fare company, in seeking to retaliate, is attacking the validity of the franchise granted the Cleveland Electric Railway for a line on Doan Street, Glenville. The result is that when the cases come up for trial the opposing attorneys will have to argue one way in one case and the other way in the other case. Whichever way the Denison Avenue case is decided, it would seem that the Doan Street case must be decided the same way; hence the 3-cent fare company would seem bound to win one case.

STREET RAILWAY PATENTS

[This department is conducted by W. A. Rosenbaum, patent attorney, Room No. 1203-7 Nassau-Beekman Building, New York.]

UNITED STATES PATENTS ISSUED NOV. 24, 1903

744,770. Trolley; Levi L. Leathers, St. Albans, Maine. App. filed April 22, 1903. Guard arms extending above the wheels are adapted to yield when a cross wire is encountered and afterwards return to normal position.

744,780. Street Car; William P. Michel, New York, N. Y. App. filed Sept. 4, 1903. A street car in which the handles on one side alternate with those on the other side, to prevent stepping from the car while facing backwards.

744,913. Car Fender; Thomas J. Glynn, Coal Center, Pa. App. filed May 2, 1903. Consists of a rotary, spring-mounted brush, disposed at an angle to the transverse axis of the car and provided with belts and pulleys whereby motion is conveyed from the car axle.

744,926. Electric Conductor; Albert E. Lytle, Chicago, Ill. App. filed April 20, 1901. A trolley-wire connector consisting of a tube having internally threaded ends and a lateral, threaded external lug.

744,973. Hand Strap; Uriah McClinchie, Brooklyn, N. Y. App. filed Sept. 20, 1903. The strap has an integral widened portion at a point above the hand-loop, which serves as a holder for advertisements.

744,975. Suspension of Dynamo Electric Machines; James F. McElroy, Albany, N. Y. App. filed Sept. 2, 1903. The motor is so constructed and mounted that parts subject to vibration have such a relation to the center of oscillation that the vibration will be neutralized.

744,983. Car Truck; George J. Smith, St. Louis, Mo. App. filed April 6, 1903. An anti-friction journal-bearing for the reception of the truck axles, straps fitting over the housing of the anti-friction bearings and spring bolts connecting said straps to the truck frame, the housing having downwardly extending ears or projections.

745,020. Trolley Controller; Walter B. Leecraft, Denison, Tex. App. filed Jan. 31, 1903. Fluid under pressure is used in connection with automatic means operating to pull the pole down when the trolley jumps from the wire.

745,033. Underground Conduit System for Electric Railways; Andrew H. Angle, Philadelphia, Pa. App. filed July 3, 1902. The conductor sections are removable, the shoe forcing them downward to make connection with the feeder.

745,065. Track Sander; Charles E. M. Knight, Huntington, Ind. App. filed June 10, 1903. Details of a pneumatic sander.

745,096. Automatic Switch Operating Mechanism; Henry T. Dumas, South Hadley Falls, Mass. App. filed April 1, 1903. A system of levers operated from the car platform to move a tappet, mounted on the car truck, to engage the switch point.

745,127. Trolley; Harry M. Williams and John W. Woomer, Pittsburg, Pa. App. filed Sept. 5, 1903. Curved guard arms carry auxiliary wheels to receive the wire in case it leaves the main wheel.

745,161. Means for Driving Traction Vehicles; Crowell M. Dissosway, New York, N. Y. App. filed Sept. 2, 1902. A motor vehicle provided with flanged wheels to keep it on the track and with a traction driving wheel adapted to bear sidewise on some part of the crown of the rail, the plane of the face which bears on the rail being perpendicular to the axis about which the wheel rotates.

745,285. Electric Railroad Brake; John S. Lockwood, Kansas City, Mo. App. filed April 21, 1903. A magnetic brake in which the rail and wheel shoes are simultaneously actuated by the same electromagnetic force.

UNITED STATES PATENTS ISSUED DEC. 1, 1903

745,359. Removable Brake-Shoe; Carl W. Larson, Schenectady, N. Y. App. filed June 30, 1901. Relates to means whereby the brake-shoe may be easily removed and replaced.

745,382. Electric Railway; William B. Potter, Schenectady, N. Y. App. filed Aug. 2, 1901. Details of a sectional conductor system.

745,383. Sectional Third-Rail System; William B. Potter, Schenectady, N. Y. App. filed April 23, 1902. A sectional conductor system in which the switches for directing main current into the sections of the third-rail are actuated by current carried on a light overhead conductor.

745,386. Friction Brake; Aldo E. Reynolds, Peoria, Ill. App. filed July 27, 1903. Comprises a friction wheel secured to the car axle to revolve therewith, a chain drum carried on the axle but free to revolve thereon, a longitudinally-shiftable friction device carried on the hub of the drum and secured against rotating on the hub, said hub being secured against movement along the axle and means carried on the hub for shifting the friction device into engagement with the friction wheel.

745,436. Electric Railway System; Frederic W. Hild, Schenectady, N. Y. App. filed April 28, 1900. The current to the sectional conductor is controlled by switches which are arranged in groups and means are provided so that when a switch is closed, its coil is open-circuited and the switch remains closed independently of its coil.

745,502. Combined Trolley and Air Brake Controller; James Kynoch, Toronto, Canada. App. filed April 20, 1903. Air brakes are automatically applied when the trolley wheel leaves the wire.

745,614. Trolley; Henry Holland, Detroit, Mich. App. filed Nov. 11, 1902. A spring plate between the wheel and harp, to carry the current.

745,650. Car Wheel; Grant Newland, Linden, Ia. App. filed Aug. 4, 1903. Rollers are journaled in recesses in the flange of the car wheel, the recesses extending longitudinally relative to the flange.

745,708. Third-Railway System; William E. Wray, New York, N. Y. App. filed March 26, 1903. A gear wheel and brush adapted to engage the third-rail and remove the snow and ice therefrom.

745,778. Contact Box for Electric Railways; William M. Brown, Johnstown, Pa. App. filed Dec. 6, 1902. The electrodes are in a cup and an arc-guard is arranged to prevent a deposit of a conducting coating on the adjoining surfaces.

745,848. Car Brake; William W. Hopkins, St. Louis, Mo. App. filed May 26, 1902. A combined service and emergency brake, means being provided in connection with the emergency brake whereby the power is automatically shut off and sand applied to the rails when said brake is applied.

745,849. Car Brake; William W. Hopkins, St. Louis, Mo. App. filed Dec. 29, 1902. Details of construction of a friction brake.

745,916. Car Step; Carl Sellergren, Chicago, Ill. App. filed Sept. 9, 1903. The hinged steps of an open car are so connected that when one step is down the other is folded into an upright position against the side of the car.

PERSONAL MENTION

MR. A. A. ANDERSON has accepted the position of general superintendent of the Indianapolis-Cincinnati Traction Company, with headquarters at Indianapolis.

MR. WILLIAM C. ANDREWS, of New York, has just accepted the position of engineer of the sales department of the Stanley Instrument Company, of Great Barrington, Mass.

MR. CHARLES REMELIUS, who recently resigned as chief engineer and master mechanic of the Indianapolis Traction & Terminal Company, has accepted a position with the St. Louis Transit Company.

MR. HARRY BULLEN, formerly assistant general superintendent of the Detroit United Railway Company, has been promoted to the general superintendency, to fill the vacancy left when Mr. Albert H. Stanley went to the Public Service Corporation, of New Jersey.

MR. H. C. REAGAN has been appointed chief engineer of the Cleveland, Painesville & Ashtabula Railwy, of Painesville, Ohio, and Mr. J. H. Lahrmar has been appointed chief dispatcher for the same company. Mr. Reagan and Mr. Lahrmar held the same relative positions with the Columbus, London & Springfield Railway, of Columbus, recently.

MR. JAMES W. CROSBY, chief electrician of the Halifax Electric Tramway Company, of Halifax, N. S., has been appointed general manager of the company to succeed Mr. F. A. Huntress, who resigned from the company to become general manager of the Worcester Consolidated Street Railway Company, of Worcester, Mass.

MR. H. A. DAVIS, who has been in charge of the improvements to the system of the Nashville Railways & Light Company, of Nashville, Tenn., has been appointed superintendent of the railway department of that company. Mr. Davis was formerly connected with the New Orleans & Carrollton Railroad, of New Orleans, La., and has also been prominently identified with other street railway companies in the South.

MR. THOMAS M. JENKINS, formerly general manager of the St. Louis & Suburban Railway Company, has been elected president and general manager of the Imperial Transit Company, of St. Louis, which plans to operate an omnibus service between the downtown district and the Louisiana Purchase Exposition grounds at St. Louis during the exposition. After the exposi-

tion, the plan is to inaugurate a regular city service with a probable uniform fare of 5 cents.

MR. JOSEPH STEHLIN has been appointed mechanical engineer in the engineering department of the New York Central & Hudson River Railroad, vice Mr. A. J. Slade, resigned. Mr. Stehlin will report to Mr. E. B. Katte, electrical engineer, on designing and construction of power stations except those in the electric traction system, and to Mr. Olaf Hoff, engineer of structures, on designing and installation of heating and lighting plants, water and coaling stations.

MR. ROBERT B. CATHERWOOD, of Brooklyn, N. Y., an old-time street railway man, is dead, at the age of eighty-four years. Mr. Catherwood built the DeKalb Avenue Railroad in, Brooklyn, now part of the prosperous Coney Island & Brooklyn Railroad system, and operated the line for two years before a company was organized to take it over. Mr. Catherwood was also connected with prominent municipal undertakings in Brooklyn. In the street railway field he was also prominently identified with early street railway work at Indianapolis, Ind.

MR. H. F. J. PORTER, who has been associated with Westinghouse interests since the first of the year and has held the position of assistant manager of the publishing department, with offices in East Pittsburg and 10 Bridge Street, New York, has been made second vice-president of the Nernst Lamp Company, of which enterprise Mr. George Westinghouse is president, with the duties of general manager and headquarters at Pittsburg. He assumed charge on Dec. 1. This appointment does not affect Mr. Porter's relations with the publishing department at the present time.

MR. EUGENIO DAVERI, who has been constructing superintendent of the Italian Edison Company at Milan for the last ten years, has resigned that position, and on Jan. 1 will act as representative for foreign manufacturers of vehicles of all kinds, such as cars for steam and street railways, automobiles, etc., and also for car supplies. The Italian Edison Company, with which Mr. Daveri has been connected, operates all of the electric street railway lines in Milan, so that he is well posted on all subjects relating to cars and car appliances. He would like to enter into communication with manufacturers who wish to extend their business in Italy.

COL. JAMES H. BAILEY, vice-president and part owner of the "Railroad Gazette," of New York, retired from active business several weeks ago. Col. Bailey has been one of the best known and most popular among technical newspaper men in New York City and has the highest respect of all who are acquainted with him. He took an active part in the Civil War, enlisting in the Union army in 1861, when he was only fifteen years of age. He served through the entire war, participating in a good many battles and being held a prisoner of war for part of the time. After his service in the army ended he went West, where he was engaged in railroad construction for a short time, then came to New York, where he engaged in newspaper work. He has been connected with the "Railroad Gazette" since 1884 and had charge of the business management of the paper. In his retirement he will have the best wishes of his many newspaper friends that he will live long to enjoy the leisure which he has so richly earned.

MR. RICHARD T. LAFFIN'S retirement as general manager of the Worcester Consolidated Street Railway Company, of Worcester, Mass., in order to become general manager of the Manila Railway & Light Company, of Manila, P. I., was considered at the annual meeting of the Worcester Company, held a few days ago, and resolutions were adopted paying the following tribute to Mr. Laffin as an executive: "Many things which cannot be enumerated have been accomplished under Mr. Laffin's care and supervision. He has shown an untiring devotion to the interests of the company, and a faithful and close attention to details and to the duties that have devolved upon him. His thoughtfulness for others, and his spirit of fairness, have won for him the confidence of those with whom he has come in contact, and by his uniform courtesy in dealing with the employees and by his treatment of the public, he has created and retained a friendly feeling for the company. His work has been well done. He leaves the road and other property in first-class condition, and he takes with him the best wishes of every one for his success in the new and larger field to which he goes."

MR. LOUIS J. MAGEE, who is a director of the Allegemeine Elektricitäts-Gesellschaft and also of the Union Elektricitäts-Gesellschaft, both of Berlin, is in this country, and has offices at 25 Broad Street, New York. Mr. Magee is an American, and before his departure to Europe, some fifteen years ago, was prominently connected with the Thomson-Houston Electric Company. He was one of the organizers in Berlin of the Union Elektricitäts-Gesellschaft, which has developed in Germany the patents of the General Electric Company, of this country. It was therefore recognized in that country as the exponent of the "American" electric railway system, and has constructed a large proportion of the electric railways now in Germany. About a year ago, at the time of the consolidation of the interests of the Allgemeine Elektricitäts-Gesellschaft with the Union Elektricitäts-Gesellschaft, Mr. Magee was elected a director in both companies. No announcement has been made that these companies are to have a permanent New York office, but Mr. Magee is planning to remain for some time at least in this country, and it has been a pleasure to his former friends in the electrical business to meet him, as his previous visits to this country at occasional intervals have been of the briefest character.

MR. ALBERT A. HONEY, inventor of an underground trolley system, and more recently of a magnetic traction increasing device, died from paralysis at the Chicago Union Hospital, Dec. 4. Mr. Honey was born at Two Rivers, Wis., in 1849, and at the age of twelve years entered the service of the old Illinois Telegraph Company. In the late 60's he was employed as one of the first three Associated Press operators stationed in Chicago. Later he was engaged with the Union Pacific road and played a prominent part in the development of the transcontinental system. In 1883 Mr. Honey entered the service of the Northern Pacific Railroad as superintendent of construction of the lines west of the Missouri River, later acting as superintendent for the same territory, with headquarters at Tacoma, Wash. He occupied this position until 1890, when he resigned, because his personal affairs required all of his attention. At that time he was president of the Washington National Bank and the organizer of the system of American District Telegraph companies operating in Portland, Seattle, Tacoma, Spokane, Butte and Helena, and was a large holder of real estate in Tacoma. Mr. Honey expended a fortune in the development of the underground trolley, which later passed into the control of Eastern capitalists. Through all these years the problem of increasing the traction of motive power vehicles without increasing dead weight had received a great deal of thought from him, and after many trials by other methods he settled upon magnetism as the important factor in securing the desired result. He commenced experimental work in 1890, and in the face of repeated failures he tirelessly continued his research and finally evolved an application which is now being exploited. In 1902 the Magnetic Equipment Company was organized to handle this system, and until within the last six months, when his health necessitated his resignation, he occupied the position of president of the company.

MR. JOHN B. McCLARY has resigned as manager of the street railway department of the Birmingham Railway, Light & Power Company, of Birmingham, Ala., his resignation to take effect Jan. 1. Mr. McClary thus will terminate on the date just mentioned connections with the street railway systems of the city after a service of sixteen years and five months, surviving various changes in ownership. For seven years previous to his connection with railway work at Birmingham, Mr. McClary was associated with the Pratt Coal & Iron Company and the Tennessee Coal, Iron & Railway Company. Later he was secretary of the Woodward Iron Company. In 1887 he was general manager of the Birmingham Railway & Electric Company, then including the East Lake, Ensley and Bessemer lines. In 1890, on the formation of the Birmingham Railway Company, he was made superintendent of the Bessemer line, and later of the East Lake line. With the organization of the Birmingham Railway, Light & Power Company, in 1900, Mr. McClary was elected manager of the entire system, and on the consolidation of the gas and electric companies of the city, in August, 1901, under the title of the old company, the Birmingham Railway, Light & Power Company, he was made general manager of the street railway department, which position he has held until the present time. For thirteen years Mr. McClary has been a member of the American Street Railway Association. He has always taken an active interest in the affairs of the association and was third vice-president of the body in 1900-1901. Mr. McClary has announced that he will go into business for himself. It is announced that his successor will be Mr. Geo. H. Harris, the present traffic manager of the company.



JOHN B. McCLARY

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Street railway news, and all information regarding changes of officers, new equipments, extensions, financial changes and new enterprises will be greatly appreciated for use in these columns.

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Paying for Wheels by Mileage

Several large companies are now purchasing wheels on a blanket mileage contract, which seems to have many desirable features. This question of wheels and wheel mileage is one of the timely subjects which will be taken up at the next convention of the American Railway, Mechanical and Electrical Association, according to the plans outlined by the executive committee. It might seem at first that a system of purchasing and paying for wheels according to the mileage that they run would call for a very elaborate system of bookkeeping and a cumbersome lot of records, as well as give rise to endless controversy between the companies supplying the wheels and the company using them. Just the contrary, however, is the case with the form of wheel contract which is now coming into vogue. Under this contract the electric railway company pays the company supplying the wheels a certain price per thousand wheel miles. A record is kept simply of the total car mileage of the cars of various classes. This record, as taken from the auditor's report, is supplied to the manufacturing company, and payment is made on basis of it. The manufacturing company simply agrees to keep the railway company supplied with wheels for the period of the contract at so much per thousand wheel miles. The company may or may not agree to grind down flat wheels, and the manufacturing company allows for this in making its price.

Under such a contract it is to the interest of both the railway company and the manufacturing company to get the greatest mileage possible out of every wheel. The labor cost of wheel renewals is so great that, of course, the railway company wishes to run every wheel as long as possible before renewing, and since the manufacturer is paid by the mileage his wheels make instead of by the pound, it is to his interest to supply a wheel which will give the greatest mileage per pound. There is no trouble with keeping the individual wheel mileage of various pairs of wheels, as the totals are the only figures dealt with. The arrangement is the most satisfactory one for all concerned that has yet been devised for the purchase of wheels, as by it both parties to the contract are working to the common end of getting the greatest wheel life possible. It has been a matter of common remark among wheel manufacturers that it is easy to make a good wheel with good iron, but that at prices which many roads wish to pay, they are expected to make a good wheel out of poor iron. When wheels are bought by mileage and not by pound, the manufacturer is not restricted by the matter of first cost as he is when quantity of iron and not quality is the thing paid for.

The Short Haul vs. the Long Haul

It has almost become an axiom in street railway work that it is the short-haul business that pays best. This was undoubtedly true in horse car days, when the speeds of cars and their carrying capacities were limited, and is still the case on many roads at the present day, especially in large cities where the crowded condition of the streets prevents more than a certain maximum rate of speed. Theoretically, also, the product sold by the street railway company is seat-miles, and if it can get 5 cents for a seat for half a mile it is making more money than when it sells the right to occupy the same seat two or more miles for the same price. Like a great many other theories and sayings, however, this analysis of the situation is an incomplete one. Theory will always agree with practice when the theory is correct and is carried far enough, but when the theorist stops half-way in his analysis he may reach conclusions which are unwarranted by the facts.

Let us consider then some features of the long-haul and short-haul traffic, bearing in mind that for the present the argument is confined to the conditions prevailing in the small or medium sized city and not to those of metropolitan size. In the first place, the cars must stop to receive and discharge short-haul passengers as many times per passenger as with the long-haul passenger, and stops are, of course, costly, on account of the delay caused as well as being a direct source of expense as regards power and depreciation. Again, the short-haul business is necessarily done on a small portion of the total length of the line, and is accompanied by a correspondingly crowded condition of the car, both of which circumstances tend to increase liability to accidents and missing fares. Moreover, the business is largely dependent on the weather, and with dry pavements or the arrival of hard times, the business will materially fall off.

On the other hand, a long-haul business, when once established, is practically permanent, as the patron is entirely dependent on the electric line for transportation, and as he can be carried in long cars, operated at high speeds, the average

car hours per passenger will not be very much higher than on a short-haul line in congested streets.

The subject possesses more than theoretical interest from the fact that the desirability of long suburban extensions is a serious question with many companies in our smaller cities and towns. Each case has, of course, to be judged on its merits, but there is no doubt that such extensions, when conservatively built, are profitable, as a rule, and that it is good policy to cater to the requirements of the long-haul passenger.

The Open Car

While considering some of the axioms in street railway work, as has just been done in the question of the short-haul traffic, the mind naturally reverts to another popular sentiment among street railway managers, and that is in regard to the accident proclivities of the open car. There is no doubt that there is a general tendency toward giving up the ordinary open car for the semi-convertible car, on account of the accidents caused to persons boarding or alighting from the open car. It is equally true that for suburban and city use in summer there is no car which is as generally popular with the public or which seats as many passengers as the ordinary open car. We shall not attempt to deny the fact that the open car is liable to accidents, but we should like to see any mechanical contrivance which is not. If passengers insist upon attempting to get off this car while it is in motion, by using the wrong grab-handle or by disregarding other rules for safety which should be instinctive with them, they have only themselves and their previous education to blame. The other passengers have certain rights, and if their comfort can be ensured better by providing them with a car of the ordinary open type than in any other way, their wishes should be considered. The only fair way to the railway companies by which this can be done is for the courts to recognize the fact that the open car is a material contribution to the comfort and welfare of a large part of the community, that while this car is perfectly safe to those who exercise discretion, it cannot be made fool-proof, and that, if necessary, those who ride in cars of this description should be held to a more strict accountability for carefulness than if they used a car with only a single rear exit or entrance.

Baleful Influence of the Boss

Recent disclosures in labor organizations have revealed a condition of affairs wholly unsuspected by the great mass of the people. Boss rule has been the order, and this has led to many abuses. We are all familiar with the political boss, and most of us have at least a hazy idea of the financial boss, but very few realize the influence exerted by the labor boss. Sam Parks' career and the record of his "entertainment committee," as disclosed through the prosecution of the obstreperous labor leader, was a startling revelation, and it should have suggested to every thoughtful reader of that tale of coercion and violence that the lawless element which Parks represented must have powerful protectors and influential supporters who hoped to profit by these deeds of violence, else he could not engage successfully in such wholesale intimidation. A writer in McClure's Magazine, who has made a study of these conditions, declares that while in theory there are few more magnificently democratic institutions than the trades union, it has often been degraded by the labor boss. "Croker never ruled his party with a stronger hand than Sam Parks ruled the Housesmith's Union and paralyzed the building industries of New York City," is the conclusion of this writer.

This is undoubtedly true, as all who are familiar with the proceedings in labor circles during the last year or two can testify. But Sam Parks does not stand alone. He is a type, and, unfortunately, "leaders" of this kind are appearing everywhere in labor circles. The street railway industry during the last year has had experience with them, and in many parts of the country, where the companies have refused to submit to extortion and oppression, they have been confronted with the danger and financial losses attending a strike, but in every case where they have taken a resolute stand public sentiment has been with the corporation ultimately, although it may not have been at first, and the men have been obliged to submit to reason and withdraw their unjust demands. The recent Chicago strike was an example of this kind, and the attempt to tie up the Jersey lines, earlier in the year, showed that the entire movement was dictated by the labor bosses and not by the men.

The labor boss is a logical result of conditions that not only admit of the existence but encourage the political boss and the financial boss, and Mr. Baker, the writer already quoted, declares that all these must be shorn of their power before we can hope for independence and freedom. Present conditions are attributed to the fact that most people shirk their responsibilities; the citizen by not performing his duty at the party caucus and in the election booth, the workman by not attending the meetings of his union and participating actively in the proceedings, and the investor by neglecting the meetings of the corporation in which he is interested.

How is a change for the better to be effected? It should be a simple matter, and Mr. Baker says: "It comes back, after all, to you and to me, personally, individually. If you want to be rid of the boss in your city, you have got to go to the primaries and the election booth and protest and vote and protest again. If you, as a workingman, want honest and efficient unionism, you have got to go to the union meetings and make things right, and if you, as a stockholder, want to see common business honesty in your trusts and in your corporations, you have got to look after the thing yourself." Why is this not done? Mr. Baker's explanation is at least plausible, and will be readily admitted by those who have attempted to bring about a change. "It is safe to say that a majority of the people in this country would prefer an honest free government to boss rule, but most of us are drifters—honest enough, but pulpy; we have no courage to stand up and say what we believe, or to back it up afterwards, if necessary, with hard knocks. We don't like to get our hands soiled, or to have our ease disturbed." And, consequently, the boss is tolerated and permitted and encouraged, by the apathy of the public, to work out his schemes. Once in a while a halt is called and an accounting demanded by an outraged public, as in the case of Parks and McCarthy, but these investigations are not complete, those "higher up" are shielded and the evil is not eradicated. It is only suppressed temporarily, and it lies dormant for a time until there is a favorable opportunity for further operations. Several severe rebukes have been administered of late, and we are encouraged in the hope that permanent improvement may be looked for.

Massachusetts Street Railway Policy

The Board of Railroad Commissioners of Massachusetts has defined the policy of the Commonwealth upon two very important points in the matter of granting applications for locations of street, suburban and interurban railways, embodying their views in a decision on the petition of the Suburban Street Railway Company, of Springfield. This document was published in the Street Railway Journal of Dec. 12, and con-

tains much to interest and instruct those engaged in similar projects throughout the country, as well as in enterprises of this character in Massachusetts. At the present time the position of the Commissioners is diametrically opposed to that maintained by similar bodies in other States, but it is confidently anticipated by many who favor the policy thus laid down that eventually the Massachusetts idea will prevail.

By denying the petition of the Suburban Street Railway Company for a location in Springfield, the Commissioners practically committed the entire State to the policy of regarding an existing street railway as an established monopoly, which the law will protect against any form of competition excepting under very unusual circumstances. And, at the same time, it called a halt on the growing practice of building electric railway lines over private rights of way, without securing special legislation. The Boston & Worcester, which secured a special charter enabling it to build on private land, evidently set the ball rolling, for other roads have since been attempting to follow this example without taking the precaution to acquire the special legislation which enabled the Boston & Worcester to execute its plans. There is no general law, it seems, under which electric railway companies can use private right of way. The Commissioners, therefore, announce that they will not approve any routes crossing private property unless they are warranted in doing so by special legislation, as there is nothing in the present general law which gives any street railway a right to run off the street and on private land except to avoid some difficult engineering task on the existing highway.

The result of this part of the decision, therefore, is not favorable to electric railways generally, especially those desiring to compete with steam roads for suburban and interurban patronage, as they are restricted to the highways and can only make 20 m. p. h., while there is no legal obstacle to prevent operation of trains of the steam road, on its private right of way, at a speed of 60 m. p. h. It would seem as if it were the purpose of the Commissioners to extend protection to steam roads threatened by trolley lines, similar to that they have furnished in the case of established electric railways when they come out frankly in favor of the "trust" idea in public service and support their contentions by citing the experience of cities where it has been given a fair trial.

New Policy for the New Haven

President Mellen, of the New York, New Haven & Hartford Railroad Company, made some very interesting statements at a dinner of the Chamber of Commerce in Providence recently, relating to the plans for improving the service of the system which he represented. To begin with, the speaker admitted that the service was not all that it might be; in fact, that it was not all that the patrons desired and had a right to demand, and, he might have added, that but for the fact that the entire transportation business of that section was controlled by his company, there was no doubt that the facilities would have long since been greatly improved.

Mr. Mellen comes back to the New Haven, as president, to find it in practically the same position and condition that it was in when he held a position not quite so prominent or important as his present office. Let us see what he will accomplish now that he is in complete control? His remarks upon former managements might be construed as uncomplimentary, but whether they were intended to be so is another question with which we have no concern. It is sufficient to know that the new president recognizes many of the shortcomings which have really hampered the development of the property to its full value, and it is earnestly to be hoped that a marked change will be made, especially in the attitude of the company toward the electric railway. Heretofore, as we have pointed out, the policy of the company has been very disappointing to its friends, and, we should judge, discouraging to those responsible for it. Instead of utilizing the electric railway for feeder lines, and equipping the suburban branches with motors, the company has opposed every suggestion of this kind until it has been compelled to adopt electricity, but, at the same time, it has tried to keep out competition, although it would not give the service demanded. The experience has not been pleasant, and, as Mr. Mellen suggested, we shall not engage in an unprofitable discussion of ancient history, but we shall hope for a change in the policy and methods adopted, especially toward the electric system, and we shall gladly give credit for any improvement that may be worked out. Certainly, the lesson should now be thoroughly learned; it has cost the company enough.

Chicago's Shame

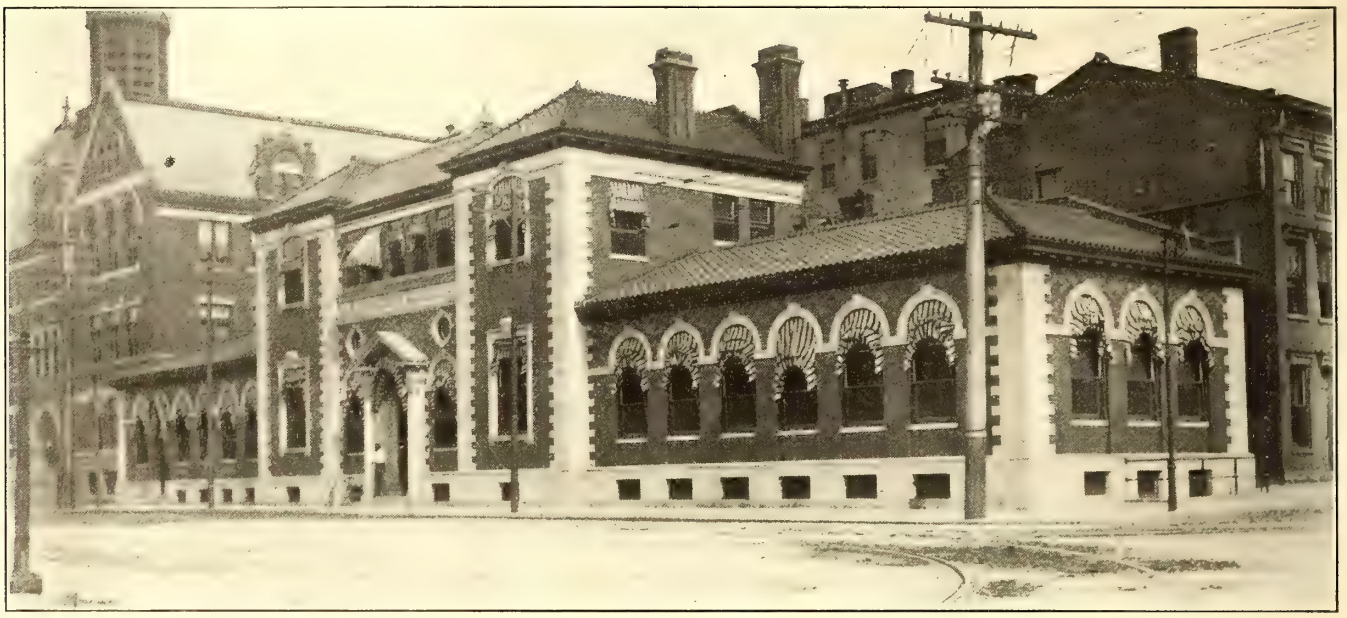
There is a "reign of terror" in Chicago, according to many well-informed residents, who are not regarded as alarmists, and this condition of affairs is not due entirely to hold-ups of the ordinary kind, house-breaking and similar outrages which have been more common than usual lately, but much of the dismay and terror, especially among women and children, is occasioned by the murderous assaults that have been made upon non-union conductors and motormen in the discharge of their duty during the day and often in much frequented places. Of course, the union repudiates these proceedings, and no wonder, for no organization or individual would dare to undertake the defense or justification of such a discreditable policy. And yet the union has accepted the terms of the company, and its members are legally and morally bound to respect them; but, unfortunately, it was demonstrated during the last strike that labor unions had little regard for the obligations of contracts, that they broke them without hesitation when it served their purpose, and that their idea of an agreement was simply an instrument to hold the other fellow to the terms he had made, recognizing no binding effect upon themselves. If any further proof were needed to show how little reliance can be placed upon them as a class, recent occurrences in the street railway controversy would furnish ample evidence. In the present instance the attitude of "organized labor" is clearly shown in the fact that at the meeting of the Chicago Federation of Labor, last Sunday, a resolution was adopted ordering all trades unionists to refuse to pay fares to conductors who have not the insignia of the street car union, namely, the union button. This refusal on the part of union men is primarily the cause of all the disturbances that have caused so much trouble.

Such a policy is bound to bring disgrace and disaster upon any organization which practices it, and while the street railway company may suffer temporarily, it is not to be expected that the union can win along these lines. Conservative and substantial business men of Chicago will not allow this blot to rest upon the fair name of that city; no matter where their sympathies may have been during the strike, they will not countenance such a disgraceful condition as has been brought about by the unions and their sympathizers. The detailed accounts that we have presented in our news pages of the rioting and intimidation practiced by the union sympathizers show the extent to which the lawless element has gained the ascendency in union organizations.

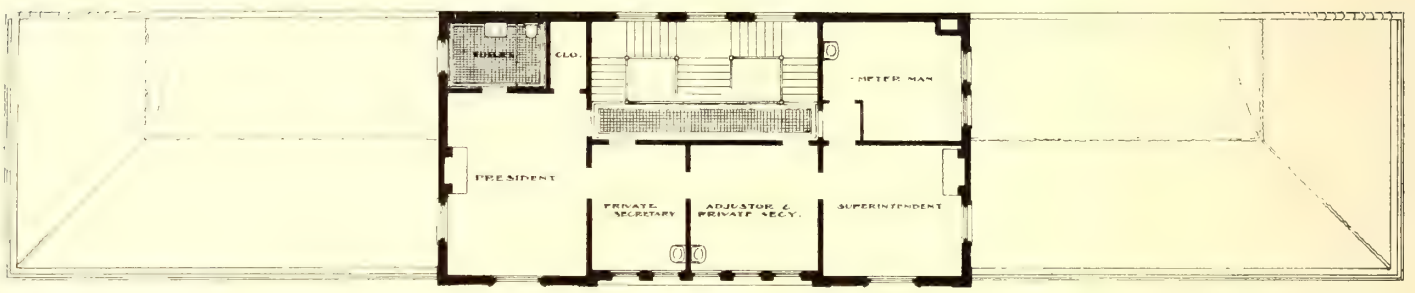
IMPROVEMENTS ON A KENTUCKY SYSTEM

The South Covington & Cincinnati Street Railway Company, which owns the Kentucky lines controlled by the Cincinnati, Newport & Covington Light & Traction Company, has been making a number of improvements in its system of late, and additions to its property.

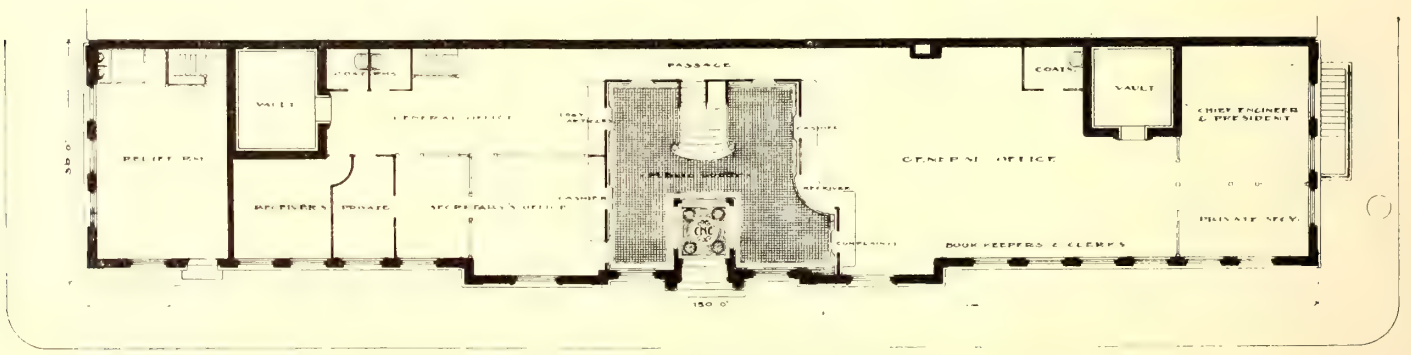
Prominent among these is the erection of the handsome and complete office building herewith illustrated, which is located on the main street in Covington, Ky., immediately adjoining the City Hall and directly opposite the postoffice. Architecturally, it is in harmony with its surroundings. The structure has 150 ft. front and is 30 ft. deep. It is constructed of Columbus fire-flashed brick laid in red mortar; trimmings of Bedford stone with copper cornice and red tile roof. It is heated by a hot-water system. The first and second floors are supported



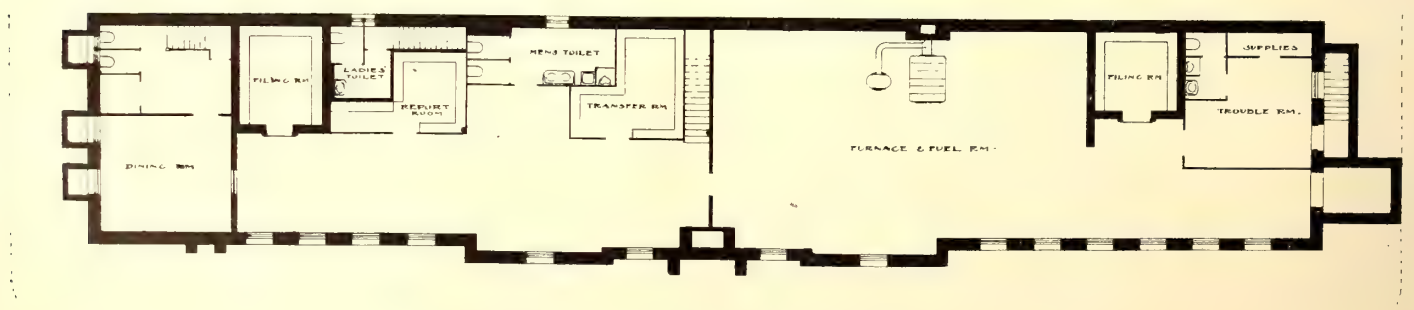
HEADQUARTERS OF CINCINNATI, NEWPORT & COVINGTON RAILWAY SYSTEM AT COVINGTON.



Second Floor



First Floor



Basement

PLANS OF HEADQUARTERS BUILDING

on iron beams throughout. The finish of all woodwork and furniture is highly polished antique oak. In the center is a public lobby with marble floor and wainscoating. There are windows for the receiver, cashier, "complaints" and "lost articles." An open stairway leads to the second floor. On either side of the lobby are the general offices with private offices for the receivers, secretary, chief engineer and relief association. On the second floor are the offices of the president, claim adjuster, superintendent and treasurer. In the basement are the trouble room, transfer room, report room, filing room and a dining room for office employees.

The company has grouped its repair shops and car house on a site adjoining its power house in Newport, and now has a very complete lay-out for a road of this size. The arrangement of the buildings is shown in the accompanying plan. The car house is 90 ft. x 375 ft., has eight tracks extending the entire length, and holds ninety-six cars. The floor is brick, and there are brick pits, 60 ft. long, in each track. The roof is slate and is supported on structural steel trusses with clear spans. In front between the two large doors is the office of the division superintendent. On the second floor is a waiting room, locker room with individual lockers for the men, reporting room and reading room, with tables and periodicals, supplied by the company. There is a fireproof oil room on one side of the building and a lavatory and a bath room for the men. This is supplied with hot and cold water, and there are both tubs and shower baths. All the plumbing is first class, and the place is well kept up. There is a track at the side of the building which connects with the machine shop, paint shop, woodworking shop and power house in the rear. The dimensions of the machine shop building are 60 ft. x 176 ft., and the construction is similar to that of the car house. It has four tracks, with pits the full length. The rear of the building is partitioned off for a blacksmith shop, a store room, electrical repair shop and office of the master mechanic and purchasing agent. Up-stairs is the office of the superintendent and the engineering department of the road. In the basement is a wash room for the men, with tubs and shower baths. To the rear of the machine shop are the paint and woodworking shops, which are each 50 ft. x 110 ft., divided in the center by a fire-brick wall. There are three tracks in each section, and the building is made accessible by a transfer table connecting with the tracks at the alley at the side. The machine shop has a good equipment of tools, including an engine lathe for turning axles, wheel lathe, boring mill, wheel press, lathes, etc.

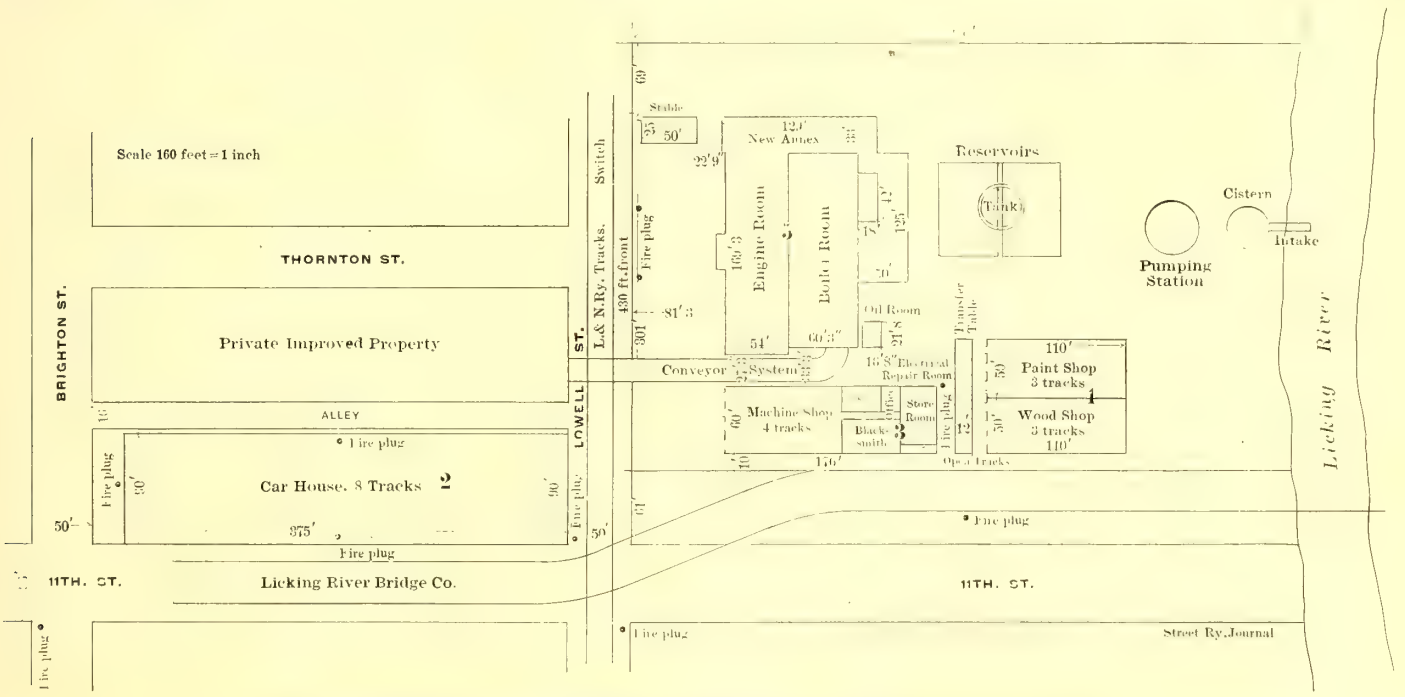
The company is receiving a lot of twenty single-truck cars,



CAR HOUSE

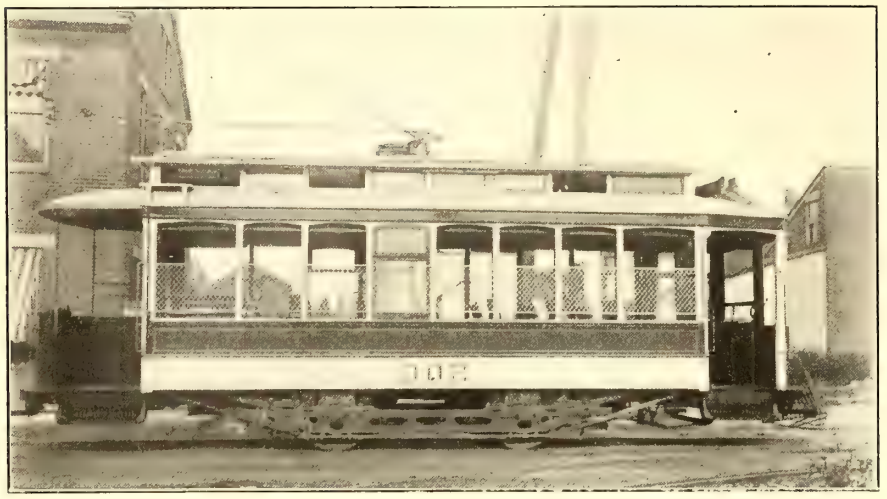


POWER HOUSE AND TRESTLE FOR COAL-CONVEYING SYSTEM



PLAN OF GROUNDS AND BUILDINGS OWNED BY RAILWAY AT NEWPORT, KY.

designed for both summer and winter service. They are the St. Louis Car Company's semi-convertible type, and are 31 ft. over all, 21-ft. body and 8 ft. wide. The bottom framing has a sill 7 ins. wide and 6 ins. deep, with a 7/8-in. strip of iron running through it edgewise. The sides are constructed of 7/8-in. poplar panels with no concave. The cars have front end vestibules, closed on one side and open on the other, and the rear end has an open platform. There are fourteen cross-seats, of the St. Louis Car Company's reversible enameled rattan type, and two side seats. The interior finish is extra fine cherry. Both the side sashes drop inside the car between the sills. The end sash and the end door sash also drop into pockets. The end inside sash is provided with a screen. Peckham No. 7-D trucks, two Westinghouse motors, a K-10 controller, Westinghouse electric brakes, St. Louis sand-boxes and Hunter fenders are included in the equipment.



NEW CAR OF CINCINNATI, NEWPORT & COVINGTON SYSTEM

Thomas Kelch, master mechanic of the shops, has designed several unique devices that have been adopted in the shops and on the road. One of these is a hinged trolley harp, illustrated herewith. By removing a cotter at the side, one arm of the harp may be opened, and the trolley wheel slipped off the bearing. It is claimed that the work of changing a trolley wheel can be done in one-fifth the time required with the ordinary harp. Any style of wheel may be used. The harp fits very close around the wheel, and there is no space for the wire to get between the harp and the wheel. A copper spring carries the current from the wheel to the pole.

For pit work a portable hydraulic jack, shown herewith, is used. This is mounted on four wheels, and it is light enough to be carried from one pit to another by one man. The construction is very simple; the lift portion being made of 3-in. iron pipe, 4 ft. long, while the water tank is of 3-in. pipe, 18 ins. long. The pump is of 1½-in. pipe, 6 ins. long. The table has 18-in. wood rollers, so that an armature may be rolled off easily, and the lift has a capacity of about 1000 lbs.

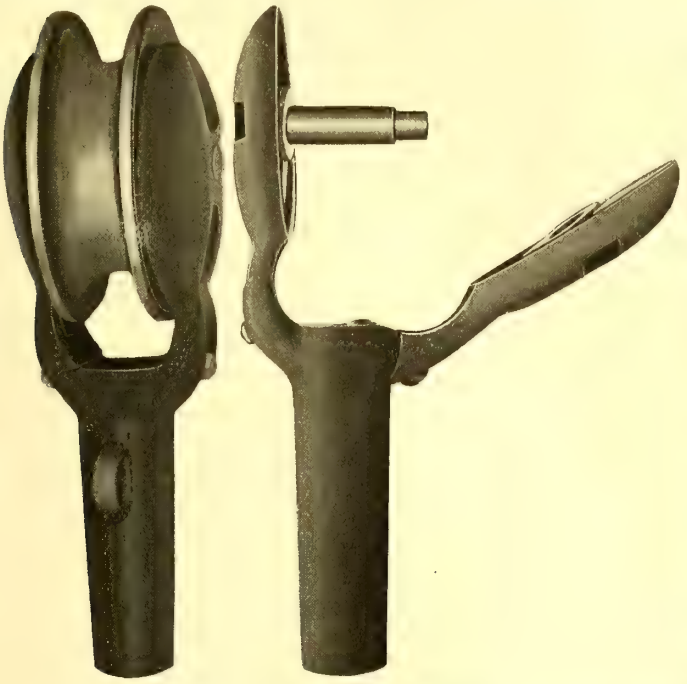
In pressing off car wheels, without removing the gear, Mr. Kelch uses a pair of cast-iron billets, having one end shaped to fit the wheel flange. The accompanying illustration shows this method in operation.



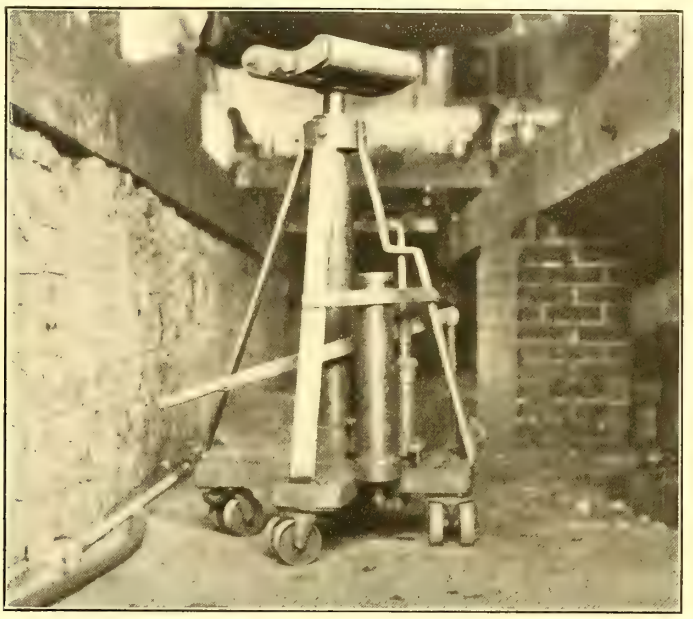
INTERIOR OF CAR HOUSE AT SOUTH COVINGTON

The company has about 150 cars in use, and two Westinghouse No. 49 motors have been adopted as standard equipment for each car. One man and four boys are

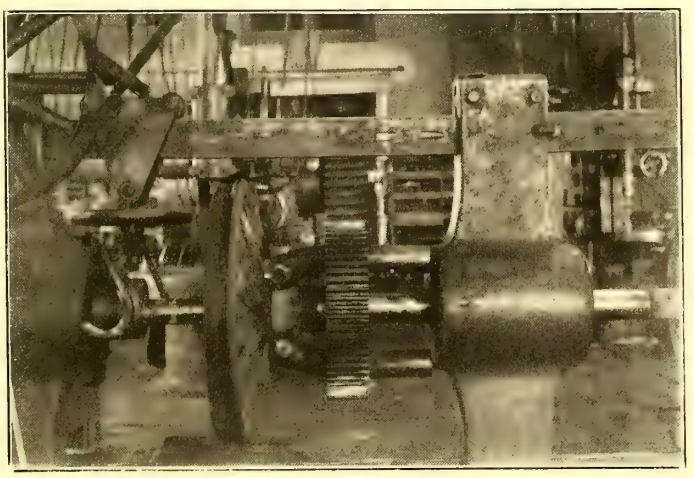
employed in electrical repair work, and they make all their own armature coils and field coils and do their own controller work, as well as car wiring, etc. Charles Ulrich, who is in charge of the department, has introduced several simple devices of his own invention that assist materially in the work. In winding Westinghouse No. 49 armature field coils he uses the wood form illustrated. This has four adjustable spring clamps, two having straight faces and two curved faces, which press the wire down tight and keep it in place during the winding. It is claimed that the device greatly facilitates the work. In forming Westinghouse No. 49 armature coils he uses a brass form made in two sections, having curves exactly the shape of the coil desired. The form is provided with a double hook, operated by one handle, for tightening or loosening the two sections. The hooks are tapered. By throwing the lever forward the two sections of the form are tightened, and by throwing the lever back, both sections are instantly released. In forming fuller-board for armature coil cells he uses a simple press, which saves a great deal of time. There is a flat steel plate in which there is a groove the depth of No. 11 Brown & Sharpe gage wire. A hinged arm forms a die to fit the groove, and when stamped down it forms one-half the desired cell. Another lever operates a pair of rollers, which, in passing over the fuller-board, gives it a double crease, thus forming the coil cell.



HINGED TROLLEY HARP

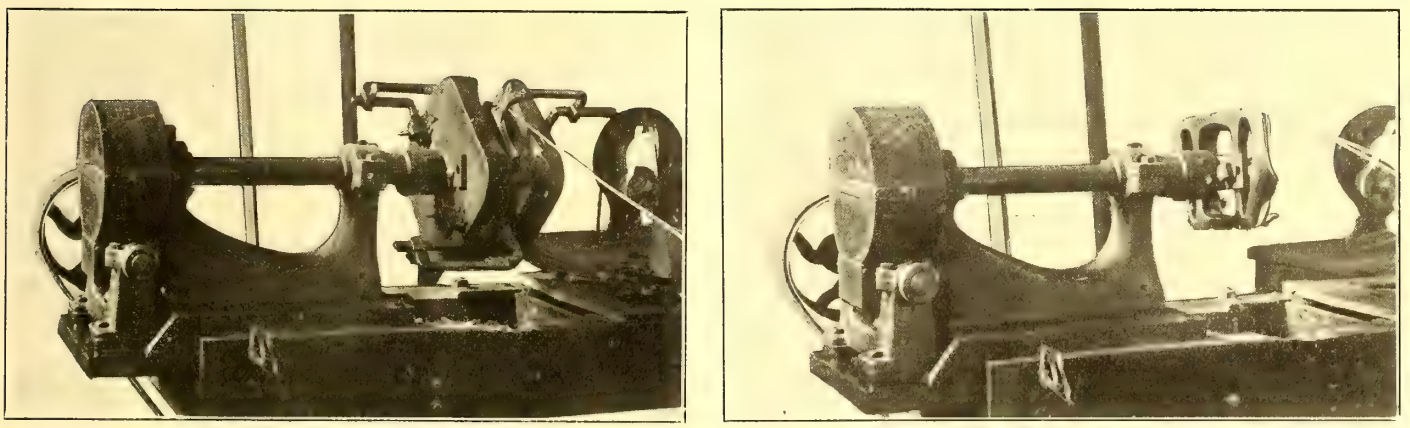


HOME-MADE HYDRAULIC PIT JACK



PRESSING OFF WHEELS WITHOUT REMOVING GEARS

The management is making extensive improvements in its power station (shown on page 1047), which has been growing piece-meal during the last fifteen years, and several additions have been built during that time. Railway, light and power loads are carried. Four Cleveland Shipbuilding Company's marine type vertical engines, belted to Westinghouse generators, are being taken out, and two Cooper-Corliss cross-compound condensing engines, of 2600 hp, directly connected to 1650-kw, Westinghouse, 550-volt railway generators are being installed. At present the railway side of the house is short of power, and a 400-kw Westinghouse rotary converter has been installed in the station. The rotary is of the shunt-wound type, and takes current through step-down transformers from a 500-



FORMS FOR WINDING FIELD COILS AND ARMATURE COILS

kw, 60-cycle revolving field lighting alternator at 4500 volts, and delivers 550-volt direct current to the railway bus-bar in parallel with the compound-wound generators in the station. A Chapman voltage regulator is used in connection with this arrangement, and it takes care of all variation within 2 per cent. The same alternating-current lighting generator delivers 4500 volts over high-tension lines to a sub-station on the new Erlanger suburban line. Here the current is stepped down to 360 volts, and is converted from alternating current to direct current. There are two rotaries in the sub-station, one of 400-kw and the other of 200-kw capacity. The total output of the company's station is about 1,000,000-kw hours per month. In spite of the fact that a considerable portion of the equipment is antiquated accurate records, which are taken regularly, show that the cost of current is .00666 per kilowatt-hour, including all cost of operation and maintenance, but not taking interest or insurance into consideration.

An addition to the boiler house has just been erected, in which are being installed four 500-hp Sterling boilers. Mechanical draft is used, supplied by two 14-ft. fans in connection with Sturtevant economizers for 2000 hp. Coal bunkers, having a capacity of 500 tons, have been erected on the boiler house roof, and these feed into 10-in. American stokers, which are used on all the boilers in the house. The United Telpherage Company's system of coal conveyance has been installed. A timber trestle, 45 ft. high and 180 ft. long, is used in conveying the buckets from a steel elevator bridge over a railway siding, which passes in front of the power house. The buckets have a capacity of 1 ton each.

The station uses about 2,500,000 gals. of water per day for feed-water and condensing purposes, and the water supply system has recently been improved. Three Lawrence Machine Company's centrifugal pumps, operated by 50-hp vertical motors, are set in a well, 78 ft. deep, near the bank of the river, which adjoins the property. These take water from a well 24 ft. in diameter and 22 ft. deep, which is connected with the river by a 36-in. intake. Water is discharged into a 12-in. header connected with a 16-in. header, supplying the feed-water and condenser pumps. In the yard there is a reservoir, 50 ft. x 90 ft. and 12 ft. deep, and suspended 15 ft. above this is an emergency tank, 10 ft. in diameter and 15 ft. high.

The new Erlanger suburban line is 7 miles long, and is double track and built entirely on private right of way across country. Track is laid with 60-lb. T-rail with rock ballast. Joints are 6-bolt fish-plates. The Harold P. Brown plastic bond is used at joints. The trolley wire is 00 grooved, and the high-tension lines are 0. The sub-station on the Erlanger line has a dwelling for the attendant attached. All buildings were designed and supervised by J. R. Ledyard, superintendent, and the improvements in the steam and electrical equipments were designed by E. E. Darrow, chief engineer.

HIGH TRANSMISSION EFFICIENCY

The results of some recent tests on the efficiency of transmission on one of the large interurban railway systems in the Middle West are given below.

The system, which comprises about 100 miles of track, built for the most part over a private right of way, is supplied with power at 26,000 volts from a single power station. The maximum distance from the station to which power is delivered is about 60 miles. The alternating-current output, measured at the generator terminals at 2300 volts, for a period of six weeks covered by the test, was 970,000 kw-hours. The output of the rotaries at the five sub-stations during the same period was 803,000 kw-hours, showing a loss of 17 per cent. This included the loss in the step-up transformers, the transmission line, the step-down transformers in each sub-station and the rotary converters. It is estimated by the engineers of the road that the apparatus losses were 121,000 kw-hours, or 11.9 per cent, and that the losses in the transmission line were 46,000 kw-hours, or 5.1 per cent.

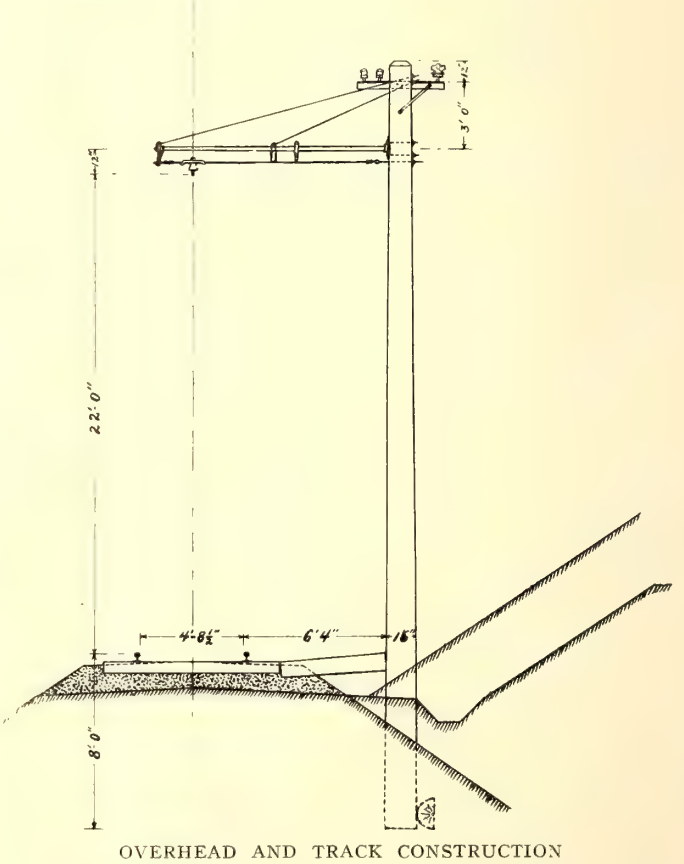
The load on the station and line is steadied by means of a storage battery and carefully adjusted booster at the farthest sub-station.

NEW INTERURBAN ROAD AT EVERETT, WASHINGTON

A new interurban line was placed in operation, Nov. 20, between Everett and Snohomish, Wash. The distance is only 9 miles and the population of the two cities is 26,000, yet the opening and operation of the new line had an important bearing upon electric railway development in that section.

The Everett Railway & Electric Company owns and operates the street railway system in Everett, consisting of about 10 miles of single track and 1 mile of double track. Through the efforts of its president, J. T. McChesney, the company has, within the last two years, rebuilt and re-equipped its entire system. It has recently constructed and equipped an entirely new power house of 1300-kw capacity for the electric railway, the city lighting and water-works system of Everett.

Last spring the company decided to build an interurban road to Snohomish, a distance of 9 miles. The route between the



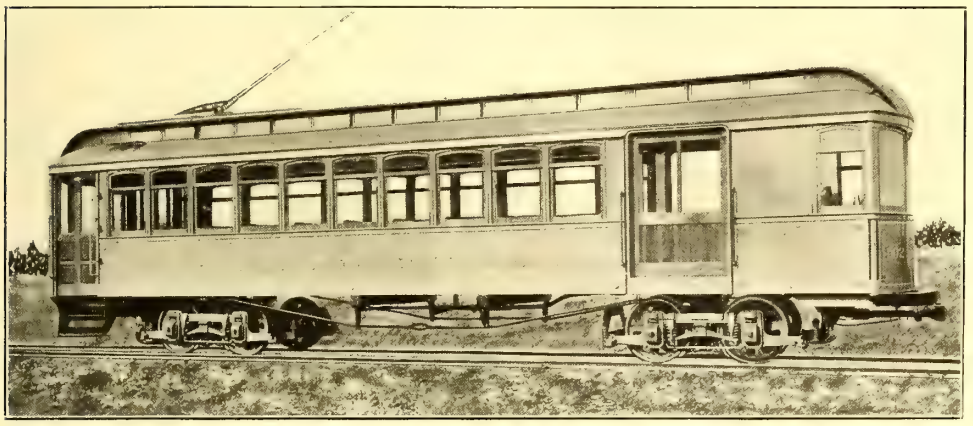
OVERHEAD AND TRACK CONSTRUCTION

two cities along the county roads was decidedly rugged to say the least, and the cost of a road so located would have been large. It was, moreover, difficult to obtain the necessary franchises from the City Council and County Commissioners.

The company recognized that the Northern Pacific Railway Company's branch line from Everett to Snohomish, on the Seattle-Vancouver-Division, was not only a direct route, but it also had the advantage of avoiding the bad grades. The steam railway passenger service, which was furnished by the Northern Pacific, was over its own private right of way and was rapid, but, with only two trains each way per day and the usual coal dust annoyance, it was concluded that a heavy traffic could not be secured. The expense of operating the passenger service with steam locomotives practically absorbed the passenger earnings.

Following several conferences last June, Charles S. Mellin, then president of the Northern Pacific Railway Company, and now president of the New York, New Haven & Hartford Railroad Company, leased this short single-track branch road to the Everett Railway & Electric Company. The lease included the use of the single track, good bridges, two railway depots, telegraph lines, and so much of the freight house, sidings, etc., as were needed by the electric railway to handle its passenger, mail and express business. The through freight, however, will be handled by the Northern Pacific Railway over the same tracks.

The Everett Railway & Electric Company, in its overhauling of the old lines, connected each rail joint with 0000 "all-wire," 12-in. protected rail-bonds, using 7/8-in. terminals, and erected a special bracket pole construction, with the pole 6 ft. 4 ins. from the gage line of the rail. This feature was designed by Edward P. Burch, consulting engineer, and the chief engineer of the Northern Pacific Railway Company approved the proposed overhead construction illustrated herewith. A 350,000-circ. mil copper feeder, and a 0000 figure 8 trolley wire were installed. The complete brackets were furnished by the Ohio Brass Company, and were of extra heavy construction.



INTERURBAN CAR ON WASHINGTON LINE

Two types of cars were furnished by the American Car Company, of St. Louis. These cars are about 46 ft. over all, one type being a passenger coach, the other a combination. Three cars will furnish all passenger and express service, including provision for theatrical scenery, of which there will be several cars per week to be carried. The cars are of heavy construction, approaching steam railway coaches in design and appearance. They have rattan cross-seats, electric heaters, are well lighted and look clean and comfortable. They are mounted on two Brill 27-E-1 trucks. A 6-ft wheel base could be used since there are no short curves. The truck centers vary from 22 ft to 25 ft. The trucks are equipped with standard Westinghouse air brakes and Westinghouse motor-driven air compressors.

Master Car Builders' wheel and other standards were adopted as far as possible. Each truck is equipped with two Westinghouse No. 68 40-hp motors—the grades being light. Cradle suspension was adopted. The complete car equipment weighs 23 tons.

No additional power house equipment was required. Power will ordinarily be furnished by a 300-kw rotary converter. Tracks between the local system and the steam road have been built, so that the electric cars use the street railway tracks in Everett. Hourly service has been installed. It is estimated that the passenger receipts will reach $2,200 per annum per mile, the fare being about 1½ cents net per mile in place of nearly 3 cents per mile by the steam road. The cars will be despatched by telegraph by the men who act as agents and operators for the steam road, and the branch will be operated by the rules of the Northern Pacific Railway Company.

The two interests are working in harmony, and there will be no wasteful competition. The schedule time will be fast. This would not be possible on a country road with its grades and curves and other speed limits. There will be but little paving to maintain on city streets. Very little anxiety is felt regarding future development or competition by other electric interurbans not on private right of way. The convenient waiting stations at the ends of the line, near the heart of each city, will cater to the comfort of passengers, which will be another strong point in favor of the present system.

The work of transforming this part of the system and equipping it electrically was done under the supervision of Edward P. Burch, consulting engineer, of Minneapolis.

THE COMMERCIAL ASPECT OF HIGH SPEEDS

The mechanical and electrical success of the high-speed experiments on the Berlin-Zossen line in Germany, are generally admitted in that country. Nevertheless, there has been a sentiment among German engineers who have followed the experiments closely that while speeds of 100 m. p. h. to 125 m. p. h. are practicable they will not be profitable. So little has been made public in regard to the results attained on the Zossen line that it is impossible to judge whether these criticisms are well founded or not. Still it is of interest to learn the basis upon which they are made.

The following, which is an extract from a recent issue of a Berlin daily, but which is said to represent the opinions of the sceptics referred to above, sums up some of the objections:

> The only positive result which the Berlin-Zossen tests have shown is the certainty that our present track construction and roadbeds are, to say the least, far from satisfactory for speeds above 150-km to 160-km per hour. There has never been any doubt that speeds up to and above 200-km could be attained; the question was whether such speeds could be used in practice. As shown by the rapid deterioration of the roadbed and track construction under high speeds, this point has been settled negatively, at least for the present.
>
> In questioning the propriety of this decision it might be claimed that a track of the requisite strength for high speed railways could be built. The reply to this is that it is useless to think of operating high-speed cars except upon an entirely new and distinct set of tracks, as high-speed service cannot be run in connection with any other. It is also doubtful whether it is even then feasible, with safety, without being accompanied with almost impossible conditions. For instance, such roads could not use a dirt sub-construction with wooden ties, and gravel ballast. They must be built massively throughout, therefore, of brick and cement, and of great width, for to insure safety against damage from windage the two tracks of a double-track road should be at least 10 meters (33 ft.) apart. A road of this construction and width between Berlin and Hamburg, for instance, would cost so much that its construction is out of the question for years to come. To make it even fairly profitable at least 60,000 passengers would have to be transported daily. It is evident that there is no such possible traffic between even the largest German cities. While, therefore, the recent high-speed tests have a theoretical and scientific value, the results do not encourage the hope of the early practical application of high-speed cars to commercial work.

There were two accidents on the Metropolitan Electric Underground, of Paris, on Monday morning, Nov. 30, somewhat similar to the catastrophe of Aug. 10, but there was no loss of life.

DAILY REPORTS, STORE ROOM ACCOUNTING AND OPERATING RECORDS OF THE CAMDEN & SUBURBAN RAILWAY

The theory of the system of daily reports followed by the Camden & Suburban Railway Company is based upon the submission to the general manager by the head of each department of a digest of the work done during the preceding day and the condition of the department. It will be impossible, of course, to reproduce all the blanks used in making these reports, but the most interesting are presented herewith.

DAILY SHOP REPORT
Camden & Suburban Railway Repair Shop.

Approved ____ M M Date ____

CAR No.	No. Order	No. Job	DATE Started	DATE Finished	No. Labor Repairs to Date	COST OF LABOR Net, This Day	COST OF LABOR Prev. Reported	COST OF LABOR Total	Cost of Material	Total Cost	REMARKS
						$ Cts.	$ Cts.	$ Cts.	$ Cts.	$ Cts.	

FORM 123

SUMMARY OF
Daily Shop Report

Date ____ 190

	$	cts.
Repairs Cars		
" Motors		
Construction Cars		
" Motors		
Sundry Accounts		
Bonus "		
Total Cost of Labor	$	

FORM 126

SHOP REPORT

The shop report is contained on Form 123, and indicates what cars (by numbers) are in the shop, date started, date when expected to be finished, number of labor repairs up to date, cost of labor and material up to date, etc. The headings, "Number of Order" and "Job," are filled out in the office. The company makes a distinction between the "order number," which is for work of some magnitude, and "job number," which is that covering a small repair only. This daily shop report is accompanied by a summary on Form 126, showing the total cost of labor for the repairs. In addition, early each morning the main office is called up on the telephone by the repair shop foreman, and notified of the cars detained in the shop for various reasons, and the time at which they will be released. This information is received by the stenographer, and is immediately typewritten out in the following form:

TYPICAL DAILY TYPEWRITTEN REPORT

Sept. 3, 1903.

Car No.	Trouble	Date finished
141	Wheels and armature	To-morrow
139	Wheels	To-morrow
132	Overhauling	To-morrow
121	Flat wheel	No stock
143	Seat casting	No stock
81	Field	To-morrow
140	Field and armature	To-morrow
129	Air brake	To-day
128	Air motor and overhauling	Sept. 20
127	Armature band	To-day
123	Broken flange and seat	Sept. 5
154	Wheels, journals and brake rigging	To-day
53	Dasher accident	To-day
155	Seat and curtain	To-day
92	Trolley base	To-day
102	Journal box	To-day

Sept. 20	1
Sept. 5	1
To-morrow	5
To-day	7
No stock	2
	16

108	Overhauling	Sept. 5
109	Overhauling	Sept. 5
110	Overhauling	Sept. 5

This statement is written out in duplicate. The original is immediately sent to the chief despatcher who requires the information in making up his time-table. He afterwards transfers the information to a special sheet containing thirty-two vertical columns. In the first column is the number of each car, while the other columns are for each day in the month. A code letter is used to indicate whether each car is in condition for service, and if not, the reason why it is not available. At the bottom of each column the despatcher totalizes daily the number of cars in the car house and those available for service. At the end of each month the total number of cars in the repair shop for each class of repairs, and the average per day is made up. From this a communication is sent monthly by the main office to the master mechanic, with a statement of how much the actual condition of affairs differs from the condition which the repair shop ought to maintain. The standard on the road is that the number of cars in the repair house shall not exceed an average of 1.11 cars per 1000 miles run during the month. The agreement with the master mechanic also provides that the cost of repairs and the maintenance of the cars in the shop will not exceed 1.4 cents per car mile, including all labor and material.

The Camden and Suburban Railway Co.
Date ____ DAILY TIME REPORT—TRACK DEPARTMENT ____ Foreman

No	NAME	Total Hours	Rate	HOURS	Job No.	DESCRIPTION AND LOCATION OF WORK

FORM 62

The carbon duplicate of the statement reproduced above is for the personal use of the general manager, and is laid on his desk as soon as it has been written out. He usually puts it in his pocket and finds it of convenience when he calls at the repair shop on his tour of inspection.

Operation No. ____

DAILY LINE LABOR REPORT
C. & S. RY. CO.

Started ____ GEN. LINE REPAIR
Finished ____ CONS. LINE
Date ____ FOR OFFICE OR DUPLICATE EX. LINE REPAIR
Sheet No. ____

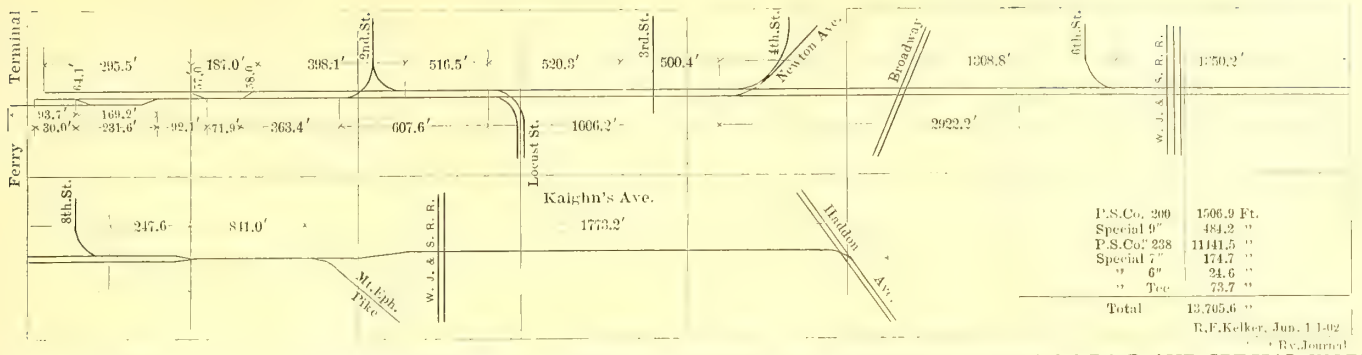
Location:
Nature of Work

Workman's No.	NAME	CLASS	HOURS	RATE	COST

FORM 121

DAILY REPORTS FROM OTHER DEPARTMENTS

Every morning the general manager also receives a report from the track foreman showing the number of men, carts and teams engaged on track work, also the date at which the track foreman expects any particular job on which he is engaged



SAMPLE SHEET FROM TRACK DEPARTMENT FILE, SHOWING METHOD OF RECORDING TYPES OF RAIL AND SPECIAL WORK

to be finished. These are filed and the manager is thus apprised of any unexpected delay in the construction of the work. The same plan is followed in the line department.

CAMDEN AND SUBURBAN RAILWAY COMPANY

DAILY REPORT OF LABOR ON TRACK

Job No. 103A

Sheet No. 129

LOCATION HADDON HEIGHTS EXTENSION

ACC CONST. TRACK

Date SEPT 16 1903

	TRACK LAYING				CONSTRUCTION				GRADING				BONDING			
	Men	Hours	Rate	Cost	Men	Hours	Rate	Cost	Men	Hours	Rate	Cost	Men	Hours	Rate	Cost
Total this date																
Previously reported				1170 45				1356 33				141 76				277 02
Total to date																
Unit Cost																

	PAVING				HAULING A				HANDLING MATERIAL				BRIDGES AND CULVERTS			
	Men	Hours	Rate	Cost	Men	Hours	Rate	Cost	Men	Hours	Rate	Cost	Men	Hours	Rate	Cost
					2	3/2	17	60								
					1	1	183	19								
					5	2 1/2	15	38								
Total this date								1 17								
Previously reported				65 38				360 22				141 59				190 43
Total to date								361 39								
Unit Cost																

	DITCHING				HAULING B DRAIN 2nd & WOODLYNNE AV.				WATCHMAN				CLEANING STREET			
	Men	Hours	Rate	Cost	Men	Hours	Rate	Cost	Men	Hours	Rate	Cost	Men	Hours	Rate	Cost
Total this date																
Previously reported				85 86				71 42				31 94				30
Total to date																
Unit Cost																

Timekeeper C. F. Hoyle Jr. Engineer

FORM 103

The daily time report of the track department is shown in Form 62. In addition, daily reports are kept in the main office of the material used and the labor on each important piece of track work upon which the company may be engaged. These forms are shown respectively in 89 and 103, and do not call for any special comment except that, as will be seen, the total cost up to date is recorded daily, both for materials used and of labor on track. A complete graphical record is kept, as on many systems, of all track and special work. This record is kept on a series of tracings, and new ones are added or corrections made as the work is changed. A small reproduction of one of the tracings is given on this page.

The line department makes its two daily reports on Form 121 and Form 122. These correspond to the two forms used in the track department, except that the headings are different. The line superintendent does not keep his time book, but the time book is made up in the office from Form 121. Both line and track departments use Form 54 for notices to the treasurer to pay for men who have been discharged. The power station department submits a copy of its daily log, reproduced on page 1054. The form of this requires no explanation, except to say that separate voltage and ampere readings, during the summer, are taken of the lighting circuit to Wood-Lynne Park, and these appear in the voltmeter and ammeter column, and also the time the booster was in service in the booster column. Once a month the output in kilowatt-hours and consumption in tons of coal are tabulated. The following is a copy of this record for the last fiscal year:

POWER-STATION RECORD

	Kilowatt-hours	Tons of coal per month
April, 1902	313,030	701.34
May, 1902	361,170	767.75
June, 1902	332,545	779.34
July, 1902	355,061	850.70
August, 1902 .	315,035	839.42
September, 1902	301,755	803.03
October	415,405	867.42
November, 1902	410,810	952.14
December, 1902	424,805	1,080.00
January, 1903	413,757	1,096.00
February, 1903	467,895	803.07
March, 1903 ...	421,955	838.59
Total	4,533,223	10,378.80

Average, 5.15 lbs. of coal per kilowatt-hour.

DAILY TRAFFIC RECORDS

Every morning a record showing the receipts of each line for the day and for the corresponding day of the previous year,

TRACK

Started JULY 1ST 03 CAMDEN AND SUBURBAN RAILWAY COMPANY Sec B. Operation No. 103

Finished REPORT OF MATERIAL USED on HADDON HEIGHTS EXTENSION Sheet No 20

Charged to CONST. TRACK SEPT. 6 1903

	MOTOR GREASE	BLACK PAINT	FORMS #93	TIES 6"x8"-7' UNION RWY SUPPLY CO	T. RAIL SEC 23? 75 LB/YARD
Total to date			150	11286	
Previously reported	40 LBS	1/2 GAL	100	10086	22993.5
Net this date			50	1200	

	CHURCHILL JOINTS	SPIKES 9/16" x 5 1/2	Y. PINE LUMBER 2"x12"-16'	20d NAILS	9/0 SD. COPPER WIRE (BARE)
Total to date					
Previously reported	1020	145 KEGS.	125 PCS.	165 LBS.	1245 LB
Net this date		5			

	COPPER BOND #3 PLATES (C&S.)	IRON BOND #3 PLATES (C&S)	MACHINE BOLTS 1"x3 1/2"	LOCK WASHERS 1"	PLASTIC ALLOY
Total to date					
Previously reported	910	910	910	910	11 LBS
Net this date					

	PLASTIC SOLDER	EMERY WHEELS	AJAX BONDS COMPLETE	TIES 6"x8"x7' (OLD STOCK)	SPECIAL WORK
Total to date	29 LBS	9			3 COMPLETE CROSSOVERS
Previously reported	26 "	8	1300	500	4 " CURVES
Net this date	3 "	1			300 FT RAILROAD GUARD RAIL
					2 COMPLETE CROSSOVERS

REMARKS

FORM 89

Form No. [illegible] (M Order)

Weather, A. M._____ P. M._____

Receipts of The Camden & Suburban Railway Co., for _____

Thermometer, A. M._____ P. M._____

ROUTE.	Cars.	Trips.	Hours.	Miles.	PASSENGERS.							RECEIPTS.				
					Trans.	Free.	Iden.	Com.	T'ks.	Cash.	Total.	Cash.	Total.	Per Hour.	Per Mile.	Per Pass.

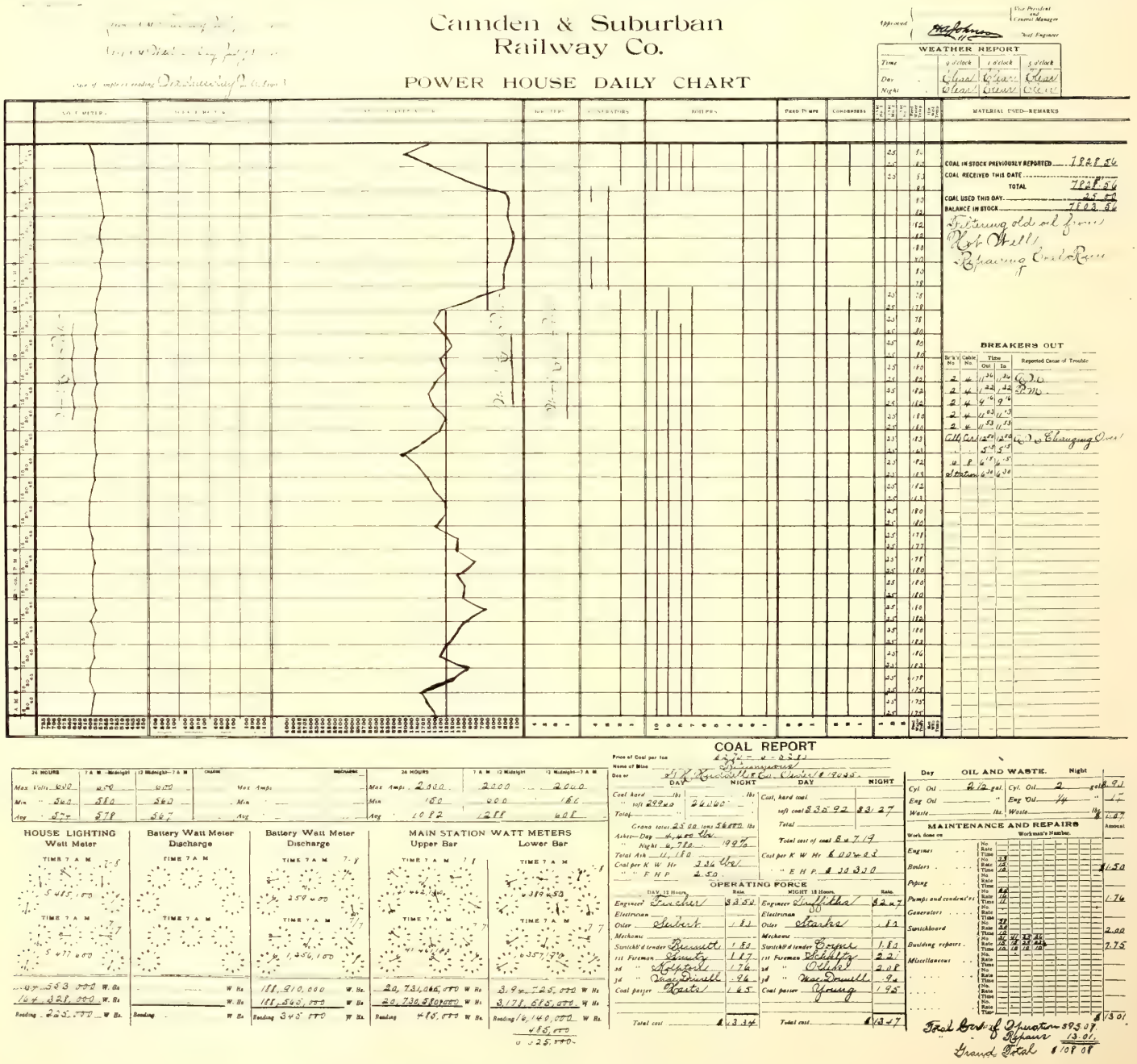
FORM 150, SHOWING DAILY REPORT

is laid on the desk of the general manager. This is followed a few days later by a summary on Form 150. From this latter form a graphical record of the daily receipts per car mile and per mile of track is made up. For some three or four years back the company has followed the practice of plotting these statistics out graphically by days and also the daily receipts per car mile and per car hour. A reproduction of a record extending from April 1, 1900, to March 31, 1901, inclusive, is shown on page 1056. This chart has been found very valuable for quickly determining whether the car service is adequate or not and making other calculations. It shows the following for each day during the year—car receipts, car miles run, car hours, receipts per car mile and receipts per car hour.

THE VALUE OF CAR-HOUR RECORDS

It might be stated in this connection that for the last five years the company has used the car-hour unit in connection with the car mile, and all statistics are worked out on both bases. The former is useful, as it is the only basis on which the labor factor can be calculated, while the latter is the only practical unit for figuring wear of parts and depreciation.

An illustration of the value of using both bases can, perhaps, best be illustrated by a comparison between one of the city and one of the suburban lines. The city line (the Kaighn's Avenue line) has receipts of 21.46 cents per car mile and $1.24 per car hour, while the suburban line has receipts of 14.69 cents per car mile and $1.90 per car hour; in other words,



FORM 115, SHOWING DAILY LOG OF POWER STATION

the suburban line has receipts 46 per cent less per car mile and 53 per cent more per car hour than the city line. If the car mile basis alone was taken the suburban line would, perhaps, be considered unprofitable compared with the usual standard as to receipts per car mile, whereas the car-hour basis shows that the line is quite a profitable one

Another valuable use of the car-hour basis, as found in analyzing expenses in Camden, is that, being a guide to the labor cost, it calls attention to the lay-over expenses. A short or a long lay-over does not affect the wear and tear of the car or power cost, both of which in Camden are worked out on a car-mile basis, but does enter directly into the labor cost which, on lines operating at different speeds, can best be figured

Form No. 54.

The Camden and Suburban Railway Co.

Camden, N. J., _____

Pay _____ *No.* _____

_____ *dollars and* _____ *cents, for*

_____ *hours work, at* _____ *cents per hour.*

$_____

_____ *Foreman.*

FORM 54

is the truck number, rather than the car number, as the same truck is frequently used under several car bodies. The first blank used is No. 86, which is made out daily, in duplicate, by the master mechanic, who keeps the carbon and turns over the original to the storekeeper. From this form the mileage record of the different parts are made up and kept on Form 64, each truck having its own sheet. From Form 64 a record can be

Started _____ LINE _____

Finished _____ CAMDEN AND SUBURBAN RAILWAY COMPANY *Operation No.* _____

REPORT OF MATERIAL USED on _____ *Sheet No.* _____

Charged to _____ *190*

	ST. LINE CLIPS	PULL-OFF CLIPS	EYE BOLTS 1/2" x 1/2"	EYE BOLTS 1/2" x 1/2"	BELL HANGERS
Total to date					
Previously reported					
Net this date					

	BRASS FEED IN BELLS	GLOBE STRAINS CLEVIS	GLOBE STRAINS, PLAIN	RIGHT H SWITCHES No. 977	LEFT H SWITCHES No. 976
Total to date					
Previously reported					
Net this date					

	LOCUST PINS 1 1/2"	IRON PINS 1 1/2"	SOLDER, AJAX	SOLDERING SALTS	TAPE
Total to date					
Previously reported					
Net this date					

	ANCHOR CLIPS, No. 106	ANCHOR CLIPS 1 1/2", No. 645	SINGLE PULL-OFFS	DOUBLE PULL-OFFS	GIANT STRAINS, No. 825
Total to date					
Previously reported					
Net this date					

	FEEDER WIRE 4-0"	SPAN WIRE 6-16"	SPAN WIRE 1/4"	FEEDER SPAN WIRE, INSUL.	GIANT STRAINS, No. 834
Total to date					
Previously reported					
Net this date					

REMARKS.

Line Foreman

FORM 122

on the car-hour basis. In other words, the company believes that in its comparisons and records of operating expenses, it is impossible to use either unit exclusively, but that both have to be employed in connection with each other.

Another instance of the value of the use of the car hour is shown in estimating the value of suburban extensions. This can best, perhaps, be shown by an example. The Moorestown line formerly terminated at Merchantville, and when the line was extended to Moorestown, a distance of 5 miles, it became a question as to whether this extension paid. The population

Form No. 86. Order No. 17827-2m-12-15-02

CAMDEN & SUBURBAN RAILWAY COMPANY.

DAILY MILEAGE MEMORANDUM.

Date _____ _____ MASTER MACHINIST.

CAR NO.	MOTOR NO.	TRUCK NO.	PART	MAKE	REMARKS

FORM 86

Form No. 116. Order No. 17827-2m-12-15-02 No. _____

CAMDEN & SUBURBAN RAILWAY COMPANY.

Daily Memorandum, Shipment of Wheels.

Date _____ *190*

ORDER NO.	MARK	DATE REMOVED	NO. CAR	NO. MOTOR	NO. TRUCK	END	MAKE	SIZE AXLE	SIZE WHEEL	DATE PLACED	MILEAGE

FORM 116

of Moorestown, or rather of the section on which the additional fare of 5 cents is charged, is 5000. The extension of the service these 5 miles required an addition of 1360 car hours a month to the service. Upon starting the service, an inspection was made to determine what proportion of the increased travel was carried into the original section. These reports indicated that 80 per cent of the traffic to and from Moorestown was through traffic, or that the 5000 population was carried an average of 120 times per capita per year, making the receipts per month about $5,000. This sum, divided by the additional car hours per month required for the service, or 1360, gives the receipts for the extension, $3.60 per car hour.

It might be said in passing that the per capita rides given above have also been found to be about the average on the Haddonfield and Haddon Heights and other interurban extensions of the company.

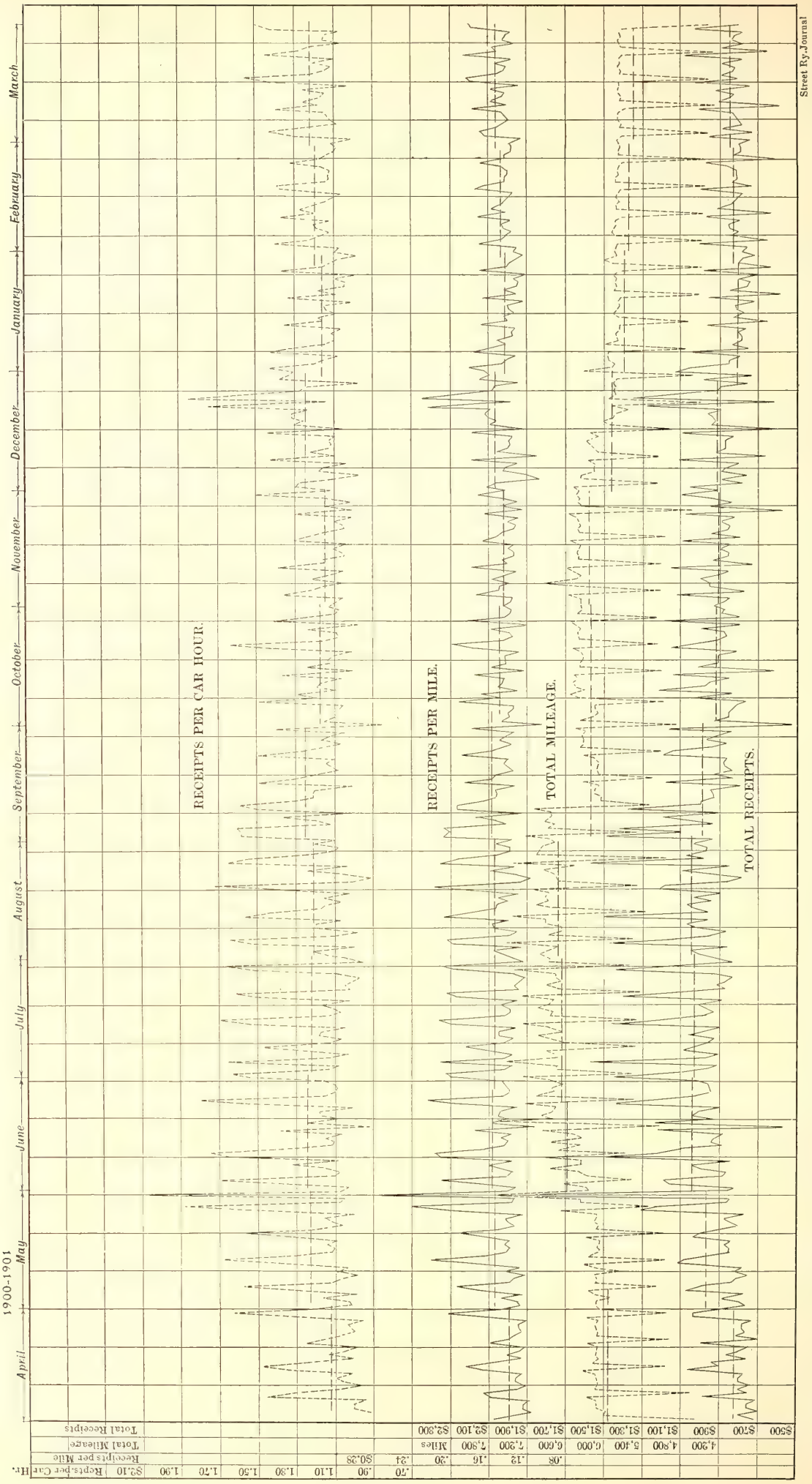
MILEAGE RECORDS

The mileage records of all cars and parts are very carefully kept by means of three forms, 86, 116 and 64. The basis used and is made up from time to time of the life of different parts. The following figures are reproduced from this record:

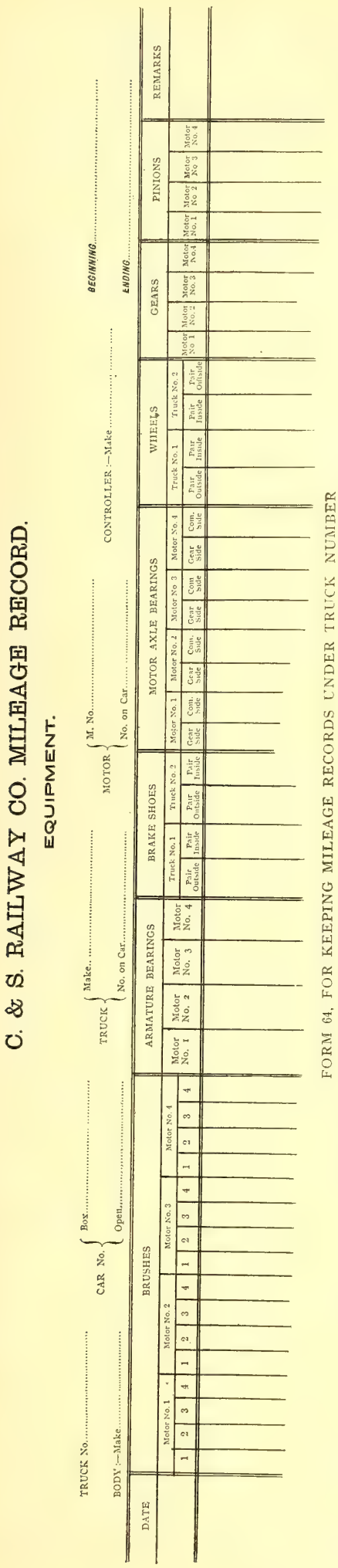
LIFE OF DIFFERENT CAR-EQUIPMENT PARTS

Part	Type of Motors (all Westinghouse).	Type of Car	Average Mileage	Remarks
Carbon brushes	Four-49	St. Louis 28 in. body	14,909	Double truck cars
"	Two-38b	Stephenson 26½' body		
"	Two-49	St. Louis 28' body	10,896	" "
"	Two No. 3	Brill 21' body	13,117	Single "
Arm. bearings	Four-49	" 18' "	11,846	" "
"	Two-38b	Stephenson	8,480	Double "
"	Two-49	St. Louis	7,312	" "
"	Two No.3	Brill	9,532	Single "
Brake-shoes		"	10,297	" "
"		St. Louis & Stephenson	17,726	Double "
Car wheel		Brill	11,648	Single "
"		St. Louis & Stephenson	23,668	Double "
Gears		Brill	19,963	Single "
Gears		Stephenson	96,238	Double "
Pinions		St. Louis	84,912	Single "
"		Brill	20,983	Double "
		"	24,636	Single "

Form 116 is used as a daily memorandum for the shipment of wheels.



REPRODUCTION OF DIAGRAM TABULATING THE DAILY RECORD OF CAR-MILES, TOTAL RECEIPTS, RECEIPTS PER CAR-MILE AND RECEIPTS PER CAR-HOUR, FROM APRIL 1, 1900, TO MARCH 31, 1901



FORM 64, FOR KEEPING MILEAGE RECORDS UNDER TRUCK NUMBER

MOTORMEN'S CAR REPORT

Each motorman when he leaves his car is obliged to turn in a card, No. 56, giving the condition of the car when turned in. This is used by the master mechanic in looking up trouble. After the trouble has been investigated and the necessary repairs are made, this card is filed by the master mechanic.

SHOP ORDERS

A record is kept of the minor repairs on orders No. 25 and No. 27. No. 27 is kept by the timekeeper at the repair shop as a time-sheet, and indicates the time expended in doing the work. Each sheet is numbered consecutively, and the word "job" or "order" is scratched out, as the conditions may require. If more than one man is working on the same operation a separate sheet is used for each man. The cost of the labor at different rates per hour is indicated by checking off the proper total in the table on the report. Form No. 25 is used for orders only, and is made out after the order has been finished. It is made up from different forms, 27 and 92. A separate form is used for repairing registers.

RECORDING THE CARS IN SHOP

The master mechanic keeps a graphical record of the condition of all cars by the arrangement shown in the sketch on page 1058. This consists of a long box of just the right size for holding wooden blocks about 3 ins. square. The blocks are used to represent every car on the system. They are made of hard wood with a bottom slotted to hold a white card for memoranda. On the edge of the block is pasted the number of the car, so that by the position of these blocks in the box the master mechanic can tell what cars are in the repair shop. After a car leaves the repair shop the position of its block in the box is changed and a note is put on the card as to the date at which the repairs were completed and the amount of work done. As all overhauling is done by contract, and as each essential kind of overhauling is given a distinctive letter, this letter only is put on the card.

TRANSFERS

The transfers are printed by the Globe Ticket Company, and require only three punches, the month, the hour and the route.

Form 56—15M—4-21-'03-18775

Motorman's Car Report.

Car No.....Date.....Car House.....
Line.....Time.....
Condition of Car when turned in.....
.....
.....
.....
Blowed Fuse.....
.....
Motorman

FORM 56

The day of the month is printed in red on the face of each ticket, and the month can be punched any time before the tickets are required, so that really two punches only are needed. The transfers are given out by the car-house despatcher, who keeps a record of all thus given out, used, destroyed, etc., on blank No. 68, which is sent daily to the office by the despatcher. The despatcher also sends out at the same time a statement on another form, showing the number of each car and the reading of its register.

STOREROOM ACCOUNTS

The storeroom of the Camden & Suburban Railway Company, as indicated in the first article on the system, is directly next to the car house, and the practice followed has a number of novel features. When a requisition has been approved by the general manager for an article which can be supplied by several manufacturies, a printed form of letter is used, which is addressed to the manufacturer asking him to quote "lowest prices for the articles specified below," giving list price, discount, net, place f. o. b. A space is provided at the bottom in which he agrees to guarantee to furnish the articles mentioned for the price specified opposite each item within a certain number of days (left blank) on receipt of the order. This form for the convenience of the manufacturer is printed with

Form No. [illegible]—92—M [illegible]

C. & S. RWY. CO.

SHOP ORDER

Order No..... Date Started.....
Dept..... Date Finished.....
Workman's No.....
Class { Repairs..... / Construction..... } No. of Repairs { Labor..... / Material..... }
Part.....
Operations.....
Remarks.....
Foreman.....
Contract Price..... Total Cost of Labor.....
Paid on Account..... Total Cost Material.....
Bonus..... Total.....

ENTER ON EACH SHEET ITEMS CHARGEABLE TO ONE OPERATION ONLY.

FORM 25

an ink which will copy, and the words, "this is not an order," are distinctly printed upon it. This form is filled out from the requisition by the stenographer in the office of the purchasing agent, and is sent to the manufacturers whose names are

Form No. 27—5m, 18936 5-8 '03

C. & S. RWY. CO.

Shop Report

Order } No.....
Job... }

Date.....

Dept.....

From..... A. M. P. M. To..... A. M. P. M.

Workman's No.....

Job Finished.....

Part.....

Operation.....

Foreman.....

X	Brs. Rate	¼	⅓	½	⅔	1	2	3	4	5	6	7	8	9	10	11	12
	9⅔	.02	.03	.04	.06	.08	.17	.25	.33	.42	.50	.58	.67	.75	.83	.92	1.00
	10	.02	.03	.05	.08	.10	.20	.30	.40	.50	.60	.70	.80	.90	1.00	1.10	1.20
	12½	.03	.04	.06	.09	.13	.25	.38	.50	.63	.75	.88	1.00	1.13	1.25	1.38	1.50
	15	.04	.05	.08	.11	.15	.30	.45	.60	.75	.90	1.05	1.20	1.35	1.50	1.65	1.80
	16	.04	.05	.08	.12	.16	.32	.48	.64	.80	.96	1.12	1.28	1.44	1.60	1.76	1.92
	16⅔	.04	.06	.08	.13	.17	.33	.50	.67	.83	1.00	1.17	1.33	1.50	1.67	1.83	2.00
	17½	.05	.06	.09	.13	.18	.35	.53	.70	.88	1.05	1.23	1.40	1.58	1.75	1.93	2.10
	20	.05	.07	.10	.15	.20	.40	.60	.80	1.00	1.20	1.40	1.60	1.80	2.00	2.20	2.40
	22½	.06	.08	.11	.17	.25	.45	.68	.90	1.13	1.35	1.58	1.80	2.03	2.25	2.48	2.70
	25	.06	.08	.13	.19	.25	.50	.75	1.00	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00
	27½	.07	.09	.14	.21	.28	.55	.82	1.10	1.37	1.65	1.92	2.20	2.48	2.75	3.02	3.30
	30	.08	.10	.15	.23	.30	.60	.90	1.20	1.50	1.80	2.10	2.40	2.70	3.00	3.30	3.60

SUMMARY

Contract Price.....

Pd. on Account.....

Bonus.....

Proportional.....

Paid 190

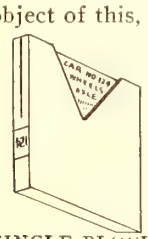
ENTER ON EACH SHEET ITEMS CHARGEABLE TO ONE OPERATION ONLY

FORM 27

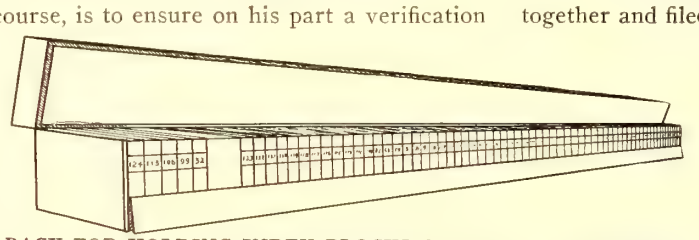
written on the back of the requisition by the purchasing agent. The blank is finally signed with a stamped signature by the general manager before being mailed.

ORDER BLANKS

The form of order book used has been the subject of considerable thought on the part of the management. It has adopted the form illustrated herewith. All orders are made out in triplicate and the upper sheet is that which is sent to the manufacturer. The second sheet is sent to the storekeeper, while the third form (not reproduced but similar in every respect to the original) is kept as an office copy. A special feature of this form of order is that the perforations in the copy sent to the storekeeper are so arranged that the quantity of goods does not appear on it. The result is that the storekeeper is apprised only that goods of a certain description are to be expected, but is kept in ignorance of the quantity ordered. The object of this, of course, is to ensure on his part a verification



SINGLE BLOCK WITH INDEX CARD



RACK FOR HOLDING INDEX BLOCKS OF CARS IN OPERATION AND IN REPAIR SHOP

of the quantity of goods received, as he is obliged to notify the office fully upon the receipt of the goods.

Adjustable binders are used in the main office for holding

Form 68—4—21—03—3m
Order 18,77

CAMDEN AND SUBURBAN RAILWAY CO.

NEWTON AVE. CAR BARN. **Transfer Ticket Statement** Date.....

Blk.	Given	Returned	Used	Short	Over	Destroyed to	Blk.	Given	Returned	Used	Short	Over	Destroyed

FORM 68

the office copies of these orders. The stubs are not kept, as there are other means of checking the bills. The office binders used for the order blanks are of the patent kind, which allow the orders to be inserted in their numerical order. Two binders are used, one for filled and one for unfilled orders, the order being transferred from the unfilled to the filled order binder upon notification from the storeroom that the goods have been received.

For.....

Acct.....

Date of Bill.....

Amount.....

Put Order No. on both Bill and Material.

Order No. 25690

Req. No.....

ORIGINAL

The Camden & Suburban Railway Co.,

CAMDEN, N. J., ... 190

M.....

Please enter our order for the following:

Quantity	DESCRIPTION	Price
Receipt No.		
Previous Order		
Remarks		
	Order No. ..... is a continuation of this order	

CAMDEN & SUBURBAN RWY. CO.

FIRST, OR ORIGINAL, ORDER SHEET (SENT TO MANUFACTURER)

For.....

Acct.....

Date of Bill.....

Amount.....

Order No. 25690

Req. No.....

STORE KEEPER

The Camden & Suburban Railway Co.,

CAMDEN, N. J., ... 190

M.....

From the above firm we have to-day ordered the following:-

Quantity	DESCRIPTION	Price
Receipt No.		
Previous Order		
Remarks		
	Order No. ..... is a continuation of this order	

F. O. B. .....

CAMDEN & SUBURBAN RWY. CO.

Per .....

CARBON OF ORDER (SENT TO STOREKEEPER)

All correspondence relating to any particular order is kept together and filed numerically.

PURCHASING AGENT'S FILES

The purchasing agent has four files. The first relates to all orders and consists of the two binders referred to above. The second relates to quotations on miscellaneous goods for which no orders have been placed, but which he thinks may be used in the future. This is arranged alphabetically according to material. There is a special portion of this file in which the purchasing agent keeps quotations for appliances which he believes will be needed before long.

The third file is called the "held-up requisition file," and contains those requisitions which have not been approved for one reason or another.

The fourth file consists of the requisitions which have been approved, and these are filed according to the different departments in the company.

BILLS

All bills received at the office are first laid before the general manager for general inspection, to enable him to know what is going on in the purchasing department and also to permit him to add any memoranda to the bills which he considers necessary or desirable. The bills are then sent to the purchasing clerk, who checks up the price and amount of goods re-

ceived and enters the amounts into a stock ledger. The bills are then sent to the bookkeeping department to be checked off against the orders and then to the treasurer's office for the preparation of the vouchers. In this connection it might be mentioned that the general manager signs all letters sent out from the office and reads all incoming mail.

STOREKEEPER'S REPORTS

Once a week the storekeeper sends to the office Form 138, showing the purchases for which requisitions have been placed but no orders given, also those for which orders have been placed but the material has not been received, also a third division giving orders to be rushed, as the material is urgently needed. The object of this blank need not be pointed out.

Two forms of requisition are used, one employed by the shop foreman, the other by all of the other departments. The latter is a simple statement of the material required with the name of the department and the account to which it is to be charged. The shop requisition is shown in blank 92.

A statement of all material issued from the storeroom is sent to the office daily. The storeroom also has a credit memorandum sheet No. 92, salmon in color, showing the amount of material returned to the storeroom by any department unused and in good condition. A regular ledger is kept in the office from these storeroom records. The pages are numbered consecutively. Each page is devoted to a separate item of material and has the same page number as the stock ledger. In this ledger is recorded the amount of material received and issued and the balance then in the storeroom at certain dates, the additional material ordered, the order number, price and manufacturer from whom it was purchased. The material is debited to the storeroom on its receipt, and as it is received and reported from the storekeeper it is credited in the ledger. An index is used in connection with the ledger, giving the page number for every item of material ordered by the company. Small material frequently issued in small quantities, such as bolts, brushes, etc., are not credited in the material ledger separately but are summarized on a long, closely ruled sheet, each column having a heading for the page numbers corresponding to those of the material ledger. They are then entered into the ledger monthly. This saves all repetition of the different items as they are entered under the proper page number.

Form No. 138 10-6-'02 17371 500

WEEKLY REPORT OF REQUISITIONS.

STOCK ROOM

Camden and Suburban Railway Company

REQUISITIONS PLACED, ORDER NOT PLACED

Requisition No.	Date Placed	Description	Office Check

ORDERS PLACED, MATERIAL NOT RECEIVED

Order No.	Date Placed	Description	Firm Ordered From	Office Check

ORDERS TO BE RUSHED, MATERIAL URGENTLY NEEDED

Order No.	Date Placed	Description	Firm Ordered From	Rush on Account of	Office Check

FORM 138

When material has been charged out for the stock room, has been used and partly worn (as, for instance, a pinion), and has then been returned to the stock room, it is kept in a small auxiliary stock room used for worn material, and popularly called "purgatory." Material of this kind, partly worn, is never credited back for its value, but the storekeeper has a side memorandum of material of this kind.

Form 92, 4-15-'02. 1 M

Credit Memorandum Stores Department

No..... Date..... 190

Camden and Suburban Railway Company

Material returned by Department .....

Credit Account..... *Armature Number*.....

Order Number..... *Car* "

Job " *Workman* "

Article No.	DESCRIPTION	Quantity	Cost	Extension
		TOTAL,		

Storekeeper..... *Returned by*.....

FORM 92, CREDIT MEMORANDA

Form 92 [illegible]

Stores Department

No *Date* 190

Camden and Suburban Railway Company.

Material issued to Department, ...

Charge Account, ... *Armature Number*, ...

Order Number, *Car* "

Job " *Workman* "

Article No.	DESCRIPTION.	Quantity	Cost.	Extension.
			TOTAL,	

Storekeeper, ... *Received by* .....

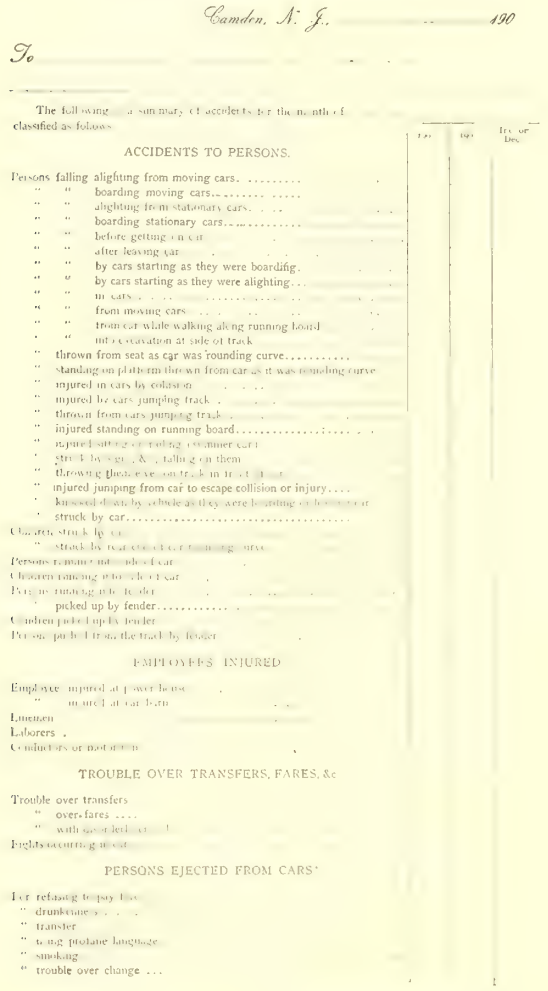
FORM 92, REQUISITION

The stock room is debited with all bills, whether approved or not, and credited with all stock sheets. If before the bills are approved any shortage or overcharge is discovered or any discount allowed, this amount is recorded in a book for this

purpose, and the stock room debited or credited accordingly. The object of this, of course, is that a bill may be held up for sometime, during which it would be inconvenient to otherwise keep track of the material which is being used, and also occasionally bills are not received until all of the goods have been used.

The stock ledger clerk acts as an intermediary between the stock room clerk and the accountants.

The stock room itself is a two-story brick structure fitted with a Morse & Williams elevator, used for carrying heavy stuff to the upper floor. Before the purchasing agent orders any new material upon requisition from the storekeeper he has the stock clerk look up the amount of material on hand in the


Camden, N. J. ... 190

To ...

The following is a summary of accidents for the month of ... classified as follows:

	190	190	Inc. or Dec.
ACCIDENTS TO PERSONS.			
Persons falling alighting from moving cars.			
" " boarding moving cars.			
" " alighting from stationary cars.			
" " boarding stationary cars.			
" " before getting on car			
" " after leaving car			
" " by cars starting as they were boarding.			
" " by cars starting as they were alighting.			
" " in cars			
" " from moving cars			
" " from car while walking along running board			
" " into excavation at side of track			
" thrown from seat as car was rounding curve			
" standing on platform thrown from car as it was rounding curve			
" injured in cars by collision			
" injured by cars jumping track			
" thrown from cars jumping track			
" injured standing on running board			
" injured sitting on rolling common cars			
" struck by cars, &c., falling on them			
" throwing themselves on track in front of car			
" injured jumping from car to escape collision or injury			
" knocked down by vehicles as they were boarding or leaving car			
" struck by car			
Children struck by car			
" struck by rear end of car running away			
Persons running into closed car			
Children running into closed car			
Persons running into fender			
" picked up by fender			
Children picked up by fender			
Persons picked from the track by fender			
EMPLOYEES INJURED			
Employee injured at power house			
" injured at car barn			
Linemen			
Laborers			
Conductors or motormen			
TROUBLE OVER TRANSFERS, FARES, &c			
Trouble over transfers			
" over fares			
" with misdirected car			
Fights occurring in car			
PERSONS EJECTED FROM CARS			
For refusing to pay fare			
" drunkenness			
" transfer			
" using profane language			
" smoking			
" trouble over change			

	190	190	Inc. or Dec.
PERSONS ARRESTED.			
For refusing to pay fare			
" drunkenness			
" damaging car			
" fighting on car			
" registering fares			
COLLISION WITH TEAMS.			
Rear end			
Side on			
Head on			
Cars backing into teams			
Teams pulling or running into cars			
Striking teams in passing			
COLLISION WITH CARS.			
Side on collision			
Head on collision			
While passing another car			
Backing into or striking stationary cars			
FATAL INJURIES FROM ACCIDENTS.			
Passengers			
Pedestrians			
Employees			
ALL OTHER ACCIDENTS.			
Wheelmen struck by cars			
Wheelmen running into cars			
Passengers or pedestrians struck by employes			
Teams frightened			
Cars jumping track			
Damage to cars other than collision			
Ran into C., G. & W. cars			
Ran into by C., G. & W. cars			
Pole coming off and doing damage to pole or car			
Electric shock to employees			
Electric shock to persons			
Boys stealing rides and falling or jumping from car			
Penna. R. R. accidents, running into gates, &c.			
Dogs run over			
Injury to persons' clothes			
Persons injured on crossing at Wood-Lynne Park			
Persons injured on pleasure railway at Wood-Lynne Park			
Miscellaneous and precautionary			
Total number of accidents during the month			
Total number of accidents during previous month			
Showing ... over the previous month of			
Premiums paid to conductors and motormen			

REMARKS

MONTHLY FORM FOR TABULATING CLASSES OF ACCIDENTS

material ledger in the office to see whether this material is needed.

FRANCHISE AND ORDINANCE RECORD

The company keeps a large manila scrap book in which are pasted copies of all the ordinances and agreements with the different municipalities through which the road extends. These are all indexed so that it is very easy to look up any of the ordinances or set of ordinances.

NEW WORK

No important new work is undertaken until the cost is very carefully estimated. Where the head of a department wishes to carry out any piece of work, the total cost of which will exceed about $50, he submits an estimate of the cost in triplicate attached to the plans. If the proposal is approved, one of these blank forms remains with the department making the requisition, another is placed on file in the main office, while the third is the order or authority for doing the work. This form is used for all material not carried in stock, for the purchase of extraordinary apparatus, new machinery, etc., and reads:

Estimated cost

Material to be purchased.....Labor.....
Material on hand .....Material.....
Total .....Total cost.....

Finished cost.

Labor .....Difference .....
Material ..... " .....
Total cost ..... " .....

Approved
(Dept. foreman)
Above work charge to
Approved
(Dept. head) Chief.
Approved
V.-Pres. and Gen. Mgr.

Notes:—
.....
.....

The finished cost is filled out after the work is completed, and is of value in determining how closely the estimate was made by the head of the department.

ACCIDENT REPORTS

The space available in this issue will not permit a reproduction of the forms used in reporting and settling accident cases, except the monthly report showing the classification used. They will, however, be briefly described.

Two forms are used by the accident department in reporting accidents to the general manager; one a daily report, giving the names of the conductor and motorman, number of car, where the accident occurred, and a short statement in regard to it. This is placed on the desk of the manager each morning, covering all accidents on the previous day. In addition, the accident department submits monthly a classified report of all accidents with the corresponding number the previous year. This monthly report is reproduced.

In addition, the company has the usual form of report used by conductor and motorman for reporting accidents, form of

statement for witnesses and injured party, release, etc., also a special report submitted after every accident by the master mechanic to the main office, indicating the extent of the damage to the car.

ALTERNATING MOTORS FOR RAILWAY SERVICE

BY LOUIS BELL, PH.D.

It has long been evident that the more serious work of electric traction is impeded by sole reliance upon direct-current motors. No one appreciates more fully than the writer the sterling quality of the standard railway equipments now in use, but just so long as direct-current motors are confined to the very moderate voltage which now seems necessary for them, they are handicapped in the larger struggle of electric railroading. For interurban and long-distance work a distribution of power limited to a few hundred volts upon the working conductors is an economic abomination. Its only decent excuse for existence has been the supposed necessity of clinging to direct-current motors on the cars.

The American interurban road has had a gradual evolution from ordinary tramways, and there has been no point at which most engineers have been willing to cut loose and to use means properly adapted to the end. In avoiding such a break in policy they have carried direct-current distribution far beyond its legitimate field, and when this became finally out of the question, have fallen back on a polyphase distribution with counter sub-stations feeding the same old low-tension working conductors. This composite distribution is a make-shift, albeit very useful in that function, and ten years from now we shall all look back with amused regret at the millions that have been squandered on a system so uneconomical and complicated.

The writer has consistently fought this temporizing policy almost since its initiation, in the firm hope and belief, which now seems to be fully justified, that it would prove possible to carry an alternating distribution clear up to the car, whenever competent engineers should drop the converter fetish and take up the alternating-motor problem with the deliberate intent of solving it.

Within the past few years a considerable group of roads employing polyphase induction motors on the cars has appeared abroad, and the result, as a whole, has been highly satisfactory, although none of the roads in question has been operated under traffic conditions as severe as frequently have to be met in this country. Three objections stand against polyphase induction motors for traction purposes. They require at least two working conductors, which complicate the overhead system seriously; they have no reserve speed unless normally operated, with some loss of efficiency, and, hence, cannot easily make up time; and, finally, they impose, unless very carefully designed, a rather poor power factor upon the system. None of these are forbidding on long, independent lines, but they are formidable in dealing with the closely interlined urban, suburban and interurban traffic characteristic of American railway practice.

Until recently no single-phase motors worthy of consideration for general railway purposes had been developed, and no one seemed to take the trouble to look into the matter save as a source of arguments to promote the use of standard direct-current motors. There were, however, a few aggressive heretics who refused to bow down to the idol of standardization, and went earnestly to work on a scheme of solution of their own. Their labors have been to good purpose, and at the present moment very encouraging results have been announced, not from a single form of alternating motor, but from three.

Obviously, a single-phase motor has a great advantage over polyphase motors in the simplicity of the conducting system, which leaves little to be desired. If the motor also has a good power factor, and can run with good efficiency over a considerable range of speed, it becomes, provided it also starts well, at once available for general traction purposes. Ordinary single-phase induction motors start badly, and have a good power factor and efficiency only near synchronous speed, so that they must be classed as unavailable. The recent experimenters, therefore, took the radical step of building commutating single-phase motors, essentially similar to ordinary series-wound direct-current machines, but laminated to avoid loss from parasitic currents and with various precautions against sparking. That a series motor with laminated field would run pretty well on a low-frequency alternating circuit has long been known. Motors of this type were proposed in the early stages of the Niagara project, and were built experimentally by several investigators, notably the late Mr. Eickemeyer. These early experiments were discouraging, for the sparking appeared to be irremediable, and the power factors obtained were far from satisfactory.

But the art of design has advanced greatly in the last decade, the principles of commutation are better understood, and better materials are available. Consequently, the causes of the early failures do not operate with the same force at the present time, and there is a far better chance of success in obtaining a practical motor.

The first announcement of a commercial single-phase motor for traction came from Mr. Lamme some months since, but it is only within the past few days that the system has passed into active exploitation. The results reported from it are most encouraging. The motor designed to take alternating current at 25 cycles per second is said to run without material sparking, and with an efficiency only a few per cent below that of a first-class direct-current railway motor. From the published curves the performance of the new motor is quite comparable with that of standard railway motors. The alternating-current equipment is somewhat heavier than that for direct current, but it does the same work, and, apparently, does it well. An acceleration of 1 m. p. h. per second was attained, which is quite sufficient for ordinary purposes, and the energy required during acceleration was not at all disproportionate. The average power factor during a 2-mile run was approximately 87 per cent, and rose when the car was at full speed, or near it, to above 95 per cent. At starting, as might well be anticipated, the power factor was low; but even so, the apparent energy was within reasonable limits, and the real energy was moderate.

In the matter of energy required, the alternating-current motor has a material advantage in that its speed can be regulated with very small loss. This gain is most apparent when the cars compared are running at moderate speed with frequent stops and starts, and, therefore, goes far toward compensating for the somewhat lower efficiency at starting of the motor itself.

The Westinghouse Company advertises that it is prepared to stand back of the new equipment, and recommends it freely for heavy interurban work with a certainty of tone that places the apparatus unequivocally upon the commercial list.

Somewhat later in its preliminary announcement and little earlier in promulgating decisive results, comes the Eichberg-Winter alternating motor, manufactured by the Union Elektricitäts Gesellschaft, with which trials have been thoroughly made on the government railroad running through the suburbs of Berlin, 3 miles of track having been equipped for the purpose. This very interesting motor apparently belongs to somewhat the same class as the Lamme motor, that is, it has a commutator, and from the published data has very similar characteristics. It is not, however, an ordinary series motor, but is more akin to the Thomson repulsion type of alternating-current motor. In the road already equipped with this motor the trolley line was worked at 6000 volts, and the working voltage at the motor was reduced by a transformer on the car, an arrange-

ment that would be naturally adopted on long lines. In this instance the electrical equipment of the car is claimed to weigh even less than the equivalent direct-current equipment, and the efficiency seems to be quite as high as with the latter. As in the case of the Lamme motor, the car equipment includes two motors fitted for multiple-unit control with all the latest appliances. The data published as yet are far from complete as regards the details of the motor, but its operation seems to be regarded as highly satisfactory.

Very recently tests of the Finzi series-wound single-phase motor have come to hand. The reports in this instance give more of detail, and one gets a pretty clear idea of what the motor equipment is, and of its practical performance. It was tried in Milan on one of the suburban lines, with a similar car equipped with a General Electric 52-motor as a trial horse. The motor was worked at 18 cycles per second, and weighed a little more than the direct-current motor it replaced. The tests at Milan were made on a light street car, which adds to the interest of the comparison with the much heavier interurban cars and the powerful motors of the Berlin and the Pittsburg trials. In spite of this the Finzi motor appears to have performed admirably, giving, thanks to induction regulation, a total efficiency rather better than the direct-current motor, with a power factor exceeding 90 per cent when up to speed, and exceeding 95 per cent under the best conditions.

Generally speaking, its performance was thoroughly confirmatory of the results obtained with the other motors, and, in particular, the sparking is categorically stated not to exceed that usual in good direct-current motors.

In addition to the three single-phase motors just referred to, it is well known that two other single-phase systems have been developed in this country, of which details will doubtless soon be forthcoming; but confining attention to those already described, it is well to enquire what it all means.

If a single one of these motors had been brought out for commercial use, the writer for one, in spite of his belief in alternating currents for traction, would have been disposed to be somewhat skeptical concerning the results claimed. They are in themselves almost suspiciously good. But they confirm each other in a most remarkable fashion, in spite of being obtained nearly simultaneously in three different countries. The variations are merely such as would be expected in apparatus from the hands of different designers, and, taking the evidence as a whole, one is forced to the conclusion that the commercial single-phase railway motor has been developed.

Improvements will probably be found desirable, and will be promptly made, but there is no dodging the main issue, that the single-phase traction motor must be reckoned with in railway work from now on. On interurban systems the single-phase motor will give a new impetus to long-distance work. Unless Finzi's view is altogether too roseate, urban lines can be easily handled by the same method, and it is worth mentioning that an interurban car taking primary currents at high voltage could slip very easily into urban sections with merely the secondary voltage on the trolley wire. For that matter, the series-wound motors would work well on direct current with suitable regulating appliances, so that there need be no line drawn at the city limits. No reason is yet apparent that would indicate the general replacement of direct current by alternating railway motors, but there is assuredly evidence that a new hand has been dealt in the traction game, and that the often condemned alternating-current contingent holds some pretty high cards.

The limited cars on the Cleveland & Southwestern Company's lines have proven so satisfactory that the company has decided to put on two more limited cars, one additional for Norwalk and another for Wellington, both to leave Cleveland in the morning.

POWER PLANTS AT THE ST. LOUIS EXPOSITION

The elaborate plans for illumination proposed for the St. Louis Exposition, together with the enormous amount of power which will be required for operating the transportation systems and the machinery which will be scattered through the various buildings, will require a correspondingly immense amount of generating apparatus. A considerable part of this is now being installed, and a brief summary of some of the principal features, as definitely arranged for up to date, may be of interest.

There will be three main sources of energy which will be available for exposition purposes. Of these the largest will be the service power plant in Machinery Building, with a nominal capacity of 8000 kw in 25 cycles, 6600-volt current. The Exposition will also purchase from the Union Electric Light & Power Company about 7500 kw of the same kind of current. Besides this there will be available a miscellaneous exhibit of engines and generating apparatus to the amount of about 20,000 kw, though the steam and gas supply will probably not permit this full capacity to be utilized at one time.

The main service power plant in Machinery Hall, with boilers in the Steam and Fuels Building, is now being installed, the contract for this entire plant having been given to the Westinghouse Companies. This plant will have four 2000-kw generators, direct-connected to vertical Corliss engines, supplied from sixteen Babcock & Wilcox boilers in the Steam and Fuels Building. The contract includes switchboard, and, indeed, the complete plant, with the exception of the buildings in which the machinery is placed.

The exhibit power plant in Machinery Building will, of course, have an immense variety of apparatus which it is not necessary to catalogue in a general article of this kind, but some of the features which will certainly attract the engineer will be the steam turbines of the Parsons, Rateau, De Laval and Curtis types, and several large gas engines. The largest steam engine unit will be a duplicate of the 5000-kw units in the Interborough station in New York, and the largest turbine a Curtis of 4000 kw. All engine and turbine units will be direct connected to dynamos, the belt having at last disappeared in exposition power plant work in this country.

The Steam and Fuels Building is the name that has very properly been chosen for a building 100 ft. west of the Machinery Building, where the steam boilers and gas plants will all be located. It seems that the gas engine is to take a prominent part in this exposition. The steam boiler capacity will be 23,000 hp, according to the usual boiler rating. A dozen foreign and American boiler makers will be represented by their products in this building. The boilers will be principally of the water-tube type.

As to fuel, oil was, of course, given much consideration at first, but was abandoned because of the uncertainties of delivery of the necessary 1400 barrels to 1600 barrels per day, and the high price as compared with coal. By the use of mechanical stokers and by making some of the fine coal into briquettes, it is hoped to make combustion sufficiently smokeless to be inoffensive. Briquette can be made from the tar by-products of gas manufacture. The gas made by the gas plants can either be used directly in gas engines or used under boilers instead of coal.

Besides the interest which will attach to this portion of the Exposition, the street railway visitor will be attracted to the Electricity Building and the Transportation Building. Just in the rear of the latter two tracks have been laid, one 3000 ft. and one 1400 ft. long, for electric railway tests. The short track can be used for imitating the conditions of city surface lines, and the longer stretch for testing higher speed motors. Two types of single-phase railway motors have been promised for test, which is a point of considerable practical interest just now. Although not in the Electricity Building, these tests and

exhibits of electric railway apparatus come under the department of electricity. The exhibits in Electricity Building and Transportation Building are not sufficiently decided upon to permit of detailed mention. Owing to the pressure of the prime movers in the Machinery Building, all the operating generating machinery will be found there.

Owing to the size of the grounds, transformer sub-stations (and rotary converters, if necessary) will be put in the various buildings, and high-tension transmission lines will supply these sub-stations.

TEST OF TURBINES FOR THE CLEVELAND, ELYRIA & WESTERN RAILWAY

An economy test of the Westinghouse steam turbines, built for the Cleveland, Elyria & Western Railway, made last summer, shows some interesting results. Particulars of the test are contained in a report made by Commander A. B. Canaga and E. N. Janson to the chief of the Bureau of Steam Engineering of the Navy Department, at Washington, from which the following facts are taken.

The turbine was of the two-stage type, direct connected to the revolving field of an alternating-current generator, 400 volts, two-pole, three-phase, 3000 alternations. It having become a commercial necessity in this country to build alternating-current generators capable of running at 25 per cent overload, and able to stand 50 per cent overload for an hour or two, the turbine in question, therefore, if used for driving anything but an alternating-current generator, would be rated as a 1500-kw turbine instead of 1000-kw turbine.

The original design, having called for a reheater between the high-pressure and the low-pressure turbine, was the cause of the great length of this turbine (about 43 ft. 3 ins., including the generator and its bearings). The reheater was not used in this machine (and is not likely to be in others), but substituted by an ordinary receiver pipe and separator. The two turbine cylinders and the generator are all bolted down to the same bed-plate, which is made of considerable depth and is quite heavy, approaching 33 per cent of the weight of the whole outfit. This bed-plate is not bolted to the foundations.

The testing of this machine was performed in the turbine department of the Westinghouse Machine Company, and was carried out with great accuracy. Steam was supplied from the boilers of the general plant of the Westinghouse Machine Company, and entered the casing of the high-pressure turbine through a series of valves. There is first an automatic stop valve, then a throttle valve which connects with a steam strainer placed between this throttle valve and the admission valve. This valve is composed of a double poppet, actuated by a piston and a small relay valve, which receives its reciprocating motion from levers connected by an eccentric through gears to the turbine shaft.

The exhaust was taken out at the bottom of the low-pressure turbine and led through a 30-in. exhaust pipe to the bottom of an ordinary surface condenser. The lower part of this pipe was formed into a hot-well, at the bottom of which was placed a nozzle with a by-pass valve, connecting the suction pipe on the pump either direct to the condenser or to the hot-well. A gage glass, with means provided to ascertain the water-level line, gave readings of the amount of water contained in the hot-well when beginning and finishing the trial. The hot-well pump discharged directly into either one of the two weighing tanks placed on scales to ascertain the amount of water condensed.

The circulating pump was driven by a direct-connected Westinghouse standard engine, running at about 360 turns per minute. The air-pump suction was attached at the top of the condenser and connected to an Alberger dry-vacuum air pump. As the name infers, no water is drawn out by this pump, but merely air and vapor. The air pump itself is composed of two tandem cylinders, and is worked at a uniform speed of about 80 r. p. m., maintaining an average vacuum of about 27½ ins. The near ends of the cylinders are connected by means of a pipe, the other end of each cylinder being joined to the condenser and the atmospheric exhaust respectively. A suspicion existing that the vapor discharged contained some amount of water, this atmospheric connection was coupled up with a small condenser, with the result that about 44 lbs. of water was separated per hour. This should be added to the results put down in the test tables.

The water separated in the receiver pipe was measured at every interval of readings and trapped back to the condenser.

After passing through transformers the current was absorbed in a water rheostat, and readings obtained on the usual instruments.

The number of revolutions of the turbine was obtained by counting the strokes of one of the governor levers, and then

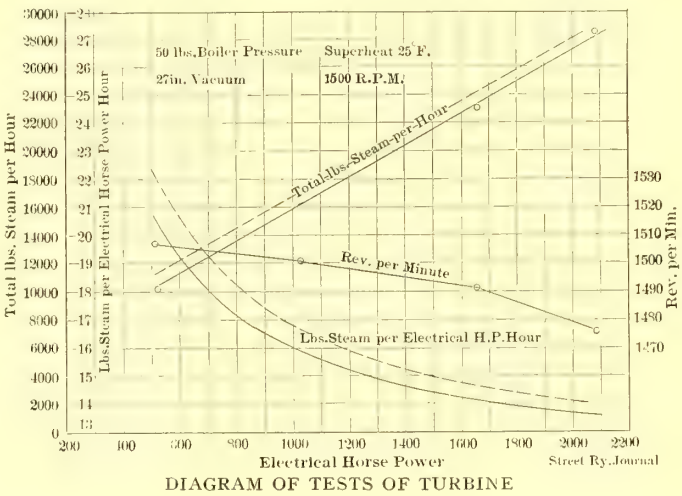


DIAGRAM OF TESTS OF TURBINE

by multiplying same with 9 1-3, which is the ratio between the worm on the turbine shaft and the gear actuating the governor levers. From the table the revolutions will be seen to vary between 1480 and 1456 per minute.

The general results referred to above will be found in the table at the end of this report.

During the whole run of four hours the revolutions of the turbine shaft were nearly constant, or 1500 turns, although the load was increased from its rated capacity of 1000 kw to 1500 kw, an overload of 50 per cent. By comparing the pressure at the horse-power inlet, when working under the two different loads, due entirely to the action of the governor, the above-mentioned fact may readily be accounted for.

The turbine ran without noise, the humming discernible being due to the generator. Its revolving parts, being accurately balanced, ran perfectly smooth, without even the slightest vibrations. All end thrust due to an excess of pressure on the steam side of the moving blades was counteracted, as is usual, by balance pistons, the difference in thrust, when finally adjusted, being so small as to allow the drum to be moved in its axial direction by a slight touch of the finger. Compared with a reciprocating engine there are fewer parts that need watching, a smaller engine room force will, in all likelihood, therefore suffice.

For the purpose the steam turbines now are being used, viz., for driving electrical generators, they are admirably suited, and are undoubtedly, both as a mechanism and a heat engine, in some cases at least, superior in efficiency when compared with the ordinary steam engine.

When analyzing the figures given below, it should be borne in mind that the turbine cylinders were not lagged, but

simply covered over temporarily with felt roughly tied in place, and, therefore, the results obtained may, under other circumstances, be slightly improved upon:

Kilowatts	1,510	1,019
Equivalent brake hp delivered to the generator, at 95 per cent efficiency of the latter	2,131	1,437
Revolutions per minute	1,456	1,480
Steam pressure per gage above throttle	149.4	146.2
Steam pressure per gage below throttle	148.8	101.1
Vacuum referred to 30-in. barometer	27.5	27.83
Dryness of steam at throttle	0.994	0.995
Steam per hour per electrical hp	13.99	15.31
Steam per hour per brake hp delivered at the turbine coupling at 95 per cent generator efficiency	13.29	14.54
Steam per hour per indicated hp of a reciprocating engine at 85 per cent combined efficiency of generator and engines.	11.9	13.01

The dotted line curves in the diagram herewith indicate the steam consumption when dry saturated steam was used, while the full-line curves answer to a superheat of 25 degs. F. of the steam.

INTERURBAN ELECTRIC RAILWAY IN HOLLAND

Work on the new interurban electric railway between Amsterdam and Haarlem, which is being built by J. G. White & Company, Ltd., of London, and in which American capital is largely interested, is being pushed rapidly forward. The operating company is known as the Electrische Spoorweg Maatschappij, and has been incorporated under the auspices of the Netherlands Tramway Company, of New York, with a capital of Fl. 3,000,000, and the same amount of 4 per cent debenture bonds. The directors of the company are: E. Luden (president), of Amsterdam; J. H. Kann, of the Hague; H. J. Pierce, of Buffalo, N. Y.; A. Van Rossum, of Haarlem, and W. C. Th. van der Schalk, of Amsterdam.

The following work is being carried out in connection with the construction of the line: The Government overhead telegraph and telephone wires along the road from Amsterdam to Haarlem are being put under the ground. This work will be done by the State, but the company will pay $60,000 toward this alteration. On account of the unsteady sub-soil, it was found necessary to drive sheet piling on both sides of the Government road on which the track is being laid. The road itself is also being graded, as well as the entire private right of way situated in the Sloterpolder. Considerable bridge construction will also be required.

In Halfweg, a village midway between Amsterdam and Haarlem, a power station is being erected, which will be equipped with six Lancashire boilers, having a heating surface of 860 sq. ft., and three triple compound-condensing, 475-ihp Belliss & Morcom's engines, directly coupled to the three 300-kw Westinghouse generators. High-speed engines were adopted largely on account of the difficulty of securing good foundations.

The line will start from a point near the center of Amsterdam, and in Haarlem joins the Haarlem local, Haarlem-Zandvoort and Haarlem-Bloemendaal electric tramways, the stock of which company is owned almost entirely by the Electrische Spoorweg Maatschappij.

The cars will be mounted on double trucks, with a capacity of about forty-four passengers each.

The distance between the termini in Haarlem and Amsterdam is about 12 miles, and is for the greater part double track. Work was started in January, 1903, and it is expected that trains will be in operation sometime during the summer of 1904.

BLOCK SIGNALING ON DOUBLE TRACK ROADS

BY ORLANDO W. HART

Since the adoption by the American (steam) Railway Association, at its fall meeting, of the report of the committee on "train rules," recommending the use of block signals in lieu of train orders on double-track roads, the report has been widely circulated through the press and more or less briefly discussed. A general misunderstanding seems to exist among electric railway companies who are operating with double track, as to the true application of these rules, and it is naturally felt that if the steam roads can safely use the block signal system the electric roads ought to be able to do the same. It is with the view of correcting this error that the following article has been written. The situation has not changed in the least from what it was before this action was taken, and electric roads are still at a disadvantage, owing to their limited control system of operation.

Nearly everyone who has carefully studied the subject admits that conditions can occur on double track, not properly guarded, which are fully as dangerous, if not more so, than any found on single track. While accidents do not occur as often as on single track it is their very infrequency which makes them dangerous.

In brief, the action of the steam roads will be found in the following rule adopted, and which is in four sections:

1. On portions of the road so specified on the time-table trains will run with the current of traffic by block signals, whose indications will supersede time-table superiority.

2. The movement of trains will be supervised by the superintendent or train despatcher, who will issue instructions to signalmen when required.

3. A train having work to do which may detain it more than —— minutes must obtain permission from the signalman at the last station at which there is a siding before entering the block in which the work is to be done. The signalman must obtain authority to give this permission from the superintendent or train despatcher.

4. Except as affected by these rules all block signals and train rules remain in force.

It will be readily be seen by these rules that it was the intention to abandon the use of train orders, but instead of sending them to the conductor and engineer of a train, as the custom formerly was, the order is now to be transmitted to the signal man, who will then, by means of his semaphore signal, direct the movements of the train which the orders are intended to govern, consequently saving the time formerly required to stop the train and sign for orders.

The plan possesses the additional advantage of enabling the depatcher to correct any error immediately, if one be made.

The system adopted has been in operation on the lines of the Chicago, Burlington & Quincy Railroad, and in outline consists of the following: On portions of the double track designated on the time-table block signal towers are placed, which are manned both night and day by operators who act as signalmen, and to whom all orders are sent by the despatcher.

If a signalman allows a train to enter his block all other trains of the same direction are blocked, and by automatic means the signals are locked and cannot be restored to safety till the train has left the block. Should the automatic lock fail, manual service can be substituted upon an order from the proper authority. Word is then received from the signalman in the next tower that the train has left the block and entered the next. The block now being clear any train, irrespective of class, may proceed with the current of traffic when a clear indication is shown from the signal tower. It is true that the train proceeds without orders, but it is still under the control of the train despatcher, through the signalman, and he alone controls its movements. By this method the system of train despatching is greatly simplified, since all trains are of the same standing.

The use of train orders is as imperative on double track as on single, and no measures for safety used on single track

should in any way be relaxed by the introduction of double tracks.

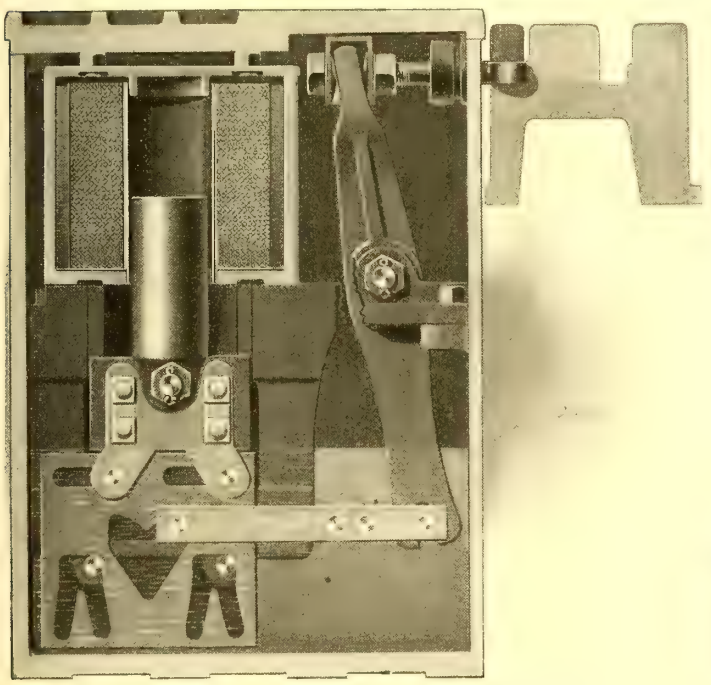
Passing points should be maintained by schedule, so as to separate the cars at proper distances. A system of communication and signaling should also be installed, by which the despatcher can, at will, stop, hold and communicate with all cars under his control.

Steam railroads use automatic block signals only as a precautionary measure; owing to the existing conditions of their track, the system employed is far more reliable than any now offered to electric roads. Managers of electric railways should guard their whole system, whether single or double track, in the same manner, instructing their employees that the same dangers exist in both systems, and for the sake of safety both should be treated in the same manner.

In the writer's opinion there is at present no satisfactory block signal system adapted for the use of electric railway companies, and many of the systems now on the market are worse than useless, owing principally to the fact that they will not show a danger signal by day and night, when any part necessary for their operation is out of order.

AUTOMATIC TRACK SWITCH

A new electromagnetic track switch has been recently placed on the market by the American Automatic Switch Company, of New York. This switch has been thoroughly tried out under the supervision of Aldred K. Warren, the company's consulting engineer. Mr. Warren is a practical railway man, and was formerly assistant engineer of line and equipment of the Brooklyn Rapid Transit Company, and for the last year and a half has been one of the electrical engineers of the Interborough Rapid Transit Company, of New York.



DETAILS OF AUTOMATIC TRACK SWITCH

The great advantages of this switch lie in its durability, simplicity, certainty of operation and safety from lightning. As will be noted by reference to the accompanying cut, the principal operating parts consist of but one magnet and one steel cam-plate for the reverse motion. The magnet is immersed in a special oil in a sealed case, giving it absolute protection from moisture. The switch may be adapted to take operating current either through rail or overhead wire.

To operate this device, the motorman must leave the controller at one or two points while passing over the breaker or insulated rail. If the switch is right, the car passes over the breaker or insulated rail with the power off. This method is very simple, and prevents the motorman from becoming careless, as it compels him to look at the switch every time before running the car over it. It is unnecessary for the motorman to memorize switches in order to operate them.

The switch mechanism is made of the finest tool steel. There are no wearing surfaces or pivoted points, nor is there any possible chance for short circuits. As the operating mechanism is enclosed in a strong sealed box, placed under ground, no dirt, water, salt or ice can come in contact with the magnet or working parts of the switch, thus reducing maintenance to practically nothing. The cam-plate produces a semi-lock, but does not prevent turning the switch with a switch-iron. The switch is easily accessible for inspection. It is also stated that switch tongue splitting and car derailments are impossible.

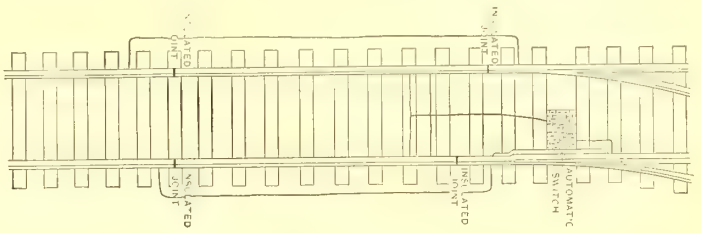


DIAGRAM OF CONNECTIONS WHEN CURRENT IS TAKEN FROM RAILS

Diagrams are published herewith of the connections used with rail and with trolley wire connection. When the former is employed a short section of track is insulated, and the current, after passing through the motors, operates the switch. With the overhead connection a breaker or insulated section is inserted in the trolley wire, so that the switch is in series with the motors. This breaker need not be placed so far away from the switch, that on streets where the cars follow closely, the car following the one crossing the switch can turn the switch before the second truck of the first car reaches it, thereby sending one truck one way and the other truck another way. The breaker is arranged to spring on the trolley wire without cutting it.

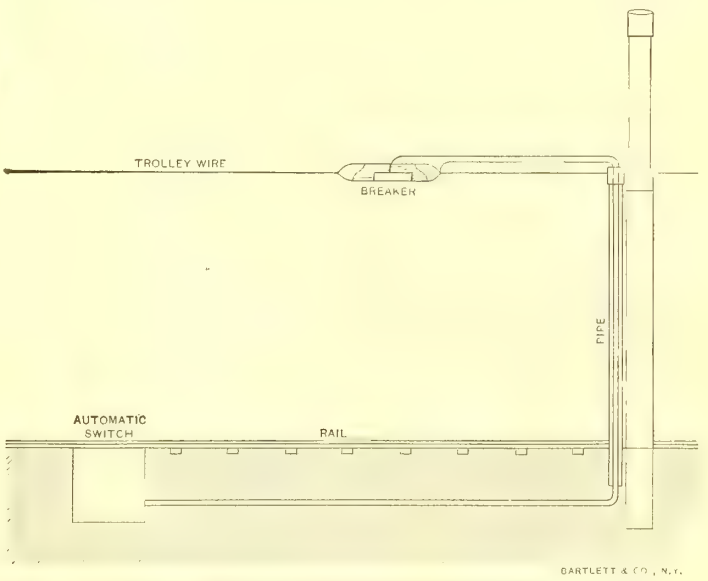


DIAGRAM OF CONNECTIONS WHEN CURRENT IS TAKEN FROM TROLLEY WIRE

One of these switches has been in practical operation for the last nine months at 149th Street and Eighth Avenue, New York, and has given excellent satisfaction. The company also has orders for installing these switches in Brooklyn, on the system of the Public Service Corporation of New Jersey, and at Albany, Utica, Trenton, Cleveland and other cities.

INTERURBAN CARS FOR AN OHIO ELECTRIC RAILWAY

The accompanying illustrations show the exterior and interior of one of several fine interurban cars built by the G. C. Kuhlman Car Company, for the Toledo, Port Clinton & Lakeside Railway Company. This railway company has about 73 miles of track under construction, and will reach an amusement resort at Lakeside. These cars have attracted much attention on account of their excellent design and appearance.

Each car is 51 ft. long over all, 49 ft. 8 ins. over vestibules, and 40 ft. over body; width over sills, 8 ft. 6 ins.; height from under side of sill to top of roof, 9 ft. 4 ins. The bottom framing is composed of longitudinal sills of long-leaf yellow pine, with end and cross sills and framing of white oak. Side sills are made of one piece, 5 ins. x 8 ins., and one piece, 2 ins. x 6 ins., with 6-in. channel, securely bolted to same, extending the full length of car body and thoroughly bolted to end sills. The sills on the left side extend through to the buffers. The center sills are of 6-in. I-beams, filled with yellow pine, and are bolted to the side sills. The end sills are 6 ins. x 8 ins., with 3-in. angle-iron bolted thereto, and extend the full width of the bottom frame. All the framing is tied together with ⅝-in. tie-rods, extending the full width of the bottom, and fitted with heavy square washers with turn buckles in the center. The bolsters are made of 8-in. x 1-in. steel plates, with iron filling blocks. The body framing is of the Kuhlman standard, with 1¼-in. x ½-in. steel carlins at each post. The roof has a monitor deck, steam coach hood type. The car is trussed with 2½-in. x ⅜-in. flat iron running the full length of car body down through side sills, fitted with washers and plates. The truss is supported alongside of car underneath sash rest by being tightly gained into side posts. This makes a car suitable to withstand any service to which it may be put in ordinary commercial service.



EXTERIOR OF BODY OF TOLEDO, PORT CLINTON & LAKESIDE CAR



INTERIOR OF TOLEDO, PORT CLINTON & LAKESIDE CAR

The car finish is quartered sawed oak, and is furnished with neat marquetry work and side panels inlaid in neat design. The car is also furnished with stationary plush seats, dry closet at rear of car containing water-cooler, etc. The ceiling is of Empire design, neatly decorated in gold leaf. The deck lights are of leaded glass of neat design, as are also the upper window sash.

The interior trimming of the car is of highly polished and lacquered bronze of extra heavy design.

UNDERWRITERS CONSIDER CAR WIRING

At the recent annual meeting of the Underwriters' National Electric Association, the committee on car wiring reported that the American Street Railway Association had appointed a committee of five to consult with it, and that, as a result of two conferences, a set of rules are being considered, which cover the following points:

First.—The protection of that part of the under side of the car, over all electrical apparatus, by fire-resisting material.

Second.—The use of standard conductors and for all conductors outside of conduits, a flame-proof braided outer covering.

Third.—The use of an approved line of switches, cut-outs, etc., with those having exposed live metal parts located in cabinets.

Fourth.—The running of wires in metal conduit, in fire-resisting moulding, under certain conditions, in hardwood moulding, or cleated direct to fire-resisting material.

Fifth.—To do away, as far as possible, with the use of clusters and lighting by individual lamps.

Sixth.—To have heaters so designed that when they are in place there will be a safe distance between current-carrying parts and woodwork of the car.

Seventh.—To improve the design of terminals that loose contacts may be avoided.

The matter was referred back to the committee for further consultation with the American Street Railway Association.

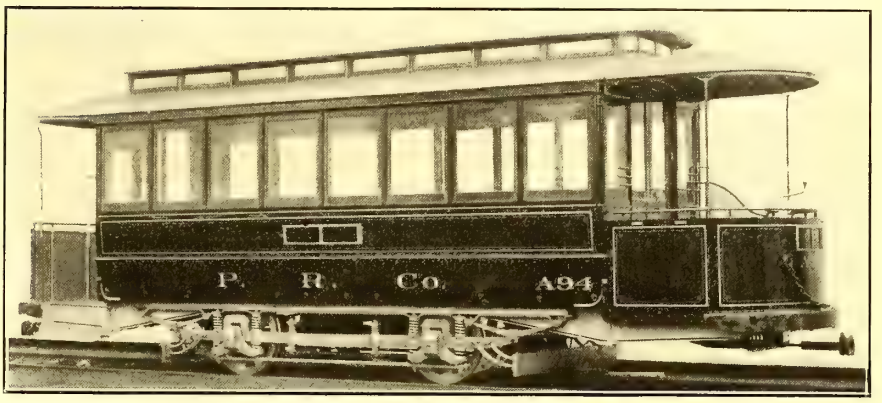
GLAZED VITRIFIED CLAY CONDUITS FOR RAILWAY AND LIGHTING WORK

The Standard Sewer Pipe Company, of Rochester, N. Y., although it has for some years manufactured glazed vitrified clay conduits, has not until recently entered into the street railway and lighting field on a large scale. It supplies sewer pipe for municipal drainage purposes on an extensive scale. The conduits heretofore manufactured have been sold and installed principally in New York State and New England, several million feet having been located in the territory mentioned above within the past two years or three years.

The company has an extensive plant in the suburbs of Rochester, and is fortunately located near some of the best clay beds in this country, and the material entering into the composition of the ducts is claimed to be the best in use. Single and multiple ducts, with round or square centers, are manufactured. The inside of the conduit is as smooth as porcelain, giving absolute protection to the passage or removal of cables through the ducts. Careful inspection of each conduit is made before it leaves the plant. Any defects in the conduit, such as imperfect glazing, cracks or brittleness through over burning, are carefully inspected. The result of such methods has given the company a number of large, steady customers, who have heretofore taken its entire output. Extensive enlargements of its plant and the recent improvements of its manufacturing facilities, however, now enable the company to enter the railway and lighting fields on a large scale.

NEW CARS FOR PITTSBURG RAILWAYS COMPANY

The Pittsburg Railways Company has lately received 100 closed trailer cars from the J. G. Brill Company and fifty motor carvs from the American Car Company. The only differences between the two types are that the motor cars are furnished with vestibules and are a trifle longer and wider. The illustration shows one of the trailer cars, the dimensions of which are as follows: Length over end panels 20 ft., over crown pieces 30 ft., and over bumpers 31 ft. Width over sills and panels 6 ft. 7¾ ins., and over posts 7 ft. 2 ins. Height from bottom of sill over roof boards 8 ft. 5½ ins. The combined truss-rod anchors and corner castings, which may be seen in the illustration, are a regular feature of the cars of the Pittsburg Railways Company. Truss-rods of flat iron are 2 ins. x ½ in., and are supported on the posts 25 ins. above the floor. The corner posts are 3¾ ins. thick, and the side posts 2 ins. The side sash lights are 24 ins. x 30 ins., and end sash lights 14¾ ins. x 30 ins. Five steel rafters, 1 in. x ⅝ in., are sandwiched between the car lines. Long-leaf yellow pine side sills are 4 ins. x 6¼ ins., and the end sills 4 ins. x 9 ins. The cross sills and cross bracings are 2¾ ins. x 4 ins. The motor cars have 6-in. x ⅝-in. plates on the outsides of the sills, bent around the corners for a distance of 20 ins. From the rail to tread of platform step is 15⅛ ins., and from step to platform 12⅞ ins. The platform timbers are 2¾ ins. thick by 7 ins. deep at the widest point, and are reinforced with angle-iron. The crown pieces are flush with the angle-iron bumpers. Platforms are 5 ft. 6 ins. long, measured at the centers. There is one entrance to the side, as the dashes extend from the hood-post around to the corner, and the front portion is supported upon the crown pieces with 1-in. x 1-in. angle-iron, to which it is riveted. The brake handles, angle-iron bumpers, alarm gongs and conductors' bells are of Brill manufacture.



TRAIL CAR FOR PITTSBURG RAILWAYS COMPANY

A report made by the Boston & Worcester Street Railway Company shows that on Nov. 1 nine cars on its line each earned $140. The company is doing a very satisfactory business, and it is estimated that its earnings will be $300,000, a ratio of capitalization to earnings of eight to one.

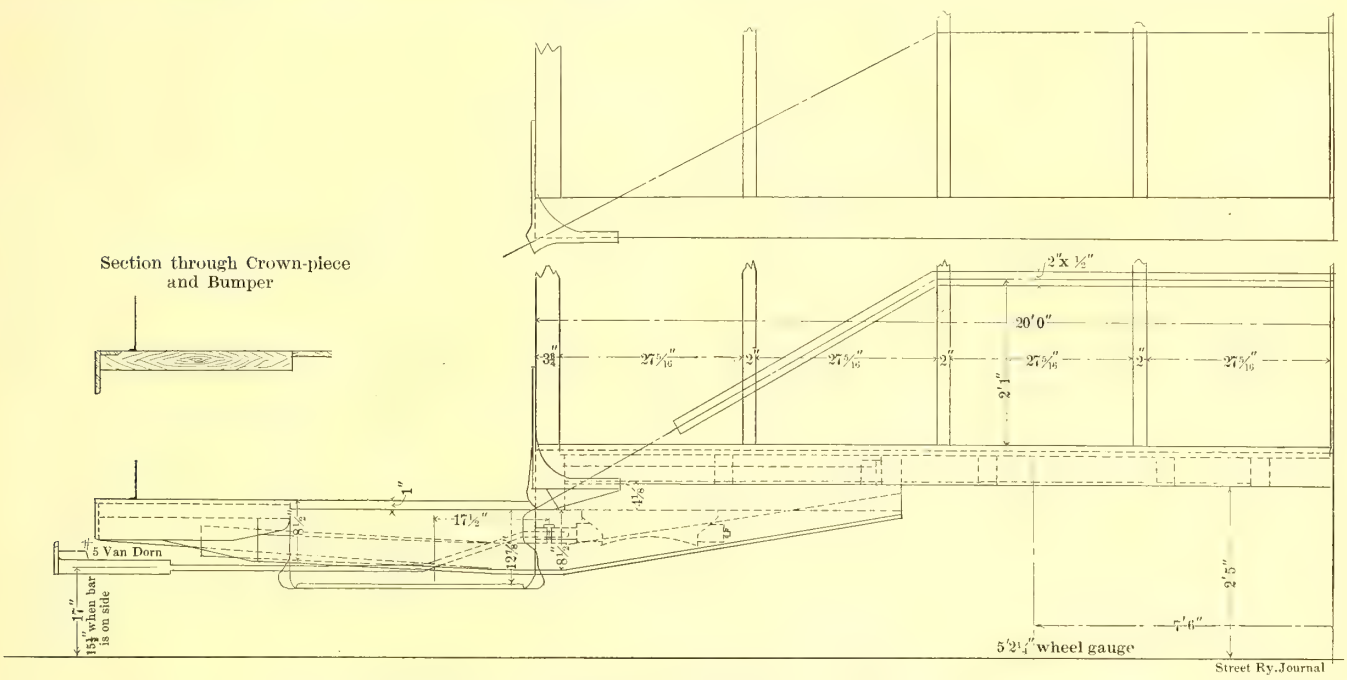
A NEW SMOKE-CONSUMING FURNACE

A few months ago a new smoke-consuming furnace was introduced to steam users by J. B. Harris, M. D., of Nashville, Tenn. Although long a member of the medical profession, Dr. Harris was formerly a mechanical engineer, and the subject of fuel economy has always been of great interest to him.

It is well known that the imperfect combustion in an ordinary furnace causes the generation of carbon gases of high calorific value, which are utterly lost unless enough hot oxygen is introduced to consume them.

To overcome this loss it is now common practice to increase the grate surface for a given amount of fuel to permit increased air circulation by spreading the coal in thin layers over the grate bars. This, however, often works more harm than good, for if too much cold air passes through the fuel the temperature of the fuel gases is lowered and their volume increased, which results in greater losses than ever. The use of forced or induced draft sometimes produces similar effects, as the oxygen which passes through the fuel will not consume the furnace gases unless both the gases and oxygen are at the kindling or flashing temperature. Chemical action would occur only in the latter case, and result in the formation of carbon dioxide—the product of perfect combustion.

In this smoke-consuming furnace, instead of trying to get oxygenated air above the coal pile by spreading the coal in thin layers or by using forced or induced draft, supply flues of sheet



CONSTRUCTION DETAILS OF PITTSBURG RAILWAYS CAR

iron are placed in the brick walls so closely in contact with the fire as to heat the air up to flash point by the time it meets the gases and floating carbon. While the coal is heating, dry distillation is going on, and the gases and floating carbon are rising to the top of the coal, 40 per cent of the total draft is permitted to reach the fire through the flues, and the remaining 60 per cent is allowed to go through the ash pit under the grate bars in the usual way.

Fig. 1 shows the construction for a return flue tubular boiler. Two flues beginning at the rear—one in each side wall—supply the double arch. The air from this double arch surrounds the gases and floating carbon above, and the air from the bridge (which has been delivered by the two other flues beginning at the front, one in each side wall, and running the whole length to the rear wall and then doubling back to the bridge) catches the smoke and gases on the under side, thereby completely surrounding the rising gases and smoke with hot, oxygenated air. The hot air, smoke and gases are dashed against the checker-work (rising on the bridge and extending back from 4 ft. to 6 ft. under the boiler), and recoil and swirl around until thoroughly mixed and consumed. The checker-work of brick being white-hot, keeps up the temperature, so that the gases and smoke are consumed under the boiler, and no heat units are wasted. If anthracite coal is used with this furnace, it is claimed that 9 per cent in fuel is saved, because there is 9 per cent of gas in such coal. If soft coal is used 35 per cent to 50 per cent is saved, as there is in that class of coal 35 per cent of gas and from 10 per cent to 20 per cent of volatile carbon.

This furnace has a bridge built in the shape of a circular arc, to conform to periphery of boiler for cylindrical, horizontal set boilers, with a baffle carried up with side walls (width of one brick) over each rising end of bridge, and up to where side walls embrace boiler just under the water level, forcing smoke and gases to pass under it and igniting them by hot air from the

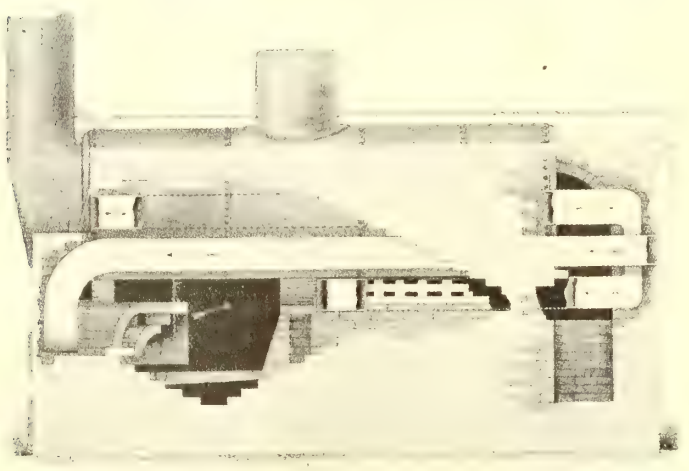


FIG. 1.—FULL SIDE ELEVATION OF CYLINDRICAL HORIZONTAL RETURN FLUE TUBULAR BOILER, SHOWING CONSTRUCTION OF SMOKE-CONSUMING FURNACE.

bridge ports. The interior flue gases in this smoke-consuming furnace, when the latter is properly built and regulated, show from 17 per cent to 18 per cent carbon dioxide, the highest efficiency attainable.

The evaporation of water in this furnace when properly designed and handled, is stated to be for cylindrical boilers of the first class, 11 lbs. of water per pound of first-class steam coal; and in water-tube boilers, 12 lbs. and above under best conditions.

The only difference in the building in of the sheet flues in a water-tube boiler, such as Babcock & Wilcox and any horizontally-set, return-flue tubular boiler, is that in the return-flue tubular-boiler furnace the last section of the flue, which conducts air from the crescent-shaped section in the rear end wall from rear to bridge, is triangular in shape, and lies in the corner of the combustion chamber. In water-tube boilers the crescent-shaped piece in rear end wall continues its lower horn further, and the same corresponding section of pipe conducting the air from this crescent to bridge is rectangular, lying wholly in the side walls as the others do. When it reaches in the side wall opposite the hollow bridge it turns out of the side walls on either side into the hollow of the bridge.

The only other distinction between the two in building in is

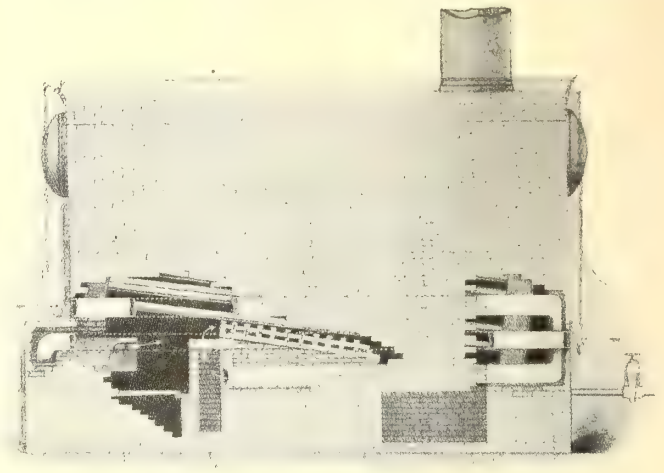


FIG. 2.—FULL SIDE ELEVATION OF WATER TUBE BOILER, SHOWING CONSTRUCTION OF SMOKE-CONSUMING FURNACE.

that the round return-flue tubular boiler furnace has a round bridge, and the checker-work of firebricks is built up immediately behind this bridge, and not on it. The water-tube boilers named have a straight, transverse bridge, and the checker-work is built up immediately behind it.

In all furnaces of this type a water pit is used in the ash pit under the grates, because the falling pieces of hot coal and ashes which wall in this water and the radiation from the grate fire evaporate it into a very heavy wet steam. This steam is carried up to the coal burning on the grate bars, and by passing through this burning coal is disassociated into hydrogen and oxygen, thus helping to produce better combustion and a hotter fire.

Several of these furnaces have already been installed, notably in the Crown Woolen Mills, Marcellus, N. Y., and the Banna Cotton & Oil Mills, Goldville, S. C. The manufacturer is also negotiating important contracts.

REORGANIZATION OF SPRINGFIELD & XENIA COMPANY

A reorganization of the Springfield & Xenia Traction Company, which was placed in the hands of a receiver about a month ago, is under way. The bondholders may decide to buy in the property and bond it for less than the present issue of $500,000, in which event the common stock would be wiped out. About half the bonds are held in Cleveland, and at a recent meeting of bondholders it was decided to appoint a committee, composed of Warren S. Hayden, W. H. Lamprecht, of Cleveland, and J. M. Hutton, of Cincinnati, to act as a protective committee and undertake the reorganization of the property. It was understood that at the time the road was sold by Cleveland interests that the control passed into the hands of a syndicate headed by Ex-Governor Bushnell, of Springfield, but that has since been denied.

The Springfield (Ohio), Troy & Piqua Railway, which has its line from Springfield to Troy partially completed, is planning to build a branch through Christiansburg, Fletcher, Lena and Conover. This will give the company direct connection with both Troy and Piqua.

FINANCIAL INTELLIGENCE

WALL STREET, Dec. 16, 1903.

The Money Market

The drift of the money market during the week has all been toward greater ease. Call money, while occasionally quoted at 6 per cent, is lending more commonly at 5½ per cent to 5 per cent. Time money for both long and short periods is distinctly easier, the rate for sixty to ninety days being 5½ per cent, and for four to six months, 5 per cent. This movement toward a lower level has been foreshadowed clearly by all the developments of the last few weeks. Up to yesterday evening gold imports from London since the 1st of November reached a grand total of over $22,000,000. This, of course, has been the primary influence in the market's improvement. Had it not been for this help it is not hard to see that the surplus bank reserve at New York, instead of standing now at $8,000,000, would have been nearly, if not quite, at the vanishing point. The season's shipments of currency to the South, on account of the abnormal cotton prices, have been almost unprecedented in their magnitude. The Treasury, in spite of the revenue deficit, has been a creditor, rather than a debtor on its ordinary operations with New York. But the enormous takings of gold from across the water have balanced these demands so effectually that the local bank surplus is sustained above the average total for this time of year. Another agency in helping the situation has been the large lending by local trust companies and out-of-town banks, which have been induced to employ their balances here by the high rates prevailing in the call money market. It is chiefly owing to this that the New York Clearing House institutions were able to reduce their loans between Sept. 12 and last Saturday no less than $46,000,000. These movements are sufficient to explain the relaxation which the market has already enjoyed. Looking to the future, the enormous capital requirements of the first-of-the-year settlements will naturally cause some temporary hardening of money rates. But after the first ten days of January the signs all point to the usual inflow of funds from the country and the usual let-down in market quotations. Assurance on this point is made doubly sure by the remarkable persistence of conditions favorable to gold imports in the exchange market.

The Stock Market

A highly professional market, with one strong contingent working for higher prices and another for lower prices, sums up the immediate situation on the Stock Exchange. A sharp reaction after the advance in the early part of last week was the natural result of selling by speculators, who had bought stocks lower down, and were taking their profits. The bear party sought to take advantage of this condition to make a turn on the short side. With this end in view, they made a well-directed attack upon the Steel shares, which was successful in forcing considerable liquidation and carrying these securities back pretty near to their low records. Later in the week the bear speculations were extended to the Pennsylvania group of stocks, but here the raid met with no success. Very little real stock was brought out, and on Monday a sharp rally set in which not only affected the stocks most under pressure, but carried back many of the active trading favorites to the high figures in the movement. The outside public has hitherto taken no part in the operations for a rise. Nor are there any indications either in the bond market or the stock market of the customary purchases by investors anticipating the first-of-the-year interest and dividends. The course of prices has been entirely governed by the cross currents of professional speculation, and opinion as to the immediate future is extremely undecided. The indications of returning ease in the money market which have been pointed out in the article above, are, perhaps, the most forceful reason for higher prices at this time. Then again the earnings of the railroads, especially in the West, are showing up much better than has been all along expected. Wherever a decrease in gross earnings has occurred, expenses have been reduced accordingly, and as many of the plans for extraordinary improvements on the various properties have either been suspended or abandoned altogether, net earnings are able to make a very favorable comparison with a year ago. Meanwhile, fears of a coming business depression count for much less than they did a month ago. One reason is that the record of the country's bank clearings, which, both by sections and as a whole, are well above last year's totals, continues to refute the idea that any serious reaction in trade is in progress. Another reason is that the iron and steel industry, which has fallen off more than any other branch of commercial activity during the last nine months, is now giving pretty plain evidence to careful observers of having turned the corner. These causes at the moment seem to be more powerful than any that favor the advocates of lower prices.

The local traction stocks continued to engross attention up to the close of last week. The sensational rise in Brooklyn Rapid Transit was the cause of much conjecture as to the reasons why such enormous purchases of the stock should be going on at this time. Obviously, there was no such improvement in the earnings of the property as to justify so violent an advance. The theory most favored in speculative circles was that of competitive buying by certain large financial interests having some ultimate undisclosed purpose in finding representation in the management. With the reaction in the stock during the last few days a saner view is taken of the matter, and it is now seen how easily the rise can be explained by the technical condition of a limited market supply, and skilful manipulation in the interest of a powerful pool. Manhattan and the Metropolitan stocks advanced rapidly for a time, while the speculation in the Brooklyn specialty was at its height. But they, too, have recoiled sharply during the more recent dealings, and interest is now shifted to other quarters of the market.

Philadelphia

Trading has not been particularly active during the week in Philadelphia, but the leading stocks have managed to hold their own. American Railways went as high as 44, and then dropped back to 43. Philadelphia Traction sold up a half point to 96. Philadelphia Electric rose 3-16 to 6 5-16, then eased off to 6 3-16. Philadelphia Company common ranged between 37⅛ and 38¾, and was notably strong. The preferred was unchanged at 43. Union Traction, with the dividend on, sold as high as 46⅛; later selling ex-dividend, the price dropped to 45⅜, but rallied to 45¾. Rapid Transit was weak at a decline from 11 to 10¾ on sales by speculative holders who disliked the proposed call for another assessment. It was given out that the proceeds of this call, which was issued some time before it was expected, are needed to carry on the underground tunnel building, which will be pushed vigorously during the winter. The advance in Consolidated Traction of New Jersey continued, the stock rising from 64½ to 65. Scattered sales were reported in Chicago Union Traction, from 7 to 7⅜, and in Thirteenth and Fifteenth Street Passenger, at 305.

Chicago

Whatever speculation there has been during the week on the Chicago Exchange has centered in the Lake Street Elevated shares. The stock, which last week sold as low as 1¾, advanced to 2⅝ on rather heavy trading, and then relapsed to 1⅞. Lake Street receipts—which mean the certificates issued to holders depositing their stock under the reorganization plan—sold as high as 2⅜, and then eased off to 2¼. The reason for this demonstration is the belief that enough of the securities have been deposited with the committee to insure the success of the reorganization. According to reliable information, about 64 per cent of the stock and about 75 per cent of the income bonds have been already deposited. Only $945,000 of the first mortgage bonds have been turned in, but, with what are owned by the Lake Street Company and allied interests, there would be $4,500,000 of these securities, or 97 per cent of the total issue, favorable to the reorganization project. On the excellent earnings, both present and prospective, Northwestern Elevated common moved up from 15 to 16, with sales of 600 shares. South Side sold at 94 and 95; Metropolitan common, from 17¾ to 17, and the preferred, at 54. Union Traction common was bid up to 7 in sympathy with a speculative movement in the stock originating in New York, but later the price fell back to 6

Other Traction Securities

The dealings in the Boston tractions have amounted to scarcely anything worth recording during the week. Massachusetts Electric common, which a week ago sold as high as 21⅞, declined on light transactions to 19. The preferred selling ex-dividend dropped from 77⅞ to 76, but the sales at the lower figure were too small to be of consequence. Boston Elevated changed hands between 140 and 140¾; West End common lost a half point, 90 to 89½, and the preferred sold at 110. The Baltimore list was also exceedingly

dull. A few sales of United Railway stock have occurred around 9 and 8⅞, the prevailing figures of the last few weeks. The income bonds, after going as high as 57⅞, reacted to 56⅞. The general 4s fluctuated between 92 and 91⅜. Transactions were recorded in Atlanta Street Railway 5s at 106, Baltimore Traction convertible 5s at 100⅝, City and Suburban of Baltimore 5s at 112, and Norfolk Street Railway 5s at 108. All the securities of the New York and Brooklyn traction companies have been active and strong in the local curb dealings, in sympathy with the traction movement on the Stock Exchange. Brooklyn Rapid Transit 4s, which for a long time past have been selling around 76¾, rose to 79. Nassau Electric 4s sold at 79¾ and 79, and a thousand shares of Brooklyn City Railroad changed hands on an ascending scale between 232½ and 238. Interborough Rapid Transit was also strong at an advance from 92½ to 95⅛ on sales of 800 shares. It may also be noted that the bonds of Kings County Elevated and the Brooklyn Union Elevated were unusually active in the trading on the Stock Exchange. Other curb sales for the week included St. Louis Transit at 13½, Washington Traction 4s at 71¼, New Orleans common at 10¼ to 11, the preferred at 30¾, and the 4½ per cent bonds at 80¼, American Light and Traction common at 36, and Chesapeake Traction 5s, from 94 to 86.

Detroit United featured at Cincinnati, about 300 shares selling from 69 to 70, an advance of two points over the best of last week. Toledo Railways & Light advanced to 26 on small sales, and Cincinnati Street Railway advanced to 133. Cincinnati, Newport & Covington preferred brought 82½ and 83 for small lots; also an advance over last week. A block of Cincinnati, Lawrenceburg & Aurora 5s sold at 105.

Columbus Railway & Light common is enjoying remarkable activity at Columbus. Probably 4000 shares changed hands during the past week. On Monday the stock was offered at 29, and it advanced steadily during the week, and sold as high as 35. There have been numerous rumors of consolidation with the interurban companies, which, together with the fact that the road is showing earnings and is likely to declare a dividend on the common, accounts for the demand. Columbus, Delaware & Marion preferred has been attracting attention at around 90.

Tractions were very quiet in Cleveland. Northern Ohio Traction advanced to 13½, and on Monday 14 was offered. Detroit United holders are asking 75 with no sales. Toledo Railways & Light advanced to 25½. Cleveland Electric was quiet, and a small lot sold at 70. Monday it sagged to 69½ for a small lot. Northern Texas Traction sold at 32, an advance over previous sales. Syracuse Rapid Transit sold at 75½ for a small lot. The quarterly dividend of 1 per cent has been declared for this stock.

Security Quotations

The following table shows the present bid quotations for the leading traction stock, and the active bonds, as compared with last week:

	Closing Bid Dec. 8	Dec. 15
American Railways	42	42½
Aurora, Elgin & Chicago (preferred)	a57½	a55
Boston Elevated	140	140
Brooklyn Rapid Transit	46⅞	49⅝
Chicago City	160	*159¾
Chicago Union Traction (common)	5½	5¾
Chicago Union Traction (preferred)	28	25
Cleveland Electric	68	67
Consolidated Traction of New Jersey	63½	64
Consolidated Traction of New Jersey 5s	105½	105
Detroit United	69	69⅛
Elgin, Aurora & Southern	,—	a38½
Lake Shore Electric	—	—
Lake Street Elevated	1½	2
Manhattan Railway	141¼	*141
Massachusetts Electric Cos. (common)	20	18½
Massachusetts Electric Cos. (preferred)	75	76
Metropolitan Elevated, Chicago (common)	17	16
Metropolitan Elevated, Chicago (preferred)	51	51
Metropolitan Street	120½	121¼
New Orleans Railways (common)	10½	9
New Orleans Railways (preferred)	30¼	30¾
North American	75	75
Northern Ohio Traction & Light	12⅝	12¼
Philadelphia Rapid Transit	11	10½
Philadelphia Traction	95½	96
St. Louis Transit (common)	13	13
South Side Elevated (Chicago)	93¼	93½
Third Avenue	115	115
Twin City, Minneapolis (common)	94	92
Union Traction (Philadelphia)	45⅝	*45½
United Railways, St. Louis (preferred)	59	59

a Asked.

Iron and Steel

The thing that has excited more interest than anything else in the iron trade of the week was the publication of the usual monthly blast-furnace statistics by the "Iron Age." From these it appears that the pig iron output was 251,181 tons on Dec. 1, as against 282,219 tons per week on Nov. 1. Yet, despite this considerable restriction of the product, there was an increase during the month of 61,000 tons in stocks on hand. The meaning of this, of course, is that at the beginning of the current month, after all the extraordinary efforts made to check production, production was considerably ahead of consumption. But this unfavorable situation has undoubtedly been relieved a great deal during the past fortnight, which has witnessed a much more active buying demand and some advance in prices. The suggestion is now made by competent authorities that purchases are apt to be larger on a rising market than they were on a falling market, the theory being that the consuming interests in their endeavor to catch the bottom will find that they have waited too long. Quotations are as follows: Bessemer pig iron $14.85, Bessemer steel $23, steel rails $28.

Metals

Quotations for the leading metals are as follows: Copper 12½ cents, tin 26⅞ cents, lead 4⅛ cents, and spelter 4½ cents.

NEW DEVELOPMENT COMPANY IN NEW YORK

The Traction Development & Securities Company has just been organized and incorporated, with offices at 74 Broadway, New York, to undertake the financial and engineering development of electric or steam railways, electric or gas lighting plants, and water works or water powers. The directors and officers include a number of men who are favorably known and have successfully carried out important enterprises.

The company will form or aid in the formation of syndicates for developing properties, underwriting securities, promoting consolidations and examining properties. It will acquire and develop properties as principal or agent, put them on a paying basis, organize subsidiary companies to own and manage them, and own or dispose of the securities therefor. It is prepared to act as adviser or agent in the organization or reorganization of companies, negotiate capital, furnish expert opinions, determine values of investments, obtain concessions, franchises, contracts or other privileges. To carry on this work the company has organized a competent staff, including experts in financial, engineering and legal affairs, with the view of having their reports accepted by banking houses, investors, and others whom it may be desirable to interest or influence. The projectors consequently claim that they should not be confounded with ordinary promoters as they have a competent staff of engineers and managers who have made a specialty of such properties.

The company recognizes the mistakes made by many promoters of such properties who usually offer the prospective investor a host of glittering generalities but lack the detailed knowledge to carry out their projects successfully. The Traction Development & Securities Company has entered the field well equipped to handle such matters in a thoroughly practical manner, thus ensuring the best results both to promoters and capitalists. The company has already been retained to examine several properties, and has arranged for the consolidation of competing railway lines upon a satisfactory basis, so that a better service is insured the community and dividends are assured to stockholders where formerly there was discontent among patrons and constant loss among stockholders.

VOTE AGAINST STRIKE IN PITTSBURG

The vote of the employees of the Pittsburg Railways Company to express their sentiments on the question of the advisability of ordering a strike if the conference with President Callery of the company failed, has resulted in a decision to accept several minor concessions of the company.

MR. WESTINGHOUSE ON THE THIRD RAIL VS. THE TROLLEY

George Westinghouse contributes an interesting discussion on the third rail vs. the trolley in the New York "Evening Post" for Dec. 15. Mr. Westinghouse's letter follows:

"Replying to your letter of Dec. 12, concerning the third-rail question, I think the following points will be generally admitted:

"(1.) That the operation of the elevated trains by electricity has been an undoubted success, and an enormous advantage to the traveling public, notwithstanding the fact that the continuous third rail has been employed to supply the current.

"(2.) That the deaths and injuries to passengers and employees, considering the number of people involved, compare most favorably with any other railway operation in the world.

"(3.) That if a third rail, charged with an immense power of electricity, and located upon the surface near the other rails, is to be used for the supply of electricity to the trains, then there will always be a source of danger to those who have occasion to come near such third rail, and, in addition, there will always be a great source of danger, due to the fact that a car may be derailed, or that some iron material may become detached and make a short-circuit between such third rail and the train.

"(4.) That this third-rail danger may be lessened by the subdivision of the third rail into sections, with provision for the automatic supply of the required amount of current to each section only as required, but that such arrangement will only minimize the third-rail danger.

"(5). That such third-rail danger may be entirely obviated by resorting to the use of overhead conductors, for which the elevated structure is peculiarly suited.

"(6.) That there never was a good reason why the overhead wire should not have been used.

"In support of these last two propositions it may be stated that the third rail is impossible for use on main railways at important junctions and terminals; that the Pennsylvania Railroad does not propose to use the third rail in its underground work between New Jersey and Long Island; that the overhead wire was used at the Zossen experiments in Germany, when a speed of 120 m. p. h. was obtained; and finally, that the New York Railroad Commissioners have recently declared that they would not permit the use of a third rail on interurban lines crossed many times by highways.

"It may seem to be heresy to advocate the use of the overhead wire, but I venture to predict that there will be a complete revulsion of feeling on this point. When I speak of an overhead wire, I do not mean the slight construction which has prevailed, and the breaking down of which has occasioned trouble, but a substantial engineering arrangement so erected that it would, in fact, not be an offense to the eye. It is obvious that the use of an overhead trolley, with the removal of the third rail, would make impossible the present risks of short-circuits between the car or parts of the car and the third rail; but it would leave other questions yet to be settled; namely, first, the proper application of the electric apparatus to those cars, so that in no event could the passengers be frightened by a short-circuit visible to them, and this means that all of the wiring and electrical apparatus would have to be located beneath the bottom of a fireproof car and with no wires carrying large currents above the floors or near the ends of the cars which might be damaged by accident.

"I am satisfied, from my conferences with railway officials, that they are moving in the right direction and giving this subject the attention it deserves; but it must be borne in mind that it has required experience to demonstrate what is necessary for safety."

A NOVEL STRIKE

One of the most novel strikes on record was inaugurated on Dec. 2, by the order of the Charlotte, N. C., Street Railway Union. The Charlotte Electric Railway, Light & Power Company had seen fit to abandon the use of its electric heaters; and, for this reason, the employees refused to take the cars out of the car house on Wednesday morning, Dec. 2. The management gave the men until 9 o'clock to change their minds, which they refused to do; in consequence, the few cars that were operated were manned by the employees attached to the different departments, the managers and the superintendent. Outside of a greased rail and a few broken windows the company has suffered no inconvenience from the hasty action of the union, and the schedule has been properly maintained since 9 o'clock of the same morning. The officials who so promptly took the situation in hand were M. N. Latta, superintendent of the gas light and fuel department; E. D. Latta, Jr., superintendent of engineering and construction, and F. D. Sampson, superintendent of the electric power and street railway departments.

THE SOUTHERN PACIFIC AND ELECTRICITY

The Southern Pacific Railroad Company is again showing especial activity in the way of planning for the electrical operation of its local and suburban lines on the Oakland side of San Francisco Bay. Allan H. Babcock, who was electrical superintendent of the North Shore Railroad, during the construction of the electric lines from Sausalito to San Rafael and Mill Valley, Cal., has been appointed electrical engineer and attached to the maintenance of way department, under engineer J. H. Wallace. Mr. Babcock was sent East by the North Shore Company to study the best Eastern electric railway practice before constructing the North Shore system, which has been highly successful. It is understood that with his assistance plans and estimates will be prepared for the conversion of the Southern Pacific local steam roads in Oakland, Alameda and Berkeley into a modern electric system. Several years ago the Southern Pacific officials had an engineer of the General Electric Company engaged for some months on the same problem, but the expense and the difficulties of handling the heavy trains prevented a consummation. The recent opening of the local electric line of the San Francisco, Oakland & San Jose Railway Companies to Berkeley, in connection with new ferryboats and the Oakland Transit Company's street railway system, have roused the Southern Pacific Company to activity, and steps will be taken to improve the ferry and local service, so as to make as good time as the new system, which is known as the Key Route. It is probable that a large electric power house will be built.

CLEVELAND TRACTION MATTERS

President Springborn, of the Cleveland Board of Public Service, has submitted a plan to the Cleveland Electric Railway Company for relieving traffic congestion on the Public Square and on the leading downtown streets. Incidentally he proposes to work out the aims of his chief, Tom Johnson, and secure lower fares for the "suffering public."

At present the city cars operate through the Public Square east, west, north and south. The crossing in the center is thought to be the cause of many of the blockades. Mr. Springborn proposes to have tracks laid along all sides of the square and form loops around all four corners, with additional loops on several side streets near the Public Square. He proposes abolishing the through lines which now operate from one end of the city to the other through the square, and make all lines short lines, extending only to the Public Square and returning. Then he proposes that the company reduce its rate of fare to three cents, or ten tickets for a quarter, and abolish transfers, except in the case of the Wilson Avenue crosstown line, and a Union Station belt line which would traverse only the downtown streets. This would obviate the through town lines and oblige a passenger who desired to cross the city to pay another fare. On the basis of the company's own statement that 40 per cent of all passengers now ask for transfers, he figures that the company could eliminate all transfers and be able to reduce its fare 40 per cent.

President Horace Andrews, of the Cleveland Electric Railway, was asked for his views of the scheme by a STREET RAILWAY JOURNAL representative, and that railway official made it obvious in no uncertain terms that the company would never consider such a proposition. He stated that while the loop plan would undoubtedly relieve the congestion, it would cause an immense amount of changing cars in the center of the Public Square and would be a great annoyance to the public. The proposition of ten tickets for a quarter, he said, was out of the question, no matter how many transfers it would save. He said that a considerable portion of the people who ask for transfers only ride a short distance on the second car, and if asked to pay another fare they would walk rather than ride, even on the basis mentioned. No company could live and give so low a fare, he said.

Certain Councilmen recently attempted to force the company to operate its Scranton-Fairfield cars around the Public Square, but the resolution was voted down by the Board of Public Service. In revenge, the disgruntled Councilmen have announced that they will attempt to pass a measure barring all interurban cars from the Public Square.

President Andrews has suggested that much of the congestion might be relieved if the company were permitted to extend the four-track system now on Superior Street as far as Erie Street, thus giving two additional tracks through the Public Square.

PUBLIC HEARINGS IN CHICAGO

The new franchise ordinance of the Chicago City Railway Company has been undergoing the ordeal of a set of public readings in Chicago, at which various individuals and organizations have had opportunity to appear before the Council committee and give their views on the subject. This committee happens to be composed of an unusually well-informed body of Aldermen who have been studying the street railway situation carefully and conscientiously for a number of years. They have listened with remarkable patience to the tirades of those who have nothing to offer but visionary schemes and abuse of the committee and of the companies. However, after listening to many hours of impractical, and at times insulting, talk, it is satisfactory to note that the chairman of this committee announced that nothing more of the kind would be tolerated and that those having their views to present must present them in a businesslike way, must give something besides generalities, and must formulate some definite, practical plans for carrying out their ideas. After reading the reports of several unfruitful sessions before this committee, it is refreshing to see the attitude taken by the Civic Federation of Chicago. The report of the Civic Federation franchise committee presented to the Council committee condemns strongly the municipal ownership idea, on the ground that it is impractical at present, would involve several years of litigation which the city might and might not win, and that important improvements must be made for which the city has not the money, even if it had the street railway lines. The committee recommends the passage of the Chicago City Railway proposed franchise ordinance as now drawn up, with the insertion of a suitable compensation clause, although its views as to the proper compensation are not stated.

Municipal ownership advocates were given another shock last Monday evening, when the Taxpayers' Association of the Tenth Ward, which is supposed to be the very hot-bed of municipal ownership, sent a communication to the Mayor and members of the Council opposing municipal ownership.

CHICAGO UNION TRACTION MATTERS

Judge Grosscup heard the petition of the receivers for making improvements in the Chicago Union Traction System Dec. 10. The attorneys for the company and city both appeared in court at that time to show cause why the court should or should not order the city authorities to issue permits for certain extensive improvements contemplated. The judge announced that his ruling in this case was entirely independent of any recommendations he might make to the receivers. The judge said that his proposal for the changes in the system for bettering the service pending a settlement of all matters with the city was made on the theory that the city would consent. He had now to consider the case in the light of the city objecting, without regard to he receivership, of which he has charge.

Judge Grosscup has asked Justice William R. Day to sit with him in the hearing of the arguments on the ninety-nine year act in January. From the decision of Day and Grosscup the case, it is thought, can be immediately appealed to the Supreme Court of the United States without the intervention of any other courts, and if the case could be brought to a trial before the United States Supreme Court in Washington next October, the company's legal rights would probably be settled inside of a year from now.

UNION BUTTONS CAUSE MORE TROUBLE IN CHICAGO

The wearing of union buttons by the union employees of the Chicago City Railway Company continues to cause serious outbreaks by passengers against non-union employees. The demonstrations against the non-union men are particularly bold in the stock yards district. On Dec. 10 a car on the Halsted Street line had all the glass broken and seats ruined by a mob which drove the motorman and conductor from the car at Halsted Street and Archer Avenue. Traffic was blocked for over an hour while the wrecking crew was at work on the car to clear the line. The trouble occurred owing to the refusal of passengers, among them several women, to pay fare to the conductor, who wore no union button. When the nickels were refused he announced that the car would stop unless the money was paid. At this several of the passengers in the car seized him, while others proceeded to the front platform and ordered the motorman to start the car. At first the motorman refused, but when one of the passengers exhibited a revolver he started the car and did not stop until Archer Avenue was reached. The high-handed practice of the union in refusing to order the men to stop wearing the buttons has been endorsed by the Chicago Federation of Labor, which has actually adopted a resolution ordering trade unionists to refuse to pay fares to conductors who have not the insignia of the street car union.

STORING CARS IN THE OPEN IN CLEVELAND

The Cleveland Electric Railway Company has decided to adopt the plan followed in Detroit of storing cars in yards, after the manner of steam roads, rather than in car houses. The recent fire, in which the company lost about seventy-five of its best cars, caused the company to investigate the plan and it has now been decided to adopt this method. At the present time the company is storing about 150 cars outdoors. The company will not rebuild its car house on Pearl Street, but will clear away the ruins and utilize the tracks for outdoor storage. In favor of this plan, it is claimed that there is less danger of loss from fire and that where cars are kept painted properly the damage from exposure to the weather is not serious. The present large car houses will be utilized largely for cars which are out of season.

THE RIGHT TO ASSESS INTERURBAN LINES IN IOWA

The right of the Executive Council of Iowa to assess interurban railway companies for taxation purposes is to be questioned by the Cedar Rapids & Marion City Railway Company, which operates between and within the cities of Cedar Rapids and Marion. The company's officials have asked for the issuance of a writ of certiorari requiring the members of the Executive Council of the State, the said council being composed of the Governor, Secretary, Auditor and Treasurer of State, the members of the Board of Supervisors and the County Auditor of Linn County, to certify their records to the district court of Linn County for review. The Executive Council, through the Attorney General of the State, opposed the issuance of the writ on the ground that the Executive Council represents the executive powers of the State and is not subject to review by the district courts, and also that the acts complained of were legal. Judge Thompson ordered the writ issued as prayed and the Attorney General appealed. The Supreme Court will take up the case at the January session, 1904.

At the session of the Executive Council in July, 1903, as an assessment board, the property of the Cedar Rapids & Marion City Railway Company was assessed for taxation purposes for the first time under the law passed by the Twenty-ninth General Assembly of Iowa in 1902, providing for the assessment of all interurban railways by the Executive Council. Heretofore the company had been assessed locally. The Council found the length of the track of the company to be 12.06 miles, fixed the actual value thereof at $14,024 per mile, and the assessed value thereof at $3,731 per mile. Section 3 of the act authorizing the assessment of interurban railways to be made by the Executive Council reads as follows:

"Any interurban railway shall, within the corporate limits of any city or town, or of any city acting under a special charter, upon such streets as it shall use for transporting passengers, mail, baggage and such parcels, packages, and freight as it may carry in its passenger or combination baggage cars only, be deemed a street railway and be governed by the laws affecting street railways."

The officials of the railway company take the position that their company is a street railway company, as all but about three-quarters of a mile of the total mileage of the line is within the corporate limits of Cedar Rapids, Kenwood Park and Marion; that the company should be assessed for taxation purposes under Section 1343 of the Code of Iowa, which provides for the assessment of street railways by the local authorities. The question at issue arises out of the interpretation to be placed on Section 3 as above given. The Executive Council contends that the above section was put in the act for the sole purpose of exempting the interurban companies from assessment of damages by abutting property owners, so long as they conform to its requirements in regard to transporting baggage and freight, and that is does not apply to assessment of interurban railways at all. On the other hand, the officials of the company claim that the section means not only that interurban companies in city limits should be called street railways, and governed by the laws exempting such companies from assessments of damages by abutting property owners, but also by the laws governing the assessment of street railways.

The case is an important one and its final result is awaited with much interest. If the Supreme Court sustains the issuances of the writ by the district court, the case will then come up for trial at once. If not, the company will seek some other way of bringing the case to an issue. This section will no doubt be amended at the next session of the Legislature which convenes in January in a way which will leave no doubt as to its meaning.

ENGINEERING PUBLICATIONS

The first number of Engineering Book Notes, containing a list of 400 engineering books published since Jan. 1, 1903, with a few issued late in the year 1902, is now being distributed by the McGraw Publishing Company. It is announced that this will be a monthly publication, and that it will deal very largely with engineering books which have appeared during the previous month. Subsequent issues will include also the books of a single month and will be supplemented by extended mention of important new books. It is also announced that in the next issue an index to electrical and engineering literature will be presented. The present number contains some interesting information regarding new books on engineering topics and other works now in course of preparation. The first number contains 32 pages and is a very valuable list of recent publications in this line.

A "Classified Catalogue of Engineering Books" is issued by the same company, covering the standard works in every line of modern engineering, and containing 96 pages. It is a very complete list, and contains a summary of the contents.

JOURNAL OF WESTINGHOUSE SHOP EMPLOYEES

"The Electric Club Journal" will be the title of a publication to be issued by the Electric Club, of Pittsburg, made up principally of the officers and employees of the Westinghouse Electric & Manufacturing Company. The first number of this journal will be issued on Feb. 1, 1904, and it is proposed to have it appear monthly thereafter. In addition to its engineering work, the club affords an opportunity for the social entertainment of its members through a series of dancing parties, whist and chess clubs and musical entertainments, as well as athletic exhibitions. The purpose of the club is primarily to supplement in a general way the shop practice of the members in much the same manner that laboratory or shop practice in colleges is relied upon to round out the course of textbook classes and the lecture room. The chiefs of departments in Westinghouse works will favor the club with lectures and informal discussions of practical subjects at frequent intervals, and it is now proposed to embody a record of these transactions in the "Electric Club Journal."

STORAGE AIR BRAKES FOR ST. LOUIS

In a short item published in our last issue an error was made in stating that the order for storage air-brakes placed recently by the St. Louis Transit Company was awarded to the National Electric Company. This order is probably the largest single order which has ever been given for air-brakes by a street railway company, and calls for 1500 storage air-brake equipments and forty station storage air-compressor outfits. The order for the equipments is being filled by the Westinghouse Traction Brake Company, while the Ingersoll-Sergeant Drill Company is filling the orders for the air-compressors. The St. Louis Transit Company placed this order largely in view of the coming enormous traffic which is expected during the summer of 1904 on account of the St. Louis Exposition. The St. Louis Company has also ordered from the Westinghouse Electric & Manufacturing Company 450 car equipments, each consisting of four No. 95 Westinghouse motors. This is a new type of motor being manufactured at East Pittsburg, and is designed for oil lubrication throughout, in place of grease.

MITIGATING THIRD RAIL DANGERS IN NEW YORK

Replying to the report of the State Board of Railroad Commissioners that the third rail on the Manhattan Elevated should be protected so that passengers and employees will be safe-guarded against accidentally coming in contact with it, E. P. Bryan, president of the Interborough Rapid Transit Commission, writes to the State Board that the company is trying to devise a plan for protecting the third rail, but that it is impossible to do anything this winter. Mr. Bryan says in his letter:

"We have plans that are now being carefully considered. I beg to advise that we have not at present anything with which we are sufficiently satisfied to submit to you. We have installed additional telephone stations, so that now every station on our line, on both sides, is being connected independently with the power station and the sub-station, and we have written Commissioner Sturgis that we can guarantee that the interval between notice from the fire department of their desire to use the structure and the time of shutting off the current will be very brief, indeed, which will be much better than any protection to the third rail. Of course, whenever the fire department comes upon the structure and places the hose across, it immediately stops traffic, and the current should be shut off, and this can be done."

BIDS FOR THE PENNSYLVANIA RAILROAD TUNNEL

Bids for the construction of the Pennsylvania Railroad's fifty-million-dollar tunnel connecting New Jersey with Long Island by way of Manhattan Island were opened on Tuesday, Nov. 15, at the company's offices in New York, in the presence of the chief operating officials and engineers, and it was announced by the officials that a cursory examination showed them to be within the company's estimate. The principal bidders were:

O'Rourke Construction Company, of New York, which put in a bid only for the land portions of the tunnel, including the work under the Borough of Manhattan, together with the great depot and the work in New Jersey and Long Island.

John B. McDonald, who bid for the whole job.

Andrew Onderdonk, who bid only for the sections under the North and East Rivers.

A Philadelphia company, which bid through a dummy for the whole job, without disclosing the names of the principals.

A Chicago syndicate, which also bid through a dummy for all the work.

New York Contracting & Construction Company, which bid for the land work only.

Mr. Pearson, an English contractor, who is said to have bid for the river sections of this job.

Charles Sooysmith and an undisclosed partner, the details of whose bid could not be learned.

United Engineering & Contracting Company, which bid for the land sections.

John Peirce Company, the terms of whose bid were not disclosed.

NEW BOND ISSUE OF THE TWIN CITY RAPID TRANSIT COMPANY

The Minneapolis Street Railway and the St. Paul City Railway, both controlled by the Twin City Rapid Transit Company, of Minneapolis, Minn., have jointly made an issue of 5 per cent consolidated mortgage gold bonds, due in 1928, authorized issue limited to $10,000,000. These bonds are secured by direct mortgage lien, subject to existing bonds, on all the properties of the two companies, whether now owned or hereafter acquired, including the entire street railway systems of St. Paul and Minneapolis, with their power houses, equipment, real estate, etc. The present issue will be only $3,500,000. It will reimburse the Twin City Rapid Transit Company in part for expenditures made in providing important additions and facilities required by the growing traffic, including the cost of erecting a large new steam electric power plant; new motor cars of the largest size for street railway service; new track construction, and other revenue-producing development work, for which the company has been compelled to make provision in order to meet the demands of the steadily growing traffic.

The mortgage is intended to provide for the present needs and the future growth of the Twin City Rapid Transit system. The apportionment of the bonds follows: Reserved, to retire the going general mortgage bonds of the Minneapolis and St. Paul Companies, due in 1911, $1,000,000; issuable to pay for new power house, equipment, track construction, new extensions, etc.; issuable only for future expenditures, etc., at 90 per cent of actual cost, $5,500,000.

NEW PUBLICATIONS

Calendar of Invention and Discovery. By John C. Wait. Published by McGraw Publishing Company. Cloth, $1.00; Wall Calendar, 60 cents.

The compiler of this calendar is well known in railway circles, having been associate editor of the "Railroad Gazette" for a number of years, and as having charge of the 1895 edition of the "Car Builder's Dictionary." He is also the author of "Engineering and Architectural Jurisprudence," and is a prominent attorney in New York City. Mr. Wait deserves the thanks of the entire engineering fraternity for his present work, which has been compiled with a great deal of care. For each day he has found a number of events of engineering interest. He has also given for each day short biographical notes concerning two prominent inventors or engineers, and has followed these sketches with one or more appropriate quotations from classical writings. Opposite nearly every calendar page, in the cloth edition, a page is left blank for notes. In addition a number of illustrations of

engineering interest is included. Indices are published of persons mentioned, inventions, quotations and illustrations.

Poor's Manual of Railroads for 1903; 1720 pages. Price, $10.

Published by H. V. & H. W. Poor, New York.

This is the thirty-sixth annual number of this well-known manual, and contains statistics in most cases for the fiscal year ending either June 30 or Dec. 31, 1902. The volume is considerably larger than in previous years and the statistics more complete than ever before.

STREET RAILWAY PATENTS

[This department is conducted by W. A. Rosenbaum, patent attorney, Room No. 1203-7 Nassau-Beekman Building, New York.]

UNITED STATES PATENTS ISSUED DECEMBER 8, 1903

746,160. Trolley Guard and Finder; William F. Reichenbach, Rochester, N. Y. App. filed June 13, 1903. Flaring arms project from the fork and have elongated, inclined rollers to receive the wire in case it becomes displaced and return it to the wheel.

746,170. Switch Operating Mechanism; Theodore Rundorff, Burlington, Ia. App. filed Sept. 26, 1903. Comprises a pivoted member journaled upon the platform of a car, a detachable end portion of the member projecting above the platform, a projection carried by the member and arranged in the path of a portion of the switch to be operated upon.

746,172. Brake-Shoe and Process of Making Same; William Durham Sargent, New York, N. Y. App. filed June 26, 1902. Consists of forming a shoe with recesses extending from the back toward the face, whereby when the shoe is worn back to a point beyond said recesses a new wearing sole may be cast thereon.

746,340. Underframing for Railway Cars; George I. King and John H. Frank, Middletown, Pa. App. filed Sept. 19, 1903. Details of construction of the main framework of a car.

746,351. Trolley; Frank A. Merrick, Johnstown, Pa. App. filed March 12, 1902. Strap springs carried by the wheel pass through holes in the hub and rub against the fixed axle to give good contact.

746,357. Fender for Street Vehicles; Emilie Munte, Langenfelde, Germany. App. filed March 17, 1903. A roller of soft elastic material projects from the front of the car and is continuously rotated in a direction opposite to the direction of movement of the car.

746,395. Underrunning Trolley for Electric Railways; Charles A. Singer, Larchmont, N. Y. App. filed Feb. 7, 1902. The fork carries two trolley wheels, either of which can be thrown into service at will.

746,417. Apparatus for Use in Electric Traction on the Conduit System; Edouard Vedovelle, Paris, France. App. filed April 7, 1899. Relates more particularly to the construction of a conduit and to the protecting and covering of the conductor therein.

746,424. Trolley Pole; Thomas F. Wetton, Newark, Ohio. App. filed Aug. 29, 1903. Details.

746,436. Hanger for Trolley Wires; Juan Antiga, Mexico, Mex. App. filed July 1, 1903. The hanger is made up of two hinged parts to which the ends of the wire are attached; when the wire breaks, the corresponding part tilts to operate a circuit controller which renders the fallen wire dead.

746,437. Hanger for Trolley Wires; Juan Antiga, Mexico, Mex. App, filed July 1, 1903. A modification of the preceding invention.

746,512. Electric Railway; Robert Hubner, New York, N. Y. App. filed Dec. 19, 1902. A third-rail covering-plate built in sections which are lifted successively by a plow in advance of the collector.

746,556. Cover for Third Rails; Harry C. Morgan, Lagrange, Ill. App. filed May 9, 1903. A two-part box hinged to a suitable support and adapted to be swung open by the action of a plow carried by the car.

746,610. Generator or Motor Suspension; Montgomery Waddell and Henry K. Brooks, New York, N. Y. App. filed Feb. 24, 1903. Details.

746,614. Trolley Pole; Edwin A. Wakefield and George W. Morse, Mechanic Falls, Maine. App. filed July 8, 1903. A device preventing the pole from flying upward when the wheel leaves the wire.

746,644. Railway Switch; James P. Pulsifer, Philadelphia, Pa. App. filed May 23, 1903. A wheel provided with radial teeth on its periphery is set in the roadbed, and when reciprocated by a lever from a passing car, moves the switch point to which it is connected.

PERSONAL MENTION

MR. PAUL DOHRMAN, formerly division superintendent on the Detroit United Railway, has been appointed assistant general superintendent under Mr. Harry Bullen, who was recently made general superintendent.

MR. F. A. BOUTELLE, formerly superintendent of the Hudson Valley Railway, of Glens Falls, N. Y., has been appointed superintendent of transportation of the Columbus, Buckeye Lake & Newark Traction Company's system, with headquarters in Newark.

MR. ROBERT J. MERCUR has been promoted from the position of manager of the Hamilton branch of the Canadian Iron & Foundry Company to the position of manager of sales on the executive board at Montreal, the head office of the company. Mr. A. E. Domville succeeds Mr. Mercur as manager of the Hamilton branch.

MR. EDWARD O'HARA has been appointed superintendent of the Lorain Street Railway, of Lorain, Ohio, succeeding Mr. T. G. Cherry, who has gone with the Saginaw Valley Traction Company, of Saginaw, Mich. Mr. O'Hara formerly was with the Muskegon Traction & Lighting Company, of Muskegon, Mich., where he started as a motorman. He became despatcher on the Lorain Street Railway in 1895.

MR. A. H. BABCOCK has resigned his position as electrical engineer of the North Shore Railroad Company, of San Francisco, and has been appointed electrical engineer for the Southern Pacific Company. In his new position Mr. Babcock will have charge of all the electrical work of the company, which will include repairs and maintenance of existing apparatus, with the engineering and design of new work. He is attached to the maintenance of way department, with headquarters in San Francisco.

MR. F. L. WANKLYN has resigned as vice-president and general manager of the Montreal Street Railway, and the Montreal Park & Island Railway, of Montreal, Que. It is said that he will become vice-president of the Dominion Coal Company and that he will also be vice-president of the Mexican Light & Power Company. It is said, unofficially, that Mr. R. W. Blackwell will be elected as his successor with the Montreal companies and that Mr. W. S. Ross will become managing director of the company. Another announcement of a change in the personnel of the companies is the appointment of Mr. P. Dube as secretary.

MR. SAMUEL J. DILL, superintendent of the Detroit, Ypsilanti, Ann Arbor & Jackson Railway for the past two years, has accepted a position as superintendent in charge of the Michigan Traction Company's property in Michigan, which consists of the city lines in Kalamazoo and Battle Creek and the interurban line between these cities. His headquarters will be in Kalamazoo. Mr. Dill, during his service in his present office, by his tact, industry and faithfulness, made many friends for his line and himself. He was formerly connected with the train service of the New York, New Haven & Hartford Railroad and later with the operating department of the Metropolitan Street Railway, of New York City.

MR. EDWARD E. GATES, claims attorney of the United Railroads, of San Francisco, and one of the foremost men in that line in the country, severed a very successful career with the United Railroads on Dec. 1, 1903, to engage in the general practice of law, which he believes offers greater advantages than his present position. Mr. Gates was born in 1871, and is now nearly thirty-three years of age. He graduated from Yale in 1891, studied law at the New York Law School, New York City, and took a degree of L.L.B. from the Indianapolis Law School, of Indianapolis, Ind. After practicing law for about six years in that city he abandoned his law business in 1900 to assume the duties of assistant claims attorney of the Southern Pacific Company, resigning his position to accept that of claims attorney of the United Railroads of San Francisco in March, 1902, at the time that company was organized. Mr. Gates is a director in the Union League Club, of San Francisco, and served with the 27th Light Battery, Indiana Volunteers, in the Spanish-American War.



E. E. GATES

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Street railway news, and all information regarding changes of officers, new equipments, extensions, financial changes and new enterprises will be greatly appreciated for use in these columns.

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Kicking up of Track Switches

The kicking up of track switches, resulting in the throwing of the switch point by the passage of a car wheel, has not been complained of much in this country. Some statistics, recently compiled in Great Britain, seem to indicate that this trouble has been noticed more in England than in the United States. That there are such troubles in the United States is conclusively shown by the fact that a certain large interurban company has had so many troubles from derailments on city tracks, due to the throwing of the switch point by the passage of the forward trucks, that its rules now require the conductors of all its interurban cars to watch the switch point while the car is taking facing point switches in cities. The trouble has been that the passage of the front trucks over the heel of the switch caused the switch to kick up at the point, and in coming down it was likely to leave the switch point so that it would send the rear trucks of the car on a different track from the front trucks. The rules of that road now require the conductor to watch the switch point, and the motorman is not allowed to proceed after the front trucks have passed the switch point until he receives the conductor's go-ahead signal. The conductors are even provided with short switch hooks for righting switch points which are thrown by the passage of the front trucks. It may be argued that this kicking up can only occur when the switch is unduly worn, but it hardly stands to reason that a large, well operated company would tolerate such delay as the observance of the foregoing rule necessitates where it is simply a question of renewing a few switch points to overcome the difficulty. This matter is one which is worth the attention of track men, as it is likely to come up more frequently as more interurban cars are operated over facing-point switches in city tracks. There are many places where a switch normally set for the route of greatest traffic and operated by a lever sunk in the pavement, is the surest and most satisfactory solution of the difficulty.

Shop Design

As we pointed out recently, in connection with a description of the St. Louis Transit Company's shops, some of the best shops in the country vary as radically in design as is possible for two installations to differ which are intended to accomplish similar results. Any shrewd master mechanic can see in the shops recently designed certain strong points and certain weak ones. The decision of the executive committee of the American Railway, Mechanical and Electrical Association to have brought together for the next convention a number of plans for a comparative study of a number of the most recent shops, so that the strong and weak points of each can be brought out in discussion, will be of great benefit to companies which are to build shops within the next few years. Such a plan cannot but result in establishing certain lines along which future work is to be conducted.

There are certain preliminaries which should first be determined. Before the design of any shop can be properly started, the best general scheme of motor maintenance must be fully decided upon. If all of the renewal of wearing parts and maintenance of equipment is to be performed at the central repair shop, it must be provided with a large number of tracks and facilities for handling material at a large number of points at once. If, on the other hand, most of the motor and truck maintenance is to be done in car houses, and the main shops are simply for the purpose of supplying renewal parts, their location with respect to repair tracks is not so important. This subject is also to be taken up at the next convention, although separately from shop design. If any considerable number of cars are to have wheels, armatures and motor bearings renewed at a car house on the same piece of property as the repair shop, it is certainly desirable to have easy access between the repair tracks and the repair shop, even if they are not actually in the same building.

As between the general policy of making all renewals at one central shop and making the renewals at various car houses, there are mainly three things to be considered. First, is it easier to take the cars to one central repair shop than to take the repair parts to the cars at various car houses? Second, can facilities for handling cars be provided at the central repair shop which are enough more economical in operation than those which can be provided at the car houses to justify bringing the cars to the central repair shop? Third, how much is to be gained by centralized management?

A master mechanic can come more directly in touch with the repair work of the entire system if it is all under one roof than if scattered in various car houses. Very often it is not possible to provide as good facilities in the way of car hoists,

pits and motor lifts in the various existing car houses as can be provided at a new central car shop. However, if the question is to be considered broadly, we should assume that first-class facilities for handling and hoisting motors, trucks and car bodies would be provided in any event, whether this handling is done at a car house or at a main repair shop. If a traveling crane is to be depended upon for all the heavy lifting, it will usually be too expensive a luxury to install at every car house, but if mechanical or hydraulic jacks are used for hoisting car bodies, together with cranes or travelers for handling motors and armatures, the cost of installing these is not necessarily greater per unit of repair track in a car house than in a central repair shop. A traveling crane does very well where but a comparatively small number of cars are to be worked upon at once. Where there are too many repair tracks to be served with one traveling crane, either more such cranes must be put in or other means of hoisting resorted to, but these other means are not necessarily inferior to the traveling crane. Assuming good hoisting facilities at the scattered car houses, it seems to settle down to a question of transporting cars vs. transporting repair parts, and centralized supervision by a few shop foremen vs. supervision through various car-house repair foremen.

Chicago Union Loop Litigation

The senseless opposition which has been aroused to the extension of the Union Elevated Loop platform, in Chicago, has been spoken of before in these columns. The result of this opposition to a much-needed public improvement has resulted in a tangle of litigation, which, to an unprejudiced observer, looks like either an attempt on the part of a few merchants to drag the city into the contest for their own selfish ends, or, what is equally reprehensible, an attempt on the part of a recently-elected corporation counsel to make a record for himself as a "champion of the down-trodden public" by persecution, or, perhaps, a little of both, of public service corporations. What a tremendous defeat said down-trodden public would administer to said corporation counsel, at the next election, if the public once realized that the corporation counsel in blocking these improvements is responsible for the discomfort, crowding and delay of traffic, which is suffered daily on the Union Elevated loop? The City Commissioner of Public Works some time ago issued permits to the company owning the Union loop to extend its platforms so that two trains could load at a platform at once, as recommended in the Arnold report; something which, apparently, the Commissioner of Public Works has full power to do. After the permits had been issued and the improvements were well under way, the present Corporation Counsel, who assumed office after the permits were issued, and who was apparently looking around to see what trouble he might make, volunteered the opinion that the Commissioner could not legally issue such permits, and the work was stopped. Now, several small property owners and tenants around the loop are trying to prevent the company from securing an injunction against interference with the work of extension. The city has now begun to club the company for the benefit of the said tenants by beginning a suit, contesting the validity of the ordinance under which the loop was built. It appears that those behind this persecution game have overstepped themselves, however, as the Mayor has been receiving letters from large property owners, protesting against the action of the city in attacking vested rights, and other large property owners on the loop are threatening to make trouble about the use of their names, without permission, on the petition before the court, asking the ordinance to be declared invalid. The Corporation Counsel seeing the questionable legal position he has placed the city in by filing a suit with ulterior motives, is now trying to make out that there is no connection between the tenants' obstructive fight against platform extension and the suit to test the validity of the ordinance, but the connection is too apparent to everyone to make these efforts more than ridiculous. This whole affair will probably result in nothing more than a continuance of a certain amount of public discomfort a little while longer.

The Properties of Single-Phase Motors

Mr. Lamme's interesting paper, published in this issue, gives a very good running comment on the practical properties of the rather novel class of alternating motors now being introduced for traction purposes. It is not easy to realize at first thought that such motors are really at the commercial stage of development, but Mr. Lamme speaks in no uncertain tone, and he is in a position to know. Broadly, the motors in question have the general characteristics of series-wound direct-current motors. They appear, in particular, to have excellent starting torque, as might fairly be expected, and when at speed and load have very high power factors, as high, in fact, as any class of alternating-current devices. In starting, the power factor is low, very much lower in fact than in polyphase induction motors, but the start is, nevertheless, accomplished with the use of a very moderate amount of energy. The curves from Dr. Finzi's motor, which we published recently, show this point very clearly, by giving the volt amperes required from the start to full acceleration. As to efficiency, the motors make a very creditable showing, lower, to be sure, than in the case of direct-current railway motors, for reasons which Mr. Lamme sets forth at considerable length. Hysteresis and eddy currents are obviously far from negligible in alternating-current apparatus, but, fortunately, there is a compensative advantage in the correspondingly greater efficiency of the regulating devices. Of course, a balance of the efficiency ledger can be struck only after the motors have become familiar in the various branches of commercial work, but enough is now evident to show that the deficit will not be large. As a matter of fact the efficiency should be reckoned clear back to the power station, and when this is done the saving in distribution will far outweigh any intrinsic losses in the motor.

It would be, indeed, a bad alternating motor that did not give as good efficiency as the combination of rotary converter and direct-current motor now in vogue. It will be hard to produce better, more efficient, or more reliable machines than the present standard traction motors. If they are to be superseded, good reason for the change must be found. We do not think it will be discovered in the regulating appliances, but rather in the very great saving in the distribution, especially in interurban work. Incidentally the general use of alternating currents will tend greatly to lessen the danger of trouble from electrolysis. It will not absolutely remove that danger, since it is well known that electrolysis by alternating currents is possible, but as a practical matter it will pretty effectively suppress it. This, of itself, is no light argument in favor of the position taken by Mr. Lamme on other grounds, that the new motors should be seriously considered for regular electric tramways. On the other hand, in using alternating currents, even of the low frequency proposed, the virtual resistance of the rails becomes several times as large as the ordinary resistance for continuous currents. In interurban work, where high voltage

will generally be carried on the trolley wire, this difficulty is minimized, since both the actual current in the rails will be small, and the low-current density will keep down the electromagnetic effects. In city work the increased resistance due to alternating current cannot altogether be neglected, and something may be said in favor of direct current on this score. But there is little doubt that the regular series-wound alternating motor can be arranged for use with direct as well as with alternating current, so that interurban cars could come into a town over the ordinary lines, if necessary or desirable. The heavier class of interurban work for which alternating motors have most been needed, will more and more become independent, so that even if it were difficult to provide alternating-current distribution in urban districts it would not very much matter.

It seems to us that the vital question in regard to the new motors is that of sparking. On this point no amount of argument, pro or con, can have very much weight. It is simply a question of fact, to be decided by experience. The art of commutation has doubtless improved, as Mr. Lamme suggests, but at no time in its history has there been reason to suppose that alternating currents could be commutated anywhere nearly as easily as direct currents of similar magnitude. We regret that Mr. Lamme did not give more definite information as to the methods adopted in these motors to suppress sparking. It is, at least, safe to say on the concurrent testimony of Mr. Lamme, Dr. Finzi and Messrs. Eichberg and Winter, that the sparking difficulty has been reduced further than has before seemed possible. It is noteworthy in this connection that while Dr. Finzi's motor was small, of the common tramcar size, the others in question were of large power, large enough to show sparking if the matter of magnitude cuts any figure in the matter. The next question when the sparking matter is settled, is whether the new construction lends itself handily to the production of powerful electric locomotives, such as would be needed for high-speed work or for such tasks in heavy traction as have been laid out by the New York Central. It would be, indeed, a strange freak of fortune if the immense equipment just ordered for that great project should turn out to be of apparatus obsolescent before delivery.

It is worth mentioning in this connection that the new move in traction is highly favorable to the steam turbine. That remarkable machine is at its best in the generation of alternating current, and as both the great American electrical companies have a fair show at the turbine business, there may be compensations even if the railway motor standards have to be changed. Finally, the production of a successful alternating motor for railway work implies the easy production of the smaller motors used for general power purposes, a fact which may have a very important bearing on general methods of electrical distribution. At all events the first steps toward success have already been taken.

Interurban Terminals

This is certainly the day of the interurban terminal station, and this is as it should be. Nearly every important interurban center from which a number of interurban railways radiate is now building or has already built a central terminal station for the use of all the lines. It was recognized soon after interurban lines began to be differentiated from ordinary street railway lines, that an interurban waiting room in the central part of the city was very desirable. As a result, there are very few interurban companies which do not have depots or waiting rooms in the principal cities which they serve, even if there is no common union terminal station. The plan of having waiting rooms scattered around in various store buildings is not altogether satisfactory to the public, and the result has been the construction of the Union terminal station.

At Indianapolis a most extensive interurban terminal station, planned from a traffic standpoint, is being erected for the use of the nine interurban lines which will soon be radiating from that city. At Cincinnati, where interurban development has been held back by certain conditions that were outlined in recent articles in this paper, a fine interurban terminal station has, nevertheless, been in use for some time. At Toledo, while there is no special building devoted to a terminal station, a very large, well-fitted up waiting room is provided at a corner where all interurban cars pass. Cleveland has only recently made efforts to secure a Union waiting room for the interurbans that have been successful. A depot is now to be provided on the public square, according to the plans recently published in this journal. At Detroit, while there is a common waiting room for all lines, there is apparently not the importance attached to it that there usually is to the Union interurban station. At Muncie, Ind., which, although not a large city, is, nevertheless, an important interurban center, another fine terminal building is going up. At Milwaukee, the company is demonstrating its faith in the city and the future of its property by erecting one of the most substantial steel frame structures in the city, to be used as an interurban terminal and general waiting room as well as an office building and a place where a few reserve cars may be kept for emergencies. In most of the larger terminal buildings provision is being made to take care of both freight and passenger business. In other cities, where the passengers are taken care of by a centrally located waiting room, the freight business is handled at a separate depot in a district at one side of the main retail district.

There is one important distinction between the steam and electric railway which should not be lost sight of in this connection, especially by property owners and business men; namely, the difference in the influence exerted upon the locality invaded. The building of a passenger station or freight house by a steam road is not generally conducive to the enhancement of real estate values, but the electric road is not so obnoxious as the almost constant presence of steam locomotives, belching forth smoke and cinders and soot, to discolor everything in the neighborhood. Consequently, it should be much easier to secure favorable locations for electric terminals. We recall one case where the building of an interurban terminal had the effect of stimulating retail business so much that other localities offered inducements to change.

A freight and passenger depot combined necessarily has something of a compromise in its location, as it is rarely advisable to utilize the exceedingly valuable land in the midst of a retail shopping district for a freight terminal, and, on the other hand, if the building is located to accommodate the freight business, it is likely to be a little out of the way of the retail center whence most of the passengers come who patronize the waiting room. This compromise is evident in the location of all the large combination freight and passenger terminal buildings which are now erected or being erected. Nevertheless, most of them are not by any means a prohibitive distance from the principal retail streets, as a very judicious selection of site is usually made. Thus, in Milwaukee, the building now being erected is but one block from the principal street, and at Indianapolis the new building is one block from the recognized street railway center.

NEW INTERURBAN RAILWAY IN SWITZERLAND

BY HENRI SOMACH

Practically all of the cities in Switzerland possess electric railway systems, but up to the present time little progress has been made with interurban electric railway construction. This has been partly due to the fact that all of the trunk lines and nearly all of the steam railway companies in Switzerland belong to the Government. But in spite of this, capitalists are coming to realize that there is a certain field in Switzerland for private interurban electric lines, especially if built with a narrow gage.

One of the few Swiss interurban electric railways is that put in operation Oct. 8, 1903, between Wetzikon and Meilen. This line is 22.5 km (14 miles) in length, and traverses an extremely fertile region near the Lake of Zurich. The line has many grades and ascends an elevation of 190.79 m (626 ft.) in 7.5 km (4¾ miles). The maximum grade is 6.5 per cent for a length of 426 m (1400 ft.), not far from the terminus of the line.

The line for the greater part of its length is built on the highway, but recourse has been had to a private right of way at points to avoid too sharp curves or too steep grades. It is single track, built to 1-m gage, and with numerous switches to freight stations. It is laid with 25-kg Vignole (50-lb. T) rail in 12-m (39.3 ft.) lengths, mounted on metal ties, fourteen to the rail



TERMINUS AT MEILEN

length, which, in turn, rest on a ballast 35 cm (14 ins.) in depth. This construction, it might be said in passing, is practically the standard for all of the new interurban lines in Switzerland. Vignole rails have proved more satisfactory, even on paved streets, than either the Broca or Phœnix types. While it is true that objection has been made to these rails as constituting an obstruction to vehicle traffic, their many advantages have led to their almost general adoption.

Current is supplied to the cars in the form of continuous current at 750 volts, the usual voltage on Swiss interurban lines.

The regular service on the line is supplied by eight trains per day in each direction. Each train consists of a double-truck motor car and a single-truck combination baggage and pas-



WAITING STATION AT OLLIKON

senger trail car. There is also a local service from each terminal station every 30 minutes, supplied by single-truck cars, also a freight service of two trains each way daily. The running time is 25 km (16 miles) per hour on a level. In descending grades the cars are not permitted by the Swiss lines to exceed a speed of 15 km, or 10 m. p. h., where the grades are from 3 per cent to 5 per cent, and must proceed at an even slower rate on steeper grades. The running time between the termini is about 1 hour and 20 minutes, including all stops.

A great deal of attention has been given to the type of car to be used, and it is interesting to note that American practice is being followed to the extent of the employment of double-truck cars. These cars, which are very long for European roads, are divided into two compartments, each seating eighteen passengers, one compartment being for smokers and the other for non-smokers. There is also room for four standing passengers on each platform. The two passenger compartments are separated by a baggage compartment about 4 m (13 ft.) square, which can also accommodate passengers if necessary. The platforms are vestibuled. Cross seats are used. The roof has a monitor deck with ventilating sash.

The main dimensions of the cars are as follows:

Length over all	14 meters (45 ft. 11 ins.)
Maximum width	2.2 meters (7 ft. 2½ ins.)
Height of car	3.5 meters (11 ft. 7 ins.)
Wheel base	1.4 meters (4 ft. 6 ins.)
Distance between centers of trucks	7.6 meters (24 ft. 11 ins.)

The cars are supplied with hand brakes and with Böker axle-driven air brakes. Air brakes are also used on the trail cars, and can be operated by the motorman. A novel feature for

European cars is the adoption of electric heaters, which are placed under the seats.

The electric equipment of the double-truck cars consists of four Oerlikon T. M. 12-22 motors of 22 hp each. These motors are designed for 375 volts each, and are operated in groups of two series with each other. The ratio of the gearing is 5 to 1. A series parallel controller with magnetic blow-out is employed. Two trolley poles are used, one for each direction of running.

The single-truck cars are very similar to ordinary European cars, having seating capacity for eighteen passengers, room for ten passengers on the platforms, and are vestibuled. They are equipped with Oerlikon T. M. 12-35 motors of 35 hp, designed for 700 volts. The electric freight cars are built to carry 5 tons, are mounted on single trucks, and are also equipped with T. M. 12-35 motors.

The trolley wire is No. 0 and 8-mm in diameter. The feeders are bare copper of the same size. The trolley wire is divided into fourteen sections, each equipped with a lightning arrester with a magnetic blow-out. The power required for operating the line is supplied from a water-power plant at Beznau, in the form of 25,000-volt, three-phase current at 50 cycles. This is reduced to 460 volts by 160-kw transformers, and changed to direct current by means of



ENTRANCE TO STATION AT WETZIKON

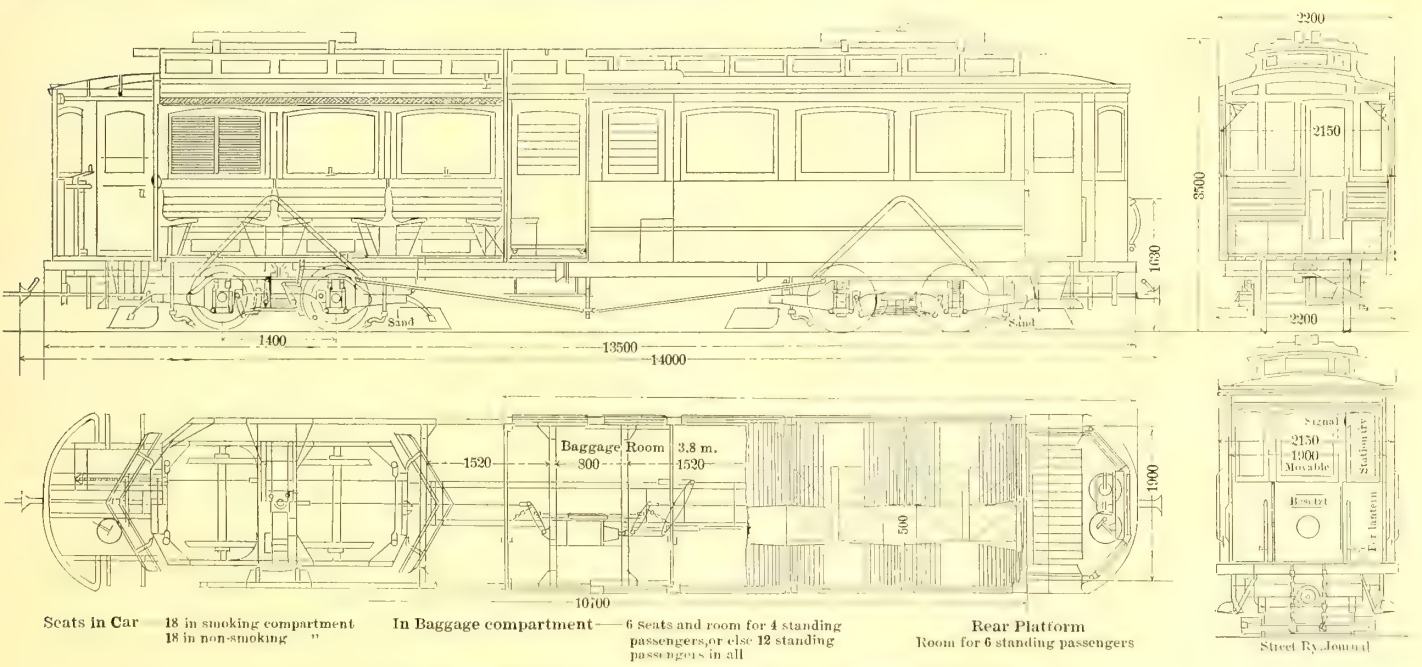


PASSING THROUGH VINEYARDS NEAR MEILEN

140-kw, compound-wound rotary converters, operating at 1000 r. p. m. The sub-station is also supplied with a battery of 360 cells, having a capacity of 270 ampere-hours.

The entire electrical equipment was installed by the Oerlikon Machine Works.

The Philadelphia & Easton Street Railway has completed its line between Easton, Pa., and Riegelsville, and cars are now in regular operation. The line is almost a direct route between Philadelphia and Easton, and the fare is about 70 cents. The run can be made in about the same time as the roundabout steam car journey. The new branch also links Trenton with the Lehigh Valley Traction system. The system is operated from a power station located at Raubsville.



Seats in Car — 18 in smoking compartment, 18 in non-smoking "

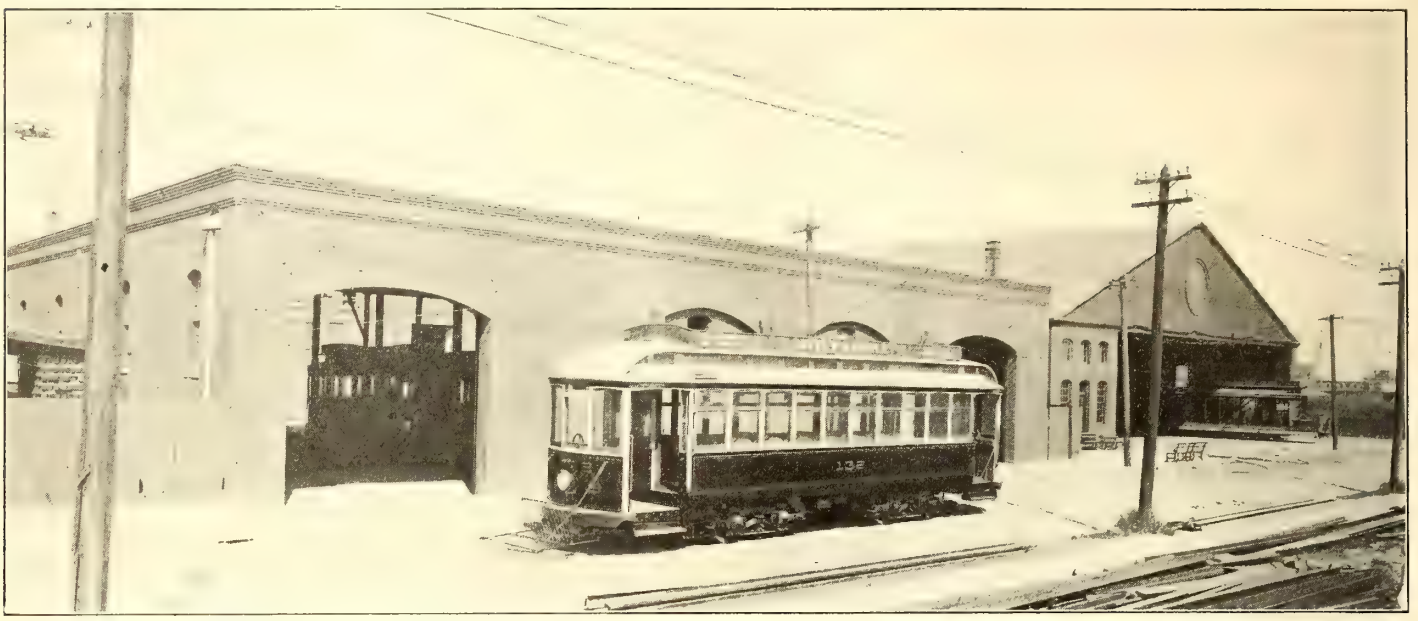
In Baggage compartment — 6 seats and room for 4 standing passengers, or else 12 standing passengers in all

Rear Platform — Room for 6 standing passengers

PLAN SECTIONS AND ELEVATIONS OF DOUBLE-TRUCK CAR

REPAIR SHOP PRACTICE ON THE CAMDEN & SUBURBAN ROAD

As stated in the issue of Dec. 5, the repair shops of the Camden & Suburban Railway Company are located on Newton Avenue, and comprise an extensive system of shops, car houses and stock rooms. Other shops are to be built, however, and



EXTERIOR OF REPAIR SHOP AND CAR HOUSE, SHOWING ONE OF THE NEW DOUBLE-TRUCK CARS OF THE COMPANY

will be devoted exclusively to overhauling. Quite a distinction is made on the Camden & Suburban Railway between ordinary repairs and overhauling, and it will be the policy of the company, after the new shops are built, to still further accentuate this difference by having the two classes of work performed at different places.

As already stated the company has made a so-called "contract" with its master mechanic for the repair of its cars. This contract is really an agreement fixing a certain price for all the different essential operations in car repair, which price the master mechanic endeavors to live up to. The arrangement was made in May, 1903, when the master mechanic agreed to effect a saving of 15 per cent on the net cost of repairs, which up to that time had amounted to 1.66 cents per car mile. It also includes the proviso that the average number of times in which a car shall be in the repair shop will not exceed 1.11 times per 1000 miles run.

All repair work is ordered by the chief engineer, with the approval of the general manager, when in his opinion the condition of the car requires it. A blank is first made out, as described in the last issue, stating the work contemplated and the expected cost, and this blank must be O. K'd. by the manager before the work is undertaken.

All work in the repair shop is divided into five main divisions, as follows:

1. Truck repairs, which comprise all repairs done to trucks but not including the gears. This class includes repairs done to the truck and brake rigging.

2. Motor equipment repairs. These repairs commence with the gears and end with the cables.

3. Electric equipment repairs. These begin with the cables and include the controllers, trolley, trolley base and all other electrical equipment except the headlights.

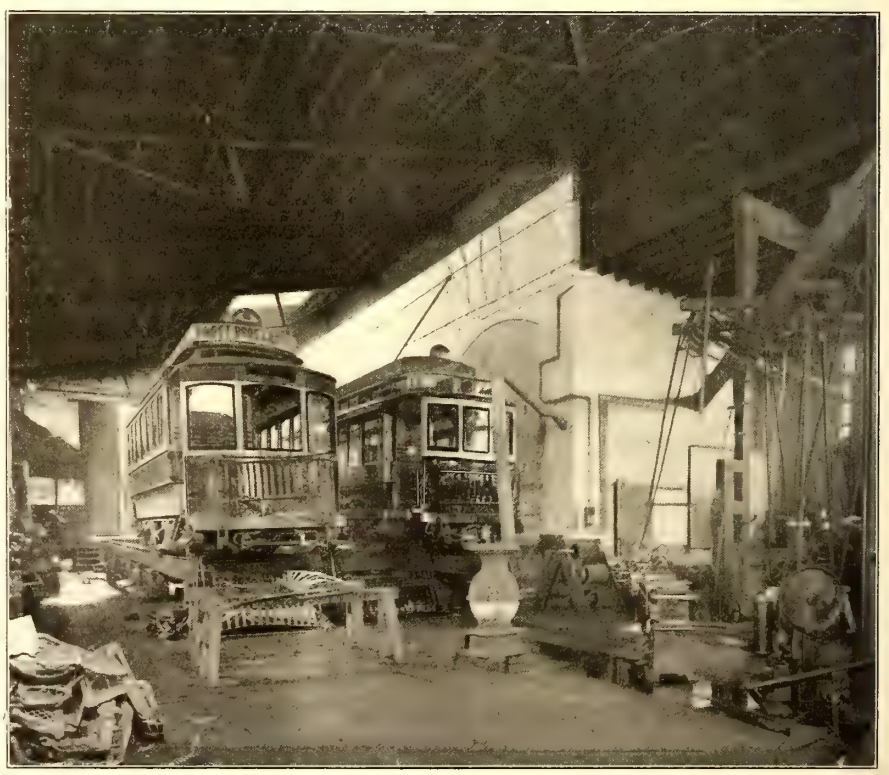
4. General body repairs.

5. Painting repairs.

For convenience, the repairs in each division are further classified under certain letters of the alphabet as follows:

CAR PAINTING

In car painting, the letter *A* is used to designate the complete overhauling of the car, as follows: Burning, scraping and pumice-stoning the outside of the car to remove the paint, when necessary; two coats of color on the main and concave panels, with at least six hours for the first coat to dry before giving



INTERIOR OF REPAIR SHOP, SHOWING ELEVATED TRACKS

the second; striping and one coat of rubbing varnish with an interval of six or more hours, according to conditions; one coat of finishing varnish with an interval of from two days to three days; a second coat of finishing varnish with an interval of three days to five days. All bare woodwork exposed to the weather receives four coats of finishing varnish, this being done in advance of the outside painting. The vestibule sashes

are grained on the outside and receive two coats of finishing varnish. For this outside work Valentine's best grade of coach varnish is used. The inside woodwork is given two coats of inside varnish, Schrack's varnish being employed. The roof receives two coats of oil color. The trucks and all other iron work are scraped clean and given one coat of metal paint, after which the trucks are also given a coat of Colonial green. All the other iron work is blackened and the brass work is burnished and relacquered. The metal seat frames are gilded with bronze. The cane seats are given one coat of varnish, and the floors and platforms two coats of floor color in oil. The roof signs are repainted.

In advance of all painting in class *A*, all bare, exposed woodwork is scrubbed with ammonia, and all spots and car trimmings are removed.

Class *B*, in painting repairs is not so extensive as Class *A*. In Class *B* the cars are first thoroughly scrubbed and cleaned. All paint work is then touched up and matched, cutting in between stripes. The outside of the car receives one coat of finishing varnish and the inside of the car one coat of inside varnish. The seat frames are gilded, and two coats of color in oil are placed on the floor. One coat of color in oil is put on the roof and one coat on the trucks. The iron work is blackened and the brass is polished and relacquered.

Class *C*, in painting repairs, includes one coat of varnish of the outside of the car and one coat of color on the floor, roof and truck.

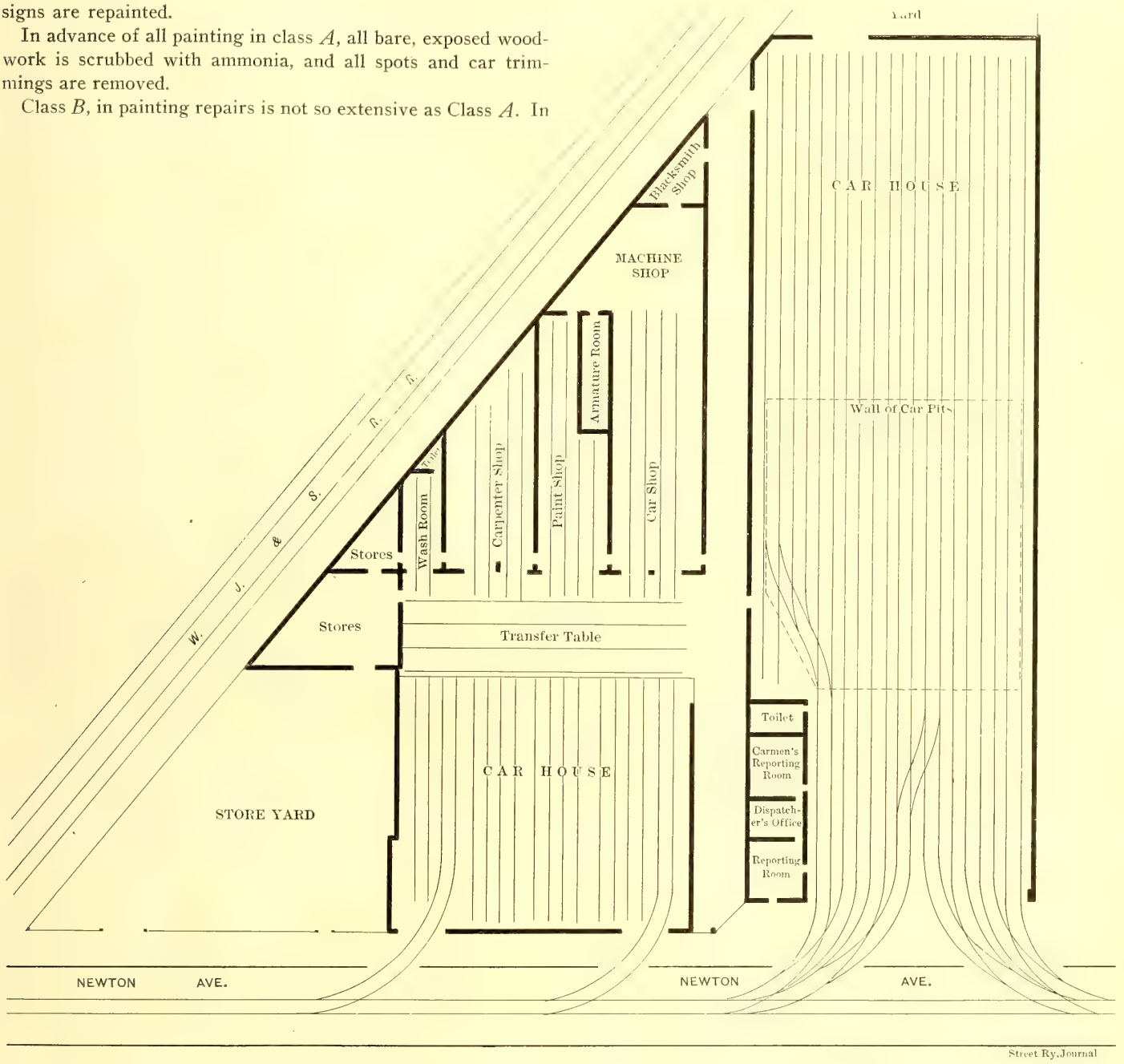
Class *D*, in painting repairs, comprises touching up the varnish, giving one coat of color to the floor, and touching up with paint any scratches or other spots necessary on the body of the car.

Class *E*, in painting repairs, comprises touching up injured parts only.

The cost in labor for these repairs, of course, varies greatly with the condition and size of car, and are set by the master mechanic and chief engineer, in council with the contracting foremen of the different departments; but the average may be said to be about as follows for cost of labor for a 28-ft. body, double-truck car, measuring 41 ft. over all:

Class *A*,	painting repairs	$35.00
B,	" "	25.00
C,	" "	18.00
D,	" "	15.00
E,	" "	$1 to 12.00

Further particulars of the cost of painting and varnishing of cars on the Camden & Suburban Company's lines were presented by Mr. Harrington at the 1900 convention of the



PLAN OF CAR HOUSE AND REPAIR SHOP PROPERTY ON NEWTON AVENUE

American Street Railway Association, and form part of the transactions of the association.

It will be understood that the figures quoted above represent only the labor cost for painting, and are figured at the rate paid to painters, which is 22½ cents an hour. This rate per hour is the "contract price" paid painters, but it may be increased or reduced by a system of bonuses in force in the shops, as will be described later.

BODY REPAIRS

Body repairs are divided into only four classes—*A*, *B*, *C* and *D*. When Class *A* is specified on an order, it includes the renewal or rebuilding of all the parts of the car, which are so worn that they would further deteriorate the car if left in use for another 1000-mile run. As Class *A* in body repairs is always ordered with Class *A* in painting, it also includes scraping all plain woodwork, taking down of all inside fixtures before the painters commence their work and replacing them after the painters are through. It also includes retruing the car. The average cost of this class in labor is $75 at the "contract price" paid to carpenters, which is 22½ cents an hour.

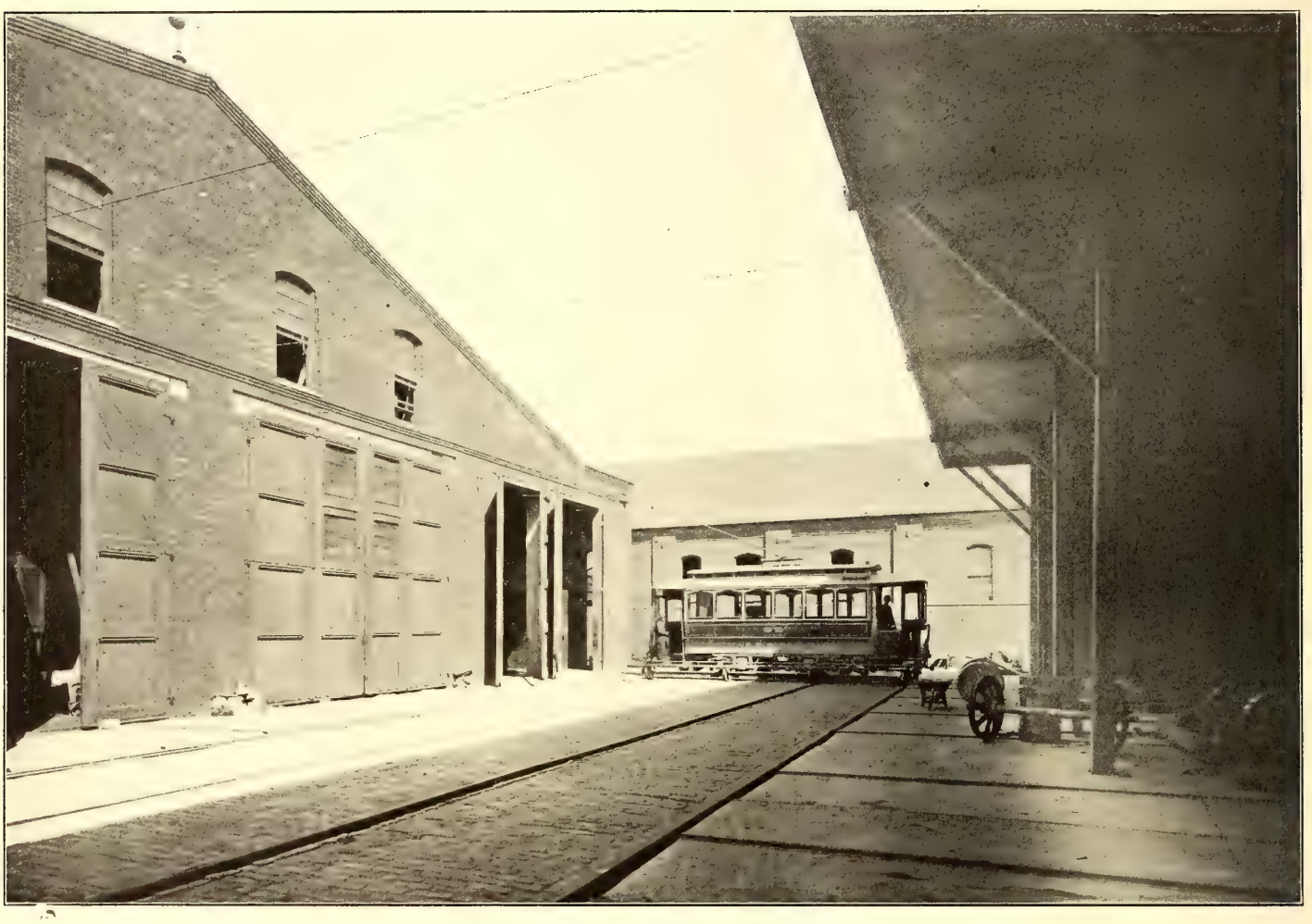
Class *B*, in body repairs, comprises repairs to the floor, putting in new floor strips, reflooring both platforms, jacking up and trussing the rigging, straightening all joints and overhauling doors and windows. The average cost for labor for this class of repairs is about $38.

Class *C*, in body repairs, includes repairs to trap-doors, platform and floor stripping, but does not include the renewal of any considerable portion of these parts. The average contract price for this work is about $6, at the contract price of 22½ cents an hour.

Class *D*, in body repairs, is emergency work.

TRUCK REPAIRS

Truck repairs all come under special orders except the complete overhauling of trucks, which comes under Class *A* in truck repairs. This comprises tearing down the truck, renewing all worn-out parts and reassembling them, placing the truck under the car and connecting it up to the car. The cost of this varies greatly with the type of truck, but might be said for the average single truck to amount for labor to $10.50, being made up of thirty hours for a mechanic at 20 cents an hour, and the same number of hours for a helper at 15 cents an hour. This work for one double truck will cost about $7, as it can usually be completed by the same men in twenty hours. Class *A*, in truck repairs, also includes replacing fields in armature, but does not include repairs to the motor, which come under motor repairs.



CAR ON TRANSFER TABLE IN REPAIR SHOP

MOTOR REPAIRS

The motor repairs are, as a rule, given out on special order, as the amount of repairs varies greatly with the condition of the motor. The following figures, however, may be quoted as representing the average contract price for some of the principal essential operations:

COST OF VARIOUS MOTOR REPAIRS

Work	Total Hours	Rate Cents	Total Cost Labor
Rewinding No. 3 Westinghouse armature	30¾	20	$6.35
" No. 38 B " "	23	30	6.90
" No. 49 " "	19½	30	5.85
Changing No. 38 B " "	5	20 and 15	0.88
" No. 49 armature and fields	11	20 and 15	2.00

As will be noticed, no figures are quoted on the cost of rewinding motor fields. The reason of this is that the company

does not consider that it pays to rewind any of its fields. When a field requires more repairs than can easily be made without rewinding, it is scrapped and credited and new fields are purchased. The chief engineer believes that a field whose resistance is sufficiently changed to unbalance an opposite new field, is not worthy of repair, because, if employed, it will shorten the life of the new field in the motor and deteriorate the armature. Experience shows that about one-third more lower fields are lost than upper fields in all motors, especially in No. 3. The best results are obtained from the No. 49 motor. The average cost for labor of overhauling the electric equipment, "starting with the cables," that is, including controllers, circuit breakers, light circuit, light switches, diverters and all minor parts of the car is about $15.

WHEELS

The company does not regrind any wheels, as it has a contract with the manufacturers of the wheels used on the system by which all this work is done for the works of the wheel company. The labor cost for jacking up a car, taking out one pair of wheels and putting in a new pair is as follows:

COST OF CHANGING WHEELS

Type of Truck	Hours and Rate of Mechanic	Hours and Rate of Helper	Total Cost of Labor
Brill No. 21 E	5 hours at 20c	5¼ hours at 15c	$1.79
St. Louis No. 13. Max. Trac.	5½ " "	6 " "	2.00

ASSIGNING REPAIR WORK AND THE BONUS SYSTEM

When a car enters the car house for repairs and it is considered necessary to give it Class *A* repairs in the paint department, the car goes through Class *A* in all the other departments. The order to the master mechanic for the work, which is made out by the chief engineer and approved by the general manager, states the class number or letter of repairs which the car will be given, the material which will be required, and also the contract price for the necessary labor. The latter price is set by the chief engineer, after he has seen the car, as closely as it can be estimated. A careful record is kept of the cost, and if it is found that the repairs have been done for less than the contract price, a bonus, limited to 20 per cent of the actual cost, is paid to the workman engaged on the job. For example, the contract price for labor upon a certain piece of work is $2.40. Suppose that the actual cost of the labor in the work when the job is finished, found by multiplying the hours required by the rate per hour paid the man, is $1. Twenty per cent of $1 is 20 cents, which is the man's bonus in addition to his regular rate of wages. The loss on contract work is figured in the same way, and it is limited to 20 per cent of the contract price. For example, suppose that the contract price for a piece of work is $2.40, while the actual cost is $3.38. The loss to the workman is limited to 20 per cent of the contract price, or 20 per cent of $2.40, which is 48 cents.

DETAILS OF CAR EQUIPMENT

Some details of car equipment can properly be discussed in this connection rather than in the first article published on the system of the Camden & Suburban Railway Company, as they are closely related to repair shop practice.

The standard color of the main panels is granite red, and cream buff is used on the concave panels. The trimming is in gold with white stripes and aluminum letters. Each car carries an illuminated hood sign of metal, with stenciled letters and celluloid fillers. These hood signs are lighted by adjustable head reflectors and throw their light through an open transom in front of the vestibule.

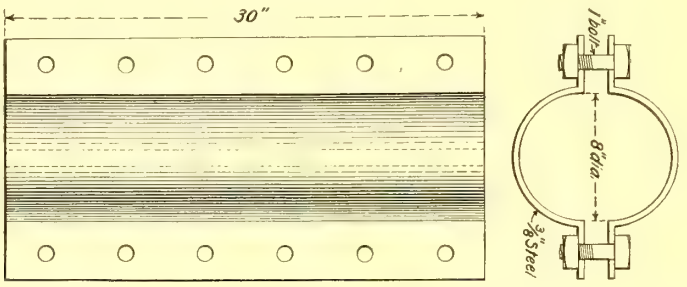
All cars also carry side destination signs fastened to the lower rail of the side panel, and also roof advertising signs, as shown in some of the illustrations of the side of the car. The frame of these signs is of wood with grooved molding. The advertisement is painted on sheet zinc strips 7 ft. long, the different sized cars being arranged for advertising signs in multiples of seven. The zinc sheets are slipped into the grooves like the cardboard signs inside the car. The advertising is all handled by the secretary of the company.

REGISTER SEALS

The company has given up the use of locks on its registers and uses in their place lead seals. This method is considered much more desirable than the use of locks, as any tampering with the seal is easily detected. Since the introduction of lead seals there has been no trouble with the registers.

REINFORCING STEEL POLES AT ST. LOUIS

The St. Louis Transit Company is using a scheme for reinforcing steel poles which have become rusted near the ground line so badly that they would be unsafe if not strengthened. The plan is to reinforce them with a sleeve or clamp, as shown in the accompanying diagram. These sleeves are pressed to the desired shape between forms by a bulldozer in the company's repair shops. They are of ⅜-in. steel, 30 ins. long. The sleeve is fitted around the pole and about one-half of the sleeve projects above the ground line.



CROSS SECTION AND ELEVATION OF ONE SIDE OF POLE CLAMP

The two parts of the sleeve are drawn together with six 1-in. bolts, and after hammering the sleeve with a sledge and drawing the bolts as tight as possible, it is considered that the pole is as strong as new.

TERMINAL STATIONS AT DAYTON

The Union Terminal Company, which has been formed for the purpose of building a terminal in the heart of Dayton, to be used by all the interurban roads, will commence work at an early date. The plans contemplate the erection of three buildings. One of these will be on the east side of Kenton Street, extending from Third Street to Fourth Street, and will be used for cold storage purposes. It will be seven stories or eight stories high, and at one side will be tracks for the electric lines which will supply produce to the company. The cold storage branch of the enterprise expects to draw supplies from all over the district traversed by the Dayton interurbans. Adjoining this building, and facing the canal, will be located a power plant which will supply electric lighting and power and operate ice machines for the storage house, as well as furnishing light and heat for the Union Passenger Station, which will be located on Fourth Street and St. Clair Street. This station will be built on an elaborate scale. It is the plan to have the cars run through an arcade from Third Street to Fourth Street, stopping between these streets at the passenger waiting rooms. The station itself will be designed to furnish every comfort for passengers. The station building will be eight stories high, of heavy mill construction, and will be designed as a power block for small manufacturing establishments.

The plans announced for these buildings are indicative of the extent of the freight business carried on by the electric railway companies centering in Dayton.

APPLICATION OF SINGLE-PHASE ALTERNATING-CURRENT FOR TRACTION AND RAILWAY SERVICE

BY B. G. LAMME

The present direct-current railway system has limitations in voltage, speed control, etc., which have long been recognized by the electrical profession. Many systems have been devised with more or less success—generally with less—in order to overcome these limitations, so that the possible field for the direct-current systems could be extended. It has also been recognized by some of those familiar with the problem that a single-phase alternating-current motor, having the characteristics of a direct-current series motor would at once furnish a means of attaining many results now impossible with the direct-current system. Such a motor obtained, the voltage limitation can at once be removed, as the transforming properties of alternating current can be brought into use. Economical operation at any desired speed can also readily be obtained through the same property of alternating current. Furthermore, the use of single-phase permits a single overhead wire where track return is used, thus retaining a most valuable feature of the direct-current system. It is thus evident that a motor of this character will permit the retention of most of the present advantageous features of the direct-current system, and also enables the use of other features not permissible without great complication and expense with the present direct-current system.

There has been perfected only one class of single-phase motors which possesses the characteristics of the direct-current railway motors, and this one class of motors very closely resembles the direct-current machine in the general features. These motors may all be given the general name of commutator type single-phase motors, as all of them have commutators on the armature or rotating member, and the armature is provided with a direct-current type of winding. Some variations from the usual types of armature winds have been proposed, but the various direct-current types have proven most successful.

All these commutator types of motors, which have the variable speed characteristics suitable for railway service, may be broadly classified as belonging to the series type. By this we mean that the field or exciting current is in series with the armature circuit, either directly or through transformer action, either in the motor itself or outside the motor. The series type of motor can be sub-divided into two classes, viz., the straight series motor, in which the current in the field wholly or partly passes through the armature, or vice versa; and those in which the field or armature forms a secondary circuit, the primary of which can be either part of the field structure of the motor, or may be outside of the motor. All these motors—whether of the straight series or of the transformer type—have the property that the field magnetism varies with the load, although not necessarily in direct proportion. Hereafter we will refer to these two types, as the straight series and the transformer types of motors. All these motors are related to a greater or less extent in their characteristics, and in many instances one type can be readily changed to the other type. In fact, by closing a single switch, we have changed a straight series motor into the transformer type with the armature closed on itself, forming a secondary circuit, with a change in performance, apparently due only to the amount of material in the magnetic circuit being insufficient for the best performance as a transformer type.

In these commutator type single-phase motors, the two most important elements, besides the speed characteristics, are the efficiency and the power factor. The efficiency of such motors will usually be less than that of a direct-current railway motor of the same output. The losses in one of these alternating-current motors can be considered as made up of the following elements:

First.—Iron loss due to reversals of magnetism in armature and field at the frequency of the supply circuit.

Second.—Armature iron loss due to variations in magnetism dependent upon rotation of the armature.

Third.—Iron loss in the surface of field and armature due to the bunching of magnetic lines from the teeth of either element.

Fourth.—Losses in field windings.

Fifth.—Loss in armature windings.

Sixth.—Brush losses.

Seventh.—Friction and windage.

Comparing these losses item by item with those of a direct-current motor, we see at once that certain losses will necessarily be greater than in the direct-current motor.

First.—Iron loss due to the frequency of the supply circuit and induction in the primary element. No such loss exists in a direct-current motor, as the machine is excited by continuous current. This loss in the alternating-current motor will not be a relatively large per cent, unless the motor is worked at a very high induction, or unless the construction of the magnetic circuit is such as will allow eddy current losses. It is at once evident that the field magnetic circuit must be laminated as completely as the armature circuit, and that there are no local circuits permissible in the field structure. It is also evident that a field structure of a straight series motor will, in general, have lower losses than of the transformer type, where the field itself forms part of the transformer, as in this latter case the total induction in the field structure will generally be greater than in the series type.

Second.—Armature iron loss due to variations in magnetism dependent upon rotation of the armature. There will be a loss in the armature due to the alternating magnetism from the primary or field circuit. This can be charged against the field loss or primary loss, as maintained above. In addition to this loss, there is a loss due to the rotation of the armature in the field. This will be dependent upon speed of rotation, inductions in the core, teeth, etc., and in general will practically average the same as that of a direct-current motor of the same capacity.

Third.—Iron loss in the surface of field and armature due to the bunching of magnetic lines from the teeth of either element. This is a loss which appears to some extent in the field pole face of direct-current machines, due to the bunching of the lines from armature teeth. This loss is relatively small on direct-current machines, if the poles are properly laminated and if the air gap is relatively large compared with the width of the armature slots. This loss in direct-current motors is included in the armature iron loss measurements, due to the methods generally used for determining iron loss on such motors. This loss will appear in the field surface or face of the alternating motor, and may be considerably greater than in the direct current, if a smaller air gap is used than in direct-current practice. By air gap we mean clearance from iron to iron.

If the field structure is of the slotted type, the slots being of such form as to give bunched lines, then there will also be a loss in the armature surface due to the bunching of these lines. It should be noted that the frequency of the secondary currents set up by the bunched lines from armature or field teeth is generally very high compared with the frequency of the supply circuit, or of that due to the rotation of the armature in the field. We believe that in general the loss due to the bunched lines will not be much greater in the alternating-current single-phase motor than in the direct current, except where very small air gaps are used on the alternating-current motor.

Fourth—Loss in Field Windings—This loss is very similar to that in direct-current machines, as the amount of copper in the field windings will generally be no greater than on direct-current motors of same capacity, and may even be considerably

less. The straight-series motor will generally have a lower copper loss than the transformer types where the field structure is used as the primary of the transformer.

Fifth—Loss in Armature Windings.—The loss in the armature windings will be very similar to that in a direct-current machine, as far as the working current is concerned. In addition to the working current, there may be secondary currents in the armature turns short circuited by the brushes, which still further increase the armature loss. The resultant armature loss may, therefore, be somewhat greater than on a corresponding direct-current machine, unless the normal resistance of the armature winding is reduced below that of a corresponding direct-current machine. In practice, the loss in the armature winding is made practically equal to that of the direct-current machine, in order to avoid increased heating.

Sixth—Brush Losses.—The brush losses due to the reversal of current in the single-phase alternating-current motors are generally somewhat greater than in a direct-current motor. Such motors are usually wound for a comparatively low voltage on the armature, and thus greater brush capacity is required than in direct-current practice. The brush losses are thus increased, due to the greater number of brushes, and in addition there may be local currents in the short-circuited coils, which may produce additional loss in the part of the brush next to the commutator. In practice this loss is evidently comparatively small, as our experience shows no signs of deterioration in the brushes in regular service. Therefore, the increased brush loss may be considered as principally due to the increased number of brushes required.

The brush loss due to the local currents in the short circuited turns can be reduced considerably by the use of very narrow brushes, a brush spanning one bar or even less. With such a brush there would be short circuiting only while the brush is bringing two bars, while at intermediate positions there would be no local current. As, in general, the commutators of such motors have a relatively large number of bars, this would mean a very thin brush, possibly less than ¼ in. in thickness. Such brushes we consider too thin for street car purposes, as any roughness on the commutator would tend to break the brushes. In some of our very early experiences with such motors, we used brushes of ¼ in. in thickness, but found they required entirely too much attention, and, therefore, they were abandoned in favor of brushes of a thickness corresponding to direct-current practice, the later designs of motors permitting the use of such brushes.

Seventh—Friction and Windage.—The friction in bearings and the windage loss in such motors will be very similar to the corresponding losses in direct-current motors, but the brush friction loss will, in general, be somewhat greater, due to the increased brush capacity. Also the large number of commutator bars generally used, tends to increase brush friction to some extent.

It is evident from the above considerations that the various losses in different parts of the single-phase alternating-current motors are either equal to or greater than the losses in the corresponding direct-current motor, although no individual loss, except that due to the reversal of magnetism in the field, may be much greater than in the direct-current motor. The sum total of the slight increases make a difference of from 1 per cent to 5 per cent in the efficiency of the motor, this difference being less with larger motors.

The frequency of the supply circuit also has a small effect on the efficiency, although the relation of the losses in the various parts is so involved that no definite figure can be given for this effect.

The losses in the single-phase motor are, to a certain extent, dependent upon the speed at which the motor is operated, with a given current and torque. Assuming a given current, with the motor running at reduced speed, we can note the effect on the losses as follows:

The iron loss due to the frequency of the supply circuit is changed but little. The iron loss due to changes in magnetism in the armature and due to bunching of lines from the teeth are very considerably decreased, due to the lower armature speed. The losses in the field and armature winding are practically unchanged, and short-circuit loss in the brushes is not greatly changed. Friction loss in brushes, bearings and windage are all decreased. Therefore, at lower speed, the actual losses in the motor are considerably decreased, but not in proportion to the decrease in output of the motor. Therefore, the efficiency decreases slightly with the reduction in speed with a given torque, this efficiency decreasing more rapidly the more nearly the zero speed is approached.

With changes in load, with a given voltage applied, the efficiency curve has very much the same shape as the efficiency curve of a direct-current motor, starting low at light load and high speed, and rising to a maximum, and then falling off considerably at very heavy overloads.

After efficiency, the next most important consideration in the performance of such motors is the power factor. This is a feature which does not appear at all in direct-current machines, as the apparent input in such motors represents true energy. In the single-phase railway motor the apparent input in general does not all represent true energy, as a certain component of the input is required to magnetize the motor, and this component represents practically no energy. Also magnetic leakage in the alternating-motor represents a component of the apparent input which is practically wattless.

In a straight series motor a certain magnetizing current is required with a given field winding. The alternating flux through the field winding set up alternating e. m. f.'s which lag practically 90 degs. behind the energy component of the motor, and the product of the field current by the field voltage thus represents a wattless component of the input of the motor. With increase of load, the field current increases, the induction increases, and therefore the field volts also increase. The wattless component in the field thus varies with the product of two values which are both increasing with the load. The energy supplied to the motor increases approximately in proportion to the current supplied. Therefore, the wattless component in the field increases more rapidly than the energy component. Consequently, if this were the only wattless component in the motor, the power factor would decrease with the increase of load, and would be highest at no load. Other wattless components of the input are represented by the cross magnetizing effect of the armature, if such exists, and by the stray field around the windings. As these effects will also increase more rapidly than the energy component, it is therefore evident that the power factor in this type of motor will be highest at no load or at highest speed, and will decrease with the load or speed with a given voltage applied. But if the windings are so proportioned that the wattless component at the rated capacity is relatively small, then a high power factor will be obtained at the rated load and speed. At lighter loads and higher speeds the power factor would be considerably higher. Such a motor can give very high power factors at half loads with correspondingly increased speed. If the motor is operated at lower voltages, then the power factor at a given speed will be very nearly the same as when operated at the same speed at a higher voltage and higher load. Therefore, it is evident that as the speed is reduced, no matter what load is carried, the power factor will be decreased, and at start the power factor will be lowest, as the energy component in this case represents only the losses in the motor. We have tested a 100-hp motor showing 92 per cent power factor at 100 hp, and approximately 98 per cent power factor at one-half load, the voltage being the same in both cases. This question of power factor is largely a question of design, as the magnetizing or exciting compound of the input depends upon the air gap, amount of material, etc. In general, larger air gap means more exciting current.

The magnetic leakage in these motors may be relatively high, or may be comparatively low, this being to a considerable extent a function of the design of the motor, just as in all alternating-current machinery. Generally it is made as low as possible without sacrificing other important features.

If the armature cross induction in a series motor is large, due to excessive armature ampere turn per pole, small air gap, etc., the armature self-induction will be large. Increasing the number of poles will reduce the cross-magnetizing effects, but at the same time will require somewhat smaller air gap, or increased excitation. These two features are, therefore, to a certain extent balanced against each other.

There are various schemes for improving the power factor of the commutator type single-phase motors. These are generally most effective at high speeds, but at start or at very low speeds the improvement is small. In certain designs of both straight series and of the transformer type motors, the magnetizing current can be supplied in whole or in part to the armature circuit instead of the field magnetic circuit by means of brushes on the commutator. At certain speeds, this current can be supplied at a considerably reduced voltage, thus requiring a reduced magnetizing input compared with excitation applied to the field. This excitation can be supplied from the secondary of a series transformer, the primary being in circuit with the primary winding of the armature. The armature excitation will thus vary as the field excitation would normally vary, thus giving the varying field induction and the series speed characteristics. While this arrangement is effective in improving power factor at certain speeds, yet, as a rule, this gives the least effect at the time when it is most required, viz., at start and at very low speed. This method also requires a second system of brushes on the commutator, thus spacing the brushes on the motor the same distance apart as if double the number of poles were used. For instance, a four-pole motor would have brushes spaced 45 degs. apart, instead of 90 degs. At start there should be practically the same input required for magnetizing, whether the current is supplied to the armature or to the field.

Comparing the straight series with the transformer type of motor, it should be noted that the straight series motor requires less magnetizing current, as the magnetizing current is only supplied to one element of the field. With the transformer type of motor a magnetizing field must be furnished, as in the straight series, but there is also a second field set up due to the transformer action, and this also requires a magnetizing current. In other words, it may be considered that there are two magnetic fields set up, approximately, 90 degs. apart, each field requiring a certain magnetizing current. These two fields may be considered as forming one resultant field of higher value than either of the components, with a magntizing current of higher value than either component. In the series motor the transformer part of the field can be made to practically disappear, only the exciting field remaining; the resultant induction is, therefore, much less than with the transformer type, the field having an approximate average value of 70 per cent of that of the transformer motor, the magnetic circuit being reduced in proportion.

It thus appears that the straight series motor can be made to give a somewhat higher power factor than the transformer type, with the field used as a transformer, and this is obtained with somewhat less weight. This difference in power factor could be compensated for at higher speeds by some means of excitation applied to the armature through the commutator, as indicated above. But for traction service, where the least weight with great compactness of design is desirable, it appears to us that the straight series motor possesses some advantages. The transformer type of motor, with the transformer in the motor itself, can be compared with the straight series motor with a separate transformer, if high voltages are to be used on the line. We consider that a number of more compact motors under a car with one separate reducing transformer forms a more suitable combination than a similar number of larger motors, each with its transformer inside itself.

There is one other method of improving the power factor on these motors, and that is by the use of resistance in series with the motors. If the voltage on the motors is controlled by the use of an external rheostat, as in common with direct-current motors, then the power factor with a given torque will be constant and independent of the speed. With a given torque the wattless component of the input of the motor is practically constant independent of the speed, and if the speed is controlled by rheostatic loss, then the energy component will also be practically constant, and the power factor can be made higher at all loads. This may appear to be a good feature to those who have not considered the problem carefully, but it is a fact that high power factor obtained in this way represents a less desirable condition than the low power factor, which would be obtained if the rheostatic method of starting were not used. With a given wattless input from the circuit, the best possible condition as regards effect on the supply system is that represented by the minimum expenditure of energy. A wattless component has a certain effect on the regulation of the system, and any improvement in power factor by increasing the energy component, means that much additional effect on the supply system.

It is surprising that so many are so imbued with the idea of high-power factors that they are even willing to obtain it by increasing the losses in the apparatus, thus in reality increasing the load on the system. A high-power factor obtained by rheostatic control would represent no more advantageous condition than the use of resistance in series with an induction motor, when running, to increase its power factor. If a permanent resistance connected be parallel with an inductance motor, it will not increase the power factor of the motor itself, although any measurements of the input to the motor and resistance will show a higher power factor than that of the motor itself; but anyone can readily see the absurdity of this combination, although it does raise the power factor. The use of resistance in series with a motor in order to give higher power factor at starting would represent a similar absurdity, although it would not be as evident on the face of it.

Leaving out the question of power factor, the rheostatic method of starting and controlling the motor will, in certain instances, possess advantages over other methods, especially where the loss in the rheostat will average but a small part of the total power expended over a given period. This method of opration should not necessarily be abandoned in all cases, simply because voltage control can be obtained.

The next point, and one which is of considerable interest to the electrical fraternity at large, is the question of commutation in the commutator type of single-phase alternating-current motor. In the early times in the electrical business it was discovered that there were many things that could not be done with alternating-current, and among these was the commutation of alternating-current without excessive sparking. This opinion has become so well established that at the present time many engineers are very doubtful of this point. This opinion is based principally upon experiments in commutation of alternating current, mostly made many years ago, and not upon the theory of commutation itself. In many cases it was considered that the alternating current had some mysterious property which caused sparking when attempts were made to commutate it.

If we go back to the early periods we also find many things which could not be done with direct current, but which are done at the present time. I well remember the time—about thirteen years ago—when I was informed by a number of the leading engineers of that time, that it was useless to consider the construction of slotted armatures for railway generators of

the then gigantic size of 200 kw. At that time the Westinghouse Company had a railway armature of this size almost completed, and this advice was very discouraging. But as the armature was so nearly ready to test, it was decided to assemble the machine and find out how badly it would work. The result of the tests was such that the Westinghouse Company immediately abandoned the surface-wound type of direct-current armature in favor of the slotted type. Other companies probably had similar experiences, for the slotted type is now almost universally used. The above is merely given as an illustration that in direct-current apparatus many early opinions have been abandoned. If one of the 200-hp New York Subway motors had been attempted ten or twelve years ago, conclusions undoubtedly would have been drawn by many engineers, showing the absurdity of attempting to make high-class motors of this size.

In the same way advances in the art have led to a more complete understanding of the underlying principles of commutation among those interested in the design of commutating apparatus, although such knowledge, except in a general form, is limited to a small number of engineers. Very few of all those who handle modern direct-current generators or motors, really know why their machines commutate so much better than some of much older designs which were apparently built on the same lines.

Motor designers with a wide experience in the problem of commutation are now awakening to the fact that commutation of alternating current does not furnish a set of new and mysterious phenomena, but that the laws which apply to direct-current commutation also apply to alternating-current commutation, and that the problem is one of degree principally. If a continuous current of X amperes have its direction reversed in a coil without sparking as the coil passes under the brush, then there should be no difficulty in reversing this current if it varies periodically from X amperes to zero and up to X amperes again. The trouble is that when opinions on commutation of alternating current were originally formed, it was not known how to communicate the current of X amperes.

The principal difficulty in commutation of alternating-current motors has been the presence of local secondary currents in the coils short-circuited by the brushes, such currents being due to pulsating or alternating magnetism through the short-circuited coils. Various arrangements have been tested at different times for lessening the effect of these secondary currents. Such motors are usually built with a comparatively large number of commutator bars, with a very small number of armature turns per bar, to lessen the effect in the short-circuited coil. Very narrow brushes have been tried in order that the period of short-circuit may be lessened, and two or more parallel windings forming the so-called "Sandwich" type have been tried. These windings lie side by side on the core, but are practically independent of each other and connect to alternate commutator bars, or to every third bar, etc., dependent upon whether two or three parallel sets are used. With two of such parallel windings on a core a commutator brush of a width slightly less than one bar could be so placed that it would never short-circuit a coil of either winding. In this case the brush passes from one winding to the next, and breaks connection with the first winding before passing to the next bar of the first winding. With this arrangement the short-circuiting of the coils would be diminished, but the type of winding is one which we do not consider satisfactory for railway motors. We consider that this is simply transforming the trouble due to the short-circuited coil to another trouble, which would in the end be just as serious, viz., the tendency of such windings to produce blackening and pitting of the commutator bars. Such an arrangement would require very thin brushes, if but two parallel windings were used, while with three parallel windings the brush could have a thickness corresponding to two commutator bars.

A number of other devices have been tested at various times by different experimenters, but these are attempts to cure an existing difficulty rather than to lessen or eliminate the cause of the difficulty.

Within the past year or two there has been a great awakening to the possibilities of this problem, with the consequence that there is now a world-wide appreciation of the field of operation for commutator types of single-phase motors which will accomplish results not hitherto attainable. Single-phase motors having good commutating properties are now on the market in this country for the commercial frequency of 25 cycles per second. Higher frequency motors could probably be built with reasonably good results, but as 25 cycles has become a commercial frequency in this country, it is probable that this will become the standard for traction service for single-phase motors.

A single-phase motor having series characteristics having been obtained, it is at once evident that it opens up various methods of control hitherto not utilized in railway service. Having the motor which can be controlled in speed by variations in the voltage supplied to it, then voltage control can at once be obtained due to well-known properties of alternating-current transformers. Such methods of control are dependent upon the use of alternating current, and have not been applied in railway apparatus heretofore, because there was no suitable motor on the market.

Many forms of apparatus for varying the voltage on alternating-current circuits have been known and used, and most of these devices permit voltage variations with comparatively small loss in power. Therefore, with an alternating motor with the series characteristics, it is at once evident that we can obtain a traction system in which the power expended is practically proportional to the work done, and therefore the least power will be consumed at starting at low speeds. This is an ideal condition for railway service, but has not been permissible with the direct-current system, except by great complication.

There are a number of ways in which the various single-phase commutator type of motors can be controlled in speed. With the straight series type, the voltage applied to the terminals can be varied, the field windings can be varied, commutated, etc., or the relative values of armature and field strength may be varied. With certain designs of motor, exciting brushes may be placed on the commutator, as we have indicated before, and the voltage applied to these brushes may be varied. All these methods may be used also with the transformer types of motors.

By shifting the polarity of the fields to one side or the other of the normal position, the speed can be also affected to a greater or less degree, and similar results can be obtained by shifting the armature brushes. The latter method we do not consider a suitable one for traction motors. Series-parallel control can also be used, if desired, just as on direct-current motors, and rheostatic control can also be used. These two methods have practically the same effect on economy as found with direct-current motors with these methods of control.

The single-phase motors of all types, in common with polyphase induction motors, have one feature which is not shared by the direct-current motors, viz., there is an active voltage between the field turns. The alternating magnetic flux through the field of the alternating motor generates an e. m. f. in the field windings, just as in the case of an alternating-current transformer. In the direct-current motor the only voltage in the field coils is that represented by the current flowing against the resistance of the windings. Therefore, in a direct-current motor a short-circuit can occur between one or more turns of the field coil without immediate disastrous effects on the motor. Those who have had a wide experience in the operation of electric railways and are familiar with the extremely high temperatures momentarily obtained under certain conditions, will appreciate the importance of this good feature of the direct-current motors.

If direct-current motors were so designed that short-circuit between two turns, due to overheating or other conditions, would immediately disable the motor so that it could not be operated, then it would be necessary to very considerably increase the dimensions of such apparatus in order to get emergency capacity. It will at once be appreciated that the alternating-current motor, with an active voltage between field turns, must be designed to stand heavy overloads without danger of short circuits between field turns. Therefore, either these motors must be designed with more margin of temperature than the direct-current practice, or the windings used must be such as will permit of more perfect insulation between turns than is used in direct-current practice. If such motors are wound for voltages corresponding to direct-current railway practice, then there is a greater danger from short circuits in the field than with direct-current motors, and if the motors themselves are wound for comparatively high voltages—say 3000 volts, for instance—then the danger from this source is very considerably increased, for with a 3000-volt motor a large number of comparatively small wires must be used in each coil, and these must be well insulated from each other, and the entire winding must be well insulated from the ground. Experience with alternating-current, high-voltage stationary motors has shown that such motors are not nearly as safe as those wound for 200 volts or 400 volts, and we believe that for motors under a car, subjected to the extreme variations of traction service, the danger from short circuits and grounds will be very much greater than in the case of stationary motors. If such traction motors are wound for low voltages, say 200 volts approximately, then heavy conductors and but a very small number of turns will be necessary on the field, and each conductor can be separately insulated both from other conductors and the ground. Therefore, the alternating current permits the use of a low-voltage motor, with the consequent advantageous construction of field coils where the conditions of operation in direct-current practice prevent the use of any lower voltage on the motors than that supplied by the line. Troubles from oil and dirt, such as frequently occur with direct-current motors, will become of great importance in alternating-current railway motors wound for very high voltages. We believe that, except for very special cases, it will be found safer to step down the voltage on the car by a transformer, thus supplying the motors with low voltage from the secondary circuit rather than to wind each motor so that it becomes a transformer subjected directly to the high voltage of the system. In cross-country work, where high voltage would preferably be used, the step-down transformer method also furnishes additional protection from lightning, as it is well known that it is easier to insulate one transformer from lightning than to insulate two or four motors. The question of safety to the passengers and apparatus in the car must be considered in this matter.

A large number of estimates have been made comparing the general performance, cost, etc., of equipping roads with single-phase alternating-current motors, instead of direct-current motors, supplied from rotary converter sub-station. In all these cases the advantage has appeared decidedly in favor of single-phase, except in a small number of cases where some small limiting condition was placed upon the alternating-current system. If the starts are very infrequent and the running periods long, then the gain in efficiency by elimination of the rheostatic losses at start may be more than compensated for by the slightly lower efficiency of the motors themselves. Where such conditions apply, generally high trolley voltage will be used, and there will be enough gain in efficiency in the transmission and distributing to more than balance the loss in the equipment. Furthermore, the elimination of the rotary converters will furnish a still further gain in efficiency. In estimates made up to the present time, we have in practically all cases found higher total efficiency for the single-phase railway than for the direct-current railway with sub-stations. In cross-country work the gain in the transmission and distributing system and the rotary converters compensates for other losses. In city work where starts are very frequent and low speeds necessary at times, the gain by elimination of the rheostatic control has appeared as a very important item in the efficiency.

It thus appears that, while suburban work was once thought to be the most important field for the single-phase railway, it has now become evident that city work, where traffic is very congested in parts of the system, will prove to be one of the best fields for this system. Of course, it is recognized that for heavy railroad service, where all kinds of speeds should be obtained economically, the single-phase railway system will undoubtedly show to great advantage compared with any known direct-current system. But as considerable time will be required to equip any railroad service, it is probable that the single-phase railway system will be well tried out before there is a good opportunity to give it a thorough trial for heavy work. There is no difficulty in designing single-phase motors for sizes up to 300 hp or larger, and of sufficiently small dimensions to be used with a single reduction gear on locomotives. There is also no difficulty in designing regulating devices for controlling the power of such motors. For example, a 600-kw induction regulator manufactured by the General Electric Company has been in commercial operation at Niagara Falls for many years, and a regulator of this capacity would be sufficient to control a 2400-hp locomotive. The induction regulator furnishes an ideal method for locomotive control, as the voltage supplied to the motors can be varied over a wide range without making or breaking the circuit.

In conclusion, we would say that the subject of the commutator type of motor is now being thoroughly studied by engineers in all the principal manufacturing companies in the world, and there is no longer any question that such motors can be built successfully for commercial service. When it is once shown that such motors are feasible and that, therefore, a new field of development is opened, there is immediately a willingness on the part of most of the manufacturing concerns to undertake the perfection of such apparatus. What is needed in any line of development is a promise of success, and it may be taken as true that success will then be obtained.

DOUBLE-TRACK CURVES FOR SINGLE TRACK ROADS

The Appleyard syndicate has adopted the practice of laying double tracks on practically all of the curves of its single-track roads. This precaution makes head-on collisions practically impossible, as with high-power headlights the danger of head-on collisions on a straight track is almost negligible. The installation of double track on all curves is comparatively inexpensive, as these lines are, for the most part, built on their own right of way. Great attention is also paid toward eliminating curves as far as possible and toward constructing the lines so that they will contitute the shortest distance between the different points. The practice of constructing double-track curves mentioned is probably unique, and is of interest to all operators of single-track high-speed lines.

THE COST OF PILOTS ON INTERURBAN CARS

The interurban cars of the Muncie, Hartford & Fort Wayne Railway have all been equipped with pilots or cow-catchers, which were made in the companies' shops. H. J. Lake, master mechanic, gives the cost of these pilots, including all labor and material, as $17.09 each. This includes, also, putting on and painting.

GAS-POWER FOR CENTRAL STATIONS *

BY J. R. BIBBINS

It is intended in the following to offer testimony upon four contentions, viz.:

(A) That present gas-power machinery is suitable for central-station service.

(B) That a well-equipped gas-power electric plant can operate with far better economy than a steam plant under similar conditions.

(C) That its operation is much simpler and requires less running expense for the same results.

(D) That gas works, laboring under low load or output-factor, can profitably install a gas-power electric generating station, and become its own largest customer, selling both gas and electricity at competitive rates.

The basis of this paper consists of data collected from various electric light and power plants in the United States, using gas engines as their principal motive power. A number of these plants being operated in connection with illuminating-gas works, it has been possible to observe the somewhat unique position of the gas-engine station as a direct, though affiliated, competitor of the gas works.

Equipment.—Table 1 presents the most important data upon the general equipment and service rendered by the first twelve plants considered. The identity of the exhibitors is withheld, in most cases by request, thus making available more complete and valuable data. These plants are located in centers ranging from 2,000 to 20,000 inhabitants, and, in most cases, where the cost of fuel is high. The equipments average about 315 brake horse-power capacity and operate every standard form of generator for arc and incandescent lighting and for railway or general power service. All the generators are belted, the majority directly, but a few through the medium of a jack-shaft, the latter arrangement being employed in order to obtain the desired flexibility of service without installing a number of engines of small size.

Plants 13 to 15 are somewhat larger and generate polyphase power for industrial works. These three plants average approximately 570 brake horse-power, and the units are all direct-connected and run in parallel. Operative results have been obtained from plants 1 to 11, inclusive, the first and last furnishing excellent data upon the comparative economy of the present gas engines and the steam engines which were replaced.

In general, the character of electrical equipment is not all that could be desired for furnishing results of great accuracy; but owing to the more or less uncertain calorific value of the fuel gas used, errors of a few per cent in particular cases will not have much effect upon the general result. In any event, the average cost of power charged against the station is the desired figure.

Service Requirements.—In considering the subject in hand from an unbiased standpoint, it is important to enumerate the qualifications imposed upon the gas engine, in order to determine its actual merits.

1. Continuity of service at any cost.
2. Simplicity of operation, conducing to the above and securing low cost of attendance.
3. Reasonable cost of equipment.
4. Economy of fuel and supplies.

A 65-hp, two-cylinder vertical engine of the type employed in the plants here considered, and operating a fan blower, has run 8230 hours out of 8472 hours, and of the 3 per cent time in which the engine was not in operation only 43 hours, or 0.6 per cent of the total time, was attributable to the machine, being for changing igniters and taking up bearings.

During this period the engine ran, without stopping, 1157 hours, and was then shut down to repair a broken belt.

In a pumping station located on the Allegheny, a short distance from Pittsburg, five 85-hp engines of the same type operate regularly at full load through the week without stopping, except on Sunday, when the units are shut down in rotation for inspection and repair. Each engine operates from 96 to 98 per cent of elapsed time. It is needless to state that such service would not be required in central stations, as reserve capacity should be available for use during peak loads. In the present exhibit, the majority of the plants operate from 18 to 22 hours per day, giving ample time for inspection and repair, even if no reserve capacity were provided.

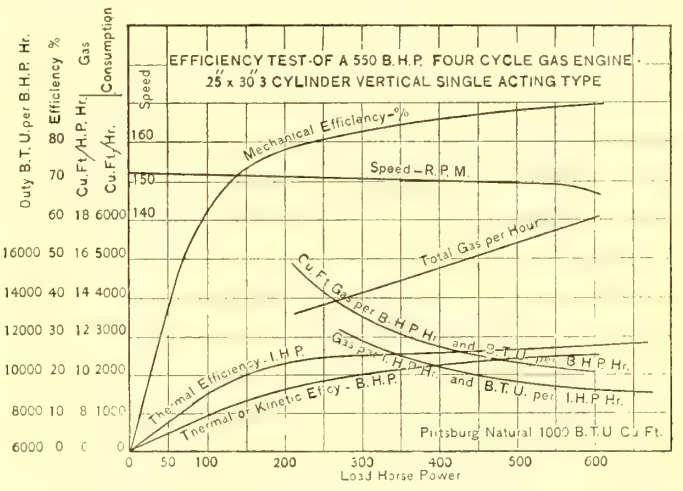


FIG. 1.—RESULTS OF EFFICIENCY TEST OF 550-HP GAS ENGINE

The skill required for operating a gas plant is apparently no greater than for steam plant. In several instances where the latter have been replaced, the old employees have been retained. In newly-established plants steam engineers have invariably taken charge after short preliminary instruction from the builders' erecting engineer.

In plant No. 11, weekly inspection of bearings, igniters and valves were at first carried out. This was found to be unnecessarily frequent, and is now done once a month. The cylinders are inspected occasionally throughout the year. This plant, 800-hp capacity, is operated by three day men and one night man, ten hours to a shift.

In cost, the gas-engine equipment is quite comparable with that of a steam plant. The engine itself costs more than a steam engine of corresponding size, on account of the increase in metal required by the higher pressures dealt with. With the cost of condensing machinery charged to the steam engine, however, this disparity is much reduced. With natural, or illuminating-gas supply available, the equipment cost would fall considerably below that of a steam equipment of boilers, engines, condensers, heaters, pumps, etc. In the case of a producer-gas plant installed to supply the gas engines, the cost of the respective equipments, each of 1000-hp is at a parity, although depending somewhat upon the gas-storage capacity provided. This, however, amounts to much less than electric storage. For producer gas the former costs in the neighborhood of $7.35 per hp-hour and the latter $100.[1] Considering the increase in productiveness of labor, which is stated by a prominent gas engineer to be fully 100 per cent (owing to the fact that one man can handle twice the amount of coal), the advantage, if any, held by the steam plant disappears.

In economy of fuel, the gas engine admittedly has no rival. The present limit of steam-engine practice is 10 lbs. water per ihp, or 11 lbs., per bhp. With an evaporation of 10 lbs. of water per lb. of good coal (14,000 B. T. U. per lb.) a performance of 1.1 lbs. coal, or 15,400 B. T. U., per bhp is realized. The gas

* Abstract of paper presented at a meeting of the American Institute of Electrical Engineers, New York, Dec. 18, 1903.

1. $100 per M cu. ft.

engine at present delivers, at full load, a bhp upon 10.5 ft. to 11 ft. of gas (of 900 to 1000 B. T. U. per cu. ft., calorific value) which is equivalent to 10,000 to 11,000 B. T. U. per bhp; Fig. 1 shows a typical test-log upon a 550-hp engine of the three-

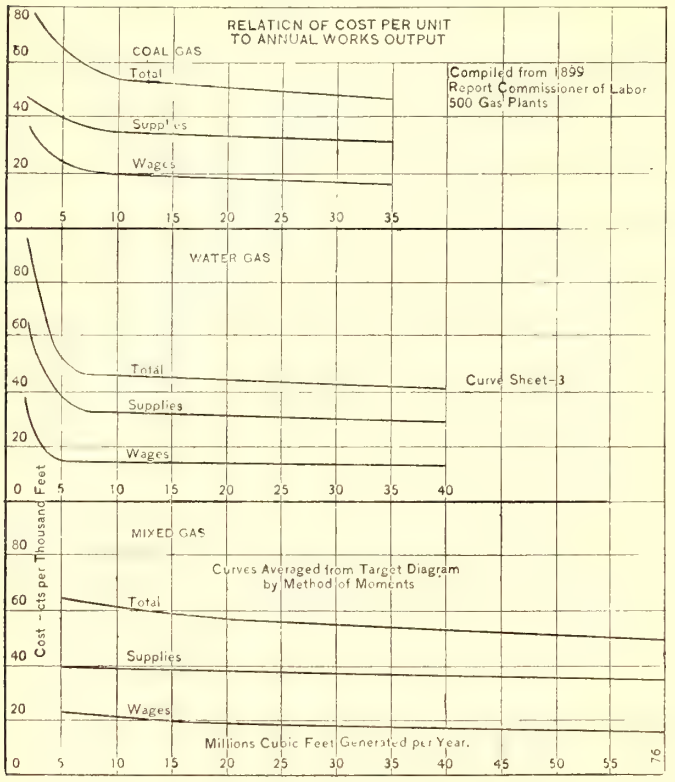


FIG. 2.—RELATION OF COST PER UNIT TO ANNUAL OUTPUT

cylinder vertical type, employing the four-stroke cycle. The thermal efficiency shown is the true or "kinetic" efficiency, viz.:

$$\frac{\text{Output}}{\text{Input}} = \frac{\text{B. T. U.: equivalent of work done}}{\text{B. T. U.: value of gas}}$$

At full load this appear at 25 per cent, considering the comparative remoteness of the theoretical limit of gas-engine efficiency, and the fact that the theoretical efficiency of a steam engine working between the usual units of 150 lbs. boiler, and 3 lbs. condenser pressure, has already been exceeded, there appears to be an encouraging future for internal combustion motors.

Advantages.—The advantages of the gas engine for central stations may be summarized thus:

1. Minimum fuel and heat consumption.
2. Light load efficiency higher than steam engine of corresponding size.
3. Low cost of operation and maintenance.
4. Simplification of equipment.
5. Small number of auxiliaries required.
6. Absence of "standby" losses.
7. Quick starting.
8. Waste heat in jacket-water suitable for building heating.
9. Ease of extending equipment.
10. Absence of high pressure, except in engine cylinder. No danger from explosion outside, as a mixture of proper proportions is required.
11. Power can be stored during light loads at small cost in the form of gas in holder.
12. Sub-division of units more easily accomplished, yielding higher all-day economy.

An important source of economy in gas plants is the fact that as soon as an engine is shut down all heat losses cease. Also, during operation no heat is lost by the gas in transit from the producer, and the plant is not hampered by inefficient auxiliaries such as steam pumps, condensers, return traps, etc., all of which largely increase the general complexity of the system. Steam-pipe and cylinder condensation losses, radiation, leakage in piping and fuel loss in banking fires have no parallel in the gas plant. The only auxiliaries required are the igniter generators and air compressors. The former are negligible as affecting the economy of the station, and the latter operate at full capacity at regular intervals. In cases where artesian wells supply jacket-water, a pump is, of course, required preferably operated by a motor or small gas engine, to which the air compressor may also be belted.

In quick starting, the gas engine fulfils every requirement. The 280-hp pumping units of the Philadelphia high-pressure fire system have been repeatedly started cold, brought up to speed and the pumps loaded to the required pressure (300 lbs. per sq. in.) within a period of 40 seconds from the starting signal.

A number of plants make use of hot jacket-water for heating buildings, ordinary cast-iron or coil-pipe-radiators being used for this purpose. One station partly supplies a municipal heating system resembling Yaryan, thereby deriving direct revenue from a waste product. Part of the return water is sent again through the jackets, the temperature being lowered to the proper degree by adding fresh water from the station supply main.

In the matter of parallel operation of alternating-current generators, plants 13, 14 and 15 have been distinctly successful, particularly in view of the variable character of load incidental to large industrial works operated by induction motors. All the units are of the direct-connected type with standard flywheels. A spring-coupling provides a flexible connection between engine and generator, to absorb cyclical speed variations. The usual copper dampers on the pole pieces assist in preventing hunting. In general, a low frequency seems to be desirable, with high peripheral speed and moderate reactance in the generator to assist in damping current fluctuations. The suddenness of the impulse in a gas engine cylinder offers, to be sure, greater difficulties than in the case of a steam engine, but the remedy has apparently been found.

Fuel Gas.—Several distinct fuel gases, suitable for gas engine use are available. When reduced to calorific values per foot of

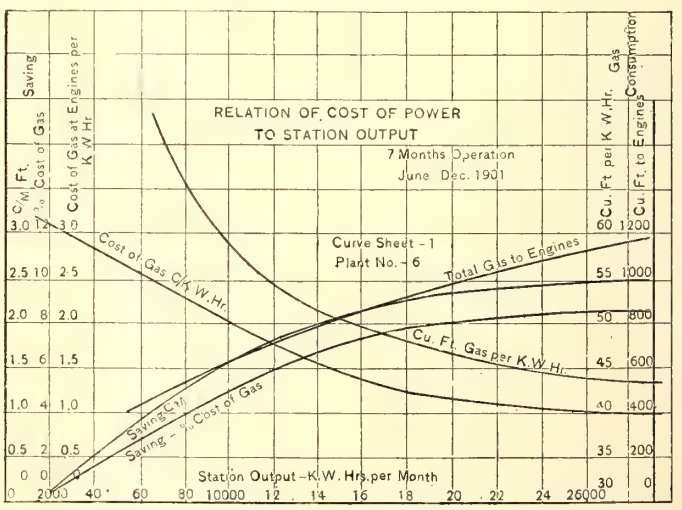


FIG. 3.—RELATION OF COST OF POWER TO OUTPUT IN PLANT NO. 6

explosive mixture of proper constituency, the ratings are nearly equal.

	Approximate B. T.U. per cu. ft. Gas.	Mixture.
1. Natural gas	1000	91.0
2. Coal gas	650	91.7
3. Water gas	300	88.0
4. Carburetted water gas	600	92.0
5. Producer gas	120 to 145	60 to 68
6. Coke-oven gas	600	90.0
7. Blast-furnace gas	90	53.0

The power to be developed by an engine of given proportions does not therefore vary within appreciable limits, except on producer gas and blast-furnace gases, when larger engines are required, or larger cylinders on the same engine frames. The rate of combustion is, however, less rapid with these than with other gases, due to the large amount of inert gases, such as N and CO_2 present in the mixture. The compression may also be carried much higher without risk of pre-ignition or "back-

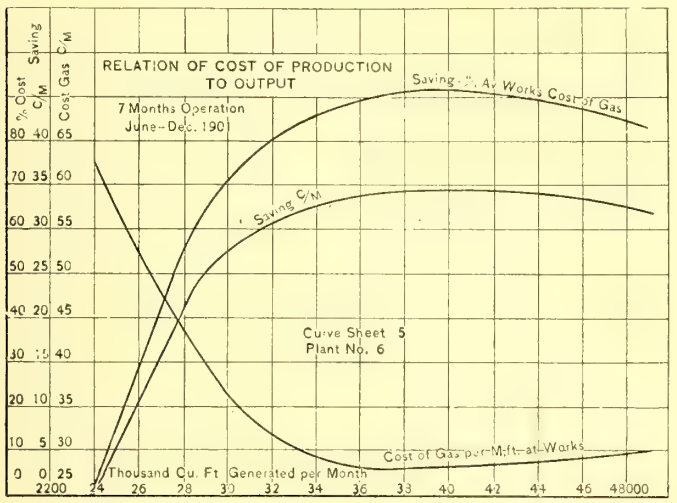


FIG. 4.—RELATION OF COST OF PRODUCTION TO OUTPUT IN PLANT NO. 6

firing," thus increasing the efficiency of the cycle. With water gas the high percentage of hydrogen occasions quicker combustion and higher flame temperatures with so considerable a tendency to pre-ignition and back-firing that this gas is not well adapted to gas-engine work.

Water gas can be used to great advantage for power purposes, however, by mixing with the air or blast furnace gas made during the period when the producers are under blast.

A comparison of the approximate thermal efficiencies of the various processes gives the following results:

Coal gas (without coke)	24%
Coal gas (with coke)	60%
Water gas	60%
Water gas, special quick-blast	75 to 80%
Producer gas	80 to 85%

Assuming the calorific value of coal as 14,000 B. T. U. per pound and the efficiency of the gas-making process 80 per cent, the heat available at the engine is 11,250 B. T. U., which is equivalent to about 1 bhp. This duty, 1 bhp per pound of coal, should, therefore, be expected from a well-equipped gas power plant.

Station Economy.—Returning to the consideration of the plants under exhibit, the average station economy observed is shown in Table 2. Although in some cases "over-dynamoed," the engines are generally underloaded and frequently so much so that good economy could hardly be expected. The average gas consumption per kilowatt-hour is 39.0 cu. ft. Assuming an average calorific value of 625 B. T. U. per foot for coal gas, water gas, or mixed gas, the heat consumption is 24,400 B. T. U. per kilowatt-hour, 18,200 B. T. U. per ehp-hour, and 14,500 B. T. U. per brake horse-power-hour. The average cost of gas charged to the engine is 33.9c/M, which is in nearly all cases considerably above the cost in the holder to companies operating both plants, with the result that the gas works realizes a handsome profit from the electric station in addition to the decrease in cost per unit with increased production. Assuming an average production cost of 20c/M, the average cost of power is 0.83c. per kilowatt-hour, equivalent to .0495c. per brake horse-power-hour at 80 per cent combined efficiency.

The comparative cost of steam and gas power is well shown in Tables III and IV. In Table III two independent stations were operated during 1902, together with the gas works. The cost of coal in the steam plant was 1.38 cents per kilowatt-hour, against 0.75 cents per kilowatt-hour in the gas plant, representing a saving of 45.5 per cent, although the cost per thousand B. T. U. of gas was 3.4 times that per thousand B. T. U. of coal. Assuming calorific values of 14,000 and 625 B. T. U. per pound and cubic feet, respectively, 92,000 B. T. U. were required per kilowatt-hour in the steam station, against 29,100 in the gas station, or a saving in the latter of 68½ per cent.

In Table IV the general balance of economy is on the side of the gas station. The steam plant started operation on natural gas at 10 cents per thousand, with a minimum of $3,000 per year. It employed boilers fired by gas. One year after starting the gas plant this minimum was reached, and the company is now paying at the rate of over 16 cents per thousand feet. The saving in total operating cost amounted to 40.5 per cent. In the face of a 30 per cent increase in station output the gas consumption has been reduced by 93 per cent.

Combined Gas and Electric Stations.—The theory of increase of profits from the operation of combined gas and electric plants is based upon the fundamental principle of reduction in cost per unit with increased output. Fig. 2 shows the cost of coal gas, water gas and mixed gas for approximately 500 gas plants in the United States, taken from the report of the Com-

TABLE I.—GAS-POWER PLANT EQUIPMENT

Plant No.	Engines: Rated Capacity Full Load BHP	Engines: No.	Engines: BHP	Engines: Transmission: Character	Engines: Transmission: Efficiency	Generators: Incandescent Power	Generators: Railway	Generators: Arc	Generators: Total kw Generating Capacity	Generators: BHP Gen. ÷ BHP Eng.
1	685	3	125-280	Belt	82.5	1-ϕ	550V.D.C.	----	370	.845 (*x*)
2	170	2	85	"	80	--	------	230 lts.	112	1.00 (*b*)
3	110	2	55-	Jack-shaft	75	2-.	------	----	75	1.3
4	90	2	35-55	Belt	80	1-.	------	----	40	0.93
5	320	4	55-125	Jack-shaft	75	3-.	------	60 lts	232	1.18 (*c*)
6	340	4	55-125	"	75	2-.	------	----	215	1.14
7	305	3	55-125	Belt	82.5	1-.	------	----	260	1.38
8	280	1	280	"	80	1-.	------	50 lts.	152	0.91
9	---	2	55-85	"	--	1-.	------	----	---	---
10	85	1	55	"	80	1-.	------	----	60	1.17
11	803	6(*x*)	125-210	"	82.5	1-.	------	200 lts.	476	0.97 (*d*)
12	255	3	85	"	80	2-.	------	----	116	6.78 (*e*)
Av.	314									
13	375	3	125	Direct-con'ct d	85	2-.	------	----	75	0.94 (*f*)
14	491	4	125	"	85	2-.	------	----	75	0.96 (*f*)
15	840	3	280	"	85	2-.	------	----	150	.85 (*f*)
Av.	568									

(*a*) Largely railway load—running 15-18 hrs. per day.
(*b*) Exclusively arc.
(*c*) Monocyclic system—runs 24 hrs. per day.
(*d*) Plants operate 24 hrs. per day—Natural gas.
(*e*) Natural gas.
(*f*) Operates in parallel—Natural gas.
(*x*) 8-hp engine belted to air-compressor and pump.

TABLE II.—COST OF OPERATION, FUEL ONLY.

Plant Number	Character of Load	Kind of Gas	Per Cent of Total Gas Gen., Used for Engs.	Manufacturing Cost Gas	Cost Charged to Engines	Gas per Kw-h. at Switchboard	Cost per Kw. Gas Only	Cost per Kw. Per Cent Steam Stat'n	Remarks
				c/m	c/m	ft.	c.	%	
1	Railway	Mixed	54	18	37.57	43.75	1 65	--	Av. 6 mos.
						28.40	1.07	81.	All day run
					at 18	46.57	0 84	63.5	Gas at cost
2	Arc.	Coal	--	18	18	33.64	0.61	24.5	Av. 4½ mos.
3	Incan.	Coal	31	--	62	53.2	3.3	--	Av 6 mos. '02
4	"	Water	30	--	59.3	41.6	2.46	--	Av. 20 mos. 1901-1902
5	Arc, and Incan.	Mixed	37.5	.	34.6	----	--	--	Output not metered
6	Incan.	Coal	26	--	39.8	48.4	1.93	--	Av. 9 mos. '02
8	"	Coal	5	19	33	28.5	0.94	--	Night run 65% rating
9	"	Mixed	19.5	--	29.5	41.7	1.22	--	Av. 6 mos. '02
10	"	Coal	15.0	--	20	41.9	0.98	--	Av. 19 days Aug. 1902
11	Incan. and Arc.	Natural	100	10	15.0	12.4	0.18	--	Special test
				10	16.0	21.5	0.34	26	Av. 6 mos.
Aveage					33.9	30.0	1.4		

Average cost per kw-h. at 20c., gas (excluding No. 11) ..... .875c.
" cu. ft. gas per kw-h 38.17

mission of Labor on Gas and Electric Plants for 1899. The curves bring out the following points:

1. Cost per unit decreases as output increases, most rapidly in coal gas plant and less rapidly in water gas plants.

2. Decrease in cost per unit in small plants of 2,000,000 to 10,000,000 per year output is very marked, being greatest in water gas plants and least in mixed gas plants.

3. The greatest opportunity for increasing revenue from combined gas and electric stations appears to be in the case of small coal and water gas plants under 10,000,000 output. The smaller the plant the greater the profit.

Fig. 3 is a diagram taken from the results obtained in plant No. 6, and represents the saving due to increased production, part of which is traceable to the electric plant and part to consumers. In this plant a saving of 24 per cent was realized, and in plant No. 9 the remarkable amount of 92 per cent of initial works-cost.

In order to bring out clearly the character of this saving, due to increased production, the following case has been estimated along the lines already discussed and indicated from the results obtained from stations in operations: A 10,000,000-ft. plant has been taken generating gas at 40 cents per thousand, works-cost, including coal, bench fuel, labor, repairs and miscellaneous material, residuals not deducted. Fixed charges have purposely been omitted. The gas is charged at works-cost to the electric station. It is assumed that the cost of gas for this plant, previous to absorption of the electric plant, was 50 cents per thousand, and that the electric plant generates electricity at twice the fuel cost, 3.2 cents per kilowatt-hour. During normal operation with an output to the electric plant of 30 per cent of the total amount of gas generated, the total net revenue of the combined works was about $13,300; 45 per cent of which was due to the electric station and 55 per cent to the gas station. The operating costs will then amount to 46.4 per cent of the net revenue.

Comparing the operations of the gas station per se, previous to and following the acquisition of the electric station, there is a net revenue of $5,835 and $7,344 respectively, or an increase of $1,509; 25.8 per cent of the original revenue. Figuring in the saving of 10 per cent per thousand, due to increased production, the total increase amounts to 43 per cent of the net revenue upon the original gas station.

Considering, finally, the combined works, the increase is $7,449, or 127 per cent of the original revenue, and adding again the saving 10 cents per thousand, the total increase is 145 per cent of the revenue of the original gas works.

Although these percentages will be considerably reduced by the consideration of investment charges, depreciation, sinking fund, etc., the fact remains that the saving due to combined operation is material and should appeal particularly to companies operating independent gas and electric generating stations.

TABLE III.—COMPARATIVE OPERATING ECONOMY.—PLANT NO. 1

	Steam Station 1250 IHP. Averages for 6 mos., April-Sept.			Gas Station 685 BHP. Average for 6 mos., May-Sept.	
	Load, Railway, Incandescent, Arc.			Load, Railway	
	1901.	1902.			
Kw-hour per mo.	.....	122733	Kw-hour per mo.		39508
Lbs. coal	761058	802507	Cu. ft. gas.		1726400
Per cent ash	8.2	7.7			
Lbs. coal per kw-hour	.....	6 52	Cu. ft. gas per kw-hour		43.75
Cost coal per ton, f. o. b	.....	4.02	Gas charged per M ft.		37.67c.
Handling	.....	.19	Price gas per kw-h		1.65c.
Total	.....	4.21	Cost gas, actu l		17.2c.
Cost coal per kw-hour;	.....	1.375	Actual cost kw-hour		0.75c.
			Per cent saving cost per kw-hour		45.5%
Cost per M.B.T.U	.00091	.....	Cost per M.B.T.U		.036c.
Watt-hours per lb. coal—A.M.	138.30	134.65	Watt-hours cu. ft. gas—A.M		24.33
Ditto—P. M.	161.40	166 02	Ditto—P. M.		21.40
Ditto—24 hours	159.97	159.08	Ditto—24 hours		22.23
B.T U. per lb., estimated	14000	14009	B.T U. per cu. ft., est		625
Watt-hours per M	.....	11.35	Watt-hours per M		.....
B.T.U. 24 hours	.....	.....	B.T.U.—24 hours		35.6
B.T.U. per kw-hour	.....	92000	B.T.U. per kw hour		29100
B.T.U. per E.P.H. hour	.....	68600	B.T.U. per E.H.P.		21700
B.T.U. per B.H.P. hour at 80%	.....	55000	Per B.H.P. at 85%		18400
			Per cent saving heat		66.5%

SPECIAL TEST, GAS STATION

All Day Run:		Five-Hour Run:	
Max. Watt-hrs per cu. ft gas	35.3	Max. Watt-hour per cu. ft	40.9
Cu. ft. gas per kw-hour,	28.40	Cu. ft. gas per kw-hour	25 0
" " " " E.H.P. hour	21.20	" " " " E.H.P hour	18.6
(1) " " " " B H.P. "	18.02	" " " " B.H.P. "	16 65
(2) B.T.U, per B.H.P.	11250	B T.U. per B H.P.	10400

NOTE.—Both plants run 15 to 18 hours per day. Gas plant started April 1, 1902. Steam station consists of compound condensing engines and water tube boilers. Average load factor of steam station higher than gas station.

TABLE NO. IV.—COMPARATIVE COST OPERATION STEAM ENGINES VS. GAS ENGINES ON NATURAL GAS.—PLANT NO. 11.

Year.	Gas ft.	Labor.	Repairs.	Oil and Waste.	Total.	Remarks.
		Steam	Plant.	Gas Fired Boilers.		575 IHP = 490 BHP.
1897	9753.20	9725.26	600 00	1185.06	.....	Gas rate, 10c. per M-ft., minimum reached in 1900. Avg. 1902 15.9 c/m.
1898	9320.70	8258.33	400.60	306.14	19924.34	
		Gas	Engine	Plant.		800 BHP Increase Revenue.
1899	6318.92	6828.74	239.85	533.56	.....	1897 %
1900	3000.40	6782.01	499.09	592.92	.....	1898 5.75
1901	3000.00	7678.83	196.90	407.01	.....	1899 7.5
1902	3000.00	7626 67	261.04	379.70	.....	1900 11.0
					11836 41	1901 13.5
						1902 18.5
						Increased load 1898-1902, —30%

Saving ..... 8087.93 = 40.5 per cent.

Operating cost { Steam ... $36.40 per year per hp. capacity of station.
Gas .... 14.80 " " " "

Saving $21.60=59.4%

ECONOMY TESTS

Steam station	Gas station
1898—24 hours	
Gas per IHP-hour ..... 51.09 ft.	Gas per kw-hour, av. 6 mo., 21.50 cu. ft.
" kw-hour ..... 86 "	Calorific value gas, 1175 BTUc/u. ft.

THE EVOLUTION OF THE ELECTRIC RAILWAY MOTOR*

BY S. T. DODD

The early investigators of the electric railway problem, Edison, Field and others, made the mistake of attacking it from the locomotive standpoint, and, consequently, their efforts contributed little or nothing to the solution of the problem. The first electric car to be driven by a motor placed under the car floor was put into operation in 1884 in Cleveland, Ohio, by the Bentley-Knight Company. A Brush arc machine was used as generator, and a machine of the same type was used as motor, the latter being connected to the car wheels by a wire rope drive. The Brush type of machine later proved itself eminently unfitted for this service, but, at that period, it was the only successful high-voltage machine, and it was believed that in this type lay the promise of the coming long-distance transmission of power. This combination of Brush machines worked reasonably satisfactorily when there was but one car on the line, but when other cars were added the generator behaved very badly, as was inevitable, since the attempt was being made to run the motors in parallel from a constant-current machine. Troubles were experienced with the wire rope drive which was first used, and bevel gearing was substituted with the conduit. The experiments on this road made it evident that further developments must be along one of two directions. Either the current must be supplied to the cars at a constant potential, or the motors along the line must be operated in series. The Bentley-Knight Company followed the former of these alternatives in its later work. It is interesting to note, however, that these experiments were made with series-wound motors, while other companies, before and after, were experimenting with compound wound or shunt motors.

In 1885 and 1886 various experiments were made by Messrs. Daft, Sprague, Van Depoele and Short. It is noteworthy that in Mr. Sprague's equipment of this period one end of the motor was supported directly on the axle, while the armature was connected to the axle by single-reduction gearing. Mr. Short

* Abstract of paper read Dec. 16 before New York Electrical Society.

attempted to develop a series railway system, and built a road in Denver which was abandoned. To Mr. Short should be given the credit of recognizing the value of the series-wound motor, as demonstrated by the earlier Bentley-Knight experiments, but not used by other designers of this time; also of seeing that for motors of the normal speed of that date, double-reduction spur gearing should be used. He built a conduit-series road in Denver in 1886, and overhead roads on the same system in Columbus, Ohio, and Huntington, W. Va., in that or the following year. The multiplicity of contacts required, however, prevented the success of the series system of distribution. By 1887 or 1888 both the Bentley-Knight and the Sprague companies had developed bipolar series-wound motors especially for railway service. The Bentley-Knight Company was using a rheostatic control, while Sprague employed commutated fields for securing a variation in speed. Sprague used also inside-hung motors, while the Bentley-Knight motors were outside hung. It was about this time also that public attention began to be attracted to the work, largely through the successful operation of Sprague's Richmond road.

The years 1888 and 1889 were very eventful; the Sprague and Edison interests consolidated, the Bentley-Knight and Van Depoele interests were acquired by the Thomson-Houston Company, and there appeared on the market a Westinghouse double-reduction motor and a Short double-reduction motor. We might say that the standard railway motor at this date was bipolar, running at a normal speed of 1000 to 1500 r. p. m. It was connected to the axle by double-reduction gearing. It was series wound, and with the exception of the motor of Sidney Short, who, by this time, had abandoned his series distribution system, was of the smooth core drum type. The high speed of these motors was a serious disadvantage. The railway managers were bitterly complaining of the expense of maintaining gears and pinions. It was seen that the electric railway motor could not be a final and permanent success until some method was found of obviating this difficulty.

The Wenstrom motor of 1890 offered the solution of this difficulty. Although this motor never attained any commercial importance, it had two marked characteristics which affected the future development of the motor. It had four poles, and, like Short's motor, was designed with slotted armature, thereby making possible the reduction of motor speed and the change to the single reduction type of motor. All of the manufacturing companies were quick to appreciate the value of these features, and it appeared on the market soon thereafter with single-reduction motors. The Westinghouse Company then introduced what might be called the first of our modern motors, its No. 3, which, with the minor modifications introduced in the No. 12 and No. 38, remains to-day the standard Westinghouse type. As is apt to happen, two of the companies went to the other extreme of bringing out gearless motors. The objection to the gearless motor of that date was its weight, its rigidity, its inaccessibility and the fact that it was not adaptable to various speeds.

The Thomson-Houston W P motor of 1892 and the General Electric 800-motor of 1893, were attempts to make an absolutely enclosed and waterproof motor. With the appearance of the enclosed motor a new problem was introduced; namely, ventilation, a factor which had previously received but little attention, and which even to-day is not always given the consideration which its importance deserves. This motor is noticeable from its use of the Eickemeyer interchangeable coil. In 1894 appeared the General Electric 1000, wherein they followed the lead of the Westinghouse No. 3, and had four poles, abandoning the consequent pole design. This motor used the straight-out or barrel winding, which has since become standard in motor armatures. In 1895 the Walker Company brought out its No. 3, which marked a decided advance, in that better provision was made for ventilation than in any previous type of motor. In 1899 the Westinghouse No. 38 introduced laminated poles. In 1896 there was a change in the character of the service demanded of railway equipments, brought about by the beginning of interurban roads and by the extension of city roads into the suburban districts, the new conditions calling for continuous service at moderate loads. In order to meet the new requirements the General Electric Company brought out its No. 52, the feature of which was the ventilated armature, which has since become standard. The Walker 15-L, a 100-hp motor which was built for the Brooklyn Elevated, and the General Electric No. 51 illustrate the limitation imposed upon motors of the standard type when built in large sizes. This limitation called for a change in motor construction, which was met by such motors as the General Electric No. 50, and particularly the General Electric No. 55, built for the Nantaskett Beach line and the Metropolitan & West Side Elevated. The latter had a solid box frame, with waste-packed bearings, from which the armature could be removed by sliding it out through one end. This type has since become popular for very heavy service.

The S. K. C. type of motor represents a still further development of the principle of motor ventilation. For the first time in a street railway motor, both ends of the armature are left open for the entrance of air into the armature, and there are ducts in the pole pieces and through the frame of the motor, which register with the ducts in the armature perpendicular to the shaft. As a result of this unusually good ventilation the all-day load of this motor is about 50 per cent of its hour rating (with the same heating), as compared with an all-day capacity of but 35 per cent of the hour rating for other motors of the same grade.

In the General Electric No. 74 motor is preserved the compactness of the General Electric No. 55, with the added advantage of increased accessibility of the armature. The General Electric No. 69 for the New York subway and the two makes of German motors used upon Berlin-Zossen line, are the most modern types of motors for heavy service, and in each of them it should be noted increased attention is being paid to ventilation. As is well known the Berlin-Zossen motors are alternating-current motors, and mark a reversion to the gearless type discarded ten years ago.

I have attempted to show you how our present type of motor grew from the stationary motor of twenty years ago. It is a series motor, a characteristic which was inherited from the Brush motor used by the Bentley-Knight people in 1884. It is hinged upon the axle and geared to it by spur gearing, for which we are indebted to Messrs. Sprague and Short in 1886; it is a multipolar motor, with slotted armature, which is derived from the Wenstrom motor of 1890; it has concentric fields, with salient poles, projecting inwardly from the surrounding case, and the armature is series-connected so that one pair of brushes suffice for a multipolar motor, characteristics which are derived from the Westinghouse No. 3 of 1891. It has machine-wound coils and a barrel armature, which are due to a development through the Westinghouse No. 3, the General Electric No. 800 and the Walker. It has laminated fields, which were introduced by the Westinghouse No. 38 in 1895; it has a ventilated armature, for which we are indebted to the General Electric No. 52 of 1896.

At the present time increased attention is being paid to disposing of the heated air from the interior of the motor and the ventilation of the motor for long-time service. This means that the motors of the future will have reduced weight of electrical parts, magnetic iron and conductors, and more attention will will be paid to the bearings, gears and other mechanical parts.

Considering the changes in motor design during the last twenty years, which I have sketched above, it would be idle to assert that we have yet reached a permanent standard type, or that new motors will not be produced from year to year, as new improvements are suggested and new problems confront us for solution.

COMBINATION CARS FOR THE CAMDEN, GLOUCESTER & WOODBURY RAILWAY

The J. G. Brill Company, Philadelphia, has delivered four combination passenger and smoking cars of its patented semi-convertible type to the Camden, Gloucester & Woodbury Railway Company, one of the systems controlled through the South Jersey Gas, Electric & Traction Company by the Public Service Corporation of New Jersey. The line is 25 miles in length, and reaches, among other popular resorts, Washington Park, much patronized by the people of Philadelphia and Camden.



COMBINATION PASSENGER AND SMOKING CAR USED BY THE CAMDEN, GLOUCESTER & WOODBURY RAILWAY COMPANY

The cars are divided into two compartments, the passenger compartment having 34-in. seats, placed transversely to the car, leaving the aisle 20¾ ins. wide; and longitudinal seats in the smoking compartment, making a total seating capacity of thirty-six. The interiors are handsomely finished in natural cherry, with bird's-eye maple ceilings. The partition between the compartments is of hardwood, with glass in the upper parts and a swinging door with 21¼-in. opening. Distance from floor to center of monitor deck is 8 ft. ½ in.; length of cars over end pieces, 26 ft. ⅛ in., and over vestibules, 36 ft. 4⅛ ins.; from panels over crown pieces, 5 ft. 2 ins.; length of smoking compartment, 8 ft. 8⅞ ins.; width over sills and panels, 7 ft. 11½ ins., and over posts at belt, 8 ft. 2 ins.; sweep of posts, 1¾ ins.; from center to center of posts, 2 ft. 10⅛ ins. The side sills are 4½ ins. x 7¾ ins., with sill plates on the inside 12 ins. x ⅜ in.; side posts are 2¼ ins, corner posts 3⅝ ins. The cars are equipped with radial draw-bars, ratchet brake handles, gongs, sand-boxes, angle-iron bumpers and other specialties of the builders' make. The trucks are Brill 27-G, with solid forged side frames, 33-in. wheels, 3¾-in. axles, and equipped with four 30-hp motors per car.

HOT-WATER HEATERS IN SINGLE TRUCK CARS

The South Chicago City Railway Company is now installing hot-water heaters in a number of its single-truck cars. This is a rather unusual practice, as while hot-water heaters have been used extensively in interurban work, stoves and electric heaters have heretofore been principally relied on for use in short cars. A very small type of Peter Smith heater is being used for this purpose, and it is placed on the front platform, which is vestibuled.

The platform supports have been strengthened to provide for carrying this extra weight continuously. The cars in which these heaters are being placed have 20-ft. bodies, and are equipped with cross-seats. Heretofore, electric heaters have been used in them, but owing to the increased demand for power, it has been a question of installing more generating machinery for the winter peak load or substituting something else for the electric heaters, and the alternative chosen was the hot-water heater.

PORTABLE CAR TELEPHONES

Telephone manufacturing companies have apparently, in some cases, failed to realize the rough usage which a portable telephone instrument for use in despatching or for other purposes on an electric car must be able to stand. This has not been true, however, in the design of the new portable car telephone just put out by the Stromberg-Carlson Telephone Manufacturing Company, of Chicago. This instrument has all parts heavy to adapt it to the rough handling it is likely to receive. Convenience of operation and the conditions under which it will be used have also been taken into account.

Fig. 1 shows the telephone instrument complete, as it would be hung in the motorman's cab of an interurban car. Fig. 2 shows the instrument open, and Fig. 3 shows the portable part or instrument proper removed, as would be necessary it it were to be used away from the car or if an exchange of instruments were to be made. The top box contains the telephone transmitter, magneto for calling and transmitter battery. The bottom box has a reel of flexible cord. When the upper or telephone box is in place it is connected to the cord in the reel in the bottom box through contact plates on top of the reel box, which make contact with buttons in the bottom of the telephone box. The object of the reel of cord is to enable connection to be made with plug receptacles on the pole near the car. The cord terminates in a plug similar to the plugs used in

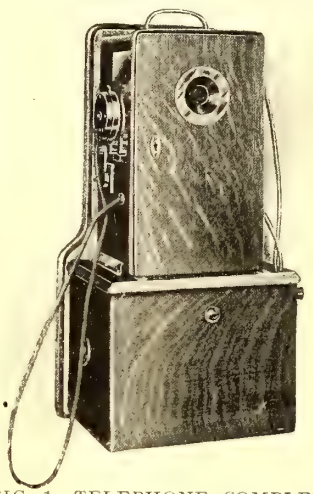


FIG. 1.—TELEPHONE COMPLETE

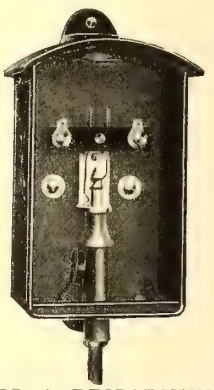


FIG. 4.—DESPATCHING PLUG BOX

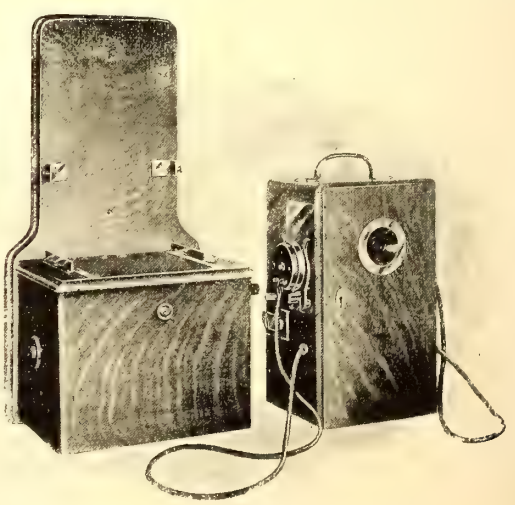


FIG. 3.—PORTABLE PART, OR INSTRUMENT PROPER, REMOVED

telephone exchange switchboard work. This plug, however, is much larger and heavier. There is a guide for the cord as it is wound onto the reel, and a crank on the outside of the reel box for winding up the cord. The receiver is of the watch-case type, and when not in use fits in a substantial receptacle, which operates like the usual receiver hook switch to cut out the transmitter when the instrument is not in use. The box is heavy and well put together, and all parts are securely fastened in it. The portable part of the instrument or telephone box has a plug and short cord attached to it, for use when the telephone is used on the line away from the car. Fig. 4 is the plug receptacle containing the jack, which is placed at the pole, and through which connection is made with the line.

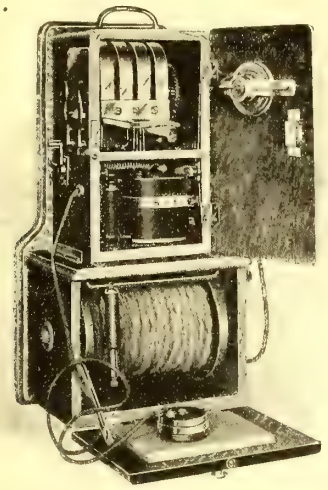
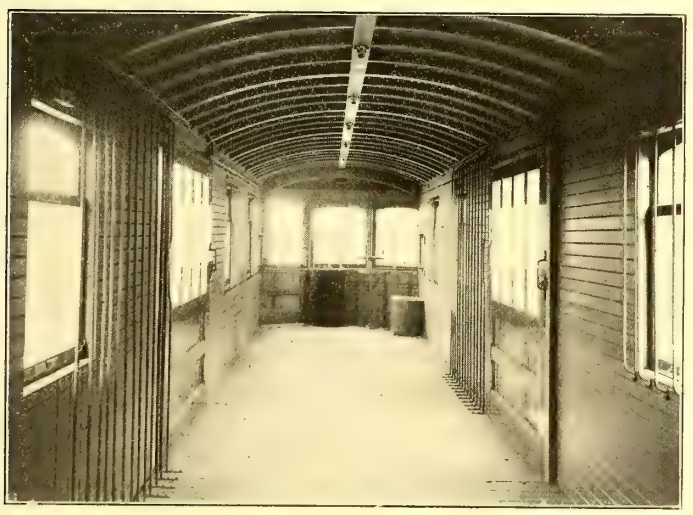


FIG. 2.—TELEPHONE OPEN

ELECTRIC LOCOMOTIVE FOR BRAIDENTOWN, FLORIDA

The Manatee Light & Traction Company, of Braidentown, Fla., has received from the American Car Company, St. Louis, the car shown in the accompanying illustration, which is intended for carrying baggage and freight and is also to be used as a locomotive. In the STREET RAILWAY JOURNAL of May 30 a description was given of the Brill type of convertible cars built by the American Car Company for the Manatee Light & Traction Company, in which it was mentioned that Braidentown is an important shipping center for quite a large district, and is at the mouth of the Manatee River, on Tampa Bay.



INTERIOR OF MANATEE FREIGHT CAR AND LOCOMOTIVE

The doors are placed at diagonally opposite corners of the car, to admit rails and long pieces of material, such as may be used in road construction. The floor is powerfully framed and trussed to carry heavy loads. The windows at the sides are arranged to be raised in the usual fashion; those in the ends have pockets in the wainscoting, into which they may be dropped.

The length of the car is 40 ft. over crown pieces, and width, including sheathing, is 8 ft. 4 ins. The side sills are 5¾ ins. x 7⅞ ins., with sill plates on the inside 7 ins. x ⅝ in. The car is equipped with angle-iron bumpers, radial draw-bars, alarm gongs and sand-boxes of Brill manufacture. The trucks are Brill 27-G, with 4-ft. wheel base and 33-in. wheels, and are equipped with 38-hp motors.



ELECTRIC FREIGHT CAR AND LOCOMOTIVE FOR MANATEE LIGHT & TRACTION COMPANY

ALTERNATING CURRENT FOR SIGNALING ON INTERURBAN ELECTRIC RAILWAYS

Upon invitation a party of railway signal experts, representatives of the technical press and others interested in the operation of suburban and interurban electric railways, visited Rochester, N. Y., last week, and was offered an opportunity of examining into the operation of the automatic block signaling system of S. Marsh Young, which is owned by the Pneumatic Signal Company, of that city. This, by the way, was the first public demonstration that has been made. The party included the following railway men:

C. W. Hotchkiss, president, Indiana Harbor Railroad Company.

J. M. Waldron, signal engineer, Interborough Rapid Transit Company.

R. G. Siegel, signal engineer, Brooklyn Rapid Transit Company.

H. H. Hillborn, electric department, Brooklyn Rapid Transit Company.

Azel Ames, signal engineer, Boston & Albany Railroad.

J. C. Irwin, signal engineer, New York Central & Hudson River Railroad.

J. S. Gillespie, superintendent, Albany & Hudson Railway.

Charles R. Barnes, engineer, New York State Railroad Commission.

George W. Aldrich, secretary, New York State Railroad Commission.

Fitzhugh Townsend, professor electrical engineering, Columbia University.

D. F. Carver, chief engineer, Public Service Corporation of New Jersey.

On the arrival of the party the members were taken in hand by the following-named officers of the Pneumatic Signal Company: J. N. Beckley, president; Charles Hansel, vice-president and general manager; S. Marsh Young, manager, electric railway department; John T. Cade, sales manager; F. L. Dodgson, chief engineer; Aaron Dean, signal engineer.

R. E. Danforth, assistant general manager of the Rochester Railway Company, placed that company's handsome special car,

"Genesee," at the disposal of the visitors, and personally attended to the transportation arrangements.

A section of the Rochester & Sodus Bay Railway, near Float Bridge, and several miles from the city, had been equipped, two blocks having been installed on a portion of the line that presented an opportunity for a very severe test. There are heavy grades and sharp curves at this point, and an exposed portion of track enabled the company to determine whether the system would be affected in severe snow storms or after the tracks had practically suffered a wash out. The records of the railway company, it may be said, show that under all conditions when it was possible to operate a car, the signals worked satisfactorily; likewise abnormal conditions, which were devised to illustrate these features during the test last week, had no apparent effect on the working of the signals.

The essential features of this system which distinguish it from others that have been commonly employed are:

1. The use of alternating current for signaling, and the employment of the traffic rails for the signal circuit as well as for the return power circuit.

2. The use of a special bond for connecting the sections of adjacent blocks around the insulated joints, and also cross-connecting the tracks, which offers little resistance to the direct current, but effectually chokes back the alternating currents.

3. The use of special relays at the entrance of every block, which control the operation of the signals.

The accompanying diagram, Fig. 1, shows the arrangement of the apparatus as employed in the demonstration last week. By reference to the cut it will be seen that X represents the block rail, Y the common rail, L the alternating-current transmission line conveying power from A C, the alternating-current generator at the station, to the signaling apparatus on the line. The signal blocks are represented in their order as 1, 2 and 3. T is the transformer furnishing current for the track circuit

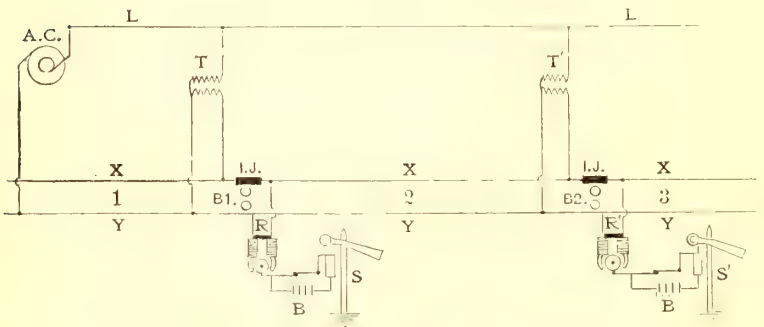


FIG. 1.—DIAGRAM OF TRACK CONNECTIONS

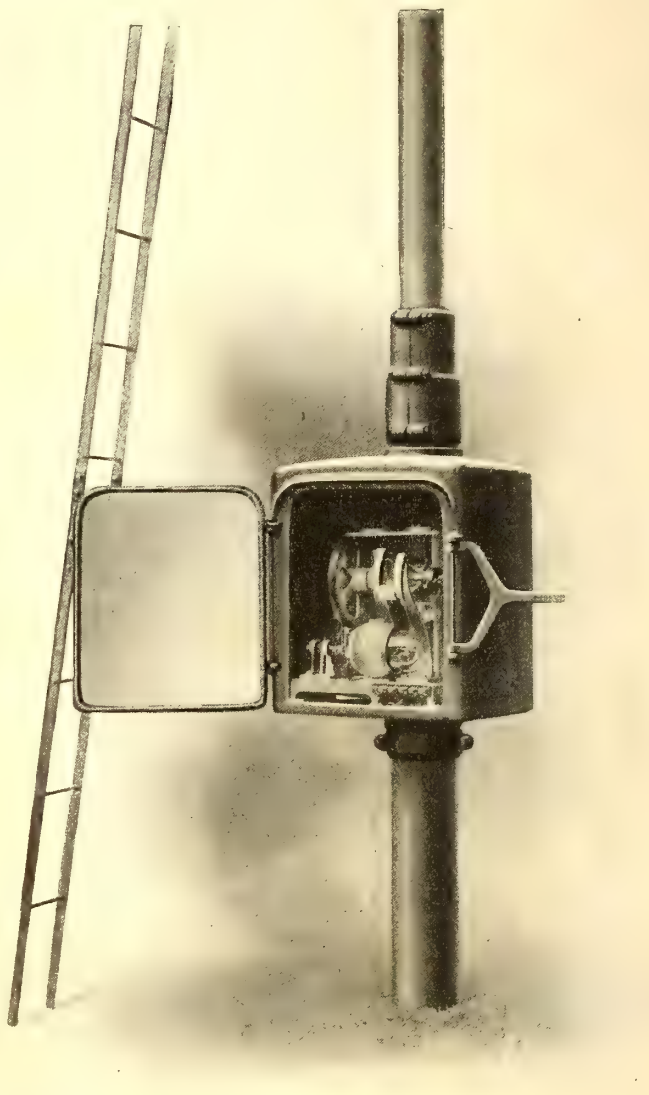


FIG. 2.—INTERIOR OF CASE OF ELECTRIC MOTOR SIGNAL

to block No. 1, and T′ performs the same service at block No. 2. R and R′, respectively, are the relays governing signals S and S′, while I J indicate the insulated joints in the block rail, around which the special bond is utilized, and B_1 and B_2 are similar bonds, which make the block rail (X) electrically continuous.

Fig. 2 shows that portion of the signal mast carrying the case containing the operating mechanism which can be readily understood. The door of the case is represented open in the cut, thus exposing the mechanism to view. It should be mentioned in this connection that the operation of the system is not limited to the use of this type of apparatus. The operating mechanism consists principally of an electric motor with a train of gear wheels, and an electrical control for making and breaking the connection between the motor and the blades. The motor is entirely enclosed, the commutator end having a glass shield. The power is transmitted through a train of gear wheels. The operation of the mechanism has been very carefully worked out, both electrically and mechanically, and it has been subjected to very severe tests.

The principle upon which this system is based is that while it is impossible to keep two direct currents of different potentials separate on the same conductors, an alternating current may be introduced to perform one of two given functions, and if proper apparatus is supplied to keep each current from interfering with the instruments designed to be operated by the other current, the track circuit becomes feasible and practicable. The apparatus must, of course, become operative only under the influence of one current, and must remain inoperative in the presence of any other current, and while it may be called upon to afford a path to the direct current, it must effectively choke back the passage of the alternating current. By this arrangement one current may be used to operate the car, and the other to operate a track circuit to control the signals without interference or interruption.

On a direct-current road, an alternating current is impressed on the direct-current line for signaling, and a road employing alternating current may also be operated if the power current and the signal current have different characteristics. In the test last week the road employed direct current at 500 volts, and the signaling circuit carried alternating current at 300 volts, which was reduced at the transformers to 3 volts.

In the main power station and in each sub-station a small alternating-current generator should be placed to provide this alternating current, and in the experimental work on the Sodus Bay Railway a motor-generator was employed. As each block only requires about 20 watts for track circuit purposes, a double-track road, 15 miles in length, with 1-mile blocks, would

only require a 1-kw machine. A No. 10 wire is carried along the entire length of the road for furnishing the alternating current to the signaling system.

It has already been mentioned and shown in the diagram how the divided traffic rail is made continuous electrically as a return path to the direct-current generator, and the other traffic rail is uninterrupted. The track is divided into blocks as it is on steam roads, although but one of the traffic rails is broken for block signaling purposes. The other rail is used as a return for both direct current and alternating current. To one end of each block is fed alternating current transformed to the proper voltage, and at the other end of the block the relay is connected across the two track rails. Between the relay and the track is interposed one of the special bonds, preventing the relay from being affected by the direct current. Between the ends of adjacent block sections are also placed bonds, which offer a free path for the direct current to return to the station, but effectively choke back the alternating current and likewise prevent its escape into adjacent blocks, thus making the operation of the signals in each block independent. While the two traffic rails are of the same direct-current potential, there is maintained between them a difference of alternating-current potential for the operation of the track circuit of the signal system, but this does not interfere with the operation of the motor circuits. Cross-bonding between the traffic rails or between the block rail and the feeder return is accomplished by the use of devices similar to those used across the ends of the blocks.

The necessity of using both rails for the direct-current return is appreciated by all electric railway men, as the conductivity of a 100-lb. rail is equal to more than 1,000,000 circ. mils, and if one rail is given up for signaling, its conductivity must be replaced by copper in the return feeder, at a cost of $2,000 to $3,000 per mile. There are other difficulties, like the interruption of the motor circuit, where only one rail is used as a return circuit.

The theory of signal engineers until very recently has been that inasmuch as the traffic rails on an electric road were occupied by the 500-volt direct-current return circuit to the station, it would be impossible to maintain between the rails a uniform difference of potential in the operation of a track circuit for signaling purposes, and if one of the two traffic rails was devoted entirely to this purpose and properly insulated from the other rail, the maintenance of such a difference of potential would be impractical, in addition to the serious objections that would present themselves to the sacrificing of one of the two traffic rails as a direct-current return.

In the Rochester exhibition the road was divided into two blocks, one of about half a mile in length controling the operation of the signals shown, and the other a short block to show that there was no interference between blocks, and that the direct-current return was made continuous through both rails of these blocks.

In the station the motor-generator was operated from a 500-volt trolley circuit, and generated a 300-volt alternating current of 100 cycles. The number of cycles employed was determined by practical considerations wholly, the adoption of this particular standard, for instance, being occasioned by the desire to strike a mean between the ordinary lighting circuit as well as to prevent synchronism between the current-operating signal apparatus and that which will probably be used on the roads employing alternating-current motors.

A No. 10 copper wire runs the entire length of the road, and feeds the primaries of transformers located at the farther end of each block. These transformers are of 100 to 1 ratio, and the secondaries are connected directly across the rails, which sets up a difference of potential between the rails of about 3 volts. The secondaries of these transformers practically take the place of a primary battery on the steam railroad track circuit.

At the entrance to the block was shown one of the relays of special construction, which are only susceptible to the action of alternating current of a proper frequency, while current of different frequency does not affect it. The relay is also independent of any difference of track-current potential that may exist between the rails.

In the demonstration, as has been mentioned, one rail was uninterrupted through the entire length of the road, the other being divided up into blocks corresponding to the signal locations, and insulated by means of standard insulated joints, the same as are employed in steam railroad work. Up to this point the system would present an insulated rail for signaling purposes, owing to the insulated joint between the sections, but this divided rail is made continuous electrically by means of the bond, which is one of the essential features of this system. This bond bridges the insulated joint, and its design and construction are such that while it presents a perfectly free passage for the direct current around the joint it chokes back the alternating current, and thus keeps each block perfectly independent. Similar bonds are placed across the traffic rails in each block.

The signal shown was of the electric motor semaphore type, and operated from the 500-volt trolley line. The resistance, consisting of five incandescent lamps, was interposed between the line and a storage battery of six cells. These lamps were utilized to illuminate the blade, and the storage battery performed the double function of operating as a reserve in case the trolley circuit was cut off, and also enabling the signal circuit to be broken between the points of the relay. The electric motor operated at 12 volts, and took 5 amps. for 5 seconds to pull down the semaphore arm. It was held down by means of a mechanical clutch, taking about .02 of an ampere.

One of the features of the system shown was that even after the insulated joints between the blocks were broken down by a special arrangement, making the polarity of adjacent blocks opposite, the current from one block would rotate the relay in the direction opposite to that which it would normally take, open the signal circuit, and produce a danger signal. This relay is in reality an alternating-current motor without brushes. Its armature is connected to traffic rails, and its field is energized from the same source of alternating current. It will thus be seen that a car, entering the block and short circuiting the secondary of a transformer supplying current for that block, will cut off the current of the armature, and thereby cause it to assume its normal position, which opens the local signal circuit. It will be seen that the presence of foreign currents in this relay will have no turning movement, and that it would require a synschronous current from an outside source to produce such a result. Beyond this it requires a quarter of a volt to operate the relay.

In operation it was shown that where there was no car in the block the track circuit was completed from the secondary of the transformers through one rail, through the relay and over the other rail back to the transformer. This circuit, when completed, holds the relay points closed, and closes the local signal circuit, which holds the signal to clear. The entrance of a car into a block short-circuits the transformer, thereby de-energizing the relay and opening the signal circuit, causing the signal to go to danger. Any interruption to the track circuit from any cause will rob the relay of its current and will result in a danger signal..

With a battery track circuit, as used on steam roads, if the leakage between the rails is excessive, owing to the limited output of the battery, the relay will fail to work and the signal will go to danger. This may occur during bad weather, when the leakage across the rails increases rapidly, and it necessitates governing the length of the blocks by the condition of the roadbed. A claim is made for the electric railway, where alternating current is furnished from transformers, and the supply

of current available is such as may be ordinarily expected, that roadbed conditions which would prevent the use of battery track circuit, will give satisfactory results with the alternating-current system.

Aside from one alternating-current generator for the entire road and the signal mechanism, which may be of any desired form, the complete apparatus for each block comprises only one 50-watt transformer, the relay and bonds.

It has been the aim of the inventor to have the system so arranged that no possible combination or failure of parts can produce a clear signal when a danger signal should be shown. For instance, the breaking down of the insulated joints between the blocks will result in the giving of a danger signal, and direct-current from any foreign source cannot affect operation, while the presence of stray alternating currents will also fail to operate the relay.

Where electric motor semaphore signals are used, six small cells of storage battery are connected through a resistance to operate the signal motor. The battery also provides a reserve which will operate the signals while the motor current may be off. The battery is charged with about ¼ amp. continuously. Incandescent lamps are used as a resistance to cut down the 500-volt trolley circuit in charging the battery, and these lamps may also be used in the signal lantern and to outline the semaphore arm.

At the conclusion of the experimental test the visitors were taken back to the city and were entertained at luncheon at the Genesee Valley Club. The afternoon was spent at the works of the Pneumatic Signal Company, in Lincoln Park, a western suburb of the city. This plant is modern and very complete, and the visitors had an opportunity to examine the details of construction of the signaling apparatus made by this company. The "Young" system may be operated in several ways, and the modifications required for the different applications were explained and illustrated in operation. Other important features of construction were investigated.

CLEANING THIRD RAILS IN OPEN COUNTRY

Successful experiments for cleaning the third rail in a sleet storm have been made by the Grand Rapids, Grand Haven & Muskegon Railway Company, which has an exposed rail and is operated through an open country. The company claims to have demonstrated that a solution of chloride of calcium poured on the third rail will instantaneously remove a covering of ice or sleet, and, moreover, will protect the rail so that it will not be covered again with ice for at least three hours. These tests have also shown, it is said, that the solution will not injure either the steel rail or the copper bonding.

Three cars on that line have been equipped with reservoirs, located in the motorman's vestibule, from which tubes extend to a point directly over the third rail. In this reservoir the solution is placed. A stop-cock regulates the flow of the fluid. The first practical test was made early this month, when the road was to all intents and purposes tied up because of the worst storm of sleet it had ever experienced. Ice formed on the third rail to the thickness of ⅛ in., preventing the current from being transmitted to the motor.

A car supplied with the calcium solution was placed in operation. After the car had moved along for several miles without hindrance from the ice on the third rail, the flow of calcium was stopped.

Immediately the car was brought to a standstill. The solution was again applied to the rail, and instantly the car moved forward again.

Since that time additional tests have been made, and with much success, so that the officers of the company decided to make public the facts in the case, so that others who had similar troubles might take advantage of this experience.

CHRISTMAS CELEBRATION AT ROCHESTER, N. Y.

The Rochester Railway Company, which has long been noted for its philanthropic work among employees and their families, has added a new feature this year by providing an elaborate entertainment on Christmas for them. The officers of the company and representatives of the employees have worked together in this matter, and during the month have distributed many circulars among those interested and their friends, of which the following is a copy:

DON'T FORGET THAT CHRISTMAS, THIS YEAR, COMES DECEMBER 25th.

DON'T FORGET

that on that day we (which means you and every other employee of the Rochester Railway Company) are planning to have a

BIG CHRISTMAS CELEBRATION FOR THE CHILDREN

at the Employees' Association Rooms and we want you to feel that you are just as much *in it* as any of the Committee.

A light lunch for the men will be served all day, the expense of this being borne by the Company; all other expense will be paid by such subscriptions as each man may feel that he can give—whether it is 5 cents or $5.00 cuts no ice. We want you all there, withl wife and children, and, as the rooms will be open from 10 a. m. to 11 p. m., it will give all a chance to come in for at least a few minutes sometime during the day.

DON'T FORGET

that you are just as much interested in the success of this Celebration as the other fellow.

Don't forget that you are contributing to it.

Don't forget that you will be making somebody happier by so doing, and that it will make you a happier and better man as well.

Don't forget to show up and have a sandwich and some coffee and see what's doing.

Don't forget that Santa Claus will be on hand all day, distributing presents to the children, and for that reason

DON'T FORGET

to give us the name and age of each of your children, so that Santa will know how to provide properly for them.

Don't forget any of the children—better take this home with you and talk it over with your wife, she can help you count them up and see that you don't forget their names, ages, etc.

DON'T FORGET

to fill in the blank at the foot of this notice and return it at once to G. G. Morehouse, Secretary Rochester Railway Company.

Where more than one child in family, make out separate slips for each, similar to the printed blank below, sending all in at the same time.

Yours for the best Christmas we can possibly give the children,

T. J. Nicholl,	A. F. Phillips,	F. McCann,
R. E. Danforth,	W. C. Montignani,	H. J. Chase,
J. W. Hicks,	A. L. Wolfert,	C. H. Bauer,
Geo. G. Morehouse,	S. C. Alberts,	H. E. Hicks,
E. J. Wilcoxen,	J. F. McCabe,	W. Snyder,
	P. H. Arthur,	P. J. Clair,

Arrangement Committee.

.....

Name of Child.....
Age of Child (nearest year).....
Father's name.....
Return to G. G. Morehouse, Secretary Rochester Railway Company.

The company found the plan an excellent one, and the contributions were of a varied and valuable character. The men entered heartily into the plans, and it was because of the interest awakened among them that the event proved so successful.

PROTECTION FOR GRIPMEN IN CHICAGO

The Chicago City Railway Company has equipped a number of grip cars with a cab surrounding the gripman's aisle for protection against cold. This company's grip cars have always been operated heretofore as open cars.

FINANCIAL INTELLIGENCE

Wall Street, December 22, 1903.

The Money Market

The most noteworthy incident of the week in the money market is the sharp recovery in sterling exchange, which has carried the rate above the point at which gold imports are profitable. No further engagements, accordingly, have been announced, and it is the general opinion in banking circles that the movement is over for the season. Gold importations, however, have thoroughly fulfilled their purpose in tiding the money market over the most critical period of the year and in building up local bank reserves to an exceedingly comfortable level. Last Saturday's statement showed an increase of over $7,000,000 in cash holdings, half of which was due to the arrival of specie from abroad, the other half to the return of currency from the West. This latter movement is steadily increasing, and, inasmuch as the demands from the South appear to be pretty well satisfied, it is fair to assume that the regular accumulation of reserve funds resulting from the return of the crop-moving money is now fairly under way. With only two weeks remaining before the termination of the New Year settlements, the New York institutions hold the unusually large sum of $14,000,000 in their surplus reserve. This is abundant assurance that whatever strain there may be in supplying the 1st of January requirements, will be felt very little in the market. Looking ahead still further, there is not the slightest doubt that a considerable term of easy money is in store after the end of another fortnight. Money rates have already begun to discount the coming change. Call money is now lending freely at 4 per cent. Time money is easily attainable for the longer dates at 5 per cent, and for the shorter dates, at 5½ per cent. The only cloud on the horizon is the possibility that the railroads and other corporations, which have long been holding back schemes for raising capital, will feel that the opportunity which they have been waiting for has arrived. The first significant suggestion of such a demand has been furnished during the past week by the offering of $10,000,000 of new bonds for the Atchison Company. It is to be hoped that the lessons of the past year have been well enough learned for the banking community to give a very short rope to these borrowing applications.

The Stock Market

The Wall Street dealings have returned to a state of comparative dullness. This is quite often likely to be the case around the holiday period. So far as a general measure of sentiment is possible, the feeling as the year draws to a close is one of cheerfulness, mingled, however, with a very positive conviction that no great rise in prices is in store. Railroad earnings in most instances are exceedingly well maintained. Except in the companies which, having large improvements under way, are charging extra sums to operating expenses, net earnings are making as good a showing as at any time in the last few years. The enormous trade balance which the country has rolled up during recent months is also a source of great satisfaction. It has enabled us to liquidate our remaining foreign indebtedness, and even to establish a surplus credit in the foreign markets. Money rates, as already pointed out, are steadily relaxing, and a long period of easy money is promised after the first of the year. With the more favorable reports recently received regarding the iron trade, the business outlook, which has been a matter of anxiety for some time past, has assumed a more hopeful phase. These causes suffice to explain the confidence felt in important financial circles as to the soundness and stability of the market's present position. The attitude of the leading financial interests appears to favor continuance of the recovery by easy stages. Even if the public are reluctant to buy, and outside investors are not at all free about employing their capital in securities, there appears to be no good reason why prices should not work slowly higher. At this writing the rather alarming reports from the Far East are having a deterring effect upon the markets, both at home and abroad. While opinion locally is that the troubles between Russia and Japan will not lead to actual hostilities, still the possibility of a war, the first results of which might be liquidation among foreign holders of American securities, is enough to provide an additional incentive to caution.

Dealings in the local traction group this week have occupied a less prominent place in the general market than they did a week before. No further efforts have been made on the part of the various speculative cliques to continue operations for the rise. On the other hand, prices have been well sustained, and the action particularly of the Brooklyn Rapid Transit and the Metropolitan shares gives the impression that they are well under the control of the forces making for higher prices. There is no special news in conection with any of these properties. The latest tale in explanation for the recent advance in Brooklyn Rapid Transit is that the stock will be guaranteed at 4 per cent dividend by the Interurban Company, but this, on its face, is so ridiculous that even the most credulous refused to treat it seriously. Brokers in touch with the inside party in Manhattan Elevated claim that there has been some rather good selling of the stock on the recent rise.

Philadelphia

Following the course of the general speculation, dealings in the majority of the Philadelphia traction stocks have again become merely nominal. Only two issues have shown any approach to activity. These are Philadelphia Electric, which ranged between 6¼ and 6, and Philadelphia Company common, which sold up as high as 39¼, and later reacted to 38¾; the strength in the latter is partly referable to the favorable report put forth by the company for the month of November. The pool manipulating the shares has, however, shown no inclination to do much while the rest of the market was so dull. The record for the week includes sales of American Railways at 43 and 43⅛, Union Traction between 45¾ and 45¼, Philadelphia Company preferred at 43, Fairmount Park Transportation at 19, Philadelphia Traction at 96, Rochester Passenger from 74 to 74½, and Consolidated Traction of New Jersey at 65. Philadelphia Rapid Transit touched 9¾ in yesterday's dealings—the lowest it has ever sold—on the call for the new $5 assessment. Payment is due on Jan. 20.

Chicago

The Union Traction Company, in its contest with the city, has received something of a blow in the order issued this week by Judge Grosscup for the installation of two trunk trolley lines on Lincoln Avenue and Blue Island Avenue. It is also admitted by the traction leaders that they have failed to obtain permission to open up the great through routes to the North and West Sides, which were contemplated. Some reflection of these unfavorable developments was witnessed in the market, particularly in the case of City Railway shares, which reached a new low level at 155. Union Traction common was not materially affected, selling at 6. The attempt to stimulate speculation in Lake Street Elevated securities, on the strength of the success of the preliminaries in the organization plan, met with failure. Lake Street receipts, after selling as high as 2⅜, dropped back sharply to 1¾, and the stock sold at the same figure. The Corporation Counsel has reached the opinion that the Union Elevated loop has no rights in the downtown street it now occupies, and property owners along the line of the road are urging that it be put out of existence altogether. The city's action is an answer to the bill filed by the Northwestern Elevated Company, asking that the municipality be restrained from interfering with the extension of loop platforms. Metropolitan Elevated common sold at 17, and North Chicago at 85.

Other Traction Securities

Some idea of the paucity of the traction dealings in Boston during the week may be gained from the fact that not a single sale of the usually active Massachusetts Electric common stock has taken place. Massachusetts preferred sold at 76 in odd lots, Boston Elevated at 140¾, West End common from 89½ to 89, and the preferred from 111 to 110⅛. Only a few transactions occurred in United Railways of Baltimore stock at 8¾ and 8⅝. The income bonds were steady, between 57 and 56¾, but the general mortgage 4s lost half a point, from 91¾ to 91¼. Other Baltimore sales included Lake Roland Street Railway 5s at 118, City and Suburban 5s (Baltimore) at 112, and Atlanta Consolidated Street Railway 5s at 105 and 106. On the New York curb Interborough Rapid Transit, after getting up as high as 94, sold down 3½ points to 90⅜, with 600 shares changing hands. Brooklyn City

Railroad went up to 239, and reacted to 238. Fractional lots of American Light and Traction sold at 35 and 40. Chesapeake Traction 5s recovered 4 points to 90. New Orleans Street Railway 4½s sold at 80¼ and 80, and Washington Traction 4s at 71⅜.

Security Quotations

The following table shows the present bid quotations for the leading traction stock, and the active bonds, as compared with last week:

	Closing bid	
	Dec. 15	Dec. 21
American Railways	42½	43
Aurora, Elgin & Chicago (preferred)	a55	a55
Boston Elevated	140	140
Brooklyn Rapid Transit	49⅝	50⅞
Chicago City	*159¾	160
Chicago Union Traction (common)	5¾	5½
Chicago Union Traction (preferred)	25	25½
Cleveland Electric	67	65½
Consolidated Traction of New Jersey	64	64
Consolidated Traction of New Jersey 5s	105	105½
Detroit United	69⅛	68
Elgin, Aurora & Southern	a38½	a38
Lake Shore Electric	—	—
Lake Street Elevated	2	2
Manhattan Railway	*141	141¼
Massachusetts Electric Cos (common)	18½	18½
Massachusetts Electric Cos (preferred)	76	75
Metropolitan Elevated, Chicago (common)	16	16
Metropolitan Elevated, Chicago (preferred)	51	51
Metropolitan Street	121¼	122¼
New Orleans Railways (common)	9	10⅛
New Orleans Railways (preferred	30¾	30½
New Orleans Railways 4½s	—	80
North American	75	75½
Northern Ohio Traction & Light	12¼	13¼
Philadelphia Company (common)	—	39
Philadelphia Rapid Transit	10½	8½
Philadelphia Traction	96	96
St. Louis Transit (common)	13	11½
South Side Elevated (Chicago)	93½	90¼
Third Avenue	115	112
Twin City, Minneapolis (common)	92	91½
Union Traction (Philadelphia)	*45½	45½
United Railways, St. Louis (preferred)	59	55
West End (common)	—	89
West End (preferred)	—	110

Iron and Steel

Interest in the iron trade centered in the recent meetings held in this city to determine whether prices of the leading steel products should, or should not be maintained. The decision has been reached in the case of steel billets and structural steel that no further concessions are necessary at this time. It is contended that the present market is a waiting one, and that business can be secured after a while, just as well at these as at lower prices. The "Iron Age" notes the interesting fact that outside makers of steel billets are offering their product $2 below the official pool prices, and are securing what limited orders there are. Trade in pig iron is very dull. Quotations are as follows: Bessemer pig $14.50, Bessemer steel $23, steel rails $28.

Metals

Quotations for the leading metals are as follows: Copper 12⅜ cents, tin 27⅝ cents, lead 4¼ cents, and spelter 4⅞ cents.

SUBURBAN LINES ENTER TRENTON, N. J.

Three companies have recently opened new suburban lines to the very center of Trenton, N. J. The New Jersey & Pennsylvania Traction Company began running the cars from its Trenton, Lawrenceville & Princeton Railroad through North Willow and West Hanover Streets, to the corner of Warren and Hanover Streets, one block from the City Hall, the early part of the month. A few days later the Camden & Trenton Railway brought in its first car from Stanton Street, or rather from the extension at Cass Street bridge, and a day later the New Jersey & Pennsylvania Company brought in a car upon its Yardley, Morrisville & Trenton Street Railway. The Camden & Trenton cars terminate at State and Warren Streets, one block from the terminus of all the New Jersey & Pennsylvania Traction Company's lines, and one short block from the City Hall, which is passed by every car, local and suburban, that is run upon the Trenton Street Railway. Less than thirteen months ago the first foreign car ever run upon the streets of Trenton was No. 209, of the Trenton, Lawrenceville & Princeton line, which ran upon North Willow Street for a distance of 200 feet. Three lines are now running into the city, and the Trenton & New Brunswick Railroad Company will soon be running in on the Camden & Trenton's Liberty Street extension, to Liberty and Adeline Streets. All of the independent suburban lines were brought in only after a fight, and the extraordinary conditions imposed upon the New Jersey & Pennsylvania Traction Company have been detailed in former issues of the Street Railway Journal. The Camden & Trenton had a fight with some of the property-owners en route, and finally with the Pennsylvania Railroad Company at the Cass Street crossing. The Pennsylvania Company changed its policy, however, and allowed the electric railway tracks to be constructed under the Union Street bridge, in South Trenton, before the depression of that thoroughfare, undertaken by the railroad to avoid grade crossings, was completed. This saved the Camden & Trenton Company a couple of month's time, as the new street will have to be completed and be approved by the city authorities before the Pennsylvania is released from its obligations.

MR. HUNTINGTON ENTERTAINS PRESIDENT RIPLEY OF THE SANTA FE.

When President Ripley of the Santa Fe Railroad and his associates were in southern California recently on a trip of inspection, for one day they were the guests of Henry E. Huntington, who tendered the distinguished party a ride over the interurban lines of the Pacific Electric Railway Company out of Los Angeles. The party traveled in a private car. Their first destination was Long Beach, whence the return trip was made in the remarkably fast time of twenty-seven minutes—a distance of a little less than 20 miles. Then they went to Whittier, San Gabriel, Monrovia and Pasadena. The return trip from Pasadena was made in twenty-one minutes. In a little less than four hours the party traveled more than 100 miles over the system. "Great thing for Los Angeles and southern California," is the way Mr. Ripley referred to the many modern electric lines that Mr. Huntington is building, and he was profuse in his compliments to the latter. There was no business significance to the trip, according to Mr. Huntington, who says that Mr. Ripley belongs to the class of progressive railroad men who look upon the electric roads kindly.

CHANGE IN ROUTES IN NEW YORK

An important change of routes has just been made by the Interurban Railway Company, operating all the surface lines in Manhattan, whereby cars of the Sixth and Eighth Avenue lines now run to the Brooklyn Bridge. Heretofore one of the downtown terminus of these lines has been at Canal Street and Broadway, but cars now continue across Broadway on Canal Street to Centre Street and along the latter thoroughfare to the Bridge and Post Office. As the addition of these cars to the already congested traffic on Centre Street might result in considerable delay, the Second Avenue cars will be withdrawn from Centre Street and sent down over the Third Avenue tracks from Grand Street. This is the realization in part of plans which have long been in contemplation for affording continuous trips along natural routes of heavy travel without the necessity for transferring. The change is expected to result in a considerable increase in business. Ultimately, it is said, all congestion of traffic on Centre Street and Broadway may be lessened by utilizing the new Elm Street, which runs between these two thoroughfares practically from the Bridge to Astor Place, above which traffic conditions offer no serious problem.

DAMAGE FROM HIGH-TENSION WIRES

A 16,000-volt, high-tension wire used to transmit power from the station of the Economy Light & Power Company at Joliet to the substations of the Chicago & Joliet Electric Railway Company between Chicago and Joliet, broke Dec. 15, and did considerable damage by falling across some Western Union Telegraph wires. The break occurred at Ruby Street in Joliet. The high-tension current started fires simultaneously in the railway station of the Santa Fe Railroad at Romeo and at Joliet, and in the Michigan Central station at Spencer. The railway stations at Romeo and at Spencer, 25 miles apart, were burned to the ground. The accident, of course, demoralized the Western Union service wherever the current had its effect, as a large number of fuses were burned out. The accident serves to emphasize the importance of an effective system of guards in the shape of grounded guard wires or netting wherever high-tension wires cross other lines.

CHICAGO UNION TRACTION EXTENSIONS

Judge Grosscup has ordered the receivers of the Chicago Union Traction Company to place over-head trolley wires above cable lines in three short stretches, which will give that company an opportunity to operate a new electric line from the heart of the city over Halsted Street and Lincoln Avenue to the north side, and will shorten the Twelfth Street electric line. These improvements, it is admitted by the Council for the city, are permissible under ordinances granted in 1895.

Judge Grosscup did not, at the hearing on Dec. 17, order the receivers to go ahead with the extensive improvements which have been mentioned in spite of the refusal of permits by the city. It was thought that possibly he might give orders to the receivers to go ahead with the improvements, which would indicate that he considered the claims of the company under the 99-year act to be sufficiently strong to justify this action. Judge Grosscup declared he could not pass upon such an important matter until all the rights of the company and the city had been adjudicated by the Supreme Court of the United States. He arranged that the company should go before the City Council pending that decision and ask as a favor the privileges which in the hearing before him it had claimed as a matter of right. Should the Council grant permission, improvements could be made during the litigation over the 99-year act.

Judge Grosscup desires to make better service possible by constructing two loops in the downtown district. One of these loops would be on Van Buren, Dearborn, and Lake Streets and Fifth Avenue. To complete this as an over-head trolley line, it would only be necessary to construct a trolley from Randolph to Van Buren Street in Dearborn. A smaller loop on Franklin, Adams, La Salle and Washington Streets is also proposed. Plans showing what the company desires to do are to be submitted at once to the Council acocrding to the judge's instructions.

REORGANIZATION OF LAKE STREET "L," CHICAGO

The securities committee of the Lake Street Elevated Railroad, of Chicago, met Dec. 19 and declared the reorganization plan operative. For the time being, at least, this is presumed to mean an end of the financial troubles of the corporation. The committee extended the time for deposits of securities until Jan. 15, 1904. This extension was granted because of the fact that it will take that long to work out the reorganization details, and it was thought opportunity might as well be given security holders to come into the plan in the meantime.

In the new company there will be preferred and common issues, the capitalization being as follows:

First mortgage 5 per cent bonds	$5,000,000
Preferred stock non-cumulative, 5 per cent	3,200,000
Common stock	6,000,000

The reorganization provides for an assessment of $2 per share on the present outstanding stock of $10,000,000.

A comparative report of the company for the years ending June 30, 1903, and June 30, 1902, follows:

	1903	1902
Gross receipts	$834,059	$794,042
Operating expenses	465,491	388,969
Net earnings	$368,568	$405,073
Charges, taxes, etc.	417,738	401,380
Deficit	$49,170	sur. $3,693

ANOTHER MOVE IN THREE-CENT FARE SITUATION IN CLEVELAND

Constituents of Mayor Tom L. Johnson, of Cleveland, have proposed an ordinance in the City Council fixing the terms of rental to be paid by the so-called 3-cent fare company for the use of the tracks of the Cleveland Electric Railway on the portion of the system known as "free territory." The route over which the low-fare company desires to build includes portions of Rhodes Avenue, Detroit Street and the Viaduct, which would enable its cars to reach the Public Square. The proposed ordinance provides for the payment of $5,000 in cash prior to the use or occupation of the tracks. It further provides that the low-fare company shall bear one-half of the cost and expense of repairs, maintenance, and replacements of tracks and foundations, and shall also pay half of all taxes, charges, costs and other expenses that may be assessed or charged against the owners of the tracks used by the other company. This ordinance is the first attempt that has been made in Cleveland to determine the rental that a new company shall pay for the use of tracks on the so-called "free territory."

COMPETITION IN OHIO

For some time past the Cleveland & Southwestern Railway, the Lake Shore Electric Railway and the Lake Shore & Michigan Southern Railway (steam) have been having lively competition for the business between Cleveland and Norwalk. The Lake Shore Electric put on limited cars making the run of 57 miles in two hours and twenty minutes. Then the Southwestern put on a Norwalk limited, but was unable to arrange a schedule of less than two hours and thirty minutes. The Southwestern started selling special round-trip excursion tickets for $1.00, good on the limited cars. For a time it got the business, because the Lake Shore Electric was charging $1.25 for the same service. Then the Lake Shore Electric dropped its special excursion rate to $1.00. This spurred the Lake Shore (steam) to action, and it advertised special holiday shopping excursions at $1.00, round trip. Both specials on the electric lines left about the same time one day recently, but the Southwestern stole a march on its rival and did a sharp piece of advertising by sidetracking every car on the line and running the special at top speed the entire distance. The 57 miles were covered in exactly one hour and thirty minutes. On both the events of the Elks' memorial service both companies again ran specials. The cars left at the same time, and both companies sidetracked all other cars. The Southwestern car made the run in 1 hour and 30 minutes. The Lake Shore Electric car made a record run to Vermillion and was stopped there by a broken trolley wire, which took some time to repair. The car proceeded at high speed, and it is claimed that the actual running time for the 57 miles was 1 hour and 20 minutes. The two roads are doing some remarkable high speed work with their limited cars.

NEW ENGLAND STREET RAILWAY CLUB MEETING

On Thursday evening, Dec. 17, the New England Street Railway Club met at the Revere House in Boston. A very substantial dinner was served at 7 o'clock to those present, including some of the most prominent street railway men in New England. About one hundred and thirty members were present. After dinner had been served, President Farrington presiding, introduced Robert A. Parke, special agent of the Westinghouse Air Brake Company, of Minneapolis, Minn. Mr. Parke read a very interesting paper on the history, invention, development, application, use and maintenance of the various brake mechanisms which have been applied to railway vehicles since they came into existence. He paid particular tribute to Mr. George Westinghouse, to whose genius was due the invention and successful application of the air brake, now in universal use upon all passenger and freight cars in this country, as well as upon the majority of railway cars outside of the United States. He gave a thorough and exhaustive exposition of the technical details of manufacture, operation and maintenance of the Westinghouse air brake, as applied both to steam and electric railway cars. The Westinghouse magnetic traction brake for street railway service received, of course, a good deal of attention in Mr. Parke's paper. Particular attention was called to advantages of this brake in emergency instances, when cars must be stopped in the shortest possible distance to avoid serious accidents; attention was also called to the economy of this brake, in the fact that the current used in its application can also be utilized in heating the car to which the brake is attached.

After Mr. Parke had finished reading his paper, Mr. Farrington introduced F. W. Sargent, of the American Brake-Shoe & Foundry Company, of New York. Mr. Sargent gave an interesting talk on brake-shoes. He said that enough attention was not paid by designers of trucks to the proper application of the brake mechanism. One result of this was that shoes would wear unevenly, one end of the shoe becoming worn through before the other end was hardly worn at all. This entails great waste. Another point brought out by Mr. Sargent was that, although the soft cast-iron shoe is the ideal shoe under all conditions, on high-speed roads a shoe of much harder composition can be used, and will be found to give as good satisfaction as a soft shoe. The reason is that the shoe, when applied to wheels at very high speed, becomes softer by the heat developed between the shoe and the wheel. Of course the advantage of using a hard shoe is its wearing qualities. Mr. Sargent also spoke of the importance of the proper inspection and maintenance of the shoe, as well as the brake mechanism. The rattling of the brake-shoe is due in almost every instance to loose bolts. This is inexcusable, and should never be allowed on any road.

At the close of the meeting a rising vote of thanks was extended to Mr. Parke and Mr. Sargent for their able exposition of the subjects under discussion.

The next meeting of the club will be held on Jan. 28, at Hotel Brunswick. On that evening the annual banquet and the election of officers will take place.

MIAMI & ERIE CANAL BANK FOR STEAM RAILROAD

Daniel J. Ryan, attorney for the Miami & Erie Canal Transortation Company, better known as the "electric mule" company, has made formal announcement that a bill is being prepared to be presented to the Legislature, asking that the canal bank, now leased to the transportation company for canal-boat towing purposes, be leased for steam railroad purposes. It is now frankly admitted that the electric mule project can never be made a success unless a large amount of money is spent in improving the canal. The company will ask the State to fix a valuation on the property, and the company will offer to pay the State an annual interest, the rate to be fixed by law. The bill will provide that the company build a tow path for the live mule on the berme bank and shall pay the cost of raising and rebuilding all canal bridges. Of course, the most important phase of the deal would be the entrance of a steam road into the very heart of Cincinnati above high water mark. The fact that the canal company is taking even ground with the old line canal boat operators, and is advocating the expenditure of a large amount of money to improve the canal, is one that will deprive the opponents of the measure of some of their ammunition. Coincident with this application comes the report of State Engineer Perkins, who states that the time has come for the abandonment of the canals, or else the expenditure of a large amount of money to convert them into modern waterways of large dimensions.

PROPOSED ELECTRIC RAILWAY FROM MONTREAL TO OTTAWA

An electric railway is projected from Montreal to Ottawa, to run through the counties of Argenteuil, Two Mountains, Terrebonne, Laval and Jacques Cartier. The district is closely settled but without anything like a satisfactory transportation service. Three branch lines are already definitely decided upon by the promoters, so as to cover as large a field as possible, and others may be built if the demand arises. These branch lines will run to St. Rose, St. Ann and St. Genevieve. Surveys have already been made along a portion of the projected route, and it is assured that there are few natural obstacles to a road being built. The president of the company that plans to build the line is Col. McMullen, of New York, who represents a company of American capitalists interested in electric roads. Further than that, it is expected the road will be subsidized by the Dominion Government at the usual percentage. The directorate is composed of F. D. Monk, M. P., T. W. Raphael, Thomas Christie, M. P., J. A. Ethier, M. P., J. E. Leonard, M. P., Thomas Gauthier, and Mr. Wells, of New York. It is proposed that the new railway will enter Montreal at the north end and run down St. Urbain and up St. Charles Borrommee. A large terminal station will be erected in the city, but the site is not yet decided upon. The head offices will be located at Montreal.

ADDITIONAL POWER FOR THE LAKE SHORE

The Lake Shore Electric Railway Company has taken steps to provide additional power equipment as soon as possible. Contracts have been placed with the General Electric Company for a 1200-kw alternating-current generator and with the C. & G. Cooper Company for a 1500-hp cross-compound condensing engine. Dean condensers will be ordered. The new equipment will be installed in the Beach Park power house, which at present supplies direct-current exclusively, operating the section from Vermillion to Cleveland. The Sandusky power station of the company will be abandoned and a sub-station will be installed at that point. The division from Lorain to Cleveland will be supplied by direct-current, as heretofore, and the new unit will feed the sub-station as far west as Norwalk, leaving the Fremont power station to operate the Toledo-Norwalk line, for which it was originally designed. The Fremont station has been giving considerable trouble during the past few months because of bad water and overloads, and the company has just completed the work of installing two new boilers at that point. With the completion of these improvements the power on this system will be in very good shape. The company is planning to double track its line from Cleveland to Lorain during the coming year. Travel on this line is especially heavy during the summer months, when numerous special cars are operated to the pleasure resorts along the lake front. The subject of running two or three-car trains has been gone over very carefully, but it has been abandoned as impractical because of the long run over the tracks of the Cleveland city system; also because some of the highway bridges are not considered strong enough for such service.

NEW CARS FOR CLEVELAND, OHIO

The Niles Car & Manufacturing Company, of Niles, Ohio, has just completed an order for twenty-five electric cars for the Cleveland Electric Railway Company, of Cleveland, Ohio. The cars are 38 ft. 7 ins. long over all, 28 ft. long over corner posts; 8 ft. 2 ins. wide, 8 ft. 6¾ ins. height inside. Each car has a monitor deck and steam type hood with enclosed vestibules, and is finished in quartered white oak.

The contract for these cars was made on Nov. 18, 1903, and was to be completed Dec. 16, 1903. The first three cars were shipped Dec. 1, and the last of the twenty-five cars were shipped on Dec. 15, 1903, thus completing the contract for the twenty-five cars in twenty-eight days. The Cleveland Electric Railway Company reports the cars as being satisfactory in every respect. These cars are to replace some of those burned in the recent fire which destroyed the car barns of the Cleveland Electric Railway Company.

UTICA & MOHAWK BENEFIT ASSOCIATION

At the annual meeting and election of officers of the Employees' Mutual Benefit Association, of the Utica & Mohawk Valley Railway Company, Secretary Harry Van Vleit made an interesting report, showing the affairs of the association in a most favorable condition. The following officers were elected: President, W. J. Root; vice-president, S. E. Patterson; secretary, Harry Van Vleit; treasurer, Ben Frankle. General Manager C. Loomis Allen, who was present, made an informal address that was received enthusiastically.

The association was formed nine months ago. The board of trustees consists of one motorman and conductor from each terminal station, making six representatives from the transportation department. There is also one representative from each of the following departments: Express, overhead, track, shop, sub-station and office, making twelve in all, seven constituting a quorum. The president of the Association also presides at trustees' meetings.

The monthly sick benefit fee is 50 cents, and for death benefit of $300 the cost is $1.00 per day for the first seven days after a member's death. During its first nine months the association has spent $600 for sick benefits, but fortunately has had no deaths in its ranks. The present reserve is fully $1,700, and the number of members is 250.

The association enjoys the use of a fine headquarters, and the social features, which are distinct from the benefit purposes, are well taken care of by a house committee composed of road employees.

WESTERN DIVISION OF BUFFALO, DUNKIRK & WESTERN OPENED

The western division of the Buffalo, Dunkirk & Western Railroad, extending from Dunkirk via Fredonia and Brocton to Westfield, N. Y., a distance of 20 miles, was opened to the public on Thursday, Dec. 10. In addition to the section of the line just placed in operation, the company has completed substantially all of the grading between Dunkirk and Buffalo, has completed all of the concrete work, laid the ties and erected poles, and is now erecting its high-level, double-track steel bridges. Under the basis of the Federal census of 1900 and exclusive of the city of Buffalo with 400,000 people—which is its terminus—the road averages 1200 people to the mile between Buffalo and Westfield. It goes through the rich section of the county in western New York familiarly known as the "grape belt." Its cars will start at Westfield, where it will be fed by a through line from Cleveland, Ohio, as well as the line from Jamestown and Chautauqua Lake and travel to the city of Buffalo, terminating upon Main Street opposite the Iroquois Hotel. It is expected to have the entire line completed and in full operation by Oct. 1, 1904.

NEW TRANSFERS IN PITTSBURG

An entirely new transfer system on all Pittsburg lines of the Pittsburg Railway Company has just become effective. It consists of extending the system adopted in Allegheny last October into Pittsburg and making the plan general on all lines operated by the Pittsburg Railways Company. Briefly, the new system is to be in the form of transfer checks with one color for morning and another color for afternoon and evening. Instead of the conductor punching for a transfer north, east, south and west, the names of the various lines will be on the check and the passenger must designate the particular line he wants. It is claimed that the new system greatly simplifies the business of the company and prevents much fraud that has been steadily worked on the company in the past.

METROPOLITAN AND FUTURE TUNNEL CONTRACTS IN NEW YORK

As a result of a letter submitted to the Rapid Transit Commission, of New York, by Alexander E. Orr, on Thursday, Dec. 17, a definite statement was obtained from Metropolitan Street Railway interests that that company would, under certain conditions, compete for contracts to construct additional tunnels in New York. Mr. Orr, in his letter, said that he had received an informal communication from Metropolitan interests, asserting that the company was willing to compete for tunnel contracts. Later in the evening the following official statement was issued by Thomas F. Ryan, of the Metropolitan Street Railway Company:

"The Metropolitan Securities Company, which, through its ownership of all the stock of the Interurban Street Railway Company, now controls the entire Metropolitan Street Railway system, is not anxious to add to its responsibilities. At the same time we realize that the control of all the surface lines in Manhattan and the Bronx places us under a grave responsibility to the city and the public. More than 622,000,000 passengers rode in Metropolitan cars during the year ending June 30, 1903, and the traffic is increasing each year at an enormous rate. Of the aggregate daily passenger traffic in Manhattan and the Bronx, including the suburban traffic, about two-thirds are carried by the Metropolitan lines.

"We appreciate our duty to take advantage of every opportunity to increase our facilities for the comfortable transportation of this great number of passengers, and especially to relieve the overcrowding along the lines running north and south. While many of our lines will be able, for some years to come, to take care of the increased traffic, some of the longitudinal lines, such as those on Broadway and the Bowery, and Third, Sixth, Eighth and Ninth Avenues, during certain hours of the morning and evening encounter a congestion of traffic so great as to be justly termed intolerable.

"In this situation it seems that the only relief possible must come from the construction of tunnels extending the entire length of the island, and so connected by transfer arrangements with our crosstown surface lines as to attract a substantial portion of the long-haul riders from the lines running north and south, thus making room for the great numbers of people who are now compelled to choose whether they will ride in overcrowded cars or walk.

"Convinced, as we are, that some such plan as this, by which passengers can be brought under a comprehensive transfer system to the tunnel in the morning, and distributed to their homes at night by our crosstown surface lines, will furnish the only real and permanent relief from present traffic conditions. Metropolitan interests are prepared to become competitors for the construction and operation of a rapid transit tunnel on Manhattan Island in connection with their system of over 400 miles of surface lines, provided the Rapid Transit Commission will lay out a route which will meet the requirements of the situation and the terms of the contract prescribed by the Commission do not place undue burdens."

QUICK DELIVERY OF RUSH ORDER FOR CARS

The Cleveland Electric Railway Company placed a large order for cars with 30-ft. bodies with the J. G. Brill Company on Nov. 17—the day after the destruction by fire of the Holmden Avenue car house and seventy-three cars. The order was given with the understanding that the cars would be delivered in thirty days, but that time was so short that some of the officials doubted the ability of the builders to make delivery on time, and were considerably astonished when they were notified that a number of the new cars were shipped on Dec. 8, just three weeks after the order was placed. Shipments were made every day thereafter till Dec. 11, when the last lot left the Philadelphia works. It is claimed that this breaks all records for fast building, and the railway company is much pleased to have the cars in time to help them handle the holiday crowds.

STREET RAILWAY PATENTS

[This department is conducted by W. A. Rosenbaum, patent attorney, Room No. 1203-7 Nassau-Beekman Building, New York.]

UNITED STATES PATENTS ISSUED DEC. 15, 1903

746,691. Sanding Device; Louis A. Gardner, Providence, R. I. App. filed Jan. 5, 1903. Details.

746,692. Life Guard for Railway Cars; Gottlieb Geiger, Cleveland, Ohio. App. filed Oct. 5, 1903. A car fender of the double or tandem variety.

746,751. Current Collecting Device for Electric Railway Systems; Abraham A. Shobe & William Embley, Jerseyville, Ill. App. filed Apr. 10, 1903. The current collecting device is adapted to enter a conduit, and is so constructed as to compensate for vertical movements of the car, thus constantly maintaining good connection with the conductor.

746,860. Trolley Catcher; Horace R. Martin, East Bloomfield, N. Y. App. filed Aug. 7, 1903. The trolley cord is wound up by a pneumatic device is case the trolley wheel leaves the wire.

746,987. Convertible Car; John O'Leary, Cohoes, N. Y. App. filed Mar. 9, 1903. Details of construction.

747,075. Street Car; John A. Kratz, Baltimore, Md. App. filed Apr. 3, 1903. A folding, two-step running board is so connected with an awning and guard rail that when the step is folded, the guard rail and awning will be simultaneously lowered.

747,090. Carrier; Max E. Schmidt, New York, and George A. Mayland, Brooklyn, N. Y. App. filed Oct. 31, 1902. A moving platform in which displacement relative to the general direction of motion is prevented by the coaction of downwardly projecting friction rollers and a centrally grooved and disposed guide rail.

747,106. Trolley; Milford J. Wilson, Painesville, Ohio. App. filed Sept. 2, 1902. Relates to the lubrication of the bearing through a hollow axle, and to the contact between the wheel and stationary parts.

747,142. Railway Signal; Henry M. Cogan, New York, N. Y. App. filed Apr. 28, 1903. A signal adapted for either single or double track trolley roads, by which more than one car moving in the same direction are permitted on a block at the same time, the first car setting a danger signal ahead on entering a block, which is not cleared until the last car leaves the block.

747,155. Trolley Switch; Lloyd E. Elwell, Los Angeles, Cal. App. filed Aug. 17, 1903. A frame having two grooves, one of which is depressed and acts in conjunction with a guiding flange to direct the trolley wheel onto a branch wire.

747,177. Electric Railway; Maurice Hoopes, New York, N. Y. App. filed Apr. 29, 1903. A third rail formed with a ridge or corner from which ice or sleet may be easily removed by means of a blade of any character, the shoe being shifted to make contact with the ridge only, whereby current sufficient to keep up the headway will be collected by the various shoes of a train.

747,217. Electric Motor; Leroy S. Pfouts, Canton, Ohio. App. filed Mar. 5, 1903. Two armatures mounted upon separate shafts in line with each other are located in the field of a single magnet, the armatures being independently geared to respective wheels of the vehicle.

747,277. Electric Railway System; Sivert Udstad, Aurora, Ill. App. filed Feb. 21, 1903. A covered third rail and feeders duly protected above it.

747,342. Railway; John Dew, Chicago, Ill. App. filed Mar. 5, 1901. Details of construction of a double deck elevated structure.

PERSONAL MENTION

MR. F. H. ELLSWORTH, general superintendent of the Pennsylvania & Ohio Railway Company, of Conneaut, O., has tendered his resignation, to take effect Jan. 1.

MR. LAWRENCE O'TOOLE, formerly assistant superintendent of the Canton-Akron Railway Company, has been appointed superintendent of the Eastern Ohio Traction Company, of Cleveland.

MR. SAMUEL S. HOFF, of Reading, Pa., has been made general superintendent of the Wilmington City Railway Company and Wilmington City Electric Company, and will assume his new duties shortly.

MR. ARTHUR BROWN has succeeded Mr. Paul Dohrman as division superintendent of the Michigan division of the Detroit United Railway, Mr. Dohrman having been promoted to assistant general superintendent.

MR. E. B. TAYLOR has succeeded Mr. Albert Eastman as a division superintendent of the Detroit United Railway, Mr. Eastman having resigned to take a position with the Public Service Corporation, of New Jersey.

MR. GEORGE BRANSON, assistant superintendent of construction on the Canton-Akron Railway, of Canton, Ohio, has taken charge of line construction work for the Pittsburg, McKeesport & Connellsville Railway, of Pittsburg.

MR. RICHARD E. McCLURE, of Connersville, Ind., has been appointed auditor of the Columbus, Greensburg & Richmond Traction Company, of Richmond, Ind., and has already assumed the new office with the company at Indianapolis.

MR. WILLIAM BIRD, for many years treasurer of the Broadway & Seventh Avenue Railroad Company, of New York, died a few days ago in his sixtieth year. Mr. Bird was born in New York and was educated at the New York University.

MR. ARCHIE MacNANEMY, formerly chief mechanical and electrical engineer of the Cleveland Southwestern Traction Company, has been appointed to the same position with the Indianapolis, Columbus & Southern Railroad Company, with headquarters at Greenwood, Ind.

MR. ELLIS BARTHOLOMEW, president and general manager of the Toledo, Columbus, Springfield & Cincinnati Railway Company, of Toledo, Ohio, was injured in a wreck on the Pennsylvania Railway near Lima a few days ago. It is thought that his injuries will not prove serious.

MR. J. L. GREATSINGER, ex-president of the Brooklyn Rapid Transit Company, of New York; Peter Kimberly, the iron man of Sharon, Pa., and associates have proved up a valuable copper mine in the wilderness sixty-five miles west of Port Arthur, Ontario, and fourteen miles south of the Canadian Northern Road.

MR. A. C. HARRINGTON, who has acted as manager, purchasing agent and superintendent of the Erie Rapid Transit Company since that railway was built from Erie to North East, has resigned. Capt. G. D. Howell, who represented the Vandegrift Construction Company, has been chosen to fill the vacancy.

MR. ISIDOR NEWMAN, of New York, has donated $1000 to the Young Men's Christian Association of Nashville, Tenn. Mr. Newman is one of the most prominent street railway men in the South. He is largely interested in this character of enterprises in Little Rock, Ark., Memphis, Birmingham, Nashville and New Orleans.

MR. ALEXANDER McCORD, for many years superintendent of the Mission Street line in San Francisco before it became merged into the Market Street Railway, and at one time superintendent of the Sutter Street Railway, is dead. Mr. McCord was a native of Canada, sixty years of age, and an old-time resident of this city.

MR. BURTON R. STARE, general manager of the Railway Journal Lubricating Company, of Chicago, and Chicago agent for the Peckham Manufacturing Company, was married at Chicago Dec. 14, the bride being Miss Ruth Isabel Braymer, daughter of Mr. and Mrs. F. A. Braymer, of Chicago. They will be at home at Chicago after Jan. 20, 1904. Mr. Stare has made many friends in Chicago since he went West.

MR. G. R. MITCHELL, formerly general superintendent of the Jersey Central Traction Company and the Middlesex & Monmouth Electric Light, Heat & Power Company, with headquarters at Keyport, N. J., has accepted the position of general superintendent of the Olean, Rock City & Bradford Railroad Company and the Bradford Electric Street Railway Company. Mr. Mitchell entered upon his new duties on Dec. 15.

MR. FRANK S. GIVEN, of Lancaster Pa., has been appointed general manager of the Erie Rapid Transit Street Railway Company, of Erie, Pa., and has already entered upon the duties of his new office. He succeeds Capt. Howell, who filled the position temporarily, after the resignation of Mr. A. C. Harrington, the former general manager. Mr. Given formerly was general manager of the Lancaster County Railway & Light Company.

MR. J. C. BRACKENRIDGE, who has for several years past acted as chief engineer of the Brooklyn Rapid Transit Company, will resign that position to accept that of Brooklyn Commissioner of Public Works under the incoming administration. It is believed that the vacancy thus caused will remain unfilled, but that Mr. H. S. Wilgus, Mr. Brackenridge's principal assistant, will be appointed engineer in charge. Mr. Wilgus was formerly connected with the Pennsylvania Railroad, and is a brother of Mr. W. J. Wilgus, fourth vice-president of the New York Central & Hudson River Railroad.

MR .GEORGE ST. PIERRE has been appointed to succeed the late Mr. George W. Spink as master mechanic of the Oakland Transit Consolidated and of the San Francisco, Oakland & San Jose Railway Company, of Oakland, Cal. Mr. St. Pierre has been connected with the street railways of Oakland for the last 18 years; in fact, since the first road was built, and has recently held the position of shop foreman at the Piedmont car shops of the Oakland Transit Consolidated. The position of assistant superintendent of transportation of the San Francisco, Oakland & San Jose Railway Company, held by the late Mr. Clark Yerrick, has been filled by Mr. Piper, of the Telegraph Avenue Divison of the Oakland Transit Consolidated.

MR. WALTER H. WHITESIDE, manager of the detail and supply department of the Westinghouse Electric & Manufacturing Company, has also been made the general manager of the Sawyer-Man Electric Company and has added the duties of this new office to his former ones. Mr. Whiteside has been connected with electrical trade interests for nearly twenty years, being a special salesman for the Westinghouse Electric & Manufacturing Company in Chicago in 1898, a year later being sent to Washington, D. C., to take charge of sales to the government, and in 1900 named as manager of the company's office for that district. From the Washington office Mr. Whiteside acquired the management of the detail and supply department, with headquarters at Pittsburg.

MR. CHARLES H. COX, resident manager of the Middleboro, Wareham & Buzzard's Bay Street Railway Company, of Middleboro, Mass., has tendered his resignation, to take effect Dec. 15, and he will immediately start for Lincoln, Neb., where, on Jan. 1, 1904, he will assume the duties of general manager of the Lincoln Traction Company, of that city. Beside the street railway, the company operates an electric light plant, furnishing city and commercial lighting and power, as well as a steam heating plant, which furnishes heat for upward of fifty buildings in various parts of the city. In 1874 Mr. Cox obtained a position with the Metropolitan Horse Railway Company in Boston. He was with that company sixteen years, and then entered the employ of the West End, remaining there till thirteen years ago, when he became connected with the Worcester Construction Company. He was with that company for some time, building roads all over New England. Before he became superintendent and later resident manager of the Middleboro, Wareham & Buzzard's Bay Street Railway Company, he was the superintendent of the Easton, Palmer & Bethlehem Company in Pennsylvania. He left that company to go to Dayton, Ohio, as superintendent of the Dayton & Xenia Traction Company.

MR. JOHN B. ALLAN, who was recently elected a vice-president and the general manager of the Allis-Chalmers Company, was born Jan. 14, 1860, in Davenport, Ia., where he received a common and high school education. He then spent some time in a general machine shop, and afterward completed a course in the Worcester Polytechnic Institute of Worcester, Mass., graduating as a mechanical engineer in the class of 1880. Upon completing his college education, Mr. Allan spent a year at lumbering in Minnesota. In May, 1881, he entered the services of the Edward P. Allis Company as a draughtsman in the engineering department, remaining at the Milwaukee works about four years, dividing his time as draughtsman, machinist and erecting engineer. During this time, Mr. Allan had general charge of making economy tests of engines and steam plants. In January, 1885, the company opened a general sales office in Chicago, of which Mr. Allan was made manager. There he had charge of the engineering, as well as the selling department. During the time that Mr. Allan was in charge of the Chicago office he succeeded in largely increasing the business of the company. After the formation of the Allis-Chalmers Company, Mr. Allan was placed in general charge of the engine sales department of the company, which position he has held up to the present time. In his new position, Mr. Allan has general charge of manufacturing, selling and general operations under the president, which is indeed a fitting tribute to his ability.

MR. THOMAS CYPRIAN FRENYEAR, sales manager of the New Canadian Westinghouse Company, died of typhoid fever at Fort William, Canada, on Dec. 10. He was a man of exemplary life, unusual business judgment and ability, and much experience in electrical work. Mr. Frenyear was born on March 16, 1865, at Middletown Spa, Vermont. He began his business career before he was 15 years old, in the office of the Boston Electric Company, under his uncle, Mr. W. R. Nutting, who was manager of the company. While there he entered the Latin School, doing his studying at night, then taking a course at Phillips Exeter Academy, graduated in 1885, and entered Harvard that autumn, but did not finish the course. He afterward entered the Boston University, but a business reverse put an end to his efforts to gain a collegiate degree. For several years after that he was in the employ of the Thomson-Houston and Brush Electric Companies as a salesman, with his headquarters in Buffalo. From 1892 to 1895 he was superintendent of the Cayadutta Electric Railroad. In the fall of 1895 he entered the employ of the Westinghouse Electric & Manufacturing Company. He was connected with the sales office of that company until Nov. 1, 1903, when he was placed in charge of the sales department of the new Canadian Company, with headquarters in Toronto. He was married to Miss Emma L. Chase, of Exeter, on June 23, 1893. Mrs. Frenyear and three children survive him. Mr. Frenyear was a deacon and trustee of the Delaware Avenue Baptist Church, of Buffalo, and had been superintendent of the Sunday School. In announcing the death to the officials of the Westinghouse Company, Vice-President Taylor said: "The management desires to place on record its thorough appreciation of his able and loyal service and of the loss to the Westinghouse interests by the untimely removal of a young and zealous official whose future seemed so full of promise."

DIGEST IN GERMAN AND FRENCH

OF THE ISSUES OF

AUGUST 8, AUGUST 15, AUGUST 22 and AUGUST 29.

INHALTS - VERKÜRZUNG.

Ausgabe vom 8. August.

Editorielle Notizen. . . . . . [Seite 191.]

In der ersten editoriellen Notiz wird der Nachweis geführt, dass sich das ganze Jahr hindurch eine gewisse Forderung für Aussensitzplätze geltend macht, und sollte diesem Umstande seitens Betriebsleiter Rechnung getragen werden. Die Bahnwagen mit Verdecksitzen werden in Amerika niemals populär werden, und hat man bis jetzt noch keinen Bahnwagen gefunden, der sich allen Verhältnissen vollständig anpasst. Die nächste editorielle Notiz bespricht die geplante Verlängerung der Untergrundbahn in New York unter dem Broadway sowie die eventuelle Störung des Strassenverkehrs, welche das Anlegen einer derartigen Bahn verursachen dürfte. Eine weitere editorielle Notiz handelt über die Wichtigkeit, die Wagenführer für die Handhabung der am Bahnwagen befindlichen Apparate gut einzuschulen; dies empfiehlt sich nicht nur vom Standpunkte der Bahn aus, sondern auch deshalb, weil eine gründliche Kenntnis des Bahnbetriebs die Selbstachtung der Angestellten hebt. Sodann folgen Einzelheiten über das Steigen der Eigentumswerte in Indiana, wie dies aus dem letzten Bericht der Steuerkommission erhellt. Die Wertsteigung findet ganz bedeutend in den Distrikten statt, welche die Ueberlandbahnen passieren, woraus hervorgeht, dass diese Bahnen dem Eigentum zum Vorteil gereichen. Die letzte editorielle Notiz erörtert Mittel und Wege, sich noch mehr Verkehr auf Ueberlandbahnen dadurch zu sichern, dass man Fahrpläne veröffentlicht, gute Anschlüsse herstellt, für gutes, anziehendes rollendes Material sorgt und die Reklame nicht verabsäumt.

Mitteilungen über das Trambahnnetz in der Stadt Denver. [Seite 194.]

Dieser Artikel widmet sich der Beschreibung besonderer hervorragender Züge der Betriebsleitung, des Betriebs und der Ausrüstung des Eigentums der Trambahnen in Denver. Ein Reparaturwagen, der zum Drahtspannen und zur Vornahme von Reparaturen an der Linie entlang dient, erfährt eine ausführliche Beschreibung. Das Magazin, welches die Gesellschaft besitzt, und das bei demselben eingeführte System werden ebenfalls beschrieben. In Folge der weiten Entfernung der Stadt von der Bezugsquelle wichtiger Bedarfsartikel hat man es für notwendig befunden, eine bedeutende Menge Material vorrätig zu halten. Dabei sind nicht nur die für elektrischen Betrieb nötigen Teile und Materialien für Luftleitung eingeschlossen, sondern auch Schwellen, Masten und Pflasterungsmaterial. Eine Organisationskarte ist ebenfalls beigegeben und kurz beschrieben.

Lage des Endpunkts auf der Ausstellung in St. Louis. [Seite 196.]

Das Diagramm veranschaulicht die allgemeine Anordnung der Termini für die Dampf- und Strassenbahnen auf der i. J. 1904 stattfindenden Weltausstellung.

Entwickelung von Ueberlandbahnen in Grossbritannien. I. Von Hon. Robert P. Porter. . . . . [Seite 197.]

Zunächst führt der Verfasser Statistiken betreffs der im Vereinigten Königreiche in elektrischen Trambahn-Unternehmungen angelegten Kapitalien an und weist nach, dass die Kapitalanlage in elektrischem Betrieb seit 1896 auf Mk. 820000000 angewachsen ist. Von dieser Summe repräsentieren Mk. 208000000 die Kapitalanlage in munizipalen Trambahnen. Man hat nämlich Anlagen von Stadt- und Ueberlandbahnen von langer Zeitdauer in Grossbritannien durch ein i. J. 1870 erlassenes Gesetz unterdrückt, welches dahin lautete, dass Trambahn-Unternehmen nur eine Dauer von 21 Jahren haben sollten. Da man auf Erneuerung des Freibriefs nicht rechnen durfte, so liess man den Trambahndienst im Laufe der letzten Jahre der Konzession immer schlechter werden. Durch den daraus resultierenden nachlässigen Dienst wurde das Publikum immer mehr gegen die Eigentümer eingenommen und die Folge davon war, dass die Gemeinde ermutigt wurde, sich auf dem Gebiete der Trambahnen zu versuchen. Indessen befinden sich Ueberlandbahnen, die gebaut worden sind, in den Händen von Privatgesellschaften. Der Verfasser nimmt auf zwei derartige Unternehmen Bezug.

Ein Vergleich zwischen den Einnahmen von Dampf- und elektrischen Bahnen. Von H. D. Emerson. . [Seite 201.]

Der Verfasser zieht eine Parallele zwischen dem Gesamteinnahme-Konto aller elektrischen Bahnen der Vereinigten Staaten, wie dies aus den kürzlich veröffentlichten Censusberichten und dem einer der Dampfbahnlinien, der Pennsylvania Eisenbahn, erhellt, deren Totaleinnahmen und Betriebsausgaben sich nicht viel von den diesbezüglichen Zahlen der elektrischen Bahnen unterscheiden. Der Prozentsatz zwischen den Betriebsausgaben und Brutto-Einnahmen lautet mehr zu Gunsten der elektrischen Bahnen als der Pennsylvania Eisenbahn. Indessen legt der Verfasser keinen grossen Wert auf die Lehre, die man aus einem Betriebsverhältnis zieht, da dies mit der Lage und den physikalischen Verhältnissen der Gegend, welche eine Bahn durchläuft, wechselt. Ausserdem ist die Pennsylvania Eisenbahn dafür bekannt, dass sie Verbesserungen in umfassender Weise zu den Betriebsausgaben hinzurechnet. Sodann zieht der Verfasser den Punkt „Sonstige Einnahme" in Betracht, die sich für die Pennsylvania Eisenbahn bedeutend höher als für die elektrischen Bahnen stellt, ebenso „Feste Unkosten", die ebenfalls höher sind. Der nach Bezahlung der Unkosten erzielte Ueberschuss stellt sich bei der Pennsylvania Eisenbahn bedeutend höher, wogegen die Kapitalisierung eine niedrigere ist. Noch weitere Vergleiche werden gezogen.

Fahrkarten und Umsteigekarten, die man in Denver verwendet. [Seite 202.]

Die auf dieser und der nächsten Seite befindlichen Abbildungen veranschaulichen zwölf verschiedene Fahrkartentypen, die in Denver zur Ausgabe gelangen; die Verwendung jeder derselben wird eingehend beschrieben.

Der Kartenindex bei elektrischem Bahnbetrieb. . [Seite 203.]

Einige Ersparungen, wie sie die Benutzung des Kartenindex bei Bahnbetrieb und technischen Arbeiten ermöglicht, werden mitgeteilt. Eine Verwendung desselben bildet die Anfertigung eines Inhaltsverzeichnisses von technischer Literatur und Zeitungsausschnitten, die beide mit dem lokalen Bahnnetz im Zusammenhange stehen. Dieselben kann man in Briefumschläge packen, alphabetisch oder zu Zehn ordnen und mit Hülfe des Kartenindex auffinden. Eine weitere Verwendung besteht darin, dass man die Führungslisten verschiedener Angestellten auf besonderen Karten verzeichnet. Eine dritte Verwendung bildet das Führen von Listen, die Wagenremise, Reparaturwerkstätte sowie Ankäufe betreffen. Der Kartenindex erweist sich auch zum Aufzeichnen von Schadenersatzprozessen von Vorteil. Weiterhin empfiehlt sich dessen Verwendung zum Registrieren von Photographien. Es scheint sich in der That für die Möglichkeit und Einrichtung derartiger Aufzeichnungen kaum eine Grenze ziehen zu lassen.

Bahnwagenreparaturen geringfügiger Art. . . [Seite 205.]

Fig. 1 illustriert ein Verfahren zum Reparieren von Schutzgeländern an Strassenbahnwagen, indem man eine lange Einfuge macht. Sodann macht der Verfasser auf die Wichtigkeit von Kreuz-

bändern an Bahnwagen aufmerksam, besonders wenn Vorräume zur Verwendung gelangen. Ein Schlag gegen das eine Ende eines nicht mit Kreuzstreben versehenen Bahnwagens verursacht oftmals keine sichtbare Beschädigung, nimmt aber dem Wagen seine rechtwinkelige viereckige Gestalt, was zur Folge hat, dass sich die Thüren nur schwer schliessen und öffnen lassen. Fig. 2 veranschaulicht den Typ einer Dachplanke, wie man sie in Boston verwendet. Anstatt zwei oder drei schmale Planken zu verwenden, benutzt man sowohl für den Dachaufsatz wie auch für das Dach selbst eine sehr breite Planke. Dies verhütet jegliche vertikale Fuge in diesem Teile des Daches, hält das Wasser ab und beugt auf diese Weise einer Zerstörung an der Spitze der Pfosten vor. Fig. 3 stellt eine andere Form einer Traufe dar, die einige hervorragende Vorzüge aufweist. Solange der Kanevas unversehrt ist, läuft das Wasser ab, wenn derselbe aber defekt ist, so dringt das Wasser um die Fugen herum ein. Fig. 4 bildet die obere Ecke eines Boston'er Bahnwagens, an dem keine Eckplatten verwendet sind. In Boston hat man auch die Verwendung von Messing und Bronze für Bahnwagenverzierungen aufgegeben und an Stelle dieser Metalle hämmerbares Eisen für diesen Zweck gewählt

Gleislegende Maschine. . . . . . [Seite 207.]

Die betreffende Maschine vermag ungefähr 2 km Gleis pro Tag u befördern und zu legen. Dieselbe wird in Denver benutzt.

Kosten für Energie in Newcastle. . . . [Seite 207.]

Die Zahlen geben die spezialisierten Kosten für den Betrieb des Kraftwerks in Newcastle, England, an.

Verteilungssystem für Rangierbahnhöfe. . . [Seite 208.]

Diesen Plan entwarf man zur Ausführung auf elektrischen Vorortstrecken grosser Bahnen, wo sich an den Endpunkten ausgedehnte Rangierbahnhöfe befinden. Lokomotiven erfordern für schwere Züge 1500 bis 2000 Amp. zu 500 bis 600 Volt, und wenn man das System mit oberirdischer Stromzuführung in Anwendung bringt, so müssten die Stromabnehmer behufs Gewährung der nötigen Kontaktfläche so gross sein, dass eine derartige Konstruktion eine sehr schwere Oberanlage erfordern würde. Wenn andererseits die Leitungsschiene zur Verwendung gelangt, so ist dieselbe an solchem Platze mit beträchtlicher Gefahr verbunden. Das geplante System sieht die Errichtung von Säulen vor, welche auf I-Balken lagern, die horizontal verlegt — wie auf Fig. 1 veranschaulicht — quer über das Geleis laufen und ungefähr je 20 m von einander entfernt angebracht sind. Energie entnimmt man diesen I-Balken mit Hülfe eines verlängerten Schuhes oder Schleifkontakts, der sich, wie aus Fig. 2 ersichtlich ist, an der Lokomotive befindet. Damit sich nun die Lokomotive von einem I-Balken bis zum anderen erstrecken kann, muss die Lokomotive selbst länger als die übliche elektrische Lokomotive sein. Ihre Länge könnte man dadurch verringern, dass man die I-Balken näher zusammen verlegt, indessen ist der Erfinder der Ansicht, dass nach dem vorgelegten Plane die Lokomotive nicht länger als ein gewöhnlicher amerikanischer Personenwaggon zu sein braucht.

Verwandelbarer Bahnwagen in Cape May. . . [Seite 209.]

Die dortige Bahn lässt Bahnwagen nach einem am Seestrande befindlichen Sommer- und Winter-Vergnügungsplatz laufen, wobei sich der verwandelbare Typ als von ganz besonderem Vorteil erweist.

Vorortbahnwagen für Indiana. . . . . . [Seite 209.]

Dieser Bahnwagen besitzt eine Länge von 16,1 m und eine Breite von 2,66 m und wird mit Hülfe von Heisswasseröfen geheizt.

Verwandelbare Bahnwagen für Bay City, Michigan. [Seite 210.]

Genannte Stadt liegt in einem der äussersten Nordstaaten, in denen die Winter strenge sind; doch der Umstand, dass ein solcher Bahnwagen bereits mehrere Winter lang zur Verwendung kommt, zeigt, dass der verwandelbare Wagentyp mit dem Warmhalten des Wagens im Winter nicht in Konflikt gekommen ist.

Ein neuer Registrierapparat für Fahrgelder. . [Seite 210]

Der betreffende Registrierapparat verzeichnet die auf jeder Fahrt eingesammelten Fahrgelder auf einem Cylinder, der sich innerhalb des Apparats befindet und welcher auf der gerade unter dem Registrierapparat befindlichen Abbildung dargestellt ist. Das Markieren der Anzahl der Fahrgelder auf dem Cylinder erfolgt auf automatischem Wege und erfordert keine Extra-Arbeit seitens des Schaffners. Wenn der Tag zu Ende ist, wird die Rolle, welche die Aufzeichnungen ersehen lässt, nach dem Bureau der Gesellschaft geschickt.

Oberleitungs-Materialien in St. Louis, . . . [Seite 211.]

Die Illustrationen veranschaulichen verschiedene Arten Oberleitungs-Materialien, bei denen man zu Isolatoren Holz verwendet. Dieses Holz wird in warmem Leinsamenöl eingeweicht. Fig. 3 und 4 stellen eine Luftkreuzung dar, welche abnehmbare Auffahrtstücke besitzt, so dass man beim Einsetzen einer neuen Kreuzung den Draht nicht abzuschneiden oder aus der Oese herauszunehmen braucht.

Internationaler Elektrotechniker-Kongress i. J. 1904 in St. Louis. [Seite 215.]

Vorbereitungen zur Abhaltung eines i. J. 1904 auf der St. Louis'er Weltausstellung stattfindenden Elektrotechniker-Kongresses, der vom 12. bis zum 17. Sept. währen soll, sind im Gange. Dieser Kongress soll in acht Abteilungen zerfallen, wovon Abteilung F elektrischer Beförderung gewidmet sein wird. Anstrengungen sollen gemacht werden, um den Beförderungs-Kongress mit der i. J. 1904 stattfindenden Jahresversammlung der American Street Railway Association zusammen tagen zu lassen, in welchem Falle es wahrscheinlich ist, dass auch Einladungen an Trambahnvereine Europas zur Teilnahme am Kongress ergehen werden. Als Präsident des Kongresses wird Herr Prof. Elihu Thomson fungieren, und werden die Vice-Präsidenten durch eine Anzahl prominenter Elektrotechniker Amerikas vertreten sein.

Ausgabe vom 15. August.

Editorielle Notizen. . . . . . [Seite 219.]

Es wird auf den Unfall, der sich unlängst auf der Pariser Stadtbahn ereignete, Bezug genommen und auf die Wichtigkeit hingewiesen, die auf Untergrundlinien zu verwendenden Bahnwagen feuerfest zu machen. Nähere Einzelheiten werden über das Konstruktionsverfahren, wie man es in London und New York beobachtet, mitgeteilt. Die nächste editorielle Notiz handelt über zwei Streiks, welche ihrer langen Dauer und Schärfe wegen beträchtliches Aufsehen erregt haben. Beide erwiesen sich als ein Fehlschlag. Eine weitere editorielle Notiz bespricht die Neigung des Publikums, bei einem Unfalle — besonders beim Verunglücken eines Kindes — den Wagenführer persönlich dafür verantwortlich zu machen, und die häufig ausgestossenen Drohungen, ihn thätlich anzugreifen. Es wird nachgewiesen, dass die Hauptschuld an derartigen Unfällen die Eltern tragen, welche ihren Kindern erlauben, sich Gefahren auszusetzen. Die beiden letzten editoriellen Notizen beziehen sich auf Energieübertragung und die Normal-Verrechnungsform, wie sie von den Rechnungsführern auf ihrer letzten Jahresversammlung zur Annahme gelangt ist. Dieselbe ist nunmehr von der National Association, die sich aus Staats-Rechnungsführern zusammensetzt, formell angenommen worden.

Die kombinierte Bahn-, Beleuchtungs- und Eisanlage in Hampton, Va. . . . . . [Seite 222.]

Eingehend beschrieben wird in diesem Artikel die Kraftanlage der Norfolk, Portsmouth und Newport News Co. in Hampton, Va., welche eine Bahn-, Beleuchtungs- und Eisherstellungsstation in sich vereinigt. Energie wird für den Betrieb der elektrischen Bahnen in Newport News und der zwischen genannter Stadt und Hampton befindlichen sowie auch für Old Point Comfort und Buck Roe Beach geliefert. Das Kraftwerk ist für eine Leistung der Krafterzeugungsmaschinerie von 2625 kw und für zwei 40t-Kühlmaschinen bestimmt. Bei der Einrichtung der Station nahm man besonders Rücksicht darauf, sich bei Handhabung des Brennmaterials sowie der Asche Ersparnisse verschaffen und den besonderen Anforderungen dieses Dienstes entsprechen zu können. Der Kesselraum enthält zwei Zweikesselbatterien an der einen Seite des Schornsteins und eine Zweikesselbatterie auf der anderen Seite, wobei Raum für eine vierte Batterie vorgesehen ist. Jeder Kessel hat eine Leistung von 250 PS. Das Dampfröhrenwerk ist mit doppelten Dampfkopfstücken versehen, welche oben hinter den Kesseln unterstützt sind. Ein einziges Zufuhrrohr ist durch die Zwischenwand nach jeder Dampfmaschine hingeleitet und mit dem Oberteil der beiden Verschlussstücke verbunden. Die Kondensation der Hochdruckdampfleitungen wird auf mechanischem Wege nach den Kesseln zurückgeschafft. In dem Maschinenraume befinden sich drei Wechselstrommaschinen von annähernd 1300 kw Leistung sowie zwei Bahnmaschinensätze nebst Raum für einen dritten, was eine Gesamtleistung von 1325 kw ergiebt. Der kleinere Bahnmaschinensatz umfasst eine Tandem-Verbundmaschine und einen direkt gekuppelten 325kw-Dynamo, der zu 100 Umdrehungen in der Minute läuft. Der zweite Bahnmaschinensatz besteht aus einer Cross-Compound-Corlissmaschine und einem Dynamo von 500 kw Leistung, der 90 U. i. d. M. macht, während der dritte Satz, dessen Installierung noch bevorsteht, dem vertikalen Typ angehören und eine Leistung von 500 kw haben wird. Drei Wechselstromdynamos, welche Energie zu 3450 Volt abgeben und eine annähernde Leistung von 1300 kw besitzen, bilden die Ausrüstung für Beleuchtungs- und Kraftzwecke. Eine Cross-Verbundmaschine, welche zu 120 U. i. d. M. arbeitet und zwei Tandem-Verbundmaschinen, die zu 150 U. i. d. M. laufen, sind mit diesen Beleuchtungsmaschinen direkt gekuppelt. Das Bahnnetz — mit Einschluss

dessen von Newport News — wird direkt von der in Hampton gelegenen Station mit Energie gespeist. Eine Speiseleitung von 500000 Kreismil Querschnitt ist nach der Seite hin geleitet und an drei Zwischenpunkten sind 0000-Speiseleitungen mit der Fahrdrahtleitung verbunden. Drei 0000-Speiseleitungen geben ausserdem noch Energie für die Bahnlinien Old Point Comfort und Buck Roe Beach ab.

Neuartiger Bahnwagen für Vergnügungsverkehr in St. Louis. [Seite 227.]

Dieser Bahnwagen weist Sitzplätze für 96 Personen auf und ist für Touristen bestimmt, die sich die Stadt ansehen wollen. Seine Herstellung kommt nicht sehr theuer zu stehen. Der abgebildete Baldachin gelangt zur Tageszeit zur Verwendung, wird aber des Abends abgenommen.

Entwickelung von Ueberlandbahnen in Grossbritannien. II. Von Hon Robt. P. Porter. . . . . [Seite 228.]

Der Verfasser zieht im Allgemeinen das Thema über Bau von elektrischen Bahnen, welches in der Nummer vom 8. August von ihm begonnen wurde, in den Bereich seiner Betrachtung und giebt zunächst genaue Einzelheiten über einige der nördlich vom Themseflusse in London gelegene Trambahnen. Diese Bahnen sind Privateigentum. Nach Besprechung weiterer Trambahnnetze kommt er auf die Schwierigkeit des Bauens der von einer Stadt zur anderen durchgehenden Bahnen zu sprechen, Schwierigkeiten, die durch die Unfähigkeit der Behörden der verschiedenen Städte, sich zu einem harmonischen Vorgehen zu verbinden, verursacht werden. Auf diese Weise führt die eine Stadt die eine Spurweite ein und eine andere eine zweite, oder aber es entstehen Streitigkeiten über Kontrole, Verteilung der Einnahmen u. s. w. Vor Kurzem wurde ein Gesetz, „Das Kleinbahngesetz" genannt, passiert, welches in mancher Hinsicht für freie Unternehmungen günstiger ist, als es die Trambahngesetze vom Jahre 1870 sind. Das neue Gesetz enthält indessen gewisse Klauseln, welche den Dampfbahngesellschaften gestatten, dem Bau einer elektrischen Ueberlandbahn sehr starke Konkurrenz zu machen. Beispiele dieser Art werden mitgeteilt.

Kraftstations-Aufzeichnungen in Anderson. . [Seite 232.]

Die vier Abbildungen illustrieren behufs Darstellung der Leistung eines Kraftwerks eine neue Karte, deren sich die Union Traction Co. in Indiana bedient. Die Aufzeichnungen erfolgen auf automatischem Wege und zwar mittelst einer neuen Form eines Aufzeichnungs-Instruments, das jede Minute durch einen Punkt auf der Karte die Belastung in Kilowatt andeutet. Von dieser Karte werden Abzüge auf Pauspapier angefertigt und nach den Bureaux der Gesellschaft geschickt. An dem oberen Teil der Karte ist die Anzahl der verwendeten Dynamos graphisch bezeichnet. Sowohl die Temperatur wie auch andere Statistiken werden verzeichnet. Die Diagramme sind den wirklichen Aufzeichnungen gemäss wiedergegeben und weisen drei Durchschnittstage sowie einen Feiertag auf.

Kritische Geschwindigkeit von Turbinen. Von F. Zurnedden. [Seite 235.]

Der Verfasser lenkt die Aufmerksamkeit auf die Notwendigkeit grosser Geschwindigkeiten, um sich bei Dampfturbinen Oekonomie sichern zu können, und weist nach, dass die dabei eintretenden Zentrifugalkräfte sich bis zu einer bisher ungeahnten Grösse steigern. Selten oder niemals ist die Möglichkeit vorhanden, den Schwerpunkt des rotierenden Teiles in der Mitte der Welle — selbst bei sorgfältigster Ausgleichung — mit mathematischer Genauigkeit zu locieren. Die dementsprechende Zentrifugalkraft hat das Bestreben, die Welle zu biegen, und dieses Biegen nimmt mit der Umdrehungsgeschwindigkeit und der Exzentrizität des Schwerpunkts zu. Dieser Umstand birgt indessen keine Gefahr in sich, wenn eine sogenannte kritische Geschwindigkeit erreicht wird. Weiter führt der Verfasser aus, was diese kritische Geschwindigkeit in Ausdrücken des durch das Gewicht der rotierenden Teile verursachten Biegens der Welle — in cm ausgedrückt — sein wird. Sodann giebt er die Verfahren an, mittelst deren man den Rotor ins Gleichgewicht bringt.

Bahnwagenfender in Liverpool und Berlin. Von John P. Fox. [Seite 236.]

Der Verfasser giebt eine Beschreibung der in Liverpool verwendeten Schutzvorrichtung, die er für sehr wirksam erklärt. Dieselbe ist am Drehgestell angebracht, und sind seit deren Einführung einundzwanzig Personen unter den Bahnwagen geraten, die aber, ohne sich auch nur annähernd eine ernste Verletzung zuzuziehen, aus der Gefahr weggestossen wurden. In Berlin sind unter dem Spritzblech Stäbe angebracht worden, die von solchen Leuten, die von dem Bahnwagen getroffen werden, erfasst werden können. Dieselben sind nicht sehr beliebt, und ist ein neuer Fendertyp, wie er in Berlin zur Verwendung gelangt, abgebildet. Ausserdem hat man vor den Rädern noch ein gerades Brett als Schienenräumer angebracht.

Motortrucks für den New Yorker Tunnel. . . [Seite 237.]

Der Entwurf der Motortrucks, die für die Tunnelausrüstung der Interborough Rapid Transit Co. von New York bestimmt sind, wird gemäss den Plänen des Ingenieurs beschrieben und durch Illustrationen veranschaulicht. Zur anfänglichen Installierung sollen 350 dieser Motortrucks gebaut werden; die eine Hälfte derselben wird aus Westinghouse No. 86-Bahnmotoren und die andere aus General Electric No. 69-Bahnmotoren bestehen, deren Leistung auf 200 PS berechnet ist. In allen Fällen will man Nasen-Aufhängung verwenden, und da die Konstruktion der benutzten Motoren verschiedene Vorkehrungen behufs deren Aufhängung bedingt, so hat man, um diesen Auforderungen genügen zu können, für jeden Fall besondere Pläne vorgesehen. Das Ganze ist durch viele Abbildungen veranschaulicht. Die Trucks werden ungewöhnlich schwer sein und sind speziell für den schweren Dienst, wie man ihn auf den Tunnellinien erwartet, entworfen.

Pläne für Schlafwagen. . . . . . [Seite 240.]

Diesen Schlafwagen will man für eine der Ueberlandbahnen in Ohio bauen, und wird derselbe in einer der neueren Nummern beschrieben. Fig. 1 bis 4 veranschaulicht die Art und Weise, wie man den bei Tage verwendeten Bahnwagen in einen solchen für die Nachtzeit verwandelt. Diese Abbildungen sind Modellen entnommen und etwas unfertig, doch beabsichtigt man, den fertigen Wagen so herzustellen, dass sein Aussehen nichts zu wünschen übrig lässt. Auf Fig. 1 ist das obere Bett wie in einem gewöhnlichen Schlafwagen aufgeklappt, und zeigt die Abbildung den Wagen zur Benutzung am Tage eingerichtet und mit Drehstühlen versehen; Fig. 2 und 3 veranschaulichen die Abteilung für die Benutzung während der Nacht und Fig. 4 lässt den verwendbaren Raum zwischen Bett und der zum Ankleiden bestimmten Abteilung ersehen. Fig. 5 zeigt einen Plan des jetzt im Bau begriffenen Wagens und Fig. 6 den eines länger konstruierten Bahnwagens. Die Betten haben je eine Breite von 686 mm, und beträgt die Entfernung von der Bettkante bis zur Schiebewand 381 mm. Die Bahnwagen sind je mit vier 150pferdigen Motoren ausgerüstet und sollen zwischen Columbus und Indianapolis verkehren; für ein Bett will man $2 (Mk. 8) oder $3 (Mk. 12) für ein Abteil berechnen. Den Wagen eignet eine besondere Schlafwagengesellschaft, welche mit der Bahngesellschaft ein Betriebsabkommen getroffen hat, damit ihre Wagen auf den Bahnlinien der letzteren Gesellschaft verkehren können.

In Toronto getroffenes Uebereinkommen zum Betrieb von Güterwagen in der Stadt. . . . . . [Seite 241.]

Die Strassenbahngesellschaft in Toronto hat mit mehreren Ueberlandlinien ein Uebereinkommen getroffen, indem sie letzteren die Benutzung ihrer Stadtgleise gestattet. Derselbe Prozentsatz von den Einnahmen dieser Linie wird der Stadt wie im Falle der Stadtlinien selbst bezahlt.

Gleisbohrmaschine. . . . . . [Seite 242.]

Dieselbe wird bei Hand bethätigt und kann auf dem Gleis entlang geschoben oder abgehoben werden.

Jahresversammlung des inkorporierten Munizipal-Vereins in Grossbritannien. . . . . . [Seite 245.]

Mitgeteilt werden eine Reihe von Vorträgen, die auf der am 16. und 17. Juli abgehaltenen Versammlung dieser Vereinigung zur Verlesung kamen; ausserdem enthält der Artikel eine kurze Schilderung dieser Versammlung.

Ausgabe vom 22. August.

Editorielle Notizen. . . . . . [Seite 247.]

Der erste Leitartikel handelt über den auf S. 267 erwähnten Ausbau der Linie, welche zwei Hauptstädte, die 300 km von einander entfernt liegen, verbindet. Mit ihren Anschlüssen bilden diese Linien gegenwärtig das längste ununterbrochene Bahnnetz in den Vereinigten Staaten. Es bietet sich die Möglichkeit, 410 km in derselben allgemeinen Richtung zu fahren, und ist dies die Bahnlinie, auf welcher man Schlafwagen verkehren lässt. Die nächste editorielle Notiz erörtert die Möglichkeiten elektrischer Schläge seitens Starkspannungslokomotiven, wenn diese auf Schienen laufen, welche mit Sand oder sonst etwas, was die Schienen isoliert, bedeckt sind. In diesem Falle ist zwischen dem Rahmen der Lokomotive und der Erde eine gefährliche Spannung vorhanden, und sind Personen, welche die Lokomotive besteigen, einem elektrischen Schlage ausgesetzt. Ein Unfall dieser Art ist bereits vorgekommen. In der folgenden editoriellen Notiz wird das genaue Nachsehen der Ausrüstung besprochen, und empfehlen die Redakteure, dass man einem der beiden Pläne folgen sollte: nämlich ent-

weder hat man genau auf die Ankerlager zu achten und die Ausrüstung nachzusehen, wenn der Verschleiss an diesen Lagern notwendig eintreten muss, oder hat sie sonst zu inspizieren, sobald sie eine gewisse Kilometeranzahl zurückgelegt haben. In der Regel deutet der Verschleiss an den Ankerlagern darauf hin, dass die Ausrüstung des Nachsehens bedarf. Eine weitere editorielle Notiz bezieht sich auf Eildienst, wie er auf einen der Bahnlinien in Indiana stattfindet. Die dann folgende editorielle Notiz berichtet über das Verschwinden von Pferden bei Strassenbahndienst, wobei einige wenige Städte eine Ausnahme machen. New York City weist jetzt ungefähr die Hälfte der im ganzen Lande mit Pferdebahnwagen zurückgelegte Meilenanzahl auf, und die Thatsache, dass solche grosse Stadt hinter anderen Städten in dieser Hinsicht zurücksteht, giebt Diejenigen, die dafür verantwortlich sind — d. h. die Stadtbehörden — der Lächerlichkeit preis. In der letzten editoriellen Notiz wird allen Automobilbesitzern der Rat erteilt, die Nummer ihres Automobils registrieren zu lassen, damit bei etwaigen Unfällen die Schuldigen belangt werden können.

Das Bahnnetz der New York & Queens County-Bahn. [Seite 250.]

Genannte Bahnlinie vermittelt den Verkehr in einem Teile der Stadt New York, welcher einen Flächenraum von 41,6 Prozent der gesamten Stadt einnimmt und eine Bevölkerung von 4,7 Prozent aufweist. Dies kommt daher, dass dieser Teil schwer zugänglich ist; doch mit einer neuen Brücken- und Tunnelanlage, die beide jetzt im Bau begriffen sind, glaubt man, eine Zunahme der Bevölkerung herbeiführen zu können. Die Bahn eignet 122 km Gleis und 203 Bahnwagen. Die Ausrüstung der Reparaturwerkstätte erfährt eine eingehende Beschreibung. Die Wagen werden jede Nacht gereinigt und nachgesehen, ausserdem aber einmal die Woche abgewaschen, und wenn der Wagen 7200 km zurückgelegt hat, werden die Lager neu geschmiert; hat der Wagen 14000 km zurückgelegt, unterwirft man ihn einer genauen Untersuchung. Sobald der Wagenführer und Schaffner einen Bahnwagen verlassen, müssen sie ein auf S. 258 veranschaulichtes Formular ausfüllen, welches besagt, ob der Wagen in Ordnung ist. Wenn dies nicht der Fall, so muss auf einer Liste, worauf sich alle Teile verzeichnet finden, der Teil der Apparate markiert werden, welcher sich in defektem Zustande befindet. Die Formulare werden aufbewahrt und haben sich als sehr vorteilhaft erwiesen, indem sie verhindern, dass sich Motorführer nach einem Unfall darauf berufen können, die mangelhafte Beschaffenheit eines Bahnwagens sei seit längerer Zeit unter den Wagenführern bekannt gewesen. Nähere Einzelheiten beziehen sich auf die Art und Weise des Führens von Reparaturwerkstatt-Listen, Magazinaufzeichnungen und auf die Arbeitseinteilung im Wagenschuppen. Das auf S. 252 abgebildete Spritzblechschild ist zur Einführung gelangt, damit man den Wagen von einer Route auf eine andere bringen kann; dasselbe besteht aus mehreren Stücken Eisenblech, die an einer Stange eingehängt werden. Da vier oder fünf Routen vorhanden sind, so braucht man für jedes Kursschild ebenso viele Blätter; letztere werden durch zwei Klemmen festgehalten, und kann man zu jeder beliebigen Zeit den Kurs eines Bahnwagens schnell ändern.

Schlackenbahnwagen in St. Louis. . . . . [Seite 258.]

Die St. Louis Transit Co. verkauft jetzt ihre ganze Asche zu Ausfüllungszwecken und zur Herstellung von Beton. Den abgebildeten Bahnwagen benutzt man zum Befördern der Asche von dem Kraftwerk nach dem Ablieferungspunkte.

Neue elektrische Lokomotiven für die Bahn Baltimore-Ohio. [Seite 262.]

Derartige Lokomotiven sind dazu bestimmt, Dampfzüge durch einen Tunnel in Baltimore zu befördern. Jede Lokomotive besteht aus zwei Einheiten, deren Gewicht je 75 t beträgt. Jede Einheit ist auf zwei Drehgestellen montiert, an denen je zwei 225pferdige Motoren angebracht sind, in Folge dessen also auf jeden Satz 900 PS entfallen oder was im Ganzen 1800 PS für die Lokomotive ausmacht. Eine solche Lokomotive wird einen Zug im Gewichte von 1500 t, wobei das Gewicht der Lokomotive nicht eingerechnet ist, zu einer Fahrgeschwindigkeit von 16 km die Stunde eine einprozentige Steigung oder zu einer Geschwindigkeit von 14 km die Stunde zu 625 Volt eine anderthalbprozentige Steigung hinaufziehen. Die Motoren werden durch dass Parallelschaltungssystem kontrolliert und sind mit den Achsen gekuppelt, anstatt wie bei den alten Lokomotiven direkt auf den Achsen montiert zu sein.

Bahnwagen für den New Yorker Tunnel. . . [Seite 264.]

In diesem Artikel werden die hervorragenden Konstruktions-Eigenschaften der Bahnwagen beschrieben, die von der Interborough Rapid Transit Co. in New York für den Verkehr im Tunnel bestimmt sind. Vor Allem hervorzuheben sind die Vorkehrungen, die man in Bezug auf Feuerfestigkeit und zur Verhütung der Zerstörung im Falle eines Zusammenstosses oder einer Entgleisung getroffen hat. Sie sind äusserst stark gebaut und Fussboden sowie alle an elektrischen Apparaten offen liegenden Teile mit feuerfestem Material überzogen. Weitere Schutzmassregeln hat man gegen Feuer, welches eventuell durch die elektrische Leitung entstehen kann, vorgesehen. Für die Beleuchtungs- und Heizstromkreise verwendet man biegsame Stahlleitungen, und sind spezielle Verbindungskästen für diesen Zweck entworfen worden. Die stromleitenden Drähte für den Motor hat man in Leitungsröhren verlegt, die aus Elektrobest hergestellt und in passende Formen gegossen sind.

Fertigstellung einer elektrischen Bahn von Columbus, Ohio, nach Indianopolis, Ind. . . . . . [Seite 267.]

Zur Beschreibung gelangt die Eröffnung einer Linie, welche die Hauptstädte der beiden Staaten verbindet, in denen Ueberlandbahnen in ausgedehntem Masse gebaut worden sind.

Eine Finanzanalyse der Interurban Traction Co. Von H. D. Emerson. . . . . [Seite 268]

Der Verfasser analysiert die Betriebsberichte der genannten Gesellschaft und erklärt dieselbe für eine trefflich geleitete.

Verwandelbare Bahnwagen für Anniston, Alabama. [Seite 269.]

Der Bahnwagen, um dem es sich handelt, hat eine Gesamtlänge von ca. 9,4 m und repräsentiert in jeder Hinsicht den verwandelbaren Typ.

Ausgabe vom 29. August.

Editorielle Notizen. . . . . . [Seite 279.]

Die Vorträge und Programme der drei Vereine, welche im September in Saratoga zusammenkommen, werden besprochen, ausserdem die Vorzüge Saratoga's als Versammlungspunkt erörtert. Dasselbe liegt nicht allein in einer malerischen Gegend, sondern bildet zugleich auch den Mittelpunkt einer bedeutenden elektrotechnischen Entwickelung, wie dies aus den Hauptartikeln dieser Nummer hervorgeht. Weiterhin setzen die Redakteure auseinander, dass mit den Artikeln, welche über die Normaleinrichtungen bei elektrischen Stadtbahnen handeln und welche dem Hauptartikel über die elektrischen Bahnen in der Umgegend von Saratoga folgen, keineswegs beabsichtigt ist, alle empfehlenswerten, in den Vereinigten Staaten eingeschlagenen Verfahren zu schildern. Es war nur möglich, die Praxis von zwölf oder fünfzehn der hauptsächlichsten Städte — New York ausgenommen — näher zu beleuchten, und selbst dies konnte nur in kurzen Umrissen geschehen. Die allgemeinen Schlussfolgerungen, die jedem Artikel beigefügt sind, heben indessen die bei dieser Bahnklasse verfolgte Richtung jedesmal hervor. Sodann besprechen die Redakteure Herrn Dawson's Artikel und weisen nach, dass die Notwendigkeit der Brennmaterial-Ersparnis eine Frage von immer grösserer Bedeutung involviert. Aus diesem Grunde hält man die erhöhte Verwendung von überhitztem Dampf und Dreifach-Expansionsmaschinen nicht für unwahrscheinlich, und werden Vervollkommnungen an Heizapparaten sowie Kesseln anempfohlen. Der Entwurf von Kraftwerken, die in der Stadt liegen, bildet das nächste Thema. Für eine grosse Stadt, wo die Zahl der vorteilhaften Oertlichkeiten wegen der Preise von Grundeigentum, Wasserzufuhr und von sonstigen nothwendigen Faktoren eine beschränkte ist, bildet dies eine ernste Frage. Die einzelnen Angaben, die in Bezug auf Betriebskosten (einschliesslich Entwertung) grossen Kraftwerken zum Vorteil gereichen, sind noch nicht vollständig genug, um eine genaue Entscheidung über diesen Punkt zuzulassen. Sicher ist jedoch, dass man grosse Kraftwerke in Unterabteilungen teilen und — um sich gegen eine allgemeine Betriebsstörung zu sichern — thatsächlich in selbständigen Sektionen arbeiten lassen muss; jede Materialersparnis eines grossen Kraftwerks einem kleinen gegenüber muss aus diesem Grunde mehr auf die Verminderung des Preises von Grundeigentum, Wasser und Brennmaterialtransport hinauslaufen, als dies beim Betrieb im grossem Massstabe der Fall ist. Die Verwendung von Dampfturbinen wird aller Wahrscheinlichkeit nach eine beträchtliche Aenderung in dem Entwurfe von Kraftwerken hervorrufen. Die letzte editorielle Notiz behandelt den von Herrn McCulloch verfassten Artikel über Reparaturwerkstätten. Die Redakteure weisen darauf hin, dass behufs Ersparnis beim Betrieb einer derartigen Werkstätte dieselbe die Arbeit so billig oder beinahe so billig wie eine grosse Fabrik herzustellen im Stande sein muss, ausserdem dass sich die Reparaturarbeiten auf einem grossen Bahnnetze, wenn das Ganze richtig in Stand gehalten wird, beträchtlich ansammeln. Die von Herrn McCulloch betreffs dieser Angaben über Reparaturkosten mitgeteilten Zahlen sind von grossem Werte, und wird der Artikel allen Lesern zu genauem Studium anempfohlen.

Von elektrischen Bahnen gebotene Attraktionen in Saratoga und Umgegend. . . . . . [Seite 288.]

In diesem Artikel wird eine Uebersicht über die Enwickelung des elektrischen Verkehrs in Saratoga und Umgegend gegeben und darauf hingewiesen, dass es dort nicht weniger als sieben Bahnnetze giebt, die von der Stadt, wo die Jahresversammlung stattfindet,

leicht erreichbar sind und von denen jedes viele interessante Punkte, was Betrieb und Konstruktion betrifft, aufweist. Einen wichtigen Faktor in dieser Gegend bildet die allgemeine Verwertung von Wasserkraft zur Herstellung von Energie. Die Anzahl der Wasserkraftanlagen sowie die bedeutende Energieanforderung seitens weit von einander gelegener Punkte hat den Ingenieuren bezüglich Energieerzeugung, Stromübertragung und Verteilung sowie des Herstellens überall geeigneter Systeme eine ausnahmsweise grosse Erfahrung verliehen. Diese Verhältnisse haben auch zur Entwickelung vieler Feinheiten und Vervollkommnungen im Unterstationswesen geführt. Erwähnt wird, dass viele dieser Unterstationen Energie für Fabrikzwecke, Bogen- und Glühlampenbeleuchtung wie auch für elektrischen Bahnbetrieb liefern und dass in mehreren Fällen die Ausrüstung für diese besonderen Betriebe unter demselben Dache installiert sind. Die Anlagen weisen viele hervorragende Eigenschaften und besondere Vorzüge auf. Alles in Allem genommen, steht der elektrische Bahndienst des von Saratoga aus zugänglichen Distrikts auf einer sehr hohen Stufe und man glaubt, dass eine eingehende Prüfung der Verfahrungsarten, welche nicht nur beim Bau und bei der Anlage der Bahnen sondern auch bei deren Betrieb und Leitung zur Anwendung gelangen, sich für Betriebsleiter ähnlichen, in anderen Gegenden des Landes befindlichen Eigentums als sehr belehrend erweisen würde.

Die Hudson Valley-Bahn. . . . . . [Seite 290.]

Es ist dies gegenwärtig die einzige elektrische Bahnlinie, welche in Saratoga einfährt. Die Hudson Valley-Bahngesellschaft, die sich i. J. 1901 bildete, hat sechs kleinere Betriebsgesellschaften aus der unmittelbaren Nachbarschaft in sich aufgenommen und dieselben zu einem umfassenden Bahnnetz gruppiert, welches jetzt von Waterford bis nach Warrensburg, mit einer Zweiglinie von Mechanicsville bis Ballston und Saratoga, reicht. Das Hauptgeschäft der Gesellschaft beruht auf Schaulustigen und Besuchern der zahlreichen Vergnügungsplätze, die an der Strecke entlang liegen. Der Distrikt um Saratoga herum ist nicht nur wegen seiner Mineralquellen berühmt, welche jeden Sommer eine Menge Personen anziehen, sondern auch wegen des in diesem hervorragenden Erholungsplatze herrschenden Lebens und Treibens im Sommer. Die Gesellschaft hat ihr spezielles Ausflugsgeschäft dadurch entwickelt, dass sie Salonwagen, die mit Kühlapparaten und Tischen behufs Servierens von Luncheons ausgestattet sind, sowie auch besondere offene Bahnwagen laufen lässt, welche eventuell für Ausflüge über die ganze Linie gemietet werden können. Die Gesellschaft hat ein sehr beträchtliches Speditionsgeschäft aufgebaut, gab indessen während des letzten Jahres diesen Geschäftszweig in Folge der Arbeitsschwierigkeiten temporär auf; doch erwartet man, dass er jetzt, da die Streiks beendigt sind, wieder aufgenommen wird. Güterwagen der Dampfbahnen werden zur Bequemlichkeit der längs der Linie gelegenen Fabriken über Strecken des Bahnnetzes zwischen Mechanicsville und Glen Falls befördert. Der reguläre Ueberlanddienst, welcher in erster Linie das Hauptgeschäft der Gesellschaft bildet, erfordert eine Ausrüstung von 16 geschlossenen Bahnwagen, 32 offenen Bahnwagen mit je 15 Bänken und fünf offenen Bahnwagen mit je 15 Bänken und fünf offenen Bahnwagen mit je 13 Bänken sowie ausserdem 50 zweiachsige Bahnwagen, die auch für die Stadtlinien benutzt werden. Acht Güterbahnwagen und zwei elektrische Lokomotiven versehen den Fracht- und Speditionsdienst. Die augenblickliche Ausrüstung des Kraftwerks umfasst fünf Zentralstationen — kombinierte Wasser- und Dampfbahnanlagen — und sechs Unterstationen. Diese Anlagen waren für die kleineren Bahnen, welche später mit dem gegenwärtigen Bahnnetz vereinigt wurden, bestimmt. Eine Anzahl weiterer Unterstationen wird jetzt gebaut und so ausgerüstet, dass sie schliesslich von der Wasserkraftstation der Hudson River Power Co. in Mechanicsville Energie entnehmen können; ebenso ist man mit dem Bau einer neuen Wasserkraftanlage beschäftigt, die etwa 4,9 km von der anderen Seite von Warrensburg entfernt liegt und ihrer Vollendung entgegengeht. Die Gesellschaft baut allmälig das ganze Bahnnetz um, da die oberirdische Leitung und der Oberbau der konsolidierten Bahnen nicht auf der Höhe des modernen Ueberlandbetriebs steht. Mehrere sehr anziehende Parks und Vergnügungsplätze an Seen werden von der genannten Gesellschaft kontrolliert, und hat dies selbstverständlich zu dem Aufschwung, welchen das Sommergeschäft nahm, wesentlich beigetragen.

Das Bahnnetz der United Traction Co. in Albany. [Seite 296.]

Die United Traction Co. in Albany kontrolliert die Stadtbahnnetze in Albany, Troy sowie in den Städten der Umgegend, und obgleich ihr die Ueberlandbahnen nicht gehören, hat sie doch mit jeder derselben ein Betriebsübereinkommen geschlossen, welches denselben gestattet, mit ihren Bahnwagen die Gleise in solchen Städten, welche die Gesellschaft kontrolliert, zu befahren. Kraft dieses Uebereinkommens fällt der United Traction Co. die Hälfte der von den Ueberlandbahn-Gesellschaften in der Stadt eingenommenen Fahrgelder zu, ebenso erhält sie 25 Cents (1 Mk.) pro Bahnwagenmeile für die Güterwagen, die auf ihren Linien verkehren. Umsteigekarten gelangen nicht zur Ausgabe, indessen ist behufs Bahnwagenverkehrs ein Plan adoptiert worden, welcher Fahrgäste in Stand setzt, innerhalb 15 Minuten von einem Teile der Stadt nach jedem beliebigen Teile eine Fahrgelegenheit zu erhalten. Die Gesellschaft hat ein scharfes Inspektionssystem eingeführt, und die Disziplin bei dieser Bahn ist ganz vorzüglich. Diese Gesellschaft war eine der ersten im Lande, welche das Speditions- und Gütergeschäft entwickelte, und ist dieser Geschäftszweig, der ganz für sich geführt wird, zu einem der bedeutendsten und hervorragendsten Faktoren des Bahnnetzes geworden. Von den Güterwagen werden zwischen Albany und Troy jeden Tag fünf Rundfahrten gemacht: drei zwischen Albany, Cohoes und Waterford und zwei zwischen Albany und Watervliet. Güterdepots sind in sämtlichen Städten errichtet, ausserdem finden sich an den hauptsächlichsten Punkten Ablieferungswagen: 5 in Albany, 4 in Troy, 3 in Cohoes und 1 in Watervliet. Beträchtliche Geschäfte kommen von der Hudson River Boat Line her, auch von der Boston & Maine-Bahn, die nicht nach Albany hineinfährt. Die Gesellschaft beharrt bei zweiachsigen Bahnwagen, indem sie behauptet, dass ein häufiger Abstand mit kleinen Bahnwagen einen besseren Dienst gewährt, als man ihn mit längeren Waggons bei weniger häufigem Abstand zu erzielen vermag. Ueberdies macht sie geltend, dass während der Stunden, wenn der Andrang am grössten, die zahlreiche Menge mit grösserer Schnelligkeit gehandhabt werden kann, indem Fahrgäste rascher ein- und aussteigen können. Weiteren Grund zu Gunsten der kleinen Bahnwagen bildet, dass das Vorkommen von Unfällen beträchtlich geringer ist. An den offenen Bahnwagen ist an der ganzen Seite des Wagens ein Netz gespannt und an jedem Ende sowie an den Mittelpfosten angeknöpft, um zu verhüten, dass Fahrgäste an der verkehrten Seite, wo sich ein Doppelgleis befindet, aussteigen. Dieses Netz kann man abnehmen und am Ende einer Linie ohne viel Zeitverlust auf der entgegengesetzten Seite anbringen. Die Gesellschaft besitzt sechs Wagenremisen, die in North Albany, Albany, Albia, Troy und Lansingburg liegen und 550 Bahnwagen aufnehmen können; sämtliche Schuppen sind mit Schachten versehen und mit zweitonnigen hydraulichen Schachtwinden ausgerüstet. In jeder dieser Wagenremisen befindet sich eine Reparaturwerkstätte, und hat die in North Albany die grösste und bedeutendste Ausrüstung. Weiterhin besitzt die Gesellschaft ein umfassendes System für Berichte und Aufzeichnungen, wovon einige Formulare wiedergegeben sind. Einen Teil der Energie zum Betrieb des Bahnnetzes entnimmt man drei Dampfanlagen in Albany, Troy und Lansingburg und den Rest der Wasserkraftanlage in Mechanicsville, welche der Hudson River Power Co. gehört. Ausserdem beabsichtigt man, noch mehr Energie von der letzteren Gesellschaft zu beziehen, sobald die Anlage in Speir Falls fertiggestellt ist. Augenblicklich sind zwei Unterstationen im Betrieb, die eine in Watervliet, welche fünf 375kw-rotierende Umwandler enthält, und eine andere in North Albany, wo sich vier gleiche Maschinen befinden. Während der verkehrsreichsten Zeit beläuft sich der Energieverbrauch auf ca. 8000 Amp., doch beträgt die Durchschnittsbelastung ungefähr nur 5600 Amp. Die Gesellschaft erhält davon 4000 PS von der Hudson River Power Co., so dass während der Jahreszeit, wenn der Verkehr am geringsten ist, der Betrieb der Dampfanlagen eingestellt werden kann.

Sommerbahn für Troy. . . . . . [Seite 303.]

Die Troy & New England-Bahn, welche den Verkehr zwischen Albia, einer Vorstadt von Troy, und Averill Park vermittelt und auf privatem Wegerecht gebaut ist, erstreckt sich quer durch Landgegend und wurde vorzugsweise für Sommerverkehr bestimmt. Averill Park, der Terminus der Bahn, ist ein beliebter Sommer-Vergnügungsort, und in Folge der Scenerie längs der Bahn ist der Park zu einem idealen Sommerausfluge wie geschaffen. Die Gesellschaft hat der längs der Bahn gelegenen Sommerplätze und Farmen wegen ein beträchtliches Gütergeschäft aufzuweisen.

Das Bahnnetz Fonda-Johnstown-Gloversville. . [Seite 304.]

Die genannte Bahn befasst sich sowohl mit Dampf- als auch mit elektrischem Betrieb, indessen ist jedes Departement vollständig für sich gehalten und auf einer Strecke des Bahnnetzes die elektrische Bahn in direkter Konkurrenz mit der Dampflinie. Gleich den meisten Bahnen in dieser Gegend umfasst das Bahnnetz mehrere Bahnen, die verschmolzen und verbunden wurden, als man den elektrischen Betrieb einführte. Ein sehr grosser Prozentsatz des Passagiergeschäfts besteht in Sommerausflugs-Verkehr. Die Gesellschaft unterhält einen schönen Park in der Nähe des nördlichen Terminus und hat mit Omnibuslinien Anschluss nach Lake Pleasant sowie nach Punkten in den Adirondacks Mountains, die in Folge der New Yorker Gesetze, welche diesen Distrikt als Waldgehege reservieren, mittelst Bahnlinien nicht erreicht werden können. Der Ueberlanddienst zwischen den meisten Städten, welche dieses Bahnnetz berührt, entwickelt sich allmälig ganz bedeutend. Normal-Oberbau und die Linienkonstruktion auf den neuen Strecken des Bahnnetzes stehen auf sehr hoher Stufe, und ist die Gesellschaft mit dem Umbau und der Vervollkommnung der älteren Strecken beschäftigt, um diese auf eine gleich hohe Stufe zu bringen. Mehrere schöne Brücken, Stahlviadukte und Betonkreuzungen sind gebaut worden, um Niveaukreuzungen zu vermeiden und die Entfernung zwischen wichtigen Punkten abzukürzen, in Folge dessen eine grosse Fahrgeschwindigkeit ermöglicht wurde. Das rollende Material der Bahn besteht, wie dies bei konsolidiertem Eigentum gewöhnlich der Fall ist, aus verschiedenen Typen und Fabrikaten; dagegen sind die neu angeschafften Bahnwagen modernen Musters und erfährt einer dieser Arten, den man für bestimmten Eildienst adoptierte, eine eingehende Beschreibung. Der Bahnwagen zeichnet sich hauptsächlich dadurch aus, dass der Fussbodenrahmen ganz aus Stahl ist und daran alle Stahlverbindungen

auf Stahl angebracht sind, wodurch dem Rahmenwerk eine bedeutende Stärke verliehen wird. Besonders hervorzuheben bei der Ausrüstung ist das neue Kraftwerk in Tribes Hill am Mohawkflusse, nur wenige km von Amsterdam entfernt. Da man diese Anlage für eine der grössten und modernsten Ueberlandzentralen in diesem Teile des Landes ansieht, so wird derselben eine eingehende Beschreibung gewidmet. Die Kesselausrüstung besteht aus zehn 500PS-Kesseln des schottischen Marinetyps. Die Dampfmaschinen, drei an der Zahl, gehören dem vertikalen Cross-Verbundtyp mit Kondensation an und entwickeln unter normalen Verhältnissen 1700 PS bei 94 Umdrehungen in der Minute. Die elektrische Ausrüstung der Zentrale und Unterstationen ist eine äusserst komplette. Die Krafterzeugungsstation enthält drei Haupteinheiten, wovon die eine für leichte Belastungen und zwei für gewöhnlichen Dienst mit einer Reserve bestimmt wurden. Die Maschinensätze sind je auf 1000 kw berechnet. Behufs Gleichstromzufuhr nach der Linie zwischen Schenectady und Gloversville erachtete man drei Unterstationen als notwendig und errichtete dieselben ungefähr 16 km von einander entfernt. Die gewählte Starkspannungsleitung von 13220 Volt bildet das höchste Normalmass, zu welchem die Unternehmerfirma Dynamos und spannungserhöhende Transformatoren baut. Bei der Uebertragungslinie ist ganz besonders die zwischen der Krafterzeugungsstation und der Amsterdam'er Unterstation liegende Linie hervorzuheben, die vierundzwanzig Stunden des Tages im Betrieb ist, d. h. den ganzen Tag für Bahndienst und die ganze Nacht für Beleuchtungszwecke. In Folge dessen führte man die Verwendung von vier Uebertragungsleitungen für Drehstrom ein, wovon eine als Reserve dient und an jedem Ende mit Schneideschaltern gekuppelt ist, so dass man irgend eine der übrigen drei Leitungen an beiden Enden ausschalten und durch diese Extraleitung ersetzen kann. Diese Einrichtung sichert einen ununterbrochenen Dienst, selbst wenn ein Draht im Falle eines mangelhaften Isolators, einer Kreuzung oder eines Bruches untauglich wird. Dieser Teil der Leitung folgt dem Gleise und liegt im Bereiche eines Reparaturwagens, damit man etwaige nötige Reparaturen bequem vorzunehmen im Stande ist. In Verbindung mit dieser Kraftanlage hat man eine äusserst vollständige Maschinenwerkstätte eingerichtet. Die Gesellschaft besitzt ein geräumiges Hauptquartier in Gloversville, welches sowohl für die elektrische wie auch die Dampfabteilung als Station verwendet wird. Das gesamte Bahnnetz ist mit einem privaten Telephonnetz, dessen Zentralstelle sich im Hauptquartiergebäude befindet, ausgestattet, und kann man mit dem kommerziellen Fernsprechernetz jener Sektion einen direkten Anschluss bewerkstelligen.

Die Leitungsschienenbahn Albany-Hudson. . . [Seite 316.]

Es ist dies die einzige elektrische Bahn mit Leitungsschiene im östlichen New York. Da dieses Eigentum im Street Railway Journal vom 2. Februar 1901 eine ausführliche Beschreibung erfuhr, so enthält der vorliegende Artikel nur eine kurze Uebersicht über die hauptsächlichsten Vorzüge dieser Bahn. Im Laufe des letzten Jahres hat die Gesellschaft Vergnügungsplätzen besondere Aufmerksamkeit zugewendet und dabei die Erfahrung gemacht, dass dieselben einen nicht zu unterschätzenden Beweggrund zur Benutzung der Bahn bildeten. An einem Tage wurden in Folge dessen 12000 Fahrgäste befördert, und zwar geschah dies, ohne dass sich dabei der geringste Unfall ereignete; die einzigen Verzögerungen wurden durch die Zugbrücke in Albany verursacht.

Das Schenectady-Bahnnetz. . . . . . [Seite 317.]

Die Schenectady Railway Co. betreibt die Linien in der Stadt Schenectady sowie Ueberlandbahnlinien, die sich bis nach Albany und Troy hin erstrecken; ausserdem ist eine weitere Linie nach Ballston im Bau begriffen, und will man gemäss eines Verkehrs-Uebereinkommens mit der Hudson Valley-Bahn Bahnwagen bis Saratoga laufen lassen. Das Bahnnetz wird sehr viel von Angestellten der General Electric Co. und der American Locomotive Works, also annähernd von 17000 Arbeitern benutzt. Viele derselben wohnen in Albany und sonstigen an der Linie liegenden Ortschaften. Auch findet ein beträchtlicher Vergnügungsverkehr statt, wovon speziell die „Zwielichts-Trolleytouren" zu nennen sind, die von Herrn Frederick Smith, dem Superintendenten der Gesellschaft, eingeführt worden sind. Jeden Abend laufen Spezialbahnwagen von Schenectady nach Troy über die Wasserleitungslinie und kehren über die Boulevardlinie zurück. Dies gestattet eine prächtige Aussicht auf das Hudsonthal. Die Gesellschaft behandelt ihre Angestellten sehr liberal, und obgleich die Arbeitervereine in dieser Gegend besonders stark sind, so sind doch wiederholte Versuche, die Motorleute und Schaffner zu organisieren, ebenso wie alle Austrengungen, das Bahnnetz zu boykotten, in Folge der Weigerung der Gesellschaft, der Union bei dieser Arbeit zu helfen, fehlgeschlagen. Eine bedeutende Rolle im Geschäfte der Gesellschaft spielt der Fracht-, Speditions- und Gepäckdienst; diese Abteilung ist trefflich organisiert und arbeitet mit den Dampfböten sowie auch den anderen Trolleybahnen, an die sie Anschluss hat, Hand in Hand. Früher herrschte zwischen Albany, Troy und Schenectady ein bedeutender Lastwagenverkehr, indessen ist dieses Geschäft mit der Zeit ganz und gar auf die Trolleybahngesellschaft übergegangen. Ein äusserst musterhafter Oberbau und ebensolche Leitungsanlage werden auf dem ganzen Bahnnetz fortwährend aufrecht erhalten, und wird eine Anzahl der hervorragendsten Einrichtungen dieser Art eingehend beschrieben. Die Gesellschaft hat hinsichtich des rollenden Materials eine grosse Mannigfaltigkeit aufzuweisen, was zum Teil den Erfordernissen des Dienstes, welcher Stadtlinien, Ueberlandbahnen, Fracht- und Speditionsgeschäft umfasst, zuzuschreiben ist. Die Wagenremisen und Reparaturwerkstätten des Bahnnetzes sind trefflich eingerichtet und mit den üblichen Apparaten ausgerüstet. In der Wagenremise, die sich in Fuller Str. befindet, hat man ein Stockwerk für die Leute reserviert, welche den Bahn-Unterstützungsverein gebildet haben. Die Klubbräume enthalten ein Billard- und Poolzimmer, ein Schrankzimmer, Waschräume, zwei Kegelbahnen, das Lesezimmer und ein Versammlungszimmer mit einer Plattform und Bühne; diese Räume wurden von der Gesellschaft ausgestattet, werden aber von den Leuten in Stand gehalten. Die Kraftanlage umfasst eine mit Dampf betriebene Erzeugungsstation mit Maschinen von annähernd 1100 PS, Dynamos von 1200 kw und Kessel von 100 PS Leistung. Doch hat die Gesellschaft, seit die Anlage in Mechanicsville fertiggestellt worden ist, Energie von der General Electric Co. bezogen. Unterstationen sind in Albany und Troy errichtet worden, während jetzt noch zwei in Ballston und Schenectady im Bau begriffen sind.

Selbständige Wasserkraftentwickelung. . . . [Seite 326.]

Viele der elektrotechnischen Unternehmungen im Hudsonthale entspringen der gegenwärtigen Entwickelung der Wasserkraftfazilitäten jenes Distrikts, und zu dieser Entwickelung hat die Hudson River Water Power Co. nebst ihren Hülfsgesellschaften, der Hudson River Electric Co. und der Hudson River Power Transmission Co., sehr wesentlich beigetragen. Dieser Artikel giebt eine kurze Uebersicht über das längs dieser Linie vollführte Werk, schliesst auch die Anlage in Mechanicsville ein, die mehrere der Gesellschaften, deren Anlagen beschrieben worden sind, sowie ausserdem die Anlage, die augenblicklich in Spier Falls nahe am Fusse des Mt. McGregor nördlich von Albany im Bau begriffen ist, mit Energie versieht. Die genannte Anlage wird jede ähnliche Ausrüstung im Osten an Umfang übertreffen und nach den Anlagen in Niagara Falls und Sault Ste. Marie erst die zweite Stelle einnehmen. Die Uebertragungslinie ist länger als irgend eine östlich von den Rocky Mountains. Energie will man für Elektrischlicht, Kraft- und Bahnzwecke an Albany, Troy und eine Anzahl kleinerer Städte abgeben. Der Dienst wird sich an die in Mechanicsville befindliche Anlage anschliessen, damit man sich auf diese Weise eine grössere Zuverlässigkeit und ein Netz mit bedeutend besserer Leitung zu sichern vermag. Die Pläne für diese Entwickelung sowie eine Karte der Uebertragungsleitungen sind beigegeben.

Die Bahn Utica-Mohawk Valley. . . . . . [Seite 327.]

Obgleich das betreffende Bahnnetz mit den Linien, die bis Saratoga reichen, nicht direkt verbunden ist, kann man es füglich doch als zu jener Gegend gehörig ansehen, da es die Stadtbahnlinien von Utica, Rome, Little Falls, Herkimer, Mohawk, Ilion, Frankfort, Clinton, New Hartford, Deerfield, Oriskany und Whitestown in sich begreift. Vor Allem zeichnet sich diese Bahn durch ihr Energieverteilungssystem aus. Energie bezieht man von der Anlage der Utica Gas & Electric Co., und erfolgt die Zuleitung der Energie mittelst der 20000 Volt-Uebertragungslinie jener Gesellschaft. Ein Teil der Energie wird in der in Utica befindlichen Unterstation verwertet, ein weiterer Teil nach den in Frankfort und Little Falls — östlich von Utica — gelegenen Unterstationen und der Rest nach der Unterstation in Oriskany übertragen. Die Unterstation in Utica wurde für drei rotirende Umwandler von je 500 kw und die übrigen Unterstationen für 300 kw-Maschinen entworfen. Augenblicklich jedoch besitzt die Utica'er Anlage nur einen Umwandler von 500 kw und zwei von 300 kw Leistung, indessen will man die letzteren bald durch Maschinen grösseren Typs ersetzen. Die in dieser Station befindlichen rotierenden Transformatoren arbeiten nach einem gemeinsamen Sammelschienensatz hin und weisen weder Drosselspulen noch Induktanz in den Wechselstrom-Hauptleitungen auf. Es befinden sich weiter dort drei ölisolierte, sich selbst kühlende Transformatoren von je 500 kw, die in Delta gekuppelt sind, den Wechselstrom zu 20000 Volt aufnehmen und ihn auf 360 Volt herabtransformieren, zu welcher Spannung er an die rotierenden Umformer abgegeben wird, welche ihn abwechselnd in Gleichstrom zu 600 Volt umwandeln, zu welcher Spannung er nach der Trolleylinie geleitet wird. Im Falle einer Störung kann man jeden Transformator für sich auskuppeln und die rotierenden Umwandler mit den übrigen beiden Transformatoren in V gekuppelt arbeiten lassen. Die Anordnung der Apparate in den Unterstationen in Frankfort, Little Falls und Oriskany ist eine ähnliche, wie sie in der Unterstation in Utica getroffen ist.

Oberirdische Normalanlage in Stadtstrassen. . [Seite 340.]

Zunächst werden von 14 hervorragenden Städten eingehende Einzelheiten über die dort übliche oberirdische Anlage mitgeteilt, woraus ersichtlich ist, dass in Bezug auf dieselbe in vielen Punkten ein Unterschied herrscht. Die allgemeinen Schlussfolgerungen lassen ersehen, dass die Konstruktion mit in der Mitte befindlichen Masten für Stadtbetrieb thatsächlich veraltet ist, d. h. die Anzahl von Städten, in denen diese Anlage zur Verwendung gelangt, ist eher im Abnehmen als im Zunehmen begriffen. Obgleich sie einen

schöneren Anblick als Seitenmasten und Querdrahtkonstruktion gewähren, so lassen sich doch der Unfälle wegen, welche Fahrgästen und dem Wagenpersonal zustossen, Einwände dagegen erheben. Wo man sie benutzt, hat man manchmal das Verfahren eingeschlagen, die Bahnwagenfenster sowie andere Oeffnungen mit einem Drahtnetz zu versehen, indessen sind Drahtnetze an und für sich zu verwerfen und ist nicht immer die Möglichkeit vorhanden, den Fahrgästen auf diese Weise einen vollständigen Schutz angedeihen zu lassen. Auch bildet die Anlage mit Mittelmasten oft ein Hindernis für Fuhrwerkverkehr und verhindert die Fuhrwerke, wie sie ist sonst thun würden, aus dem Gleis zu fahren. Ausserdem war eine derartige Anlage in manchen Fällen eine Quelle beträchtlicher Unannehmlichkeiten in Folge der Starrheit der Ausleger und des daraus folgenden Abbrechens der Fahrdrahthalter; jedoch hat man diesem Uebelstande vielfach durch das Anbringen biegsamer Ausleger abgeholfen. Bei Ueberlandbahnkonstruktion, wo Masten weit weg von den Bahnwagen errichtet werden, sind diese Einwände nicht stichhaltig. An Gewicht und Stärke haben die Masten eine Zunahme erfahren, ebenso auch die Isolierung zwischen Fahrdraht und Mast. In einigen Städten verwendet man zwischen einem Fahrdraht und dem Stahlmast drei Isolatoren. In Milwaukee indessen hat man die Isolierung am Fahrdrahthalter aufgegeben und die Gesellschaft verwendet nur zwei Kugelisolatoren mit Oesen am Querdraht. Ein Argument, welches sich dagegen geltend machen lässt, bildet, dass dadurch der Querdraht mit Elektrizität geladen wird; doch fällt dies in der Praxis nicht sehr ins Gewicht, indem man sicher darauf rechnen kann, dass ein Telephon- oder sonstiger Draht, wenn er auf den Querdraht fallen sollte, ohnehin mit dem Fahrdraht in Berührung kommt, weil er am Querdraht entlanggleiten wird, bis er den Fahrdraht berührt. Wie sich aus der Praxis ergiebt, sind die Ansichten über zwei- und dreiteilige Stahlmasten verschieden. Aluminium wird für Speiseleitungen nicht sehr viel benutzt. Der 8-Fahrdraht erfreut sich gerade keiner grossen Beliebtheit, doch verwenden ihn einige Gesellschaften und sind auch damit zufrieden. St. Louis benutzt durchweg Holz für Fahrdraht-Isolatoren.

Normalverfahren bei Stadt-Oberbau. . . . [Seite 340.]

Mitgeteilt wird das Verfahren, wie es von vierzehn hervorragenden Städten der Vereinigten Staaten beobachtet wird; Brooklyn und New York bleiben unerwähnt, weil deren Verfahrungsart bereits in der Oktober-Ausgabe 1901 geschildert worden ist. Die auf der zweiten Seite des Artikels gegebenen Profile veranschaulichen die verschiedenen benutzten Rillenschienen. Buffalo ist die einzige von den erwähnten Städten, welche elektrisch geschweisste Stösse verwendet, und hat die dortige Gesellschaft mehr als 162 km elektrisch geschweisstes Gleis aufzuweisen. Was das seitens anderer Gesellschaften bezüglich der Schienenstösse beobachtete Verfahren angeht, so kommen verriegelte und umgossene Stösse in fast gleichmässiger Verteilung zur Anwendung. Denver und Milwaukee verwenden durchweg T-Schienen. In Milwaukee ist diese Schiene aber mit einem besonderen Stoss, dessen Seiten vertikal sind, vergossen, so dass die Pflasterung daran erleichtert wird. Diese Gesellschaft benutzt auch eine 77 mm breite Lauffläche. Unter der Ueberschrift „Allgemeine Schlussfolgerungen" wird mitgeteilt, dass der bemerkenswerteste Unterschied zwischen heutigem Oberbau nnd dem vor mehreren Jahren in der häufigeren Verwendung von Beton-Langschwellen unter den Schienen besteht. Eine Anzahl Gesellschaften benutzt bei dieser Konstruktion auch Schwellen, die in manchen Fällen aus Metall, in anderen dagegen aus Holz sind. Die Erfahrung hat gelehrt, dass bei Verlegung des Strassenpflasters auf Beton es wünschenswert erscheint, dass der Beton die Schiene stützt und man diese Unterstützung auf das ganze Pflaster ausdehnt. Eine grössere Neigung zeigt sich jetzt auch für die Verwendung von Rillenschienen; diese Schienen sind aber so konstruiert, dass die Rille durch die Thätigkeit der Bahnwagenräder automatisch reingehalten wird, während man das Reinhalten der Lauffläche durch deren genügendes Hervorragen über das Pflaster bewerkstelligt, so dass sie durch den Regen und Wasserstrom der Strassen reingewaschen wird. Schienen mit schmaler Rille haben sich als ein Fehlschlag erwiesen. Vor einigen Jahren galt die Rillenschiene jedoch bei vielen Bahnen als Normalschiene. Die Stadtbehörden indessen erhoben Einwand gegen dieselbe, weil sie ihrer Ansicht nach ein Hindernis für den Verkehr beim Kreuzen der Gleise bildete, wogegen die Eisenbahnen Schwierigkeiten damit hatten, weil die Fuhrwerke, da die Schiene dem Wagenverkehr eine gute Pflasterung zur Benutzung bot, dem Gleise folgte und auf diese Weise die Bahnwagen aufhielten.

Normalverfahren in Bezug auf Bahnwagen für Stadtdienst. [Seite 347.]

Der betreffende Artikel zieht das von vierzehn der grössten Städte — New York ausgenommen — der Vereinigten Staaten eingeschlagene Verfahren in Betracht, und hat sich im Laufe der letzten zehn Jahre eine Neigung zu längeren Bahnwagen kundgegeben. Den Hauptvorzug bildet, dass eine grössere Anzahl Fahrgäste für dieselben Arbeitskosten befördert werden können. Wenn ein langer Bahnwagen bedeutend überfüllt ist, so wird der Schaffner ohne Zweifel einige Fahrgäste beim Einsammeln des Fahrgelds übersehen. Sodann werden über das Bahnwagenwesen verschiedener Städte ausführliche Mitteilungen gemacht. Die längsten und schwersten Bahnwagen für Stadtdienst sind diejenigen, welche die Chicago'er Stadtbahn im Betrieb hat; diese Bahnwagen besitzen einen Wagenkasten in der Länge von 10,37 m und eine Gesamtlänge von 14,7 m. Ihr Gewicht mit Motoren, doch ohne Fahrgäste, beläuft sich auf 21800 kg. In Denver und San Francisco gelangt ein halb offener, halb geschlossener Bahnwagen zur Verwendung. Doch haben die meisten Städte einen halb verwandelbaren Bahnwagen im Betrieb. Ein solcher Waggon ist im Winter sehr beliebt, aber im Sommer, wenn der Verkehr stets ein grösserer ist, lassen die Gesellschaften auch die üblichen offenen Bahnwagen laufen. Es giebt keinen Bahnwagen, der im Sommer so beliebt ist wie der normale offene Bahnwagen und keinen, der so viele Fahrgäste befördert; indessen die Unbequemlichkeit, einen doppelten Bestand an Bahnwagen führen zu müssen, bewegt viele Gesellschaften zur Einführung des halb verwandelbaren Bahnwagens, welcher ausserdem auch weniger Veranlassung zu Unfällen als der normale offene Bahnwagen giebt. Längere Plattformen kommen nur bis zu einem gewissen Grade zur Verwendung; seitens der Fahrgäste erfreuen sie sich einer grossen Beliebtheit, werfen aber das Gewicht auf das äusserste Ende des Wagens und sind in Folge dessen vom technischen Standpunkte aus zu verwerfen. Panelen aus Stahlplatten werden nur in zwei Staaten verwendet. Luftbremsen sind fast überall eingeführt. Die Tabelle, die dem Artikel beigegeben ist, lässt die Hauptdimensionen der von den Gesellschaften als mustergültig angesehenen Bahnwagen ersehen. Die Mehrzahl dieser Gesellschaften ist im Besitze sehr vieler anderer Wagentypen, und zwar in einigen Fällen, weil sie für besondere Verhältnisse passen, und in anderen Fällen, weil sie eben im Besitze der Gesellschaften sind. Die in der Tabelle beschriebenen Bahnwagen sind indessen sämtlich solche, welche bei den verschiedenen Gesellschaften als Normalbahnwagen gelten.

Kraftwerke für grosse Stadtbahnen. . . . . [Seite 358.]

Den Inhalt dieses Artikels bildet eine gedrängte Uebersicht über das Verfahren bei Kraftwerkkonstruktion, wie es die verschiedenen Bahnlinien, die in dieser Nummer besprochen sind, eingeschlagen haben. Viele dieser Kraftstationen, die bereits vor zehn oder noch mehr Jahren gebaut wurden, sind etwas veraltet; nichtsdestoweniger kann man sich von der gegenwärtigen Richtung, welche die Praxis verfolgt, einen guten Begriff machen. Von den drei Tabellen veranschaulicht die erste die Gesamtleistung von Kraftstationen, welche Stadtbahnen mit Energie versehen, die Gesamtleistung pro Gleismeile, die Gesamtleistung pro Bahnwagen, der zu den Zeiten des grössten Verkehrs die Linie befährt, und die Kilowattstunden pro Wagenmeile während des letzten Jahres. Die zweite Tabelle giebt Statistiken, die sich auf die neueren Krafterzeugungsstationen, wie sie von den verschiedenen Gesellschaften errichtet werden, beziehen. Die dritte Tabelle enthält Einzelheiten über einige der grössten verwendeten Dampfmaschinen. Obschon man für den grösseren Teil der in diesen Städten gebrauchten Energie Gleichstrom verwendet, hat doch auch Wechselstromverteilung bis zu einer begrenzten Ausdehnung Eingang gefunden, und sind jetzt die meisten Gesellschaften mit der Einführung von Wechselstromverteilung beschäftigt. Boston ist ungefähr die einzige Stadt, in welcher Wechselstrom keine Verwendung findet oder in welcher man dessen Einführung noch in Erwägung zieht. Die Diagramme, welche Pläne von Stationen veranschaulichen, sind sämtlich nach demselben Massstabe gezeichnet und illustrieren das Arbeitsdampf-Röhrenwerk sowie die Stellung von Kesseln und Dampfmaschienen in den verschiedenen Kraftwerken. Eine genaue Betrachtung zeigt, dass in den neuen Kraftwerken spezielle Vorkehrungen getroffen sind, um eine Trennung der Kessel, Dynamos und Dampfmaschinen gruppenweize zu bewerkstelligen, so dass Störungen bei der einen Gruppe die andere nicht in Mitleidenschaft ziehen, und dies bezieht sich sowohl auf die Dampfsektion der Ausrüstung wie auch auf die elektrotechnische Abteilung. Die Dynamos haben gewöhnlich eine Leistung von 5000 kw oder mehr. Elektrisch bethätigte Dampfventile werden jetzt eingeführt. Grosse Fazilitäten sind zum Aufspeichern von Kohlen und zu deren schnellen Handhabung vorgesehen. Die Stationen sind so entworfen, dass Vergrösserungen leicht vorgenommen werden können.

Eventuelle Ersparnis in Zentralen und bei Verteilungssystemen. Von Philip Dawson. . . . . [Seite 364.]

Zunächst zieht der Verfasser einen Vergleich zwischen dem Entwurf einer europäischen und dem einer amerikanischen Zentrale. Dabei lassen sich in Zukunft Vervollkommnungen nach zwei Richtungen hin vornehmen, nämlich die eine hinsichtlich vorhandener Maschinerie und hinzukommender arbeitsparender Apparate, die andere dagegen in der Richtung radikaler Aenderungen im System wie z. B. Verwendung von Dampfturbinen, Gasmaschinen oder eventuell Gasturbinen für Dampfmaschinen mit hin- und hergehender Bewegung. Die Mehrzahl der in allgemeinem Gebrauch befindlichen arbeitsparenden Apparate hat in den Vereinigten Staaten ihren Ursprung, darunter Handhabungs-Apparate für Kohlen und Asche, die heutzutage als notwendiger Zusatz für jedes grosse Kraftwerk angesehen werden. Mechanische Beschickungsapparate kommen ebenfalls allgemein zur Verwendung. In Grossbritannien ist der bewegliche Kettenbeschickungsapparat am meisten beliebt. Die auf dem Kontinent gehandhabte Praxis neigt sich in Folge der Billigkeit der Arbeitskräfte der Handbeschickung zu.

Der Verfasser ist der Ansicht, dass in Verbindung mit mechanischen Beschickungsapparaten viel billigere Kohlen gebrannt werden können. Die Kessel weisen in Vergleich zu dem früheren Verfahren keine grosse Aenderung auf. In Grossbritannien ist der Wasserröhrenkessel äusserst beliebt, und ungefähr 30 Prozent von den Kraftwerken verwenden gegenwärtig einen horizontalen Kessel dieses Typs. In den Vereinigten Staaten gelangt dieser Kessel ebenfalls in ausgedehntem Masse zur Verwendung, doch benutzt man auch vertikale Wasserröhrenkessel. Auf dem Kontinent sind die Kessel von denen der beiden anderen erwähnten Länder grundverschieden, und werden gewöhnlich zweistöckige Kessel verwendet. Künstlicher Zug erfreut sich in Amerika einer grossen Beliebtheit, obgleich derselbe keineswegs in genanntem Lande überall zur Einführung gelangt ist. Der Verfasser meint, dass dessen Verwendung immer mehr eine allgemeinere Verbreitung findet. Was Dampfmaschinen betrifft, so herrscht in Grossbritannien eine ausgeprägte Neigung für vertikale Maschinen, und neigt sich die amerikanische Praxis derselben Richtung zu. Die Normaldampfmaschine ist für beide Länder eine stehende Cross-Compound-Maschine, wogegen man in Deutschland horizontale Maschinen bevorzugt. Amerikanische und britische Maschinen weisen eine einfachere Konstruktion auf, und gelangt das Corliss-Ventil in ausgedehntem Masse zur Anwendung. Auf dem Kontinent verwendet man mehr das Kegelventil, hauptsächlich weil man überhitzten Dampf in grösserem Umfange zur Anwendung bringt; die deutschen Dampfmaschinen sowie die der Schweiz charakterisiert eine kompliziertere und verwickeltere Schiebersteuerung als sie Grossbritannien und Amerika aufweist. Weiter erörtert der Verfasser die relativen Vorteile überhitzten Dampfs sowie die Untersuchungen, wie sie von kontinentalen Ingenieuren in Bezug auf Schmiermittel und Packung, welche die bei überhitztem Dampf stattfindenden höheren Temperaturen aushalten können, angestellt worden sind. Sodann werden einige Versuche, die in den Berliner Elektrizitätswerken an einer Maschine mit überhitztem Dampf vorgenommen wurden, angegeben. Weiterhin nimmt der Verfasser auf die immer mehr um sich greifende Verwendung von Dampfturbinen Bezug und erwähnt deren Vorzüge in Vergleich zu Maschinen mit hin- und hergehender Bewegung. Kühltürme gelangen in Grossbritannien und auf dem Kontinent mehr als in den Vereinigten Staaten zur Verwendung. In Grossbritannien benutzt man auch Türme mit künstlichem Zug, während auf dem Kontinent die Verwendung von Kühltürmen mit natürlichem Zug eine grössere Verbreitung gefunden hat. Ein Hauptmoment in der kontinentalen Praxis bildet die Benutzung von Hülfsmaschinen, die mit den Hauptdampfmaschinen direkt gekuppelt sind; so werden Luftpumpen gewöhnlich direkt getrieben, und ist es ein übliches Verfahren, Erregeranker auf der Welle der Hauptdynamomaschine zu montieren. Das amerikanische Verfahren unabhängiger Hülfsmaschinen wird von dem Verfasser als Richtschnur bevorzugt. Kontinentale Ingenieure sind betreffs der Verwendung von Akkumulatorenbatterien verschwenderischer gewesen, und ein Grund dafür ist darin zu suchen, dass auf dem Kontinent Dreifach-Expansionsmaschinen in grösserem Massstabe Verwendung finden und diese Maschinen unter schwankenden Belastungen nicht mit ihren besten Erfolgen arbeiten. Gasmaschinen werden jetzt auf dem Kontinent mehr als in Grossbritannien oder Amerika eingeführt. Sodann bespricht der Verfasser die Frage betreffs Gleichstromspannung. Bis vor Kurzem waren 500 Volt die von der Handelskammer Grossbritanniens erlaubte Maximalspannung, indessen hat man sich jetzt thatsächlich entschlossen, eine Spannung von 600 Volt zu gestatten. Auf dem Kontinent verwendet man 750 Volt, doch ist es fraglich, ob man in Anbetracht der hinzukommenden Schwierigkeiten, die sich beim Entwurf von Bahnmotoren geltend machen, irgend einen materiellen Vorteil dabei erzielt hat. Sodann geht der Verfasser kurz auf Mehrphasenbetrieb ein und weist nach, dass der Erfolg von Mehrphasenbahnen, wie man sie in Europa — besonders in der Schweiz — gebaut hat, vor Allem von lokalen Verhältnissen abhing, worunter als Hauptfaktoren zu nennen sind, dass die Zahl der verkehrenden Wagenzüge verhältnismässig gering ist, so dass man der Reparaturfrage keine allzu grosse Bedeutung beizumessen braucht, und dass die Elektrizität in den meisten Fällen mittelst Wasserkraft gewonnen wird, so dass sich der Verlust an Energie wenig fühlbar macht. Ingenieure in Grossbritannien und den Vereinigten Staaten rechnen indessen auf den Entwurf eines praktischen Wechselstrommotors, vor Allem aber eines Einphasenmotors.

Verfahren in modernen Reparaturwerkstätten. Von Richard McCulloch. . . . . [Seite 368.]

Der Verfasser erörtert in ausführlicher Weise die in den Reparaturwerkstätten der Chicago'er Stadtbahn erzielten Resultate, einer Bahn, über welche in dieser Zeitschrift (in der Ausgabe vom 7. März 1903) eine Beschreibung veröffentlicht worden ist. Im Jahre 1902 betrieb die Gesellschaft 206 Kabelzüge, 125 vierachsige elektrische Bahnwagen mit je vier Motoren und 402 zweiachsige elektrische Bahnwagen mit je zwei Motoren. Sie besitzt eine Zentral-Reparaturwerkstätte und sechs Bahnwagenschuppen, worin die Reparaturarbeiten an Bahnwagen ausgeführt werden. Die in den Wagenremisen vollführte Arbeit besteht im Nachsehen und Reinigen der Ausrüstung, in dem Einrichten und Untersuchen der Bremsen, im Justieren von Rädern und Untergestellteilen, in der Auswechslung von Trolleyfüssen, Trolleyruten und Rollen, im Reparieren der Wagenleitung sowie in unbedeutenderen Reparaturen an elektrischen Apparaten wie in Erneuerung einzelner Teile derselben und von Kontrollerteilen. Zuerst werden die in diesen Wagenremisen benutzten Maschinenwerkzeuge und die Zahl der beschäftigten Leute nebst der von ihnen zu vollbringenden Arbeit angegeben. Die Gesamtanzahl derselben in den Wagenremisen und der Reparaturwerkstätte beträgt zwischen 300 und 350. Tabelle No. I bildet eine Klassifizierung der Betriebsausgabenkonti, wie man sie beim Aufstellen der Werkstattzeit anwendet. Tabelle II veranschaulicht — je nach der Beschäftigung — die Einteilung der Zahlungsliste für das Jahr 1902. Interessant ist dabei die Wahrnehmung, dass die Maschinenwerkstatt, ferner Wagenreparatur- und Anstreicher-Abteilung ungefähr gleich sind und die grössten Posten aufweisen, indem auf jede dieser Abteilungen mehr als 15 Prozent der Gesamtheit entfallen. Tabelle III giebt die Beträge der Arbeitskonti für Werkstatt und Wagenremisen. Tabelle IV bildet eine Aufstellung der Posten, welche die Reparaturverrechnungen betreffen. Die bezahlten Löhne variieren von 10 Cents bis zu 33 Cents (40 Pf bis zu Mk 1,32) die Stunde und werden ausführlich wiedergegeben Tabelle V und VI lassen die Kosten für die Ausführung irgend einer der gewöhnlichen Verfahrungsarten in der Reparaturwerkstätte ersehen. Sodann beschreibt der Verfasser eine Anzahl solcher Verfahrungsarten, darunter auch das Verfahren, wie man alten Draht in den Feldspulen zum Bewickeln neuer Spulen verwertet. Ferner beschreibt er die Ausrüstung jeder einzelnen Werkstatt. In Verbindung mit den Werkstätten betreibt die Gesellschaft auch eine Wäscherei behufs Waschens von Handtüchern und öliger Abfallbaumwolle, ebenso eine Werkstätte zum Anfertigen von Schienenkreuzungs- und Herzstücken, weiter eine Druckerei zum Drucken von Umsteigefahrkarten sowie allen Drucksachen, die von der Gesellschaft gebraucht werden. Die Druckkosten für Umsteigekarten erhellen aus Tabelle No. IX. Weiterhin führt der Verfasser einige Schlussfolgerungen an, die er aus dem in Chicago beobachteten Verfahren gezogen hat. Die erste lautet dahin, dass die Möglichkeit, Reparaturkosten verringern zu können, auf folgenden Punkten beruht, wobei das Herstellungsverfahren das bestmögliche sein muss: Bearbeitung grosser Mengen Materials von gleicher Natur zu derselben Zeit; nichts durch Handarbeiten zu verrichten, was man mittelst Maschinerie ausführen kann; Bethätigung der Werkzeugmaschinen zu ihrer grössten Leistungsfähigkeit. Besonderen Nachdruck legt er auf die Wichtigkeit der Normierung von Apparaten. Während die Normierung von Bahnwagen, Trucks, Motoren und Bahnausrüstung wohl unmöglich ist, liegt doch die Möglichkeit vor, Lagerschalen, Achsen, Räder, Bahnwagen-Ausstaffierung, Trolleyruten, Trolleyrollen u. s. w. zu normieren. Seiner Ansicht nach ist nur den grössten Gesellschaften anzuraten, die Herstellung von Apparaten, die zu ihrem eigenen Gebrauch dienen sollen, selbst zu unternehmen. Zum Schlusse zählt er die elf wichtigen Erfordernisse, wie sie die Verfahren in Reparaturwerkstätten verlangen, auf.

Neues Blocksignalsystem für eingleisige Bahnen. . [Seite 378.]

Ein derartiges System hat den Zweck, dass ein oder mehr Bahnwagen in einem Block hinter einander fahren können, zugleich aber gegen einander geschützt sind und zu verhüten vermögen, dass ein Bahnwagen von der entgegengesetzten Richtung her den Block zu passieren versucht. Ein Stromkreisdiagramm wird auf Fig. 1 veranschaulicht. Sobald der erste Bahnwagen in den Block einfährt, setzt er ein rotes Signal an dem entfernteren Ende und mehrere dazwischenliegende Signale, welche den nachfolgenden Bahnwagen anzeigen, dass der Block befahren wird. Durch einen besonderen, auf Fig. 4 und 5 abgebildeten Schaltapparat werden die Wagen beim Verlassen des Blocks auf automatische Weise registriert, und wenn der letzte Bahnwagen aus dem Block auftaucht, zeigen die Lichter freie Bahn an. Die seitens der Wagenführer bei diesem System zu befolgenden Instruktionen sind äusserst einfach.

Neue Zeitkarte. . . . . . [Seite 379.]

Ein solche Zeitkarte gelangt auf Ueberlandbahnen zur Ausgabe. Des Agenten Stempel, Koupons und Kontrakt befinden sich auf einem daran befindlichen ununterbrochenen Streifen, wodurch verhütet wird, dass Fahrgäste abgetrennte oder alte Koupons in neuem Umschlage abgeben können.

Fortschritte in elektrischen Untergrundbahnen in London. [Seite 380.]

Zunächst wird eine kurze Skizze von sämtlichen elektrischen Untergrundbahnen Londons gegeben; weiterhin dann folgen Einzelheiten über die Zentrale der Metropolitan Railway, welche nicht mit derjenigen der Metropolitan District Railway zu verwechseln ist. Das Kraftwerk soll vier 3500kw-Dampfturbinen, die mit Dynamos direkt gekuppelt sind, enthalten, und hat man behufs Einstellung von zwei weiteren Sätzen hinreichende Vorkehrungen getroffen. Der Schornstein besitzt eine Höhe von 61 m und 4,57 m Durchmesser. Ein Kohlenkonveyor soll installiert werden und die Uebertragung der Energie zu 11000 Volt ohne Anwendung von spannungserhöhenden Transformatoren erfolgen.

Glasierte Leitungsröhren und Isolatoren. . . [Seite 381.]

Die Figur illustriert einen Isolator, der aus glasiertem Thon hergestellt und von der Manhattan Hochbahngesellschaft in New York eingeführt worden ist.

Automatische Weiche. . . . . . [Seite 382.]

Zwei Abbildungen stellen eine neue automatische Weiche dar; dieselbe wird mittelst eines auf der Bahnwagenplattform befindlichen Kolbens gestellt.

Speisewasser-Heiz- und Reinigungsapparat. . . [Seite 382.]

Es ist dies ein stehender Heiz- und Reinigungsapparat, welcher das Speisewasser vorwärmt und reinigt, ausserdem auch die Verdichtung und das Oel aus dem Ausströmungsdampf beseitigt.

Durch einen Motor bethätigte Gleisbohrmaschine. . [Seite 383.]

Die Abbildung stellt eine Gleisbohrmaschine dar, welche durch einen elektrischen Motor getrieben wird.

Besondere Bahnkreuzung. . . . . . [Seite 383.]

Die beigefügte Abbildung veranschaulicht die Kreuzung einer elektrischen Ueberlandbahn nebst drei Dampfbahngleisen. Diese Kreuzung ist mit einer sich verstärkenden Schiene hergestellt, die dazu dient, sich den Radspurkränzen von Lokomotiven anzupassen, und welche deren Schlagen gegen die angrenzenden Schienen der elektrischen Bahn verhütet.

Motorgetriebene Triplex-Pumpe. . . . . . [Seite 384.]

Es ist dies eine Pumpe für allgemeinen Dienst. Auf der Abbildung ist dieselbe mit einem elektrischen Motor direkt gekuppelt dargestellt, doch lässt sie sich auch so einrichten, dass sie mittelst anderer Kraft bethätigt werden kann.

Für Omaha und Council Bluffs bestimmte Bahnwagen, die ein schnelleres Ein- und Aussteigen ermöglichen. [Seite 384.]

Die Abbildungen veranschaulichen einen Bahnwagen, dessen Thüren und Sitzplätze so angeordnet sind, dass sie das Ein- und Aussteigen von Fahrgästen erleichtern. An dem einen Ende des Wagens hat man einen Quersitzplatz fortgelassen, um an der Thür mehr Raum zu schaffen. Denselben Zweck verfolgte man am anderen Ende dadurch, dass man einen der Längssitzplätze um 35 cm kürzer als den anderen gemacht hat. Die Thüren sind an der Seite näher am Tritte angebracht und verringern auf diese Weise die Entfernung zwischen Thür und Tritt.

Prüfungsinstrumente für Gleis und Motoren. . [Seite 385.]

Der Prüfapparat für Schienenverbindungen (Fig. 1) bringt den Widerstand einer Länge von einer geraden Schiene mit dem Widerstande des Schienenstosses in Einklang. Die Ausgleichung erfolgt mittelst Anwendung des Telephons. Ein Mann vermag 1000 Stösse den Tag zu prüfen. Der Motor-Prüfungsapparat (Fig. 2) dient zur Bestimmung von Kurzschlüssen sowie anderer Defekte und kann bei einem heissen Motor angewendet werden.

Eine Muster-Triebwerkanlage. . . . . . [Seite 386.]

Beschrieben werden einige Vergrösserungen, die man in den Werken einer bedeutenden Triebwerkfabrik in Pittsburg vorgenommen hat.

Vervollkommnetes Gleis- und Schnee-Kratzeisen. . [Seite 386.]

Eine derartige Vorrichtung zum Abkratzen des Schnees wird an dem Bahnwagentruck angebracht und reinigt das ganze Gleis zwischen den Schienen sowie auch die Aussenseite jeder Schiene auf 230 mm Entfernung.

Schienenverbindungen „ganz aus Draht". . . [Seite 386.]

Derartige Verbindungen werden aus weichem, kalt gewalztem Kupferdraht hergestellt, dessen Enden unter Druck zusammengeschweisst sind, um Enden zu bilden und die Verwendung aller gegossenen Stösse überflüssig zu machen. Die Verbindung wird mit der Schiene verlötet. Fig. 1 veranschaulicht eine Verbindungsform, die man unter der Lasche anwendet, Fig. 2 eine solche zur Benutzung unter der Schiene auf Hochbahnen sowie Leitungsschienenbahnen und Fig. 3 eine solche zur Verwendung auf der unteren Fläche des Schienenfusses oder der oberen Schienenfläche, wo diese Verbindung auf die Laschen nicht störend einwirkt.

Verbessertes Ventilierungsverfahren, wie es an einem neuen, für Leicester (England) bestimmten Bahnwagen zur Anwendung gelangt. . . . . . [Seite 388.]

Ein neuartiges Ventilationssystem hat man bei einem für die Leicester Korporation gebauten Bahnwagen eingeführt. Frische Luft gelangt in den Bahnwagen durch Fenster, die mit Angeln versehen und über den grossen festgemachten Glasfenstern angebracht sind, sowie auch durch ein auf jeder Seite der Endthüren befindliches, mit Scharnieren versehenes Fenster. Die schlechte Luft entweicht durch einen Abzug im Dache und ausserdem durch Ventilatoren, die so konstruiert sind, dass, wenn der Wagen im Fahren begriffen ist, die schlechte Luft herauszieht. Ein Diagramm ist beigefügt, welches die Zirkulation der Luftströme ersehen lässt, ebenso veranschaulichen Abbildungen das Aeussere und Innere des Bahnwagens,

Elektrischer Heizapparat für Bahnwagen mit Quersitzen. [Seite 389.]

Der betreffende Heizapparat is so eingerichtet, dass man ihn der Länge nach im Bahnwagen anbringen kann, und die Abbildung zeigt, wie dies möglich ist, ohne mit der Stütze des Sitzplatzes in Konflikt zu kommen.

Elektrischer Bahnwagen-Heizapparat. . . . [Seite 390.]

Der abgebildete Bahnwagen gelangt auf grossen Ueberlandbahnen in ausgedehntem Masse zur Verwendung. Die Abbildung veranschaulicht, wie der Heizapparat am Sitze festgemacht ist.

Gradier-Maschine. . . . . . [Seite 390.]

Eine derartige Maschine verwendet man beim Bahnbau zum Gradieren der Wege. Dieselbe ist mit einem Pflug und einem Förderriemen ausgestattet, welcher die aufgepflügte Erde entweder nach einem Wagen hin schafft oder an der Seite der Strasse abwirft. An der Maschine sind ferner Vorrichtungen zum Einstellen des Pflugscharwinkels sowie zum Grademachen und Anziehen des Förderriemens angebracht.

Der Snow'sche Wiedereinrichtungs-Apparat. . [Seite 391.]

Der Apparat soll dazu dienen, entgleiste Bahnwagen und Lokomotiven wieder auf die Gleise zu schaffen.

Schalter zum Regulieren der Wärme. . . . [Seite 391.]

Artikel und Illustration beziehen sich auf einen Dreikontaktschalter zum Regulieren der Bahnwagen-Heizapparate.

Neuartige Trolleyrolle. . . . . . [Seite 391.]

Die Abbildung stellt eine Trolleyrolle dar, welche eine Graphitausfütterung mit einer sich automatisch speisenden Oelkammer in sich vereinigt; letztere lässt sich füllen, ohne dass man die Rolle aus der Gabel herauszunehmen braucht.

Neue Bahnwagen für die elektrische Lake Shore-Bahn. [Seite 392.]

Dieser Artikel enthält eine Beschreibung einiger Bahnwagen, die auf der elektrischen Lake Shore-Bahn in Cleveland, Ohio, in Dienst gestellt werden sollen. Es ist dies eine lange Ueberlandbahn, und gleichen die Bahnwagen in mancher Hinsicht denen, wie sie auf Dampfbahnen benutzt werden. Jeder Wagen zerfällt in drei Abteile: In ein Personen-, Rauch- und Gepäckabteil. Das Gepäckabteil ist zugleich für den Wagenführer eingerichtet und enthält einen Heisswasser-Heizapparat. Man erwartet, dass diese Bahnwagen bei regelmässigem Dienst 257,44 km — so weit ist Cleveland von Toledo entfernt — in 4½ Stunden zurücklegen werden.

Apparat, Bahnwagen auf die Schienen zu heben . [Seite 393.]

Der betreffende Apparat bringt entgleiste Bahnwagen auf die Schienen zurück, sobald das Bahnwagenrad bis zum oberen Teile der Schiene gelangt.

Balanzierte Trolleyrolle. . . . . . [Seite 393.]

Die Illustration stellt eine vervollkommnete Form einer Trolleyrolle dar, welche behufs einer grösseren Abnutzungsfläche eine breitere Rille besitzt. Die neuartige Form des Spurkranzes gewährt der Rolle eine erhöhte Stärke, um einem Schlage widerstehen zu können, und schliesst ausserdem iede Möglichkeit einer Reibung am Fahrdraht aus.

Kombinierte Bogen- und Glüh-Signallaterne. . . [Seite 393.]

Eine derartige Frontlaterne ist sowohl für Bogen- als auch Glühstromkreise eingerichtet. Mit Hülfe eines Zweikontaktschalters können beide Stromkreise in Verbindung mit einem besonderen Reflektor zur Verwendung gelangen. Die Signallaterne ist speziel Ueberlandbahnen angepasst, welche in Stadtstrassen ein schwächeres Signallicht als bei der Fahrt über Land verwenden wollen.

Uni-Signalsystem. . . . . . [Seite 394.]

Dies ist ein elektrisches Signalsystem für elektrische Bahnen, die Trolleys verwenden, und besteht aus einem am Terminus der Linie befindlichen Kasten und Blitzschutzvorrichtungen, einem Signalkasten und einer doppelt wirkenden Trolleyweiche. Wie aus dem Leitungsdiagramm erhellt, fliesst, wenn ein Bahnwagen am Einfahrtsende des Blocks die Trolleyweiche passiert, Energie aus

dem Fahrdraht durch den Beleuchtungsmagnet sowie durch die im Signalkasten befindliche Widerstandsplatte an jenem Ende zur Erde, was zur Folge hat, dass der Ausschaltungshebel in dem Signalkasten nach dem links befindlichen Kontakt des Ausschalters geworfen wird. In Folge dessen erfolgt dann das Entnehmen von Energie von dem Ausfahrtsende des Blocks, welche durch die rote Lampe sowie den Sperrmagnet an jenem Ende und weiter durch die Beleuchtungssignalleitung nach dem Einfahrtsende fliesst, wo sie durch die grüne Lampe, den Beleuchtungsmagnet und die Widerstandsplatte zur Erde geht. Zum Auslöschen des Signallichts wird dem Fahrdraht an dem Auslöschschalter Energie entnommen, die durch den Auslöschungsmagnet an jenem Ende und von da durch die Auslöschleitung nach dem Einfahrtsende fliesst, wo sie dann durch den Auslöschungsmagnet und die Widerstandsplatte zur Erde geht.

Untergrundleitungs-Konstruktion in Brooklyn. . [Seite 395.]

Die Illustration stellt eine 14,4 m langes Speiseleitungsrohr für Gleichstromdrähte dar, die in Brooklyn gelegt werden.

Luxuriöses Reisen auf Bahnen. . . . . . [Seite 395.]

In diesem Artikel gelangt das Innere eines Bahnwagens zur Beschreibung, der zur Benutzung bei feierlichen Gelegenheiten gebaut ist und auf den Linien der British Electric Traction Co., England, zur Verwendung kommt.

Drehgestell No. 46. . . . . . [Seite 396.]

Dieses Drehgestell ist für schweren elektrischen Bahndienst bestimmt und hat ein Gewicht von ca. 5000 kg. Sämtliche Teile des Drehgestells sind besonders stark angefertigt.

Von selbst aufblitzende Lampe für Schilder. . [Seite 396.]

Es ist dies eine Glühlampe, die mit einem gewöhnlichen Edison'schen Fusse ausgerüstet ist, worin sich ein Mechanismus befindet, der das Licht von dem grossen nach dem kleinen Filament in unregelmässigen Zwischenpausen nach oben und nach unten dreht. Derartige Lampen verwendet man hauptsächlich für Anzeigeschilder.

Verwandelbarer Konstruktions-, Schotter- und Gondelbahnwagen. [Seite 397.]

Ein derartiger Bahnwagen vereinigt drei Typen in sich: Als Wagen, der seine Ladung in der Mitte abwerfen kann oder als Schotterwagen seine Ladung auf das Gleis wirft; als Wagen mit seitlicher Entleerung lässt er sich zum Abladen an einer oder beiden Seiten des Gleises verwerten; ausserdem kann man ihn in eine Gondel mit ebenem Boden verwandeln.

Schön ausgestatteter Privatbahnwagen. . . [Seite 398.]

Die Abbildungen veranschaulichen einen Waggon, der für Privatgebrauch auf elektrischen Ueberlandbahnen gebaut wurde. Derselbe ist vortrefflich ausgestattet und mit einem Salon, Rauchzimmer, einer Küche, ferner mit Speise- und Kleiderschränken, einem Schlafzimmer und einem Toilettenraume versehen. Der Wagen hat eine Länge von ca. 15 m und wiegt über 30 t.

Sicherheits-Bahnwagenriemen. . . . . . [Seite 400.]

Wie aus der Illustration hervorgeht, ist der Riemen wie ein Y geformt. Der auf die Riemenstange ausgeübte Druck konzentriert sich deshalb nicht auf einen Punkt und vermindert so das Risiko eines Stangenbruchs. Der Riemen ist aus Leder hergestellt und in solcher Weise angebracht, dass er in Folge der Zugbewegung nicht an der Riemenstange entlanggleiten kann.

Ein Oelmaschinen-Kraftwerk. . . . . . [Seite 400.]

Die Abbildung veranschaulicht ein kleines Kraftwerk, welches zwei Diesel'sche Oel-Dampfmaschinen von je 75 PS Leistung enthält. Diese Maschine arbeitet nach der bekannten Otten'schen Periode, und wird das Oel, nachdem der Aufwärtshub des Kolbens die Luft zu einem Drucke von 30 bis 35 Atmosphären hineingepresst hat, mittelst Druckluft in den Cylinder gepresst. Die daraus entstehende hohe Temperatur (ca. 540° C.) entzündet das Oel, worauf die Verbrennungsgase die Maschine in Gang setzen. Es wird behauptet, dass der thermale Nutzeffekt 35 Prozent beträgt. Die Maschine soll garantiegemäss zwischen 0,21 und 0,23 kg Oel pro PS-Stunde verarbeiten.

Bahnwagen für die Eilbahnlinie Detroit-Monroe-Toledo. [Seite 401.]

Diese Bahnwagen sollen den Ueberlandverkehr zwischen Detroit und Toledo vermitteln und werden dabei eine sehr grosse Fahrgeschwindigkeit entwickeln, weshalb man besondere Vorkehrungen getroffen hat, sich in jeder Hinsicht eine grosse Stärke zu sichern.

Moderne Sprengwagen und Fegemaschinen. . [Seite 401.]

In diesem Artikel wird ein kombinierter Wagen zum Besprengen und Fegen beschrieben, der einem Strassenbahnwagen gleicht. Die Vorrichtungen zum Fegen befinden sich an jedem Ende und sind unter dem Ueberhang angebracht. Die Sprengvorrichtungen sind so eingerichtet, dass man die Strasse — je nach Belieben — vor oder nach dem Fegen besprengen kann. Ein anderer Sprengwagen, der in diesem Artikel beschrieben wird, weist eine Einrichtung auf, wobei der letzte Rest des Wassers in dem Behälter mittelst Druckluft ebenso weit, wie wenn der Behälter gefüllt ist, gespritzt werden kann.

Allfree Dampfmaschinen. . . . . . [Seite 401.]

Artikel und Illustrationen beziehen sich auf eine Dampfmaschine mit besonderem Schiebermechanismus, welcher durch ein Getriebe bethätig wird, welches der Erbauer mit Expansionsvorrichtung bezeichnet. Diese Vorrichtung bewirkt eine Dampfverteilung, die der bei Corliss-Maschinen mit doppeltem Exzenter gleicht, ausgenommen dass der Ausströmungsverschluss nicht konstant ist. Indessen reicht die Veränderung bei dem Ausströmungsverschluss gerade zum Ausgleichen des Unterschieds in der mittleren Cylindertemperatur bei schwankenden Belastungen hin, so dass die daraus entstehende Verdichtungsspannung konstant bleibt. Dampfmaschinen dieser Art, wenn mit Wechselstrommaschinen direkt gekuppelt, werden mit einem besonderen Regulator geliefert, der mit einer Vorrichtung ausgerüstet ist, mittelst deren man die normale Geschwindigkeit, während die Maschinen im Gange sind, um fünf bis zehn Prozent erhöhen resp. verringern kann.

RÉSUMÉ DES MATIÈRES.

Numéro du 8 Août.

Articles de fond. . . . . . [Page 191.]

Le premier article déclare qu'il y a toute l'année une certaine demande pour des sièges en plein air ce dont les directeurs de compagnies devraient tenir compte. Les voitures à impériale n'auront jamais la vogue en Amérique et on n'a pas encore trouvé de voiture satisfaisante sous toutes les conditions. L'article suivant discute l'extension projetée du tramway souterrain de New York sous Broadway et l'obstruction possible que cette construction occasionnerait à à la circulation. L'article qui suit traite de l'importance d'enseigner aux mécaniciens l'emploi des divers appareils qui sont sur la voiture. Outre que la compagnie s'en trouve bien, la connaissance approfondie de l'exploitation du tramway stimule l'amour propre des employés. On donne ensuite quelques détails sur l'augmentation dans l'évaluation de la propriété foncière dans l'Indiana que montre le dernier rapport des répartiteurs de l'impôt. Cette augmentation s'est surtout produite dans les districts desservis par les tramways interurbains, ce qui démontre les bénéfices qu'ils rendent aux propriétés. L'article final discute les moyens à employer pour augmenter la circulation sur les lignes interurbaines tels que publication d'horaires, bonnes correspondances entre les trains, matériel roulant comfortable et réclames.

Notes sur le réseau de tramway de Denver. . [Page 194.]

Cet article a pour but de décrire les particularités spéciales de l'administration, de l'exploitation et de l'équipement du réseau des tramways de Denver. L'auteur décrit en détail un fourgon destiné à la pose des fils et aux réparations urgentes le long de la ligne. Il décrit également les magasins de la compagnie et le système qui y est appliqué. La distance de la ville de tout centre d'approvisionnement important, oblige à avoir sous la main une grosse quantité de matériel qui comprend non seulement les parties d'appareils électriques et aériens, mais les traverses, poteaux et matériaux de pavage. Un plan d'organisation accompagne l'article avec de brèves explications.

Emplacement des têtes de lignes pour l'Exposition de St. Louis. [Page 196.]

Le diagramme montre l'arrangement général des têtes de lignes pour chemins de fer et tramways à l'Exposition de 1904.

Développement des tramways interurbains dans la Grande Bretagne. I. Par Robert P. Porter. . . [Page 197.]

L'auteur commence par donner des statistiques des capitaux engagés dans des entreprises de tramways dans le Royaume Uni et montre que depuis 1896 les placements dans la traction électrique ont augmenté de 1.025.000.000 frs. Sur cette somme 260.000.000 frs. représentent les placements en tramways municipaux. La construction des tramways urbains et interurbains a été pendant longtemps arrêtée dans la Grande Bretagne par une loi passée en 1870 qui limitait à 21 ans la durée des concessions de tramways. Comme il n'y avait pas de promesse de renouvellement les concessionnaires

laissaient le service des tramways péricliter pendant les dernières années de la concession. Le mauvais service qui en résultait causait contre les concessionnaires un ressentiment général qui engendrait la possession municipale des tramways. Les lignes interurbaines qui existent, ont cependant été construites par entreprise privée. L'auteur cite deux entreprises de ce genre.

Comparaison des rendements des chemins de fer et des tramways. Par H. D. Emerson. . . . . [Page 201.]

L'auteur compare les revenus totaux de tous les tramways électriques dans les Etats Unis, que donne le dernier recensement, avec ceux de l'un des chemins de fer, le Pennsylvania Railroad, dont les recettes totales et les dépenses d'exploitation ne diffèrent pas beaucoup de celles des lignes électriques totalisées. Le pourcentage entre les dépenses d'exploitation et les recettes brutes est plus favorable aux lignes électriques qu'au Pennsylvania Railroad. L'auteur cependant n'accorde pas trop de valeur aux leçons que donnent les taux d'exploitation, car ils varient suivant l'emplacement, et les conditions géographiques du pays traversé. De plus on sait que le Pennsylvania met beaucoup d'améliorations permanentes sur le compte des dépenses d'exploitation. L'auteur considère ensuite l'article "Autres Revenus" qui est beaucoup plus fort pour le Pennsylvania que pour les tramways, et l'article "Dépenses Fixes" qui est aussi plus fort. Le surplus après le paiement des dépenses est beaucoup plus fort pour le Pennsylvania, bien que la capitalisation soit plus faible. L'auteur se livre à d'autres comparaisons.

Billets et correspondances employés à Denver. . [Page 202.]

Les illustrations de cette page et de la page suivante montren. douze différents types de billets employés à Denver: On décrit l'emploi de chacun.

Classement par fiches dans le service des tramways. [Page 203.]

On décrit quelques économies qui sont possibles par l'emploi du classement par fiches dans le service des tramways et celui des ingénieurs. L'un des emplois de ce classement sert aux articles sur l'art de l'ingénieur et aux coupures de journaux ayant trait au système local de tramways. On place les coupures dans des enveloppes que l'on classe par ordre alphabétique ou décimal et que l'on trouve au moyen des fiches. Un autre emploi est de classer les dossiers des différents employés. Un troisième emploi est de classer les comptes et les achats des dépôts et ateliers de réparation. Le classement par fiches est aussi utile pour les procès en dommages et intérêts. Il sert aussi à retrouver les photographies. En somme les possibilités et la commodité de ce genre de classement semblent illimitées.

Petites réparations aux voitures. . . . . . [Page 205.]

La Fig. 1 montre une méthode de réparer des barrières sur les voitures de tramways au moyen d'une longue épissure. L'auteur attire ensuite l'attention sur l'importance des renforcements diagonaux dans les voitures, surtout les voitures vestibulées. Un coup sur l'extrémité d'une voiture non renforcée ne produira souvent pas de dommage visible mais la mettra hors d'aplomb ce qui rendra difficile l'ouverture ou la fermeture des portes. La Fig. 2 montre un type de plateau de toit employé à Boston. Au lieu d'employer deux ou trois plateaux étroits on se sert d'un très large plateau sur la gallerie et sur le toit. Ceci évite les jointures verticales sur cette partie du toit, empêche l'eau de pénétrer et prévient ainsi la pourriture autour des têtes de poteaux. La Fig. 3 montre une autre forme d'écoulement qui a du bon. Tant que la toile est intacte, l'eau s'écoule, mais, si la toile se crève l'eau se glissera dans les jointures. La Fig. 4 montre le coin supérieur d'une voiture de Boston sans plaque de coin. On commence aussi à Boston à cesser d'employer le cuivre et le bronze pour les garnitures de voitures et à les remplacer par du fer malléable.

Machine pour poser les voies. . . . . . [Page 207.]

Cette machine peut transporter et mettre en place environ 2 km de voie par jour. On l'emploie à Denver.

Coût de l'énergie à Newcastle. . . . . . [Page 207.]

Les chiffres donnent le coût détaillé de l'exploitation de la Centrale de Newcastle en Angleterre.

Système de distribution pour les gares d'aiguillage. [Page 208.]

On a devisé ce plan pour le service des divisions électriques suburbaines des grosses compagnies de chemin de fer qui ont de grandes gares d'aiguillage aux têtes de lignes. Les locomotives pour les gros trains requièrent de 1500 à 2000 ampères à entre 500 et 700 volts et si l'on se servait d'un système aérien il faudrait des collecteurs de courant si gros, de manière à obtenir la surface de contact nécessaire, qu'une telle construction nécessiterait une superstructure très lourde. D'autre part l'emploi du troisième rail dans un tel endroit ferait courir beaucoup de dangers. Le système proposé comporte l'érection de pilliers supportant des poutrelles en I placées horizontalement à travers la voie, comme le montre la Fig. 1, et espacées d'environ 20 m. Un sabot ou patin allongé dont est muni la locomotive (Fig. 2) prend le courant à ces poutrelles pour l'amener à la locomotive. Pour que la locomotive aille d'une poutrelle à l'autre il faut qu'elle soit beaucoup plus longue que la locomotive électrique ordinaire. On pourrait réduire sa longueur en rapprochant les poutrelles, mais l'inventeur croit que son plan tel qu'il est ne nécessiterait pas des locomotives plus longues que le wagon à voyageurs américain ordinaire.

Voitures convertibles pour Cape May. . . . [Page 209.]

Cette ligne opère dans un rendez-vous balnéaire d'hiver et d'été où les voitures convertibles sont particulièrement avantageuses.

Voitures suburbaines pour l'Indiana. . . . [Page 209.]

Cette voiture a 16,1 m de longueur et 2,66 m de largeur. Elle est chauffée à l'air chaud.

Voitures convertibles pour Bay City, Michigan. . [Page 210.]

Cette ville est située dans l'un des Etats les plus septentrionaux où les hivers sont très-froids, mais le fait que ces voitures y sont en service depuis plusieurs hivers montre qu'on peut les tenir chaudes en hiver, bien que convertibles.

Un nouvel enregistreur de places. . . . . . [Page 210.]

Cet appareil enregistre le nombre des places perçues chaque voyage, sur un cylindre placé à l'intérieur et que montre la gravure au dessous de celle de l'enregistreur. Cet enregistrement des places sur le cylindre se fait automatiquement et ne nécessite pas de travail supplémentaire de la part du receveur. A la fin de la journée on envoie au bureau de la compagnie le rouleau sur lequel l'enregistrement a eu lieu.

Matériel aérien à St. Louis. . . . . . [Page 211.]

Les gravures montrent différents types de matériel aérien dans lequel on se sert comme isolant de bois trempé dans de l'huile de lin chaude. Les Figs. 3 et 4 montrent un croisement aérien à approches mobiles de sorte qu'il n'est pas nécessaire de couper le fil pour renouveler le croisement.

Congrès international d'électricité de 1904 à St. Louis. [Page 215.]

On fait des arrangements pour réunir un congrès international d'électricité à l'Exposition de St. Louis du 12 au 17 Septembre 1904. Ce congrès sera divisé en huit sections dont la section F sera dévouée aux transports électriques. On s'efforcera de faire coïncider le congrès des transports avec la convention annuelle de 1904 de l'Association Amérieaine des Tramways et on invitera alors les associations européennes de tramways à se faire représenter au congrès. Le président du congrès sera le Prof. Elihu Thomson et parmi les vice-présidents on comptera un nombre d'ingénieurs électriciens américains de marque.

Numéro du 15 Août.

Articles de fond. . . . . . [Page 219.]

Le récent accident sur le Métropolitain de Paris fait l'objet de remarques et on fait ressortir l'importance de rendre incombustibles les voitures destinées au service de lignes souterraines. On donne quelques détails de la construction employée pour Londres et pour New York. Le seconde article traite de deux grèves qui ont attiré beaucoup d'attention par leur violence et leur longueur. L'article suivant discute la tendance qu'a le public à rendre le mécanicien personnellement responsable en cas d'accidents, surtout si la victime est un enfant, et des menaces qu'on fait souvent de le battre ou de le blesser. On fait remarquer que pour des accidents de ce genre, ce sont les parents qui laissent leurs enfants courir des risques à qui le blâme principal doit être imputé. Les deux derniers articles traitent des sujets de la transmission de l'énergie et de la forme étalon de comptabilité adoptée par les comptables à leur dernière convention. Cette forme a été officialement adoptée sur l'Association Nationale formée des comptables des Etats.

L'usine combinée pour tramways, éclairage et manufacture de glace à Hampton, Virginie. . . . . . [Page 222.]

Cet article donne la description de l'usine de force de la Norfolk, Portsmouth & Newport News Company, à Hampton, Virginie, qui combine une centrale pour tramways, une usine à éclairage et une manufacture de glace. Elle fournit du courant pour opérer les tramways électriques à Newport News et entre cette ville et Hampton, Old Point Comfort et Buck Roe Beach. L'usine est dessinée pour une capacité de machines génératrices

fournissant 2625 kw et pour deux machines frigorifiques de 40 tonnes. On a dans la disposition de cette usine visé à obtenir une manipulation économique du combustible et des cendres ainsi qu'à satisfaire aux nécessités spéciales de ce service combiné. La chambre des chaudières contient deux batteries de deux chaudières d'un côté de la cheminée et une batterie de deux chaudières de l'autre, avec un espace libre pour une quatrième batterie. Chaque chaudière a une capacité de 250 chevaux. Le tuyautage à vapeur est arrangé avec un duplicata de têtes à vapeur supportées en haut et en arrière des chaudières. Un seul tuyau d'alimentation pour chaque machine passe à travers le mur de séparation et communique avec le haut des deux têtes. La condensation des lignes de vapeur à haute pression retourne automatiquement aux chaudières Il y dans la chambre des machines trois machines à courant alternatif produisant ensemble 1300 kw et deux unités pour tramways, avec de la place pour une troisième, qui donnent un total de 1325 kw. L'appareil pour tramways le plus petit comprend une machine tandem compound et un générateurà accouplage direct de 325 kw qui tourne à 100 révolutions par minute. La seconde unité pour tramways a une machine Corliss cross-compound et un générateur de 500 kw actionné à 90 révolutions par minute; tandis que la troisième unité qui reste à installer, sera du type vertical et d'une capacité de 500 kw. Les appareils pour l'éclairage et la force motrice se composent de trois générateurs à courant alternatif fournissant du courant à 3450 volts et d'une capacité totale de 1300 kw. Une machine cross compound opérant à 120 révolutions par minute et deux machines tandem-compound marchant à 150 révolutions par minute sont accouplées directement à ces machines d'éclairage. Le réseau de tramways y compris celui de Newport News est fourni directement par l'usine d'Hampton. Un feeder de coupe transversale 500.000 cir. mils. est placé sur le côté et, à trois points intermédiaires trois feeders 0000 établissent la connexion à la ligne du trolley. Trois feeders 0000 fournissent aussi du courant à la ligne Old Point Comfort et Buck Roe Beach.

Nouveauté en voiture pour trafic de plaisir à St. Louis. [Page 227.]

Cette voiture a des sièges pour 96 personnes et est destinée à faire parcourir la ville aux touristes. La construction revient bon marché. Le baldaquin qui se voit sert pendant le jour et on l'enlève le soir.

Développements des tramways interurbains dans la Grande Bretagne. II. Par l'Hon. Robt. P. Porter. . [Page 228.]

L'auteur considère le sujet général de la construction des tramways électriques commencé dans le numéro du 8 Août et commence par donner quelques détails sur quelques uns des tramways de Londre au Nord de la Tamise. Ces tramways sont des propriétés privées. Après une discussion d'autres réseaux il aborde les difficultés que l'on rencontre en construisant des réseaux directs à travers des villages par suite du défaut d'harmonie qui existe entre les différentes municipalités. C'est ainsi qu'une ville adoptera une certaine largeur de voie, et une autre un écartement différent, ou bien il surgira des disputes à propos de la surveillance, du partage des recettes, etc. Un Act appelé "l'Act des Tramways Légers" a été récemment adopté et il est à plusieurs égards, plus favorable, à la liberté des entreprises que l'Act des Tramways de 1870. Il y a cependant dans ce nouvel act certaines clauses qui permettent aux compagnies de chemin de fer d'offrir une oposition formidable à la construction d'un tramway interurbain. L'auteur en donne des exemples.

Enregistrement pour une centrale à Anderson. . [Page 232.]

Les quatre gravures montrent une nouvelle carte pour tracer la production d'une centrale comme le fait l'Union Traction Company de l'Indiana. L'enregistrement se fait automatiquement par un instrument enregistreur de nouvelle forme qui trace sur la carte toutes les minutes un point montrant la charge en kilowatts. On fait avec cette carte des tracés qui sont envoyés aux bureaux de la compagnie. Le nombre des générateurs en service est indiqué graphiquement à la partie supérieure de la carte. La température est enregistrée ainsi que d'autres statistiques. Les diagrammes publiés sont des reproductions de tracés effectifs et représentent trois jours ordinaires et un jour de fête.

Vitesse critique des turbines. Par F. Zurnedden. . [Page 235.]

L'auteur attire l'attention sur la nécessité des grandes vitesses pour que les turbines soient économiques, et fait remarquer qu'à ces hautes vitesses les forces centrifuges qui entrent en jeu sont d'une magnitude inconnue jusqu'ici. Il est rarement, pour ne pas dire jamais, possible de placer le centre de gravité de la partie tournante au centre de l'arbre avec une exactitude mathématique, même après les tâtonnements les plus minutieux. La force centrifugue résultante tend à tordre l'arbre et cette torsion augmente avec la vitesse de rotation et l'excentricité du centre de gravité. Cet effet de torsion ne devient dangereux, cependant que lorsque une vitesse dénommée critique est atteinte. L'auteur déduit alors ce que sera cette vitesse critique en termes de torsion de l'arbre, exprimés en centimètres, occasionnée par le poids de la partie tournante. Il donne ensuite des méthodes de centrer la partie rotative par tâtonnements,

Fenders à Liverpool et à Berlin. Par John P. Fox. [Page 236.]

L'auteur décrit le fender de Liverpool qu'il considère très efficace. Il est fixé au truck et depuis qu'on l'utilise vingt et une personnes sont tombées sous des voitures et ont été rejetées hors de danger sans blessures graves. On a placé à Berlin des tiges autour du tablier d'avant pour que les personnes heurtées par la voiture puissent s'y cramponner. Ces tiges ne sont pas en vogue maintenant et le dernier type de fender employé à Berlin se voit dans une gravure. On se sert de plus d'une planche-pilote droite en avant des roues.

Trucks auto-moteurs pour le Souterrain de New York. [Page 237.]

Le dessin des trucks auto-moteurs pour l'équipement du Souterrain de l'Interborough Rapid Transit Company de New York est décrit avec illustrations d'après les plans de l'ingénieur. On construira pour l'installation initiale trois cent cinquante de ces trucks auto-moteurs; la moitié d'entre eux auront des moteurs de tramways Westinghouse No. 86 et l'autre moitié des moteurs de tramways General Electric No. 69, avec une capacité nominale de 200 chevaux. On se servira dans tous les cas de la suspension "par le nez", et comme la construction des moteurs employés requièrera une disposition différente pour la suspension, on a préparé des plans séparés dans chaque cas pour se prêter à ces exigences. Cette particularité est l'objet d'illustrations complètes. Les trucks seront beaucoup plus lourds que d'habitude et ont été spécialement dessinés pour le service très dur qu'on prévoie dans le Souterrain.

Plans pour voitures-lit. . . . . . [Page 240.]

Cette voiture-lit est en construction pour l'une des lignes interurbaines de l'Ohio et a été décrite dans un numéro récent. Les Figs. de 1 à 4 montrent la méthode de changer la voiture de jour en voiture de nuit. Ces gravures ont été faites d'après des modèles et sont un peu grossières mais on se propose d'avoir une voiture très élégamment construite. Dans la Fig. 1 la couchette supérieure est relevée comme dans un wagon-lit ordinaire et la voiture parait pour l'usage de jour avec des chaises tournantes; les Figs. 2 et 3 montrent la section pour l'usage de nuit et la Fig. 4 montre l'espace libre entre la couchette et la partition pour s'habiller. La Fig. 5 donne le plan de la voiture en construction et la Fig. 6 celui d'une voiture plus longue déjà construite. Les couchettes ont 686 mm. de largeur et il existe un espace de 381 mm. entre la couchette et la partition mobile. Les voitures sont équipées avec quatre moteurs de 150 chevaux. Elles seront opérées entre Columbus et Indianapolis et on prendra 10 frs. pour une couchette et 15 frs. pour un compartiment. Ces voitures appartiennent à une compagnie spéciale de wagons-lit qui a un agrément d'exploitation avec la compagnie de tramways pour faire circuler ses voitures sur les lignes de tramways.

Accord auquel on est arrivé à Toronto pour l'opération de voitures de marchandises dans la ville. . . [Page 241.]

La compagnie de tramways de Toronto a passé un contrat avec différentes lignes interurbaines pour permettre à leurs voitures de pénétrer dans la ville sur ses voies. On paie à la ville le même pourcentage des recettes venant de cette source que dans le cas des lignes urbaines elles-mêmes.

Machine à forer les voies. . . . . . [Page 242.]

Elle est opérée à la main et peut être placée contre la voie on en être enlevée.

Convention de l'Association Municipale Incorporée de la Grande Bretagne. . . . . . [Page 245.]

On donne une liste des rapports présentés et une courte description de la réunion de cette Association qui a eu lieu les 16 et 17 Juillet.

Numéro du 22 Août.

Articles de fond. . . . . . [Page 247.]

Le premier article traite de l'achèvement de la ligne dont il est question à la page 267 et qui fait communiquer deux capitales d'Etats situées à 300 km l'une de l'autre. Cette ligne et ses embranchements forment le réseau continu le plus long qui existe à présent aux Etats Unis. Il est possible de voyager pendant 410 km dans la même direction générale et c'est le réseau sur lequel les voitures-lits vont être introduites. Le second article discute les possibilités d'éprouver des chocs produits par des locomotives à voltage élevé lorsque celles-ci parcourent des rails recouverts de sable ou des rails que d'autres causes rendent isolés. Dans des cas semblables il se produit un voltage dangereux entre le châssis de la locomotive et le sol et les personnes qui montent sur la locomotive peuvent recevoir des chocs: il s'est

déjà produit un accident de ce genre. L'article suivant discute l'inspection de l'équipement et les rédacteurs recommandent l'adoption de l'un des deux plans suivants: soit de surveiller les supports d'armature et d'inspecter l'équipement lorsque l'usure de ces supports le rend nécessaire, ou bien de faire une inspection après un nombre donné de miles parcourus. En règle générale l'usure des supports d'armature est une indication que tout l'équipement a besoin d'une inspection. L'article suivant réfère au service à grande vitesse que donne l'une des lignes de l'Indiana. L'article qui suit a trait à la disparition des chevaux du service des tramways excepté dans quelques villes. La ville de New York possède actuellement environ la moitié de la longueur totale des lignes à chevaux dans tout le pays et le fait qu'une si grande ville est si en retard sous ce rapport sur d'autres villes, fait tourner en rédicule les autorités municipales qui sont responsables pour cet état de choses. L'article final traite de l'opportunité de forcer tous les propriétaires d'automobiles à faire enregistrer le numéro de leurs machines de manière à ce qu'on puisse arrêter le coupable en cas d'accident.

Le système de New York & Queens County Railway. [Page 250.]

Cette ligne est opérée dans une section de la ville de New York dont l'étendue est de 41,6 pour cent de l'étendue de la ville, mais dont la population n'est que de 4,7 pour cent. La population y est si clairsemée parceque cette section était difficile à atteindre, mais on pense que le nouveau pont et le Souterrain qu'on est en train de construire auront pour effet d'augmenter la population. La compagnie possède 122 km de voies et 203 voitures. L'équipement de l'atelier de réparation est l'objet d'une description détaillée. On nettoie et on inspecte les voitures tous les soirs; on les lave une fois par semaine; lorsqu'une voiture a parcouru 7.200 km on regraisse les journaux, lorsqu'elle a parcouru 14.400 km on l'examine à fond. Lorsqu'un mécanicien et un receveur quittent une voiture, ils ont à remplir un imprimé qui se voit à la page 258 et qui indique si la voiture est en bonne condition. Si elle ne l'est pas ils ont à spécifier quelles parties de l'équipement sont défectives. On conserve ces imprimés qui ont l'avantage d'empêcher les mécaniciens, après un accident, de prétendre qu'il était connu parmi eux que la voiture était en mauvaise condition depuis quelque temps. On donne des détails sur la méthode de tenir les registres de l'atelier de réparation, ceux du magasin et de la division de la main d'oeuvre dans le dépôt. On a adopté l'écriteau de tablier qui se voit à la page 252 de manière à pouvoir facilement changer la voiture d'une route à une autre. Cet écriteau consiste en plusieurs plaques de tôle fixées par des charnières à une tige. Comme il y a quatre ou cinq routes que peuvent suivre les voitures il faut ce nombre de plaques à chaque écriteau. Les feuilles sont maintenues en position par deux pinces et la route de la voiture peut être rapidement changée n'importe quand.

Voitures pour transporter les cendres à St. Louis. [Page 258.]

La St. Louis Transit Company vend maintenant toutes ses cendres pour faire des remblais ou manufacturer du béton. La voiture que montre l'illustration sert à transporter ces cendres de l'usine de force au point de livraison.

Nouvelles locomotives électriques pour le Baltimore & Ohio Railroad. . . . . . [Page 262.]

Ces locomotives sont destinées à trainer les trains à vapeur à travers un tunnel à Baltimore. Chaque locomotive se compose de deux unités pesant chacune 75 tonnes. Chaque unité est montée sur deux doubles trucks transportant chacun deux moteurs de 225 chevaux ce qui fait un total de 900 chevaux pour chaque unité ou de 1800 chevaux pour la locomotive. Cette locomotive tirera un train pesant 1500 tonnes, sans la compter, sur une pente de 1 pour cent à une vitesse de 16 km à l'heure ou sur une pente de 1½ pour cent à une vitesse de 14 km à l'heure à 625 volts. Les moteurs sont contrôlés par le système de l'unité multiple et sont engrenés aux essieux au lieu d'être montés directement sur les essieux, comme dans les vieilles locomotives.

Voitures pour le Souterrain de New York . . [Page 264.]

Cet article décrit les particularités de construction des voitures destinées à l'Interborough Rapid Transit Company, de New York, pour le service du Souterrain. Les points les plus remarquables de cette construction sont les précautions prises pour rendre les voitures incombustibles et se garer contre leur destruction en cas de rencontres ou de déraillements. Les voitures sont très solidement construites et le plancher ainsi que toutes les parties exposées aux appareils électriques sont recouverts d'un matériel incombustible. On s'est aussi prémuni contre les incendies qui pourraient être occasionnés par les fils électriques. On se sert, pour les circuits d'éclairage et de chauffage de conduits flexibles en acier pour lesquels on a devisé des boites spéciales de jonction. Les fils qui amènent le courant aux moteurs sont placés dans des conduits d'électro-abeste moulé en formes convenables.

Achèvement d'un tramway électrique entre Columbus, Ohio et Indiana. . . . . . [Page 267,]

C'est la description de l'inauguration d'une ligne qui fait communiquer les capitales des deux Etats dans lesquels on a construit le plus de tramways interurbains.

Une analyse financière de l'Interurban Traction Company. Par H. D. Emerson. . . . . [Page 268.]

L'auteur analyse les rapports d'exploitation de cette compagnie qu'il trouve bien administrée.

Voitures convertibles pour Anniston, Alabama. . [Page 269.]

Cette voiture a environ 9,4 m de longueur totale et est du type convertible absolu.

Numéro du 29 Août.

Articles de fond. . . . . . [Page 279.]

On discute les rapports et les programmes des trois associations qui doivent se réunir à Saratoga en Septembre, ainsi que les avantages de Saratoga comme point de réunion. La ville outre qu'elle est pittoresque est le centre d'un grand développement électrique, comme le fait ressortir l'article de tête de ce numéro. Les rédacteurs expliquent ensuite que les articles qui traitent des étalons en pratique urbaine de tramways et qui suivent l'article de tête sur les tramways électriques autour de Saratoga, n'ont pas la prétention de décrire toutes les méthodes recommandables suivies aux Etats Unis. Il n'a été possible d'aborder que les douze ou quinze villes principales en dehors de New York et même ont-elles été passées en revue brièvement. Les conclusions générales qui suivent chaque article indiquent, cependant, la tendance de la pratique suivie par cette classe de lignes. Les rédacteurs discutent alors l'article de M. Dawson et déclarent que la nécessité de l'économie dans le combustible devient une question d'importance toujours croissante. Cette raison fait considérer comme probable une augmentation de l'emploi de vapeur surchauffée et de machines à triple expansion; elle amène a recommander des améliorations dans les fournaises et les chaudières. Le dessin des centrales pour service urbain est ensuite discuté. C'est une question très sérieuse dans une grande ville où le nombre des emplacements favorables est limité par le coût des terrains, la proximité de l'eau et autres facteurs nécessaires. Les données disponibles concernant le coût d'exploitation, y compris la dépréciation pour les grandes usines, ne sont pas encore assez complètes pour permettre de déterminer exactement ce point. Il est certain cependant, que les grandes usines devraient être subdivisées et opérés en sections pratiquement indépendantes pour se garder contre un arrêt général, et toute économie matérielle résultant d'une grande usine au lieu de petites doit, pour cette raison, provenir d'une diminution de coût des terrains, de l'eau et du transport du combustible plutôt que d'une opération sur une grande échelle. L'emploi des turbines changera probablement beaucoup le dessin des centrales. Les rédacteurs critiquent enfin l'article de M. McCulloch sur les ateliers de réparation. Ils font remarquer que pour obtenir une économie d'opération dans des ateliers de ce genre on doit pouvoir y faire les travaux aussi bon marché ou presque aussi bon marché que dans une grande manufacture, et aussi que les travaux de réparation sur un réseau font une grosse somme si les appareils sont bien entretenus. Les chiffres que donne M. McCulloch sur les coûts de réparation d'articles ont beaucoup de valeur et son article est recommandé aux lecteurs comme digne d'une étude approfondie.

Attraits des tramways électriques à Saratoga et dans le voisinage. [Page 288.]

Cet article passe en revue le développement de la traction électrique à Saratoga et dans le voisinage, faisant remarquer qu'il n'y a pas moins de sept réseaux, facilement accessibles de Saratoga, qui offrent chacun plusieurs particularités intéressantes de construction et d'opération. Un facteur important de cette situation est l'utilisation générale de la force hydraulique pour développer du courant. Le nombre des usines hydrauliques et la grande demande pour du courant à des points très éloignés les uns des autres a fourni aux ingénieurs une expérience exceptionnelle pour la génération, la transmission, la distribution du courant et la construction d'un système très flexible. Ces conditions ont aussi amené plusieurs amélioration et rafinements dans la pratique des sous-stations. L'auteur mentionne le fait que beaucoup de ces sous-stations fournissent du courant pour les manufactures, pour l'éclairage par lampes à arc et lampes incandescentes aussi bien que pour l'opération des tramways, et, dans plusieurs cas, les équipements pour ces services distincts sont installés sous le même toit. On a introduit dans ces systèmes beaucoup de particularités spéciales de construction. Pris dans son ensemble, le service des tramways électriques du district accessible de Saratoga est d'un ordre très élevé, et l'auteur croit, qu'un examen des méthodes employées non seulement dans la construction de l'équipement des lignes mais aussi dans leur exploitation et leur administration, serait très instructif pour les administrateurs de semblables propriétés dans d'autres parties du pays.

Le tramway de la vallée de l'Hudson. . . . [Page 290.]

C'est la seule ligne électrique qui entre à présent dans Saratoga. L'Hudson Valley Railway Company, fondée en 1901, a absorbé six plus petites compagnies d'exploitation dans le voisinage immédiat et les a groupées en un réseau bien compris qui s'étend maintenant de Waterford à Warrensburg avec un embranchement de Mechanicsville à Ballston et à Saratoga. Il y a le long de la route plusieurs points historiques et le paysage égale celui de n'importe quelle partie du pays. La compagnie dérive la plus grosse partie de son trafic des touristes et des visiteurs aux nombreux rendez-vous le long de la route. Le district autour de Saratoga est renommé pour ses sources minérales qui attirent beaucoup de personnes chaque été ainsi que le faste de la vie estivale de cette ville d'eau renommée. La compagnie a développé son trafic spécial pour touristes au moyen de voitures-salon pourvues de glacières et de tables pour servir des repas; elle a aussi des voitures ouvertes spéciales que l'on peut louer pour des excursions sur le réseau entier. La compagnie faisait aussi un gros service de messageries, mais ce service a été temporairement abandonné depuis une année à cause des troubles ouvriers, elle va le reprendre probablement, maintenant que les grèves sont finies. On remorque les wagons de marchandises des chemins de fer sur une partie du réseau entre Mechanicsville et Gleen Falls, pour accommoder les usines le long de la ligne. Le service régulier interurbain qui est en somme l'affaire principale de la compagnie requiert un équipement de 16 voitures fermées, 32 voitures ouvertes à 15 bancs et 5 voitures ouvertes à 13 bancs. ainsi que 50 voitures à truck unique qui sont aussi employées sur les lignes urbaines. Huit voitures de messageries et deux locomotives électriques comprennent l'équipement réservé aux marchandises et aux messageries. L'équipement actuel fournissant la force motrice se compose de 5 usines génératrices combinant un emploi de vapeur et de force hydraulique, et 6 sous-stations. Ces usines étaient destinées aux petites lignes qui ont été consolidées dans le réseau actuel. On est en train de construire d'autres sous-stations et on les équipe en vue d'une prise ultérieure de force à l'usine hydraulique de Mechanicsville appartenant à l'Hudson River Power Company, et à la nouvelle usine hydraulique qu'on est en train de construire 3 miles au delà de Warrensburg. La nouvelle compagnie reconstruit peu à peu le réseau entier, car les constructions de la partie aérienne et de la voie des lignes qui ont été consolidées n'étaient pas au niveau de l'étalon moderne du service interurbain. La compagnie a aussi le contrôle de plusieurs parcs et lacs avec des rendez-vous très agréables, et ceci a, naturellement, beaucoup aidé à augmenter matériellement le trafic d'été.

Système de traction unifié à Albany. . . . [Page 296]

L'United Traction Company, d'Albany, contrôle les systèmes d'Albany, Troy et du groupe de villes qui les entoure. Bien qu'elle ne possède pas les lignes interurbaines, elle a avec chacune d'elles un arrangement de trafic qui permet à leurs voitures d'entrer dans les villes qu'elle contrôle sur ses voies. Par cet arrangement l'United Traction Company reçoit la moitié du prix des places perçu dans les villes par les lignes interurbaines et 1,25 frs. par voiture mile pour les voitures de messageries opérées sur ses lignes. On ne donne pas de correspondance mais le parcours des voitures est arrangé de manière à ce que les voyageurs trouvent, en deça de 15 minutes dans n'importe qu'elle partie de la ville une voiture qui les conduira à toute autre partie de la ville. La compagnie maintient un système d'inspection très sévère et la discipline sur ses lignes est excellente. Cette compagnie à été l'une des premières dans ce pays-ci à développer le transport des marchandises et des messageries, et cette branche d'affaires qui est conduite séparément est devenue l'une des principales du réseau. Cinq voyages aller et retour sont fait journellement par les voitures de messageries entre Albany et Troy, trois entre Albany, Cohoes et Waterford et trois entre Albany et Watervliet. Des gares des messageries ont été établies dans tous les villages avec des fourgons de livraison aux points principaux, cinq à Albany, quatre à Troy, trois à Cohoes et un à Watervliet. On fait beaucoup d'affaires avec les lignes de bateaux de l'Hudson et le Boston & Maine Railway qui n'entre pas à Albany. La compagnie adhère aux voitures à truck unique, prétendant que de petites voitures se suivant de près donnent un meilleur service que de plus longues voitures passant moins fréquemment. Elle prétend de plus qu'aux heures d'encombrement on peut disposer des foules plus rapidement, car les voyageurs peuvent entrer et sortir plus vite. Une autre prétention en faveur des petites voitures est, qu'avec elles, les chances d'accident diminuent considérablement. Sur les voitures ouvertes, il y a sur toute la longueur du côté un filet de corde boutonné à chaque extrémité et aux poteaux de centre, pour empêcher les voyageurs de descendre du mauvais côté, là où il y a une double voie. Ce filet peut être changé de côté à l'extrémité de la ligne sans beaucoup de délai. On emploie six dépôts de voitures, à North Albany, Albany, Albia, Troy et Lansingburg, qui peuvent contenir 550 voitures. Tous ces dépôts sont pourvus de tranchées et on y trouve des crics hydrauliques de deux tonnes. Il y a dans chaque dépôt un atelier de réparation: celui de North Albany est le plus grand et le mieux équipé. La compagnie a un très bon système de rapports et de classement: on reproduit quelques imprimés employés. Une partie de l'énergie pour opérer le système est prise à trois usines à vapeur, à Albany, Troy et Lansingburg, et le reste à l'usine hydraulique de l'Hudson River Power Company à Mechanicsville. On entend prendre d'avantage d'énergie à cette dernière compagnie ausitôt que l'usine de Speir Falls sera complétée. Il y a actuellement deux sous-stations en opération, l'une à Watervliet, qui contient cinq convertisseurs rotatifs de 375 kw et l'autre à North Albany, où il y a quatre équipements similaires. Pendant la saison où le trafic est le plus fort la consommation de courant se monte à environ 8000 ampères, mais la charge moyenne n'est que d'environ 5600 ampères. Sur cette quantité la compagnie reçoit 4000 cheveaux de l'Hudson River Power Company, de sorte que pendant la saison où le trafic est le plus faible il n'est pas nécessaire d'opérer les usines à vapeur.

Ligne d'été pour Troy. . . . . . [Page 303.]

La ligne que le Troy & New England Railway opère d'Albia, un faubourg de Troy, à Averill Park, est construite sur un chemin privé qui traverse la campagne et a été spécialement choisi pour le trafic d'été. Averill Park, le terminus de la ligne est un rendez-vous d'été en vogue et le paysage le long de la ligne rend le parcours un voyage d'été idéal. La compagnie transporte beaucoup de messageries pour les hôtels d'été et les fermes qui sont le long de la route.

Réseau Fonda, Johnstown & Gloversville. . . [Page 304.]

Ce chemin de fer combine l'opération par la vapeur et par l'électricité, mais chaque département est entièrement distinct et sur une portion du réseau le tramway à l'électricité est en concurrence directe avec le chemin de fer à vapeur. Comme la plupart des propriétés de cette région, le réseau se compose de plusieurs lignes qui ont été combinées et que l'on a fait communiquer entre elles lorsqu'on a introduit l'électricité. Une très grosse proportion du trafic des voyageurs se compose du transport des touristes, l'été. La compagnie entretient un joli parc près du terminus du Nord Est et communique par un service de diligences avec le lac Pleasant et des points dans les Adirondacks auxquels les voies ferrées ne peuvent atteindre à cause des lois de New York qui réservent ce district comme forestier. Le service interurbain entre les différentes villes desservies par le réseau se développe dans des proportions considérables. La construction des voies et des lignes des portions nouvelles du système est du meilleur étalon et la compagnie reconstruit ou améliore graduellement les anciennes portions de manière à les amener au même étalon. On a construit un nombre de jolis pontsr de viaducts d'acier et de croisements en béton de manière à évite, les passages à niveau et à réduire la distance entre des points importants, ce qui rend les grandes vitesses possibles. Le matériel roulant du réseau comprend plusieurs types et manufactures, ce qui est habituel dans les réseaux formés d'une consolidation, mais les dernières voitures sont d'un dessin moderne et l'une d'elles, qui a été adoptée comme type pour le service direct à grande vitesse, est l'objet d'une description détaillée. Sa particularité consiste en ce que le châssis du plancher est tout entier en acier et que tous les accouplements d'acier sont faits en acier, ce qui assure un châssis très fort. L'une des particularités les plus importante de l'équipement est la nouvelle usine de force à Tribes Hill sur la rivière Mohawk, à quelques miles d'Amsterdam. Comme cette usine est considérée l'une des plus grandes et des plus modernes des usines interurbaines dans cette partie du pays elle est décrite très en détail. L'équipement des chaudières consiste de dix chaudières genre Marine-Ecossais de 500 chevaux. Les machines, au nombre de trois, sont du type vertical cross-compound à condenseur et développent 1700 chevaux sous des conditions nominales à 94 révolutions par minute. L'équipement électrique de l'usine primaire et des sous-staitons est très complet. La station génératrice contient trois unités principales, dont l'une est destinée aux faibles charges et deux au service ordinaire avec une unité en réserve. Ces unités sont cotés à 1000 kw chacune. On a considéré trois sous-stations nécessaires pour fournir du courant continu à la ligne entre Schenectady et Gloversville et on les a espacées d'environ dix miles. Le voltage choisi pour la ligne à haute tension, 13.220 volts est le plus haut pour lequel la compagnie soumissionnaire construise des générateurs et des transformateurs d'augmentation. L'une des particularités du système de transmission est la ligne entre l'usine primaire et la sous-station d'Amsterdam, qui est en opération vingt-quatre heures par jour, c'est-à-dire tout le jour pour le service des tramways et toute la nuit pour le service d'éclairage. Celà a été cause de l'adoption de quatre fils de transmission pour un circuit trois-phasé; l'un des fils est de rechange et mis en connexion avec des commutateurs à rouleau à chaque extrémité, de manière à ce que n'importe lequel des trois autre fils puisse être enlevé du circuit aux deux extrémités et remplacé par le fil de rechange. Cet arrangement assure un service continu même si l'un des fils est mis hors de service par un mauvais isolateur, un croisement ou une rupture. Cette partie de la ligne suit la voie et est accessible à la tour d'un fourgon de réparation de manière à pouvoir facilement faire les réparation nécessaires. On a adjoint à l'usine centrale un atelier mécanique très complet. La compagnie à ses bureaux principaux très commodément installés à Gloversville, et s'en sert comme d'une station pour les deux divisions électrique et à vapeur. Le réseau est couvert entièrement par une ligne de téléphone privé avec un bureau de connexions dans le bâtiment de la compagnie à Gloversville. On peut obtenir une connexion directe avec le réseau téléphonique commercial de cette section.

Le réseau à troisième rail Albany & Hudson. . [Page 316.]

C'est la seule ligne électrique à troisième rail dans l'Est de New York. Comme la propriété a été très complètement décrite dans le Street Railway Journal du 2 Février 1901, cet article-ci ne fait que passer brièvement en revue les particularités générales. Durant

l'année dernière la compagnie s'est attachée particulièrement à développer les rendez-vous de fêtes et s'en est bien trouvée au point de vue du trafic. Il y a eu en un seul jour 12.000 voyageurs de cette classe transportés sans le moindre accident et avec les seuls délais occasionnés par le pont tournant d'Albany.

Le réseau de tramways de Schenectady. . . [Page 317.]

La Schenectady Railway Company opère les lignes électriques dans la ville de Schenectady et les lignes interurbaines qui s'étendent jusqu'à Albany et Troy, ainsi qu'une autre ligne qui est en construction jusqu'à Ballston et dont les voitures seront opérées jusqu'à Saratoga d'après un arrangement de trafic avec l'Hudson Valley Railway. Le réseau est surtout patronisé par les employés de la General Electric Company et des American Locomotive Works dont le nombre total s'élève à 17.000. Beaucoup d'entre eux habitent Albany et d'autres points le long de la ligne. Le trafic de plaisir est aussi considérable et M. Frederick Smith, l'administrateur de la compagnie, a inauguré des "Tournées en Trolley au Crépuscule" qui ont beaucoup de succès. Des voitures spéciales quittent Schenectady tous les soirs pour Troy en passant par la ligne de l'aqueduct et retournant par la ligne du boulevard. Ceci donne une vue magnifique de la vallée de l'Hudson. La compagnie se montre très libérale envers ses employés et, bien que les syndicats ouvriers soient particulièrement forts dans cette région, tous les essais de syndiquer les receveurs et les mécaniciens ont échoué, ainsi qu'un effort pour mettre le réseau en quarantaine à cause du refus de la compagnie d'aider le syndicat dans cette entreprise. Une branche importante des affaires de la compagnie est le service des marchandises, des messageries et des bagages. Ce département est très bien organisé et travaille de concert avec les lignes de bateaux à vapeur et les autres lignes à trolley avec lesquelles elles ont des connexions de lignes. Il y avait autrefois beaucoup de roulage entre Albany, Troy et Schenectady, mais toutes les affaires ont été absorbées par la compagnie interurbaine de tramways. On a maintenu sur tout le réseau un étalon très élevé dans la construction de la voie et de la ligne dont un nombre de particularités sont décrites en détail. Le matériel roulant de la compagnie est assez varié ce qui est dû en partie aux nécessités d'un service qui comprend des lignes urbaines, des lignes interurbaines, et un transport de marchandises et de mesageries. Les dépôts de voitures et ateliers de réparation sont bien tenus et contiennent les appareils usuels. Un étage du dépôt de Fuller Street a été réservé à l'usage des hommes qui ont formé une Association Mutuelle de tramways. Les salles de club comprennent une salle de billard, des placards pour les membres, un cabinet de toilette, deux allées-jeux de quille, une salle de lecture et une salle d'assemblée avec une plate-forme et une scène. Ces salles ont été installées par la compagnie, mais les hommes les entretiennent. Le système de force motrice comprend une usine génératrice à vapeur avec des machines fournissant au total 1100 chevaux, des générateurs d'une capacité de 1200 kw et des chaudières d'une capacité de 100 chevaux. La compagnie prend cependant du courant à la General Electric Company depuis que l'usine de Mechanicsville a été terminée. Des sous-stations ont été établies à Albany et à Troy, et on en construit deux autres à Ballston et à Schenectady.

Développement indépendant de la force hydraulique. [Page 326.]

Beaucoup des entreprises électriques de la vallée de l'Hudson sont dues au développement présent des facilités hydrauliques de cette section, et la plus grosse part de ce développement est due à l'Hudson River Water Power Company, ses compagnies subsidiaires, l'Hudson River Electric Company et l'Hudson River Power Transmission Company. Cette article passe brièvement en revue le travail fait dans cette direetion y compris l'usine de Mechanicsville, qui fournit le courant à plusieurs des compagnies décrites dans ce numéro, et l'usine qui est en construction à Spier Falls près du pied du Mont McGregor, au Nord d'Albany. Cette usine sera plus considérable que toute autre usine similaire de l'Est et ne le cédera qu'aux usines de Niagara Falls et du Sault Ste. Marie. La ligne de transmission sera la plus longue de toutes celles à l'Est des Montagnes Rocheuses. On fournira du courant pour la lumière électrique, la force motrice commerciale et l'opération des tramways à Troy, Albany et autres plus petites villes. La seconde usine sera mise en connexion avec celle de Mechanicsville ce qui assurera une plus grande certitude de fonctionnement et une plus grande flexibilité du système. L'article est accompagné des plans de ces développements et d'une carte des lignes de transmission.

Le tramway d'Utica et de Mohawk Valley. . . [Page 327.]

Ce réseau, sans faire connexion avec les lignes qui aboutissent à Saratoga, peut être proprement classé comme appartenant à cette région, car il embrasse les lignes urbaines de tramways d'Utica, Rome, Little Falls, Herkimer, Mohawk, Ilion, Frankfort, Clinton, New Hartford, Deerfield, Oriskany et Whitestown. La particularité la plus importante de cette propriété est le système de distribution de l'énergie. Le courant est fourni par l'usine de l'Utica Gas & Electric Company sur la ligne de transmission à 20.000 volts de cette compagnie à Utica. Une partie de l'énergie est utilisée dans la sous-station d'Utica et le reste est transmis aux sous-stations de Frankfort et Little Falls à l'Est d'Utica puis à la sous-station d'Oriskany. La sous station d'Utica a été dessinée pour trois convertisseurs rotatifs de 500 kw, et les autres sous-stations pour trois équipements de 300 kw. Pour le, présent la station d'Utica n'a qu'un convertisseur de 500 kw et deux convertisseurs de 300 kw, mais ces derniers seront bientôt remplacés par de plus fortes machines. Les rotatifs dans cette station opèrent sur un assortiment commun de barres polaires et n'ont pas de bobines d'étranglement ou d'inductance dans les conduites de courant alternatif. Il y a trois transformateurs à auto-refroidissement, isolés à l'huile, de 550 kw accouplés en delta, qui reçoivent le courant alternatif à 20.000 volts et le réduisent à 360 volts, pression à laquelle il est envoyé aux convertisseurs rotatifs qui le transforment à leur tour en courant continu à 600 volts pour distribution au fil de trolley. En cas d'accident n'importe quel transformateur peut être désaccouplé et les rotatifs opérés sur les deux transformateurs restants accouplés en V. L'arrangement des appareils dans les sous-stations de Frankfort, Little Falls et Oriskany est semblable à celui des appareils de la sous-station d'Utica.

Pratique étalon pour la construction des voies urbaines. [Page 329.]

On donne la pratique pour la construction des voies de quatorze des villes principales des Etats Unis, en dehors de Brooklyn et de New York où la pratique a été décrite dans le numéro d'Octobre 1901. Les coupes à la seconde page de l'article montrent les différents rails américains et rails à rainures employés. Buffalo est la seule des villes mentionnées où l'on emploie des joints faits à l'électricité et il y a 162 km de voies avec des joints de ce genre. La pratique des autres compagnies en ce qui concerne les joints est à peu près également divisée entre les joints boulonnés et les joints à la fonte. A Denver et à Milwaukee on se sert entièrement de rails en T. A Milwaukee ce rail est joint à la fonte mais avec un joint spécial à pans verticaux de manière à ce qu'on puisse facilement paver tout contre lui. La compagnie de cette ville emploie aussi un rail avec une surface de 77 mm de largeur. Sous le titre "Conclusions Générales" l'auteur dit que la différence la plus notable entre la construction actuelle des voies et celle d'il y a quelques années consiste dans l'augmentation de l'emploi de contre-forts en béton sous les rails. Un nombre de compagnies emploient aussi des traverses avec cette construction. Ces traverses sont tantôt en métal, tantôt en bois. L'expérience a démontré que lorsque le pavé de la rue est fait sur béton il est désirable que le béton qui supporte les rails et celui qui supporte le pavé forment une masse continue. La tendance à employer des rails à rainure augmente aussi, mais ces rails sont construits de telle sorte que la rainure est automatiquement nettoyée par l'action des roues de la voiture et la surface se tient propre parcequ'elle projette suffisament au dessus du pavé pour être lavée par les pluies et les arrosages des rues. Les rails à rainure étroite ont un insuccès complet. Il y a quelques années le rail américain était l'étalon sur beaucoup de lignes. Les municipalités cependant objectaient à son usage parceque, disait-on, il présentait une obstruction au trafic de roulage qui traversait les voies. Les compagnies de leur côté ont éprouvé des difficultés avec ce rail parcequ'il presentait une si bonne surface de roulage pour les charettes qu'elles suivaient la voie et retardaient les voitures de tramways.

Construction aérienne étalon dans les rues. . . [Page 340.]

On commence par donner d'abord la pratique de 14 compagnies urbaines importantes dans leur construction aérienne et il ressort de cet exposé qu'il y a de nombreux points de différence. Les conclusions générales déclarent que la construction à poteaux de centre est devenue surannée, c'est-à-dire, que le nombre des villes où on emploie cette construction diminue au lieu d'augmenter. Bien que ces poteaux aient meilleure apparence que les poteaux latéraux et les fils de traverse, ils ont l'inconvénient d'occasionner des accidents aux voyageurs et aux employés sur les voitures. Lorsqu'on s'en sert, on protège quelquefois les fenêtres de la voiture et autres ouvertures par un grillage, mais ce grillage est lui-même désagréable et il n'est pas toujours suffisant pour protéger complètement les voyageurs. Les poteaux centraux obstruent aussi quelque peu le trafic roulier et empêchent les camions de quitter la voie aussi vite qu'ils le feraient autrement. Ils ont aussi occasionné souvent beaucoup d'ennuis par suite de la rigidité des tasseaux et du bris des supports de trolley qui en résulte; ce dernier inconvénient a toutefois beaucoup diminué par l'emploi de tasseaux flexibles. Dans la construction de tramways interurbains, où les poteaux sont très éloignés des voitures toutes ces objections n'existent pas. On a augmenté le poids et la force des poteaux ainsi que l'isolation entre le fil de trolley et les poteaux. Dans quelques villes on emploie trois isolateurs entre le fil de trolley et un poteau d'acier. A Milwaukee, cependant, on a cessé d'isoler les supports de trolley et la compagnie n'emploie que deux isolateurs dans le fil de traverse. Un argument qu'on peut opposer à cette façon de faire est que celà rend le fil de traverse vif, mais cet argument a peu de poids, parceque, si un fil de téléphone ou autre tombe sur le fil de traverse il viendra presque certainement en contact avec le fil de trolley parcequ'il glissera le long du fil de traverse jusqu'à ce qu'il touche le fil de trolley. La pratique est presque également divisée entre les poteaux d'acier à deux et à trois sections. On ne se sert presque pas d'aluminium pour les feeders. Le fil de trolley en forme de 8 n'a pas rencontré beaucoup de vogue bien que quelques compagnies en soient satisfaites. A St. Louis on n'emploie que du bois pour les isolateurs de fils de trolley.

Pratique étalon pour les voitures du service urbain. Page 347.]

Cet article donne la pratique dans 14 des villes les plus importantes des Etats Unis en dehors de New York. La tendance durant les dix dernières années a été d'allonger les voitures. L'avantage principal qui en résulte est de pouvoir transporter un plus grand nombre de voyageurs pour le même coût de main d'oeuvre. Lorsqu'une longue voiture est extrèmement encombrée il est hors de doute que les receveurs manquent de percevoir quelques places. La pratique dans différentes villes est donnée en détail. Les voitures les plus longues et les plus lourdes employées sur un service urbain sont opérées par le Chicago City Railway. Ces voitures ont une longueur de caisson de 10,37 m et une longueur totale de 14,7 m. Leur poids avec les moteurs, mais sans voyageurs, est de 21 800 kg. A Denver et à San Francisco on se sert d'une voiture mi-ouverte et mi-fermée. La plupart des villes, cependant emploient une voiture semi-convertible. Cette voiture est très en vogue pour l'hiver, mais l'été où le trafic est toujours plus fort, les compagnies y ajoutent des voitures ouvertes régulières. Il n'y a pas de voiture qui ait plus de vogue en été que la voiture ouverte étalon, ou qui puisse transporter plus de voyageurs, mais l'inconvénient d'avoir un double assortiment de voiture, conduit beaucoup de compagnies à adopter la voiture semi-convertible. Il y a aussi moins de risques d'accidents avec cette voiture qu'avec la voiture ouverte ordinaire. On augmente jusqu'à un certain point la longueur des plates-formes. Les voyageurs les aiment beaucoup, mais elles rejettent le poids sur l'extrémité de la voiture ce qui les rend mauvaises au point de vue mécanique. On ne se sert de panneaux en tôle d'acier que dans deux villes. Les freins à air sont d'un emploi presque universel. La table qui accompagne l'article montre les dimensions principales des voitures adoptées comme étalon par les différentes compagnies. La plupart de ces compagnies ont beaucoup d'autres types de voitures qu'elles continuent à employer, dans quelques cas, parcequ'elles se prêtent à des conditions spéciales et dans d'autres parceque les compagnies les ont déjà. Les voitures décrites dans la table sont, cependant, celles que les différentes compagnies donnent comme leur étalon.

Usines centrales pour les grands réseaux urbains. . [Page 358.]

Cet article passe brièvement en revue la pratique de construction pour les usines centrales des différents réseaux discutés dans ce numéro. Plusieurs d'entre elles sont surannées, car elles ont été construites il y a dix ans ou plus. On peut néanmoins obtenir une bonne idée de la tendance de la pratique actuelle. Les trois tables montrent: la première, la capacité totale des usines centrales fournissant les lignes urbaines, la capacité totale par miles de voie, la capacité totale par voiture opérée aux moments du trafic le plus fort, et les kilowatt-heures par voiture-mile pendant l'année dernière. La seconde table donne des statistiques ayant trait aux récentes usines génératrices construites par différentes compagnies. La troisième table donne des détails sur quelques unes des plus grosses machines en service. Bien que le courant continu soit employé pour la plus grande partie dans les villes citées, la distribution par courant alternatif se fait sur échelle limitée et la plus part des compagnies sont en train d'introduire ce genre de distribution sur leurs réseaux. Boston est à peu près la seule ligne où l'on n'emploie pas du tout de courant alternatif à présent, où l'on n'étudie pas son introduction. Les diagrammes qui donnent les plans des usines sont tous faits à la même échelle et montrent le tuyautage à vapeur active ainsi que la position des chaudières et des machines dans les différentes usines. En résumé, on peut dire que, dans les usines nouvelles, on prend des précautions spéciales pour obtenir une séparation des chaudières, des génereteurs et des machines en groupes, de manière à ce qu'un accident à un groupe n'affecte pas les autres; et ces précautions s'appliquent également à la portion de l'équipement à vapeur et à celle de l'équipement électrique. Les générateurs sont généralement de 5000 kw ou plus. On est en train d'introduire l'emploi de soupapes à vapeur opérant à l'électricité. On s'assure de grandes facilités pour l'emmagasinage et la manipulation rapide du charbon. Les usines sont construites de manière à pouvoir être agrandies très facilement

Economies possibles dans les centrales et les systèmes de distribution. Par Philip Dawson. . . . . [Page 364.]

L'auteur commence par comparer le dessin des centrales en Europe et en Amérique. On peut faire des améliorations à l'avenir dans deux directions: d'abord dans les machines existantes et l'augmentation des appareils économisant la main d'oeuvre; ensuite par des changements radicaux dans le système, tels, par exemple, que l'emploi de turbines à vapeur, de machines à gaz et peut être de turbines à gaz pour les machines réciproques. La plupart des appareils pour économiser la main d'oeuvre d'un emploi général sont d'origine américaine, tel l'appareil à transporter le charbon et les cendres que l'on considère maintenant indispensable à l'équipement de toute centrale considérable. On emploie aussi beaucoup les passeurs mécaniques. Dans la Grande Bretagne c'est le passeur mobile à chaine qui est généralement préféré. Sur le Continent on emploie d'avantage d'ouvriers passeurs, vu le bon marché de la main d'oeuvre. L'auteur croit cependant que les passeurs mécaniques permettent de brûler un charbon bien meilleur marché. Les chaudières ont peu changé. Dans la Grande Bretagne on préfère généralement la chaudière tubulaire et environ 30 pour cent des centrales emploient actuellement une chaudière horizontale de ce type. Aux Etats Unis on se sert beaucoup aussi de cette chaudière mais on y emploie également des chaudières tubulaires verticales. Sur le Continent les chaudièrss diffèrent radicalement de celles qui sont en vogue en Angleterre et aux Etats Unis et on y emploie généralement une chaudière à deux étages. Le tirage mécanique jouit d'une certaine vogue en Amérique, bien qu'il soit loin d'y être universel. L'auteur croit que son emploi se répand dans la Grande Bretagne. En ce qui concerne les machines, la machine verticale est la plus en faveur dans le Royaume Uni et elle gagne également du terrain aux Etats Unis. La machine étalon pour les deux pays est une machine verticale cross compound. En Allemagne ce sont les machines horizontales que l'on préfère. Les machines américaines et anglaises sont d'une construction plus simple; on y emploie beaucoup la soupape Corliss. Sur le Continent c'est la soupape à pavillon qui est la plus employée, en grande partie parcequ'on s'y sert beaucoup plus de vapeur surchauffée. Les machines allemandes et suisses sont caractérisées par des appareils de soupape beaucoup plus compliqués et embrouillés que ceux des machines anglaises et américaines. L'auteur discute ensuite les avantages relatifs de la vapeur surchauffée et les recherches faites par des ingénieurs du Continent pour trouver des lubréfiants et des garnitures qui puissent résister aux températures plus élevées qu'occasionne la vapeur surchauffée. Il décrit à ce propos quelques essais d'une machine avec de la vapeur surchauffée dans les ateliers de la Berlin Elektrizitäts Werke. L'auteur fait allusion à l'emploi croissant des turbines à vapeur et mentionne les avantages qu'elles ont sur les machines réciproques. On se sert d'avantage de tours de refroidissement sur le Continent et en Angleterre qu'aux Etats Unis. On emploie en Angleterre des tours à tirage artificiel tandis qu'on emploie d'avantage sur le Continent des tours de refroidissement à tirage naturel. Une autre particularité de la pratique continentale est l'emploi d'auxiliaires accouplées directement aux machines primaires. C'est ainsi que les pompes à air sont généralement actionnées directement et qu'il est habituel de monter l'armature de l'excitateur sur l'arbre du générateur primaire. L'auteur préfère en règle générale la pratique américaine d'avoir des auxiliaires indépendantes. Les ingénieurs du Continent se sont aussi montrés prodigues de batteries-tampon; l'une de leurs raisons est qu'on se sert d'avantage sur le Continent de machines à tripple expansion et que ces machines ne donnent pas leurs meilleurs résultats avec des charges variables. On commence à se servir de machine à gaz beaucoup plus sur le Continent que dans la Grande Bretagne ou l'Amérique. L'auteur discute ensuite la question du voltage du courant continu. Jusqu'à ces derniers temps le Board of Trade ne permettait dans la Grande Bretagne qu'une pression de 500 volts, mais il a décidé maintenant d'autoriser 600 volts. Sur le Continent on emploie 750 volts, mais il est discutable de savoir si on y gagne aucun avantage matériel à cause des difficultés additionnelles que ce surcroît de pression occasionne pour le dessin des moteurs de tramways. L'auteur réfère enfin brièvement à la traction polyphasée, et fait remarquer que bien que des tramways polyphasés aient été construits en Europe, surtout en Suisse, leur succès a été dû, dans une grande mesure, à des conditions locales, parmi lesquelles les facteurs principaux ont été: le nombre relativement faible des trains ou voitures opérés de sorte que la question des réparations ne tire guère à conséquence, et la dérivation de l'électricité de chutes d'eau dans la plupart des cas de sorte que la perte d'énergie ne se fait pas sentir. Les ingénieurs de la Grande Bretagne et des Etats Unis prévoient cependant la construction d'un moteur à courant alternatif pratique, spécialement d'un moteur à phase unique.

Méthodes modernes pour ateliers de réparation. Par Richard McCulloch. . . . . [Page 368.]

L'auteur discute en détails les résultats obtenus dans les ateliers de réparation du Chicago City Railway dont une description a été publiée dans le numéro du 7 Mars 1903 de ce Journal. La compagnie opérait, en 1902, 206 trains funiculaires, 125 voitures électriques à quatre essieux et quatre moteurs et 402 voitures électriques à deux essieux et deux moteurs. Elle a un atelier central de réparation et six dépôts de voitures dans lesquels on répare les voitures. Les travaux qui se font dans les dépôts sont: l'inspection et le nettoyage de l'équipement, l'ajustement et l'arrangement des freins, l'ajustement des roues et des parties de trucks, les renouvellements des bases, perches et roues de trolley, les réparations au réseau de fils dans les voitures et les petites réparations aux appareils électriques telles que les renouvellements de parties d'appareils et de contrôleurs. L'auteur donne une énumération des machines-outils employées dans ces dépôts et le nombre des hommes employés avec leurs fonctions. Il y a au total dans les dépôts et l'atelier central entre 300 et 350 hommes. La table No. I donne le classement des comptes de dépenses d'exploitation employé pour répartir le coût de la main d'oeuvre. La table II montre la division des salaires payés en 1902 suivant les fonctions. Il est intéressant de remarquer que l'atelier des machines, le département des réparations aux voitures et l'atelier de peinture ont coûté à peu près la même chose et le plus, leur coût dépassant dans les trois cas 15 pour cent des dépenses totales. La table III donne les montants du coût de la main d'oeuvre pour l'atelier central et les dépôts. La table IV donne le compte détaillé des dépenses de réparation. Les salaires payés varient de 0,50 centimes à 1,65 frs. par heure et sont détaillés. Les tables V et VI montrent le coût des opérations usuelles dans les ateliers de réparation. L'auteur décrit ensuite un nombre de ces opérations y compris la méthode par laquelle on utilise les vieux fils des bobines de champ

pour faire de nouvelles bobines. Il décrit également l'équipement de chacun des ateliers. La compagnie opère une blanchisserie pour laver les serviettes et les déchets huileux, un atelier pour faire les croisemenls et les rails de croisement, ainsi qu'une imprimerie pour les billets de correspondance et toute la papeterie dont se sert la compagnie. La table IX donne le coût d'impression des billets de correspondance. L'auteur tire alors quelques conclusions de la pratique suivie à Chicago. La première est que la possibilité de réduire le coût des réparations dépend de la condition de suivre d'aussi près que possible la meilleure pratique manufacturière; de travailler sur de grosses quantités de matériel d'une nature semblable au même moment; de ne rien faire par main de ce qui peut se faire par machine; et de faire donner aux outils toute leur capacité. Il s'étend sur l'importance de rendre les appareils étalon. Bien qu'il puisse être impossible d'adopter des étalons de voitures, de trucks, de moteurs et d'équipement de voitures, il est possible d'avoir des cuivres de journaux, des essieux, des roues, des garnitures de voitures, des perches et roues de trolley, etc., étalon. M. McCulloch croit qu'il n'est avisable que pour les grandes compagnies de vouloir manufacturer des appareils pour leur propre service. Il résume enfin les onze exigences importantes de l'opération des ateliers de réparation.

Nouveau système de signal de bloc pour lignes à voie unique. [Page 378.]

Ce système est arrangé de manière à ce qu'une ou plusieurs voitures puissent se suivre sur un bloc tout en se protégeant l'une contre l'autre et en empêchant une voiture d'essayer de passer en sens contraire. La Fig. 1 montre un diagramme des circuits. Lorsque la première voiture entre sur un bloc, elle fait paraître un signal rouge à l'autre extrémité et plusieurs signaux intermédiaires indiquant aux voitures suivantes que le bloc est occupé. Au moyen d'un commutateur spécial, dont les Figs. 4 et 5 donnent des illustrations du bloc, les voitures se trouvent enregistrées à mesure qu'elles sortent, et lorsque la dernière voiture sort du bloc les signaux montrent que la voie est libre. Les instructions que les mécaniciens ont à suivre avec ce système sont très simples.

Nouveau billet d'abonnement. . . . . . [Page 379.]

C'est un nouveau billet d'abonnement en usage sur les tramways interurbains. La souche de l'agent, les coupons et le contrat sont une bande continue, ce qui empêche les abonnés de présenter des coupons détachés ou de vieux coupons insérés dans une nouvelle couverture.

Progrès dans les tramways électriques sonterrains de Londres. [Page 380.]

On donne d'abord une courte esquisse de tous les tramways souterrains de Londres, puis en donne des détails sur l'usine centrale du Metropolitan Railway. L'usine contiendra quatre turbines à vapeur de 3500 kw, accouplées directement aux générateurs et on a gardé de la place pour pouvoir ajouter deux autres assortiments d'appareils. Le tuyau de la cheminée a 61 m de hauteur et 4,57 m de diamètre. Il y aura un convoyeur mécanique de charbon. La force motrice sera distribuée à 11.000 volts sans emploi de transformateurs d'augmentation.

Conduits et isolateurs vitrifiés. . . . . . [Page 381.]

La gravure montre un isolateur fait en terre vitrifiée et qui a été adopté par la Manhattan Elevated Railway Company de New York.

Aiguille de voie automatique. . . . . . [Page 382.]

On donne deux vues d'une nouvelle aiguille de voie automatique. L'aiguille est actionnée par un plongeur placé sur la plateforme de la voiture.

Appareil à chauffer et à purifier l'eau d'alimentation. [Page 382.]

Cet appareil vertical chauffe et nettoie l'eau d'alimentation et sépare la condensation et l'huile de l'équipement.

Foret de voie actionné par un moteur. . . . [Page 38 .]

La gravure montre un foret pour voies actionné par un moteur électrique.

Croisement spécial pour tramway. . . . . [Page 383.]

La gravure qui accompagne l'article montre le croisement d'un tramway électrique interurbain avec trois voies de chemins de fer. Ce croisement est construit avec un rail de renforcement qui sert à supporter les bandes de roues de la locomotive et les empêche de frapper les abouts de la voie du tramway électrique.

Pompe triplex actionnée par moteur. . . . [Page 384.]

C'est une pompe pour service général. Dans la gravure qui accompagne l'article on la voit accouplée directement à un moteur électrique mais on peut aussi l'arranger pour qu'elle soit actionnée par d'autres formes de force motrice.

Voiture pour Omaha et Council Bluffs. . . [Page 384.]

Les gravures montrent une voiture dont les portes et les sièges ont été arrangés pour faciliter l'entrée et la sortie des voyageurs. Un des sièges transversaux est supprimé à l'une des extrémités pour augmenter l'espace libre près de la porte, et l'un des sièges longitudinaux est plus court que l'autre de 17 pouces à l'autre extrémité dans le même but. Les portes sont placées sur le côté le plus rapproché des marches pour racourir la distance avant d'entrer dans la voiture.

Instruments pour essayer voies et moteurs. . . [Page 385.]

L'essayeur de joints (Fig. 1) met en balance la résistance d'une longueur de rail droit avec la résistance du joint. La balance s'effectue au moyen du téléphone. Un seul opérateur peut essayer 1000 joints par jour. L'essayeur de moteurs sert à trouver les courts circuits et autres défauts: on peut s'en servir avec un moteur échauffé.

Une manufacture modèle d'engrenages. . . . [Page 386.]

C'est la description de quelques agrandissements à une grande manufacture de roues dentées située à Pittsburg.

Racloir de voie et de neige amélioré. . . . [Page 386.]

On attache ce racloir au truck de la voiture et il nettoie la voie entre les rails et 23 mm de chaque côté en dehors des rails.

Joints de rails "tout fils." . . . . . [Page 386.]

Ces joints sont faits de fils de cuivre doux roulé à froid dont les extrémités sont soudées ensemble par pression pour former les bouts: ils dispensent de l'emploi de tous joints à la fonte. Le joint est soudé au rail. La Fig. 1 montre une forme de joint employé sous l'éclisse, pour usage sous le rail sur les réseaux élevés ou à troisième rail, Fig. 2, et pour usage sur la surface inférieure de la base du rail, ou la surface supérieure du rail là où il n'interfèrera pas avec les éclisses, Fig. 3.

Méthode améliorée d'aération sur une nouvelle voiture pour Leicester, Angleterre. . . . . [Page 388.]

On a installé un nouveau système d'aération sur une voiture construite pour la Corporation de Leicester. L'air frais entre dans la voiture par des fenêtres à pivot placées au dessus des grandes fenêtres fixes en verre et par des châssis à pivot placés de chaque côté des portes. L'air contaminé s'échappe par un renforcement du toit et des ventilateurs construits de manière à rejeter au dehors l'air contaminé lorsque la voiture marche. On donne un diagramme qui montre la circulation des courants de l'air et des gravures qui montrent l'intérieur et l'extérieur de la voiture.

Appareil de chauffage électrique pour voitures à sièges transversaux [Page 389.]

Cet appareil est destiné à être placé longitudinalement dans la voiture et l'illustration montre comment celà peut se faire sans interférer avec les supports de siège.

Machine à construire les chaussées. . . . [Page 390.]

Cette machine est employée dans la construction des tramways pour faire la chaussée. Elle est pourvue d'un soc de charrue et d'une courroie-convoyeur qui transporte la terre labourée dans un tombereau ou la rejette sur les côtés. Elle est équipée avec des appareils pour régler l'angle de la pointe du soc et pour redresser et resserrer la courroie-convoyeur.

Appareil électrique pour chauffer les voitures. . [Page 390.]

Cet appareil de chauffage est beaucoup employé sur les grandes voitures interurbaines. L'illustration montre la manière dont il est fixé au siège.

Commutateur pour régler le degré de chauffage. . [Page 391.]

Cet article et l'illustration traitent d'un commutateur à trois pointes pour régler le degré de chauffage des voitures.

Appareil Snow à replacer les voitures. . . [Page 391.]

C'est un appareil pour replacer sur les voies, voitures et locomotives déraillées.

Nouvelle roue de trolley. . . . . . [Page 391.]

L'illustration montre une roue de trolley qui combine une garniture de graphite avec un godet à huile à alimentation automatique qu'on peut remplir sans enlever la roue de la fourche.

Nouvelles voitures pour le Lake Shore Electric Railway. [Page 392.]

Cet article contient une description de quelques voitures qui seront mises en service sur le Lake Shore Electric Railway de Cleveland, Ohio. C'est une longue ligne interurbaine et les voitures sont semblables en plusieurs points aux wagons de chemins de fer. Chaque voiture est divisée en trois compartiments: voyageurs, fumeurs et bagages. Le compartiment des bagages sert aussi au mécanicien et contient l'appareil de chauffage à l'eau chaude. Lorsque ces voitures seront en service régulier elles devront, d'après l'horaire, parcourir les 160 miles qui séparent Cleveland de Toledo en quatre heures et demie.

Appareil à replacer les voitures sur la voie. . [Page 393.]

Cet appareil remet en place les voitures déraillées, aussitôt que la roue de voiture atteint le niveau de la surface des rails.

Roue de trolley balancée. . . . . . [Page 393.]

La gravure montre une forme améliorée de roue de trolley avec un rainure plus large pour donner une plus grande surface d'usure. La nouvelle forme des rebords lui donne une force de résistance plus grande contre les coups et élimine tout danger de frottement contre le fil de trolley.

Système d'uni-signal. . . . . . [Page 394.]

C'est un système de signaux électriques pour les tramways électriques qui emploient le trolley. Il consiste en une boîte terminus avec paratonnerres, boîte de signal et une aiguille de trolley à double action. Comme le montre le diagramme des fils, lorsqu'une voiture passe sous l'aiguille de trolley en entrant dans le bloc, du courant venant du fil de trolley passe à travers l'aimant d'éclairage et la plaque de résistance dans la boîte de signal jusqu'à la terre à cette extrémité, ce qui rejette le levier d'aiguille dans la boîte de signal contre le contact à main gauche de l'aiguille. Ceci occasionne alors une prise de courant, à l'extrémité de sortie du bloc, qui passe à travers la lampe rouge et l'aimant de fermeture à cette extrémité et de là à travers la ligne de signal d'éclairage à l'extrémité d'entrée où il traverse la lampe verte, l'aimant d'éclairage et la plaque de résistance puis à la terre. Pour éteindre le signal, le courant se prend du trolley à l'aiguille d'extinction, passe à travers l'aimant d'extinction à cette extrémité et de là à travers la ligne d'extinction à l'extrémité d'entrée où il passe enfin à travers l'autre aimant d'extinction et la plaque de résistance jusqu'à la terre.

Construction de conduits souterrains à Brooklyn. . [Page 395.]

L'illustration montre un conduit de feeder d'alimentation pour des fils à courant continu qu'on est en train de poser à Brooklyn.

Voyages de luxe sur tramways. . . . . [Page 395.]

Cet article décrit l'intérieur d'une voiture construite pour servir en cas de cérémonies. On s'en sert sur les lignes de la British Electric Traction d'Angleterre.

Lampe d'avant combinée pour lumière à arc et incandescente. [Page 395.]

Cette lampe d'avant est équipée à la fois pour des circuits à arc et à incandescence. Au moyen d'un commutateur à deux pointes ont peut employer l'un ou l'autre circuit en conjonction avec des réflecteurs séparés. Elle est spécialement adaptée pour des tramways interurbains qui désirent employer une lumière plus faible dans les rues que dans la campagne.

Truck No. 46. . . . . . [Page 396.]

Ce truck destiné au service de lourds tramways électriques pèse environ 5000 kgs. Toutes ses parties sont renforcées.

Lampe d'écriteau à lueur intermittente. . . [Page 396.]

C'est une lampe incandescente ordinaire pourvue d'une base ordinaire Edison à l'intérieur de laquelle se trouve un mécanisme qui fait passer la lumière du gros au petit filament à intervalles irréguliers. On se sert surtout de ces lampes pour les écriteaux de réclame.

Filtre Capillaire pour huile. . . . . . [Page 397.]

L'opération de ce filtre dépend de la capillarité; l'huile sale passant à travers un assortiment de mèches qui excluent toute la saleté. Comme elles sont auparavant trempées dans l'huile elles excluent également l'eau qui pourrait autrement passer avec l'huile purifiée.

Construction convertible, tombereau et gondole. . [Page 397.]

Ce wagonet combine trois types en un seul: par sa construction à trappe centrale il diverse automatiquement la pierre concassée au centre de la voie; comme tombereau à planches latérales il peut déposer le matériel d'un côté ou des deux côtés de la voie; ou bien enfin il peut être converti en gondole à fond plat.

Une jolie voiture privée. . . . . . Page 398.]

La gravure montre une voiture construite pour usage privé sur des tramways interurbains électriques. Elle est richement meublée et contient un salon, un fumoir, une cuisine, des placards pour les provisions et les vêtements, une chambre à coucher et un cabinet de toilette. La voiture a environ 15 m de longueur et elle pèse plus de 30 tonnes métriques.

Courroie de sûreté pour voiture. . . . . [Page 400.]

Comme le montre la gravure, cette courroie a la forme d'un Y. La pression de la courroie n'est par conséquent pas concentrée en un seul point de la barre ce qui minimise les bris de barres. La courroie est en cuir et est arrangée de telle sorte que les mouvements de la voiture ne la font pas glisser le long de la barre.

Une usine de force avec des machines à huile. . [Page 400.]

L'illustration montre une petite usine qui contient deux machines à huile Diesel de 75 chevaux. Ces machines fonctionnent d'après le cycle bien connu d'Otto: l'huile est forcée dans le cylindre par l'air comprimé après que le coup de piston de montée y a comprimé l'air qui y était contenu à une pression variant entre 30 et 35 atmosphères. La temérature élevée qui en résulte (environ 540 degrés centigrades) enflamme l'huile, après quoi les gaz de combustion actionnent la machine. On dit que l'efficacité thermique de la machine atteint 35 pour cent. Les machines sont garanties fonctionner avec une consommation d'huile variant entre 0.21 et 0,25 kg par cheval vapeur et par heure.

Voitures pour la ligne raccourcie Detroit, Monroe et Toledo. [Page 401.]

Ces voitures sont destinées au service interurbain entre Detroit et Toledo, et seront opérées à une très grande vitesse. On a en conséquence pris des dispositions pour leur assurer une grande force structurale.

Tonneaux arrosoir et balayeuse modernes. . . [Page 401.]

Cet article contient la description d'une balayeuse combinée à un tonneau-arrosoir qui ressemble à une voiture de tramway. Les balais sont aux deux extrémités placés sous la partie de la voiture en dehors des essieux. Les têtes d'arrosage sont arrangées de manière à ce qu'on puisse arroser la rue en avant des balais ou après, comme on le désire. Un autre tonneau arrosoir décrit dans cet article possède un arrangement qui permet de forcer au dehors, au moyen d'air comprimé, le peu d'eau qui peut rester dans le tonneau aussi loin que si le tonneau était plein.

Machines Allfree. . . . . . [Page 401.]

L'article et les illustrations qui l'accompagnent on trait à une machine qui emploie un mécanisme spécial de soupape opérant au moyen de ce que le constructeur appelle un appareil d'expansion. Cet appareil donne une distribution de vapeur semblable à celle que l'on obtient des machines Corliss ayant des excentriques doubles, excepté que la fermeture d'épuisement n'est pas constante. La variation dans la fermeture d'épuisement n'est, cependant, que juste suffisante pour compenser la différence entre la température principale du cylindre pour des charges variables, de sorte que la pression résultante de compression est constante. Lorsque des machines de ce genres sont accouplées directement à des générateurs de courant alternatif, elles sont fournies d'un régulateur spécial équipé avec une invention qui permet d'augmenter ou de diminuer la vitesse de 5 à 10 pour cent au dessus ou au dessous de la normale pendant que les machines sont en opération.

NEWS OF THE WEEK

CONSTRUCTION NOTES

BIRMINGHAM, ALA.—The Birmingham Railway, Light & Power Company has begun work on the Glen Iris branch, about a mile long.

BIRMINGHAM, ALA.—At a meeting of the committees from the commercial bodies of Huntsville and Birmingham and intervening towns, held in Birmingham, to take steps for building a direct line of railway between Birmingham and Huntsville, it was determined to appoint a joint committee of twelve to arrange all preliminaries looking to making a survey for the route, securing rights of way, etc. The special committee is made up as follows: For Huntsville, W. I. Wellman, Ben P. Hunt, Oscar Hundley, Milton Humes, D. E. Scroggins and W. L. Halsey; for Birmingham, Rufus N. Rhodes, N. F. Thompson, J. A. Montgomery, James Bowron, M. V. Joseph and Robert Jemison.

PRESCOTT, ARIZ.—Ground has been broken for an electric street railway for the city of Prescott, with the objective point at Fort Whipple. It is proposed that the line will eventually furnish passenger and freight transportation for a number of the more important mining districts of the company, the first to be tapped being the Groom Creek section. Backing the enterprise is the Prescott Electric Company, from whose works power will at first be furnished.

MONTEREY, CAL.—The Monterey & Pacific Grove Electric Railway has been placed in operation.

SAN JOSE, CAL.—The work of laying the rails of the San Jose & Los Gatos Interurban Railway was begun at San Jose a few days ago. Already 15 miles of line are graded, and ties are laid ready for the rails for a distance of 5 miles. The officers of the company are: President, J. W. Rea; vice-president, E. N. Rea; general manager, F. S. Granger; secretary, Thomas Rea; directors, J. W. Rea, F. S. Granger, O. A. Hale, Gus Lion, A. Barnard and L. M. Robbins.

BRADENTOWN, FLA.—All work on the line of the Manatee Light & Traction Company has been completed except the placing of the steam turbines. The road extends from Bradentown to Manatee, a distance of 6 miles, with two 3-mile branches. Six motor-cars and two trail cars will be operated. The power-station equipment consists of two 260-kw Bullock generators, two 300-hp De Laval steam turbines, two 300-hp Babcock & Wilcox water-tube boilers. The cars were made by the J. G. Brill Company, of Philadelphia, and are of the convertible type. The authorized capital stock of the company is $100,000, all of which has been issued. The authorized funded debt of the company is $100,000, none of which has been issued. The officers of the company are: John A. Graham, president and manager; W. A. Carter, vice-president; N. H. Graham, secretary and treasurer; H. C. Sloan, superintendent and electrician; R. N. Ellis, engineer.

DECATUR, ILL.—W. B. McKinley, of Champaign, the head of the McKinley syndicate, which is building electric lines in Illinois, has announced that work would begin in connecting up interurban and street railway lines and making a through fast-service line between Danville, Ill., and St. Louis. At Danville the syndicate expects to have connections into Terre Haute, and, by the line that the Consolidated Company is building, through Crawfordsville, Veedersburg and Covington, into Indianapolis and to the East.

DECATUR, ILL.—The sale of the Decatur Traction & Electric Company's property has been effected by a syndicate of Eastern capitalists represented by W. B. McKinley, of Champaign, purchasing the entire issue of $250,000 in capital stock for $200,000. The system has been bonded for $212,000. This makes the total valuation of the system $412,000. The capitalists represented by Mr. McKinley are now building interurban systems that will eventually be joined and make an electric railway from Danville through Champaign and Decatur to Springfield, thence to St. Louis.

CRAWFORDSVILLE, IND.—Additional laborers have been put to work at Lebanon on the Northwestern Traction Company's line, and the grade is now being made toward Crawfordsville. The work of building eastward from Crawfordsville is progressing satisfactorily, and tracks are connected with the steam road, and cars of material are run out 3 miles or more to a point where the tracks are laid. The grade has been completed for a distance of 5 miles. All material for the track is distributed, and the contractors expect that the line will be completed by Sept. 1.

FORT WRYNE, IND.—It is stated that the Fort Wayne & Southwestern Traction Company, between Wabash and Fort Wayne, which is now in the hands of a receiver, will probably be restored to the stockholders within a few days. The property was placed in the hands of S. L. Nelson, the general manager, as receiver, at the instance of the National Bank of North America, New York, which held a $100,000 note of the company, and which sued to prevent its claim becoming a junior lien under a mortgage about to be executed. The bank has dismissed the case, the company having adjusted the claim to its satisfaction, and Mr. Nelson, it is said, will soon retire as receiver and resume his duties as general manager. The company has no floating debt.

FRANKFORT, IND.—The dispute between the Indianapolis & Northwestern and the Consolidated Traction Companies for the possession of the disputed right of way between this city and Lebanon has been decided by Judge Neal in favor of the Northwestern Company, which is given priority of right and authority to proceed with the construction of its line.

INDIANAPOLIS, IND.—The Consolidated Traction Company, which is now busy pushing the construction of its line to Crawfordsville, by the direct route through Jamestown, will build a line from Crawfordsville to Lafayette, will extend the Indianapolis-Crawfordsville line on to Danvile, Ill., through Veedersburg and Covington, and will build a coal road from Crawfordsville down into the Parke County fields. The road will be a coal carrier into Indianapolis. The grading on the Crawfordsville-Indianapolis line is completed from Crawfordsville to Jamestown. Steel for 20 miles is arriving. The Lafayette line, the Danville extension and the coal road will be built next year. This will give Indianapolis two electric lines to Lafayette. It is not unlikely that the coal road into Parke County will be pushed on to Rockville, where it will connect with the Danville Company's line into Clinton and Terre Haute.

MUNCIE, IND.—The Muncie, Hartford & Fort Wayne Railway Company has just begun schedule service on 30 miles of road from Muncie, through Eaton to Hartford City and Montpelier. Cars had been running irregularly since May 1. There are no curves and the grades are 1 per cent outside the cities where fifty-year franchises are held. The 40-ft. right of way outside the cities is owned outright by the company. Seventy-pound rails, oak ties, Stephenson cars, General Electric Company equipment, Cooper engines, Sterling boilers and Packham trucks are used. The company owns and operates a summer resort park at Eaton. It contains 37 acres, and is located on the Mississinawa River. The fare is 2 cents a mile. The road will be built to Bluffton, 14 miles from Montpelier, by Nov. 1. The company is capitalized at $1,000,000 and bonded for the same amount. Lewis Hester, Muncie, Ind., is general manager. The superintendent is L. J. Shlessinger, of Eaton, Ind. S. M. Hester, of Cleveland, is president; A. L. Johnson, of Muncie, Ind., vice-president; J. C. Gilcris, of Cleveland, treasurer, and F. W. Osborne, of Cleveland, secretary. The other directors are: W. B. Cooley, of Hartford City, and L. Hexter and A. Lewenthal, of Cleveland.

NEW ALBANY, IND.—The incorporators of the company that is to build the proposed electric railway between Louisville and Cincinnati have organized the Indiana Interurban Bridge Company to build over the Ohio River. The company is capitalized at $1,500,000, and the bridge that it plans to build will span the river at the head of Sand Island, about 200 yards above the Kentucky and Indiana Bridge. The new structure will be constructed of steel, double-tracked, and will be used for the interurban cars and wagons.

RICHMOND, IND.—The Eastern Indiana Electric Railway Company has commenced its survey of the proposed line from Richmond to Portland, Ind., the road to be completed by July 1, 1904. It has a clear right of way and franchises granted along the proposed route.

SEYMOUR, IND.—The City Council has granted a thirty-year franchise to the Indiana Central Electric Railway Company, which is projecting a line from Columbus to West Baden.

VERSAILLES, IND.—Center Township, Ripley County, has voted by a large majority in favor of a subsidy in aid of the Madison, Greensburg & Indianapolis Electric Railway.

DUBUQUE, IA.—The Dubuque & Western Railroad Company has filed articles of incorporation. Peter Kiene, of Dubuque, is president. The purpose of the promoters is to connect Dubuque and the northern and southern parts of the county by electric lines. The Eastern Securities Company, of New York, is backing the project.

IOWA CITY, IA.—Smith & Dows, of Cedar Rapids, who have in contemplation the construction of an interurban railway between Iowa City and Cedar Rapids, have applied for a franchise in Iowa City. A hearing is to be given on the application on July 17.

MARSHALLTOWN, IA.—The Marshalltown Electric Street & Interurban Railway Company has been voted a franchise by the Council.

ROCK FALLS, IA.—The Rock River Traction Company, which will build an electric railway to Rock Island, has secured the right of way from Rock Falls to Geneseo.

CARIBOU, MAINE.—The Caribou, Washburn & Perham Railroad Company has made a preliminary survey of its route from Caribou to Washburn and Perham, and it has considerable preliminary work to do before getting down to the work of construction. The road is to be principally a freight road, and will be built mostly outside the highway so as to get a very low grade. The company will not make any contracts at present. The line will connect Caribou, Washburn and Perham, a distance of 14¼ miles. The officers of the company are: S. L. White, president; J. D. Emery, vice-president; E. A. Holmes, secretary; George W. Irving, treasurer.

BOSTON, MASS.—The Railroad Commissioners have issued three certificates, to the effect that the following extensions of locations are consistent with public interests: Of the Framingham, Southboro & Marlboro Street Railway, in the town of Framingham; of the Boston & Worcester Street Railway, on Eastern Avenue, in the town of Framingham; of the Lowell & Boston Street Railway, on Boston Road, in Billerica.

BOSTON, MASS.—The Railroad Commissioners have issued a certificate of operation approving the reconstruction of that portion of the Old Colony Street Railway, located in West Roxbury, which was leased to the Boston Elevated Railway Company.

BOSTON, MASS.—The Massachusetts Electric Companies has increased its order for General Electric turbine engines from five to ten, deliveries to extend over this year and 1904. These engines will be each of 2000 hp capacity, and will be distributed among the various power stations operated by the subsidiary companies.

BOSTON, MASS.—The Boston Transit Commission has opened bids for the construction of the last section of the tunnel which will connect East Boston with the city proper. Eight bids were received, ranging from $125,000 to $229,170. The successful contractor will have until Dec. 20 to complete his work, and this will not include the laying of the tracks. This section will run from the westerly end of the old State House across Washington street and along Court Street to Scollay Square, where it will connect at grade with the present subway.

BOSTON, MASS.—The Boston Elevated has filed a protest with the Railroad Commissioners against the route determined by the transit commission. The notice reads as follows: "Believing that the route designated by the transit commission will not furnish the best facilities for public travel, the company feels it duty bound to apply to the Board for revision of such determination of the commission, to the end that the board may consider and finally determine the question." The notice is signed by President William A. Bancroft.

CONCORD, MASS.—The Concord, Maynard & Hudson Street Railway Company has petitioned the Selectmen of Stow for locations in that town for an extension of its present line to connect with the proposed Lowell, Acton & Maynard Street Railway.

EXETER, MASS.—The Epping, Brentwood & Kingston Street Railway, chartered at the last session of the Legislature, with an authorized capital of $200,000, has been organized. The directors are: Russel H. Fellows, of Brentwood; Levi W. Bartlett and L. Waldo Collins, of Kingston; D. Frank Fellows, of Brentwood; John Scammon, of Exeter; Mr. Perrin, J. A. Edgerly, W. S. Goodridge and R. R. Morris, of Epping. Russel H. Fellows was elected president. The proposed road will run through Epping, Brentwood and Kingston, towns without electric service, to Exeter.

FALL RIVER, MASS.—The Tiverton & Seaconnet Street Railway incorporators—the company proposing to build from New Bedford to Horse Neck and thence through Little Compton and Tiverton to Fall River—has formed a corporation with the following directors: A. S. Pennock, of Boston; B. W. Carlow, of Boston, N. L. Sheldon, of Boston; Henry M. Brett, of Boston; George T. Howard, of Little Compton; Job Wordell, of Tiverton, and Frank Grinnell, of Tiverton.

HUDSON, MASS.—The Concord, Maynard & Hudson Street Railway Company has selected new locations in Stow and Acton, which are to become a part of the Lowell, Acton & Maynard Street Railway, now being built. These locations are over private right of way for most of the distance, and franchises are being asked for where highways are crossed.

NORTH ADAMS, MASS.—The petition of the Hoosac Valley Street Railway Company for approval of a location on private land in Adams will be granted as soon as word is received from the Selectmen of the town that a location on the adjoining highway has been revoked, the Board not desiring to have two locations standing at the same time.

PITTSFIELD, MASS.—The Selectmen of Lee have revised their ruling relative to the speed of street cars in that town, and have adopted a rule permitting cars to be run at a speed of 6 miles an hour in the center of the town and 15 miles an hour elsewhere in the town. The Berkshire Street Railway Company, of Pittsfield, is the company affected by this rule.

SPRINGFIELD, MASS.—The Springfield Board of Aldermen has come to an agreement with the Springfield Suburban Street Railway Company relative to a franchise for which the company has asked for locations in Springfield. The company is to post a forfeit of $10,000 in cash or a certified check for that amount, and will give in addition a bond of $50,000 to insure satisfactory execution of all the conditions of the franchise. The line must be complete in eighteen months after the franchise is granted. The bond and forfeit are provided by Fred T. Ley personally as a temporary arrangement until the organization of the company is completed.

SPRINGFIELD, MASS.—A franchise has been granted to the Springfield-Suburban Street Railway Company from the Wilbraham line to the post-office of Springfield.

TIVERTON, MASS.—The Tiverton & Seaconnet Street Railway Company has been incorporated to build an electric railway from Tiverton to Horse Neck, and thence through Little Compton and Tiverton to Fall River. The directors of the company are: A. S. Pennock, B. W. Carlow, N. L. Shelden, Henry M. Brett, of Boston; George T. Howard, of Little Compton; Job Wordell, of Tiverton; Frank Grinnell, of Tiverton.

WHITINSVILLE, MASS.—The Selectmen of Northbridge have voted to grant a franchise to the Uxbridge & Blackstone Street Railway Company for an extension of its track to connect at Whitinsville with the Linwood Street Railway.

WORCESTER, MASS.—The Worcester & Providence Street Railway Company is renewing its efforts to get locations in towns between Worcester and Providence. The company has met with delay in Millsbury, but the obstruction there has been removed.

WORCESTER, MASS.—The franchise granted the Hartford & Worcester Street Railway Company for locations in Charlton, which expired June 13, has been extended to June 13, 1904.

WORCESTER, MASS.—The Railroad Commissioners have approved the extensions of the Boston & Worcester Street Railway Company in Eastern Avenue, Framingham; of the Framingham, Southboro & Marlboro Street Railway Company in Worcester street, Framingham, and of the Hampshire & Worcester Street Railway Company in Warren.

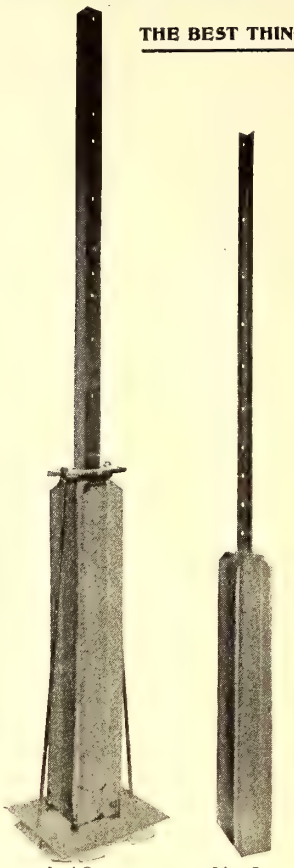
WORCESTER, MASS.—The Railroad Commissioners have given a hearing to the Boston & Worcester Street Railway Company on its petition for authority to issue $1,000,000 in bonds and additional stock to the amount of $250,000. The present stock issued by the company is $1,000,000.

WORCESTER, MASS.—The Worcester, Rockdale & Charlton Depot Street Railway Company has been given a hearing by the Railroad Commissioners on its petition for authority to issue bonds to the amount of $40,000 to pay for putting in double track in Worcester. The company has a capital stock of $40,000 and no bonds outstanding.

WORCESTER, MASS.—The Worcester & Southbridge Street Railway Company has completed a $10,000 sub-station near Pinehurst, the principal pleasure resort on the line. The new station is to provide additional power for the section of the line between Pinehurst and Worcester, over which the heaviest part of the travel will go. A transformer is being put in at Pine-

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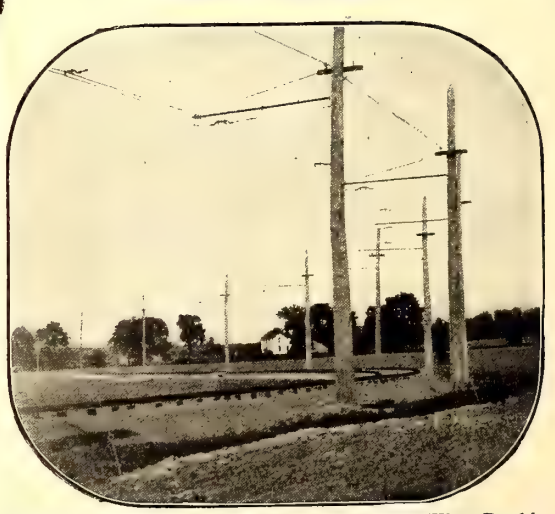
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hurst, through which the current for the electric lighting service at the park will pass. The park is being developed into one of the finest street railway amusement parks in New England.

WORCESTER, MASS.—Work will be begun within a month on the Hartford & Worcester Street Railway. James F. Shaw & Company, who built the Boston & Worcester Street Railway, will build the new line, and will transfer men to this job as soon as the Boston & Worcester line, on which there is a little more work to be done, has been finished. The line is to be built over private rights of way for most of the distance in Massachusetts, and the track will be laid with the purpose of operating at a high-speed schedule. Existing lines from Hartford to Rockville, Conn., will be used, and the greater part of the new construction will be in Massachusetts, where about 35 miles of track are to be built.

BENTON HARBOR, MICH.—In order to hold its franchise the Kalamazoo-Benton Harbor Electric Railway Company began work here a few days ago on its proposed line. Only a few poles were placed in position, but the assurance is given by the promoters that active work will be begun at once.

HANCOCK, MICH.—The Council of Lake Linden has granted the Houghton County Street Railway Company a franchise to build a line through the village.

JACKSON, MICH.—Articles of incorporation have been filed by the Jackson, Ann Arbor & Detroit Traction Company, with a capital stock of $2,500,000. The company is organized to lease, purchase or otherwise acquire an electric railway from Jackson to Detroit, through the counties of Jackson, Washtenaw and Wayne, the city of Ann Arbor and all intervening villages and cities. The stockholders are: William Halls, Jr., Summit, N. J.; U. S. Potter, Jackson, Mich.; Leonard H. Hole, Montclair, N. J.; William N. Coler, Jr., Newark, N. J.; W. A. Boland, Yonkers, N. Y.; Henry R. Carse, New York, N. Y., and George W. Mechem, Battle Creek, Mich.

LAKE LINDEN, MICH.—The Common Council has granted a franchise to the Houghton County Street Railway Company to extend its line into Lake Linden.

LANSING, MICH.—A. J. White and others, of Battle Creek, are the incorporators of the Grand Rapids & Southern Michigan Traction Company, organized with $1,300,000 capital to build an electric line connecting Grand Rapids, Battle Creek and Kalamazoo.

ST. JOSEPH, MO.—The County Court has refused to grant changes asked by the St. Joseph, Parkville & Kansas City Electric Railroad Company, in the franchise formerly granted the company for a line through this county.

ST. LOUIS, MO.—The West Olive Street Railway Company has filed a petition in the County Court asking for a franchise to construct and operate a street railway.

SPRINGFIELD, N. H.—At the annual meeting of the Springfield Electric Railway Company the following directors were elected: E. C. Crosby and C. W. Wyman, of Brattleboro; F. S. Coolidge and M. A. Coolidge, of Fitchburg, and W. W. Brown, of Springfield. The directors elected E. C. Crosby president and general manager, M. A. Coolidge, vice-president and treasurer, and Allyn J. Crosby, superintendent.

JERSEY CITY, N. J.—The Public Service Corporation has recently placed an order for 150 new cars. The new vehicles are to be of three different types. Twenty-five are to be of the half-open, half-closed type adopted by the Metropolitan Street Railway Company, of New York; twenty-five are to be of the Detroit platform type with an entrance in the middle, and the others are to be of the convertible type.

JERSEY CITY, N. J.—President Thomas N. McCarter, of the Public Service Corporation, in a lengthy communication to the Street and Water Board, Jersey City, has promised that by Sept. 1 transfers will be granted by the company at several points where lines intersect and transfers are not now granted. He declares that the company is studying the transfer problem with a view of ascertaining where transfers will most benefit the public. After making this promise, Mr. McCarter asks for three new trolley franchises, two of which will be for the purpose of establishing a double line to Hoboken in place of the single-track line which now runs through Grove Street, and the third is a request that the company be permitted to connect the tracks of the Jersey City, Hoboken & Paterson Street Railway Company at the Five Corners with those of the North Jersey Street Railway Company.

PERTH AMBOY, N. J.—The Central Jersey Traction Company has applied to the South Amboy Borough Council for a franchise. The route outlined is from the borough line at Swamp Hill, through Broadway to Bordentown Avenue, where it will connect with the Middlesex & Somerset Traction Company. The Central Jersey has its tracks laid to the borough limits. For several months it has been understood that the tracks would be built around South Amboy to reach the new bridge across the Raritan River.

BUFFALO, N. Y.—Justice Kruse has dismissed the complaint of the New York Central Railroad Company in its action brought against the Buffalo & Williamsville Electric Railroad Company. The plaintiff asked for an injunction restraining the defendant from constructing an electric railway from Williamsville to Rochester, on the assertion that the electric road should first have applied to the State Railroad Commission for a certificate of necessity. The construction of the road will now be proceeded with.

NEW YORK, N. Y.—The sub-committee of the Rapid Transit Commission, which has had under consideration the application of the Hudson & Manhattan Company for permission to construct a tunnel from Jersey City to Cortlandt Street, has reported favorably on the project to the Rapid Transit Commission. The proposed franchise provides for the payment to the city of $9,000 a year for the first ten years and $15,000 a year for the next fifteen years; and at the end of twenty-five years for a readjustment of terms, with the proviso that the price to be paid to the city shall not be decreased.

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JAMESTOWN, N. Y.—The Chautauqua Traction Company has been granted authority by the State Railroad Commission to build an electric railway 14 miles long from Lake Wood to Mayville. The company has a capital of $500,000.

SYRACUSE, N. Y.—Horace Andrews, president of the Utica & Mohawk Valley Electric Railway Company, has approached the Syracuse Rapid Transit officials with a proposition for a traffic arrangement in this city. The road is now complete from Little Falls to Canastota, and a survey has been made between Canastota and Syracuse, 19 miles. It is planned to enter this city.

CINCINNATI, OHIO.—The stockholders of the Indianapolis & Cincinnati Traction Company have voted to increase the capital stock of the company from $1,500,000 to $2,000,000, and have authorized a bond issue of $4,000,000. The company's line will be double track. The right of way as far as Connersville has practically been secured, and the contract for the construction of the grade has been let to the Callahan Bros. & Katz Company, of Omaha, Neb., who are ready to begin work. Rails for the line have been purchased from the Cambria Steel Company, and the ties have been contracted for from the Gray Tie Company, of Evansville. Fence posts have been ordered from the Fowler-Jacob Company, of Chicago.

CINCINNATI, OHIO.—Charles W. Baker has been elected to the board of directors of the Cincinnati, Milford & Loveland Traction Company in the place of J. H. Puerrung, who resigned in order that he might give his personal attention to the construction of the road beyond Milford, to which point the track has been practically completed. Mr. Baker, Jr., will have charge of the company's office, which is to be opened in the building on Fifth Street, near Walnut, occupied by the Carrara Paint Company, and will give his whole time to this work. The board has created an executive committee, consisting of President B. H. Kroger, Charles W. Baker and Thorne Baker, which will have charge of the business affairs of the company. President Kroger states that cars will be running between Cincinnati and Milford by Aug. 1, and probably at an earlier date. A temporary contract for power has been made with the Cincinnati, Georgetown & Portsmouth Railroad Company, but the Cincinnati, Milford & Loveland will begin the erection of a power house, probably at Camp Dennison, as soon as acceptable plans can be secured. This, it is expected, will not be later than Aug. 1, and by the end of the year the company contemplates operating its cars with power from its own plant. Work on the extension of the road from Milford to Loveland and Blanchester will begin in a few days, and under the direct supervision of Mr. Puerrung will be pushed to the earliest possible completion. The formal transfer of the Cincinnati, Milford & Eastern franchises and properties to the Cincinnati, Milford & Loveland Traction Company has been made, all of the papers having been approved and signed by the parties interested.

CLEVELAND, OHIO.—Glenville's City Council has granted the Cleveland City Railway Company a new franchise for the operation of cars on Doan Street. The ordinance grants the right for the construction and operation of a line from the Lake Shore Railway tracks to the city limits near Superior Street. The new ordinance was passed to overcome the fight being made in the courts by Mayor Johnson on the old one. By the terms of the new ordinance two transfers must be given on each fare paid, the same rate of fare obtaining as in Cleveland, cars must be operated between Saint Clair and Superior Streets within six months, and the company must pave 17 ft. of Doan Street whenever the city is ready to pave that thoroughfare.

COLUMBUS, OHIO.—The Lancaster, Logan & Nelsonville Traction Company, of Logan, has been incorporated, with a capital of $10,000, by A. Magoon, J. W. Jones, D. A. Rannells, F. M. McKay and F. E. Pierpont. The company will operate an electric line from Lancaster to Nelsonville, through Fairfield, Hocking and Athens Counties.

MANSFIELD, OHIO.—It is said that the Mansfield & Eastern Railway has been financed and that the construction of the road will be begun in about two weeks. The line will run from Mansfield to Petersburg Lake, a small pleasure resort 12 miles southeast of Mansfield, and thence to Ashland, a distance of 17 miles. It is the intention after the line from Mansfield to Ashland is built to run from Petersburg Lake to Wooster, a distance of 22 miles. Robert McCrory and W. J. Pentz, of Mansfield, are interested.

NEWARK, OHIO.—J. F. Shrontz, Edward Kibler, Edward H. Everett, Frank Moore and F. E. Elliott have applied for incorporation papers at Columbus for the Newark, Martinsburg & Mount Vernon Traction Company. Ninety per cent of private right of way has already been secured for the 33-mile road, which will be built through Gambler. This will form a link in the electric railway from Cleveland, and when constructed will give Newark four electric interurban roads.

PORT CLINTON, OHIO.—The long-projected Napoleon, Bowling Green & Lake Erie Railway has taken on new life, and the Kerlins, of Toledo, who have an entire roadbed built from Fremont to Port Clinton, a distance of 16 miles, are said not to be averse to joining hands with the Toledo road into Port Clinton and Lakeside. Their line would use about 5 miles of the Toledo road, should a traffic agreement be made, between Port Clinton and Fremont alone, and the Fremont road could, no doubt, make further arrangements to run its cars through to Lakeside and Marblehead over the Toledo, Port Clinton & Lakeside Railway, now building. The Bunn syndicate, of Tiffin and New York, has a roadbed constructed between Tiffin and Fremont, and rumors are often heard of a joining of forces of the Bunn people and the Kerlins. The latter recently secured an extension grant from the Commissioners of Sandusky County.

SIEGFRIED, PA.—The Siegfried & Danielsville Traction Company has filed in the office of the Recorder of Deeds, at Easton, a notice of the extension of its route. The extension includes a line beginning in the borough of Alliance and extending to a point known as James Bossard's Corner, in Lehigh Township, passing through Cherryville en route.

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MESSAGES AT OUR EXPENSE.

TOLEDO, OHIO.—The Onio & Michigan Traction Company hopes soon to be able to let the contracts for building its proposed line between Toledo and Ann Arbor, Mich. Forty-seven miles of track will be laid and ten motor cars will be operated. The three-phase power transmission system will be used. The authorized capital stock of the company is $1,650,000, and the authorized funded debt is $1,000,000. The officers of the company are: John H. Clauss, president; Harlow C. Stahl, vice-president; L. L. H. Austin, secretary and general manager; J. W. Pero, treasurer; W. J. Sherman, engineer.

ALLIANCE, PA.—The Town Council has granted the Siegfried & Danielsville Trolley Company a franchise.

CONNELLSVILLE, PA.—If the Council passes the ordinance now pending, the Pittsburg, McKeesport & Connellsville Railway Company will build two loops in the town, one on the North Side and one on the South Side. The completed system in the town will form a figure 8. In connection with this new line through town, the company proposes to build either a new line to Moyer, making a loop with the present line out Main Street, or to build the line to Broad Ford, the right of way for which has already been secured and the final survey made. All the bridges, nine in number, have already been completed for the latter line. The franchise is asked for in the name of the Connellsville Electric Traction Company. The company's line from Fairchance to Mount Pleasant is now connected up with the exception of the big viaduct between Everson and Scottdale, a distance of 30 miles. From Fairchance to Uniontown the distance is 5 miles; from Uniontown to Dunbar, 9 miles; from Dunbar to Connellsville, 4 miles; from Connellsville to Scottdale, 7 miles; from Scottdale to Mount Pleasant, 5 miles. Besides this, the company's branch lines reach in all directions. The tracks are now laid to the edge of Vanderbilt and the Leisenring lines have been busy hauling passengers for a year.

CONNELLSVILLE, PA.—The first car was run over the tracks of the Pittsburg, McKeesport & Connellsville Electric Railway from Connellsville to Uniontown July 1. The Vanderbilt line is also in service.

DOYLESTOWN, PA.—The Bedminster Railway Company, capital $15,000, has been chartered to build an electric line 2½ miles long from Bedminster over the Frenchtown Road to the tracks of the Philadelphia & Easton Railway Company, on Durham Road, Bedminster Turnpike. This line will be a spur of the Philadelphia & Easton system. The incorporators are: Isaac R. Rosenberger, of Colmar, president; Lewis Keller, Dr. N. S. Nonamaker, John S. Bissey and John H. Nickel, of Bedminster; Charles R. Rosenberger, of Colmar; Harry J. Shoemaker and Samuel A. Hellyer, of Doylestown; Aaron Kratz, of Plumsteadville, and L. P. Muthart, of Allentown.

FREELAND, PA.—The Freeland Electric Coach Company has been organized to operate a trackless trolley line from this place to Upper Lehigh, St. Johns, Eckley, Sandy Run and other towns. The officers are: President, Hugh Malloy; vice-president, Albert Goeppert; secretary, S. J. Neuberger; treasurer, M. Schwabe; directors, Hugh Malloy, A. Goeppert, S. J. Neuberger, M. Schwabe, A. Oswald, of Freeland, and Harry W. Davis, of Wilmington, Del.

GETTYSBURG, PA.—Engineers have begun the preliminary surveys for the proposed electric railway between Mount Holly Springs and Gettysburg via Biglerville and Bendersville.

HARRISBURG, PA.—The East Harrisburg Passenger Railway Company, which is operated by the Harrisburg Traction Company, has filed notice at the State Department of extensions of its tracks on a number of city streets and to Dauphin and Penbrook. The extensions embrace all of the territory covered by the charter issued to the Dauphin County Street Railway Company two years ago, but whose franchises have lapsed because permission to build the lines was not secured from the local authorities, as required by law.

HUMMELSTOWN, PA.—The Borough Council has granted a franchise to the Palmyra & Hummelstown Electric Railway Company.

HARRISBURG, PA.—A charter was granted July 9 to the Central Pennsylvania Traction Company, capital $2,100,000, which will take over the lines of the Harrisburg Traction Company by August. The directors are: T. C. Calder, Edward Bailey, James M. Cameron, E. Z. Wallower, A. G. Knisely, H. A. Kelker, Dr. W. H. Seibert, James Russ, George W. Reily, B. F Meyers, E. E. Walz, S. F. Dunkle, Harris Cohen, E. C. Felton, E. W. S. Parthemore. Edward Bailey is president; W. G. Calder, secretary and treasurer, and Frank Musser, general manager. The stock is divided into 42,000 shares, the par value of $50 each. It is stated that the property of the Harrisburg & Mechanicsburg Electric Railway Company, with lines to Riverton, New Cumberland, Shiermanstown, Mechanicsburg, Camp Hill, Wamleysburg, West Fairview and Marysville will be acquired by the new company shortly. The company is now building an extension from Progress to Linglestown, and has extensions to Hummelstown and Dauphin projected. New machinery will be installed at the power plant and new rolling stock secured.

HARRISBURG, PA.—Gov. Pennypacker has been holding under advisement the granting of charters to the Central Pennsylvania Rapid Transit Company, the corporation which is to take over the Harrisburg Traction Company and the South Broad Street Railway Company, of Philadelphia; the former until he is assured by the Attorney-General that the powers of the Harrisburg Traction Company can be so enlarged in the charter asked for as to cover territory outside of Dauphin County, and the latter, because the description of the route proposed was rather vague. It is understood that both charters will be issued in a few days, however.

HARRISBURG, PA.—A charter has been issued to the Wilkinsburg, Turtle Creek & East Pittsburg Railway, capital $36,000, to build 6 miles of road in Allegheny County. The line will extend from Penn Avenue and Hay Street, Wilkinsburg, along Hay Street to South Avenue, thence to Johnson, to Penn Avenue, to the borough line of Wilkinsburg; thence along the Greensburg Pike to Turtle Creek at the Penn Avenue intersection; thence along Penn Avenue to Brown. The officers are: President, Thomas Gearing; directors, E. J. Kent, George McClelland, C. G. Kiscadden, M. Doganiere, all of Pittsburg.

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HARRISBURG, PA.—The East Harrisburg Passenger Railway Company, which is operated by the Harrisburg Traction Company and will be operated by the New Central Pennsylvania Traction Company, has filed notice at the State Department of an extension of its tracks covering all of the territory of the new Dauphin County Street Passenger Railway Company. The Dauphin Company was chartered two years ago, but its franchises have lapsed, as permission to build its line was not secured from the local authorities as required by law.

HAZLETON, PA.—Surveys are being made for the new electric railway between Hazleton, Weatherly and Mauch Chunk. The company, of which Frank W. Larned, of Wilkesbarre, is president, expects to secure right of way through Beaver Meadow. By failing to comply with the terms of the ordinance granting the company a franchise in this city the promoters sacrificed all rights in this city.

HOMESTEAD, PA.—An electric railway is to be built from Hays Borough south to Currys Station, a distance of about 6 miles. The right of way has been secured by E. W. Curran, of Homestead. The capital of the new company is $36,000. The officers of the company are: President, F. N. McKinney, of Pittsburg; secretary, F. W. Curran, of Homestead.

IRWIN, PA.—It is announced that the Pittsburg, McKeesport & Greensburg Traction Company has obtained right of way along the original survey between this place and Manor, and will abandon the old line at the Union Cemetery, building a spur to connect with the line already surveyed from West Newton through Herminie, Madison, Edna and Adamsburg, and out to the Pittsburg-Greensburg Pike. The line will eventually reach McKeesport via White Oak Level.

LANCASTER, PA.—The Lancaster County Railway & Light Company has leased the line of the Lancaster & Rocky Springs Railway Company.

MEADVILLE, PA.—Ten surveyors have begun work on the proposed system of the Cleveland, Geneva & Meadville Electric Railway Company, from Geneva to Meadville, a distance of 45 miles. It is expected to complete the surveys in about six weeks, the line as contemplated being almost straight. Two other lines are seeking entrance into Meadville.

MECHANICSBURG, PA.—An effort is being made to interest New York capitalists in a scheme to merge several local trolley companies into one company, which would build a line from Steelton to Mechanicsburg by way of New Cumberland and Bowmansdale, and also a line from Bowmansdale to Dillsburg, making a total mileage of 23 miles.

PITTSBURG, PA.—The new Atlantic Avenue Street Railway Company has secured a franchise to operate on both North and South Atlantic Avenue, in Pittsburg. The company is backed by the same men who have been promoting the new electric system in that city, and who now have grants for a dozen new lines.

PITTSBURG, PA.—An electric railway system is to be built between Avalon and Freedom, in the Ohio Valley. It is the project of officials of the Pennsylvania Railroad. Ordinances asking the right of way are pending in Ben Avon, Emsworth and other Borough Councils. Mr. Taylor, fourth vice-president of the Pennsylvania Company, says: "The Pennsylvania Company is not in the trolley business, and has not heretofore favored the introduction of trolley lines into the Sewickley Valley, but on account of the recent location of large industries at Leetsdale and Ambridge, it is thought that the building of a street railway system is a necessity. The Pennsylvania Company is prepared to withdraw any opposition that it had heretofore exerted, and will use its influence toward securing the construction of an electric street railway, provided that it is of up-to-date construction and operated so as to assist in building up the community through which it will pass."

POTTSTOWN, PA.—It is reported that the Pottstown & Reading Street Railway has closed all contracts for material, and that the construction of the road, which will form the connecting link by electric railway between Philadelphia and Reading, will be started at once.

SHAMOKIN, PA.—An extensive addition is being built to the car house of the Shamokin & Mount Carmel Electric Railway.

SHAMOKIN, PA.—It is proposed to extend the Shamokin & Edgewood Electric Railway to Trevorton and Herndon, connecting at the latter place with the Sunbury lines, which will in turn connect with Northumberland, Milton, Danville and Lewisburg, all of which lines are to be combined in one company. A large new pavilion is to be built at Edgewood Park.

SHENANDOAH, PA.—The Council has refused the Shenandoah Suburban Electric Railway Company a franchise because of the objections of a number of property owners. The company will proceed, however, next spring with the construction of a line from Shenandoah toward Hazleton.

SCRANTON, PA.—Select Council has passed the Dalton Street Railway ordinance, which has, however, been held up in Common Council.

WASHINGTON, PA.—The Washington & Canonsburg Electric Railway, running between Washington and Cannonsburg, has been placed in operation. The line is 10 miles long, and was built by Pittsburg capital. It is said that the intention is to extend the line in one direction to Pittsburg, and in the other to Wheeling, W. Va.

WILKESBARRE, PA.—The Lackawanna & Wyoming Valley Railway Company has begun the erection of its terminal buildings in this city, including a brick freight station 40 ft. x 100 ft. and a passenger station on Market Street costing $40,000. Westinghouse, Church, Kerr & Company, New York, are erecting the freight station. The abutments for the bridges and the up-raffing along the river are about completed, and the workmen are divided into day and night shifts. It is expected to have the line in operation to this city by Jan. 1.

YORK, PA.—The Gettysburg Battlefield Electric Railway, which was recently sold by the Gettysburg Transit Company to Philadelphia capitalists, will be extended to Westminster, Md. The line will run by way of Littles town.

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A. T. WHITSEL, Wabash Engineer.

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EASTON, PA.—The ordinance granting a franchise to the Easton & Washington Trolley Company has passed first reading in Phillipsburg Council. A protest has been filed against the ordinance by the Easton Traction Company, Easton Consolidated Electric Company, the Lehigh Valley Traction Company and the Phillipsburg Horse Car Company, based on the act of March 27, 1896, prohibiting the building within two blocks of a street railway parallel to an existing street railway, except for a distance of 200 ft.

NASHVILLE, TENN.—The Tennessee Western Railway Company has been incorporated, with $100,000 capital stock, to construct a railroad from Humboldt, Gibson County, to Alamo, in Crockette County, a distance of about 40 miles. A portion of the line will extend over to Dyer County, and it is thought this means ultimate extension to the Mississippi River. The line may go over as far as Brownsville, in Haywood County. It will tap two leading trunk lines. The plans may call for a steam railway, but all the gentlemen in the enterprise have lately been identified with electric railway enterprises. They are Pittsburg and Nashville parties. Part of the personnel of the company is interested in the interurban line to be constructed between Nashville and Columbia. The incorporators of the company are: W. H. Skevington, J. H. Connor, Albert Akers, James Brown and Bradley Walker.

SALT LAKE, UTAH.—Plans are being perfected by the Consolidated Railway & Power Company for the removal of its car houses and power station from their present location on Second East Street to a point in the western part of the city beyond the Jordan River. The size of the tract of land purchased affords ample room for car houses and every other building or improvement that will be needed by the company.

NORFOLK, VA.—The Chesapeake Transit Company has increased its capital stock from $500,000 to $630,000. The additional capital is to be used for the construction of more cars and other equipment. One feature of the additional equipment is to be an electric locomotive and another is to be a booster.

SEATTLE, WASH.—The differences between the Seattle Electric Company and the linemen's union, which have been on for the past eight or nine months, have been finally and amicably adjusted.

CHARLESTON, W. VA.—The Kanawha Water & Light Company, which proposes to build an electric railway to connect Charleston with Montgomery, St. Albans and a number of other towns in the Kanawha Valley, has been granted a franchise by the Council of Charleston to run its track on a number of the principal streets.

MORGANTOWN, W. VA.—Surveys have been started on the proposed electric railway from Morgantown to Granville. The Union Utility Company is having the surveys made. It will build the line under the charter recently granted the Fairmont, Morgantown & Cheat River Trolley Company, and they will operate it together. The latter company will build from Fairmont to a point at or below Rivesville this summer, and will connect Fairmont and Morgantown next year.

EAU CLAIRE, WIS.—The Chippewa Valley Electric Railroad Company has asked the Common Council of Menominee to pass a franchise giving the company the right to operate an electric line in the city of Menominee.

FOND DU LAC, WIS.—The Fond du Lac & Northwestern Railway Company has been incorporated to construct and operate an interurban railroad from Fond du Lac to Manitowoc and Appleton. The line is to start in Fond du Lac and extend northerly and northeasterly through Fond du Lac, Taycheedah and Calumet, in Fond du Lac County, to the northerly line of Calumet; thence in a northerly direction through Brothertown and Chilton, in Calumet County, to the city of Chilton; thence in an easterly direction across Charlestown to the east line of Calumet County; thence through Eaton, Liberty, Cato, Manitowoc Rapids and Manitowoc, in Manitowoc County, to the city of Manitowoc, also extending in a northerly direction in the town of Brothertown, Calumet County, through Stockbridge and Harrison to Appleton and Kaukauna. The line is to follow the highways as much as possible. The incorporators are: W. H. Phillips, H. W. Wilson, Franklin Phillips, J. E. McMullen and F. H. Sweet.

LA CROSSE, WIS.—The La Crosse & Black River Electric Railroad Company, which proposes to build between La Crosse and Black River Falls, has made application for a franchise. The construction of the road will begin in the fall, and it will cost $1,000,000. The road is incorporated temporarily at $500,000.

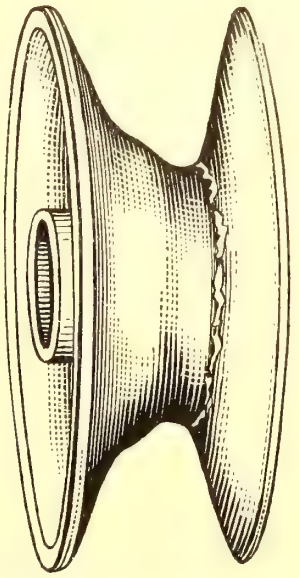
MADISON, WIS.—The Fond du Lac & Northeastern Railway Company is building an electric line from Fond du Lac to Appleton and Kaukauna. The capital stock of the corporation is $10,000. The route of the proposed new line is from Fond du Lac northeast through the towns of Fond du Lac, Taycheedah and Calumet, through the towns of Brothertown and Chilton in Calumet County to the east line of Calumet County; thence through the towns of Eaton, Liberty, Cato, Manitowoc Rapids and Manitowoc Town to the city of Manitowoc; thence through the towns of Stockbridge and Harrison to the cities of Appleton and Kaukauna.

MILWAUKEE, WIS.—The Milwaukee Street Railway & Light Company will build a line on Lisbon Avenue.

MILWAUKEE, WIS.—Attorney W. J. McElroy is authority for the statement that the electric railway contemplated by the Withee & Maplehurst Electric Railway & Light Company, recently incorporated, will eventually connect with the Soo and Omaha roads. The right of way for the line is now being secured.

MILWAUKEE, WIS.—It is said that the Milwaukee Heat, Light & Traction Company will renew its application for a franchise in the city of Wauwatosa, which was withdrawn a few weeks ago, owing to the opposition of certain citizens who, when the franchise was about to be accepted, made a sudden demand for a decrease in the rate of fare.

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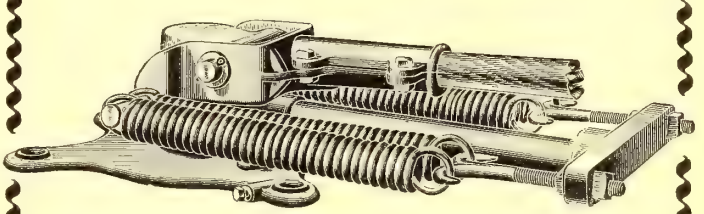
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CANADIAN NOTES

WINNIPEG, MAN.—Last week the first car built in the shops of the Winnipeg Street Railway Company left the shops of the company. It is one of the many cars which the company intends to build in Winnipeg this year, and is superior to anything at present in service. It is of the open type, and is by far the largest car of that type at present operated in Winnipeg. It is 36 ft. long with eighteen seats, giving a seating capacity of ninety persons, and a total carrying capacity of more than 150 passengers. The car is mounted on double trucks, each equipped with two motors.

SYDNEY, N. S.—The Cape Breton Coal, Iron & Railway Company will build an electric railway from the mines to the docks at Mira Bay, a distance of 5 miles.

PORT ARTHUR, ONT.—A by-law to raise funds to extend the electric street railway to Current River will be voted on July 28.

TORONTO, ONT.—At a recent meeting of the directors of the Toronto Street Railway Company, Frederick Nichols was elected vice-president in the place of James Ross, resigned.

NEWS NOTES

SAN FRANCISCO, CAL.—Plans, specifications and cost estimates for the reconstruction and new equipment of the Geary Street, Park & Ocean Railroad have been filed by the Board of Public Works. It is estimated that the entire cost will be $751,000, and that the total receipts will be from $175,000 to $200,000 annually. The expenses are put at $202,850, in addition to which money would need to be put aside to create a sinking fund for bond redemption. The question of the purchase of the road will soon be submitted to the voters at a special election.

SAN JOSE, CAL.—The differences between the San Jose & Santa Clara Railroad and its employees regarding wages and conditions of service have been amicably adjusted. The terms of the settlement are that the men shall receive 21 cents an hour and 25 cents for overtime, ten hours to constitute a day's work. Heretofore the men have received a flat rate of pay.

OAKLAND, MAINE.—The Waterville & Oakland Electric Railway has been opened.

BOSTON, MASS.—The Massachusetts Railroad Commission held a hearing on July 6 in reference to the petition of the Boston & Worcester Street Railway Company for authority to issue bonds to the amount of $1,000,000 and additional capital stock of $250,000, the present capital stock being $1,000,000. President William H. Butler stated that the money was desired for paying off floating indebtedness. G. W. Townsend, an engineer, who has been making an inventory of the property, filed a statement showing that there had been expended $2,595,843.32. Treasurer Butman filed a statement showing the assets and liabilities to be $2,657,854.72. The commission asked for a more detailed financial statement, which will be submitted in a few days.

ST. LOUIS MO.—The St. Louis Transit Company has closed a ten-year contract with the Union Electric Light & Power Company for the use of approximately 12,000 hp per day. Delivery of this power will commence on May 1, 1904. The closing of this contract indicates the abandonment of the plans outlined a few months ago, whereby the St. Louis Transit Company was to establish a power house on the East Side.

CRAWFORDSVILLE, IND.—The litigation between the Indianapolis & Northwestern Traction Company and the Consolidated Traction Company in regard to the laying of tracks in Crawfordsville has, by motion of the latter company, been removed to the United States Court.

BROOKLYN, N. Y.—The Postoffice Department has issued a fraud order against the American Street Car Transportation Company of Brooklyn. The company advertised to sell for one cent each, tickets good on any electric and elevated street car in the United States. This it did by an "endless chain" scheme, whereby, in order to obtain 25 cents worth of one-cent tickets, it would be necessary for the applicant to sell three "introductions" at 25 cents each to his friends, and for each of the three friends to return their "introductions" to the company with 75 cents, with which to supply in turn three of their friends, with "introductions." The company operated in many cities, and by its methods caused street railway managers much annoyance.

CINCINNATI, OHIO.—The Council has decided that the franchises of the Cincinnati Street Railway Company, which are expiring, are not subject to public sale and cannot be offered, in view of the litigation which is pending in connection with the validity of the Rogers law, under which the company holds a fifty-year franchise.

BEAUMONT, TEX.—The employees of the Beaumont Street Railway Company are on strike. The rate of wages is 20 cents an hour, but the men are not satisfied. The strike was precipitated without warning, and the residents of the city are thoroughly incensed at what they term the high-handed action of the men.

FINANCIAL NOTES

CHICAGO, ILL.—The chairman of the creditors' committee of the National Bank of Illinois has sent out a circular letter to the depositors of the Calumet Electric Railway, endorsing the plan for taking the road out of the hands of the receiver and exchanging its stock for the claims of the bank's creditors. Messrs. Cobe and McKinnon have announced that they are ready to take up the question of reorganizing the Calumet Electric. Their plan, briefly stated, provides for the purchase of the property and all of the other assets of the National Bank of Illinois now in the hands of the receiver in behalf of the certificate holders who join in such a way as to free the road

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from the bonded indebtedness. Messrs. Cobe and McKinnon have asked that the certificates be deposited with the Chicago Title & Trust Company, as trustee, as an evidence of the desire to carry out a plan.

CHICAGO, ILL.—It is announced that the Lake Street Elevated Railroad securities committee has secured sufficient deposits of stock to warrant its proceeding with its reorganization plan. Pending the preparation of such a plan the committee has adopted resolutions extending the time for depositing the securities to Sept. 15, 1903.

ANDERSON, IND.—A mortgage for $5,000,000 by the Indiana Union Traction Company to the Girard Trust Company, of Philadelphia, has been filed for record here. It secures a bond issue by the Indiana Company and is payable thirty years from July 1, 1903, with 5 per cent interest, and redeemable any time after five years from date at $1.05 and accrued interest. The mortgage covers existing systems leased by this company and for such additional lines as it may build in eighty counties named out of ninety-two in Indiana.

LAFAYETTE, IND.—The directors of the Lafayette Street Railway Company have voted to turn the road over to the Fort Wayne, Logansport & Lafayette Traction Company. Superintendent C. D. Emmons, of the Lafayette Company, will become general manager of the Traction Company, with headquarters at Fort Wayne. This is the beginning of the merger system.

LOUISVILLE, KY.—Work on the Blue Grass Consolidated Traction Company's lines has been suspended and the office here has been closed. The office furniture and fixtures have been attached for $2,700, and nothing definite can be learned about the promoters. It is said unofficially that a new company will be organized to complete the roads.

BALTIMORE, MD.—Upon the application of the Cleveland Construction Company, of Cleveland, Ohio, Judge Morris, of the United States District Court, has appointed James Christy, Jr., of Akron, Ohio, and George Weems Williams, of Baltimore, receivers of the Washington, Baltimore & Annapolis Electric Railway Compay. Receivers will also be appointed in the District of Columbia. The bill alleges that the construction company entered into a contract with the railway company to furnish plans and specifications for the road, and also to design and supervise the construction of cars. The railway company has an authorized capital stock of $2,000,000, and was chartered to build an electric railway between Baltimore and Annapolis and Washington. The road between Baltimore and Washington is now being constructed, and large sums of money have been spent upon it. The company alleges that it is a creditor to the amount of $9,300.46 by virtue of the contract. This amount has been demanded and not paid. It is alleged that the railway company is now insolvent and is unable to pay its liabilities. An answer was filed by the railway company admitting the allegations and assenting to the appointment of receivers.

NEWTON, MASS.—The Railroad Commission has authorized the Newton Street Railway Company to issue $185,000 additional capital stock for payment of floating indebtednes. The Board determines that the value at which the new stock shall be offered proportionately to stockholders is $125 per share. The previous issue of stock by this company was authorized on Dec. 11, 1896, when the Railroad Commissioners authorized $105,000 to be sold at $120 per share.

DETROIT, MICH.—The United States Circuit Court at Detroit has ordered the discharge of the receiver of the Detroit & Toledo Shore Line Railroad. Control of the company is now held by the Grand Trunk Western Railway and the Toledo, St. Louis & Western Railroad, which own the entire stock, and jointly guarantee the bonds, principal and interest by endorsement.

ST. LOUIS, MO.—According to the report of the auditor of the St. Louis Transit Company, the gross earnings of the company for June were $645,589, as against $557,114 during the same month last year. This shows a gain on the gross earnings of $88,475. The June earnings bring the total gross earnings of the company for the first six months of this year up to about $3,467,249. During the first half of 1902 the gross earnings were $3,014,686. This shows a gross gain of $471,060 for the first six months of 1903 over the same period in 1902.

JERSEY CITY, N. J.—The Consolidated Traction of New Jersey has declared a dividend of 1½ per cent, payable as registered June 30.

HUDSON, N. Y.—Permission has been granted by the State Railroad Commissioners to the Albany & Hudson Railroad Company to issue $150,000 additional bonds for improvements.

NEW YORK, N. Y.—It is reported that the proposed deal between the American Light & Traction Company and the United Gas Improvement Company, of Philadelphia, has been abandoned. Under the deal, the American Company was to have been leased to the Improvement Company on a 6 per cent guarantee on the stock of the former.

COLUMBUS, OHIO.—The stockholders of the Central Market Street Railway Company will meet Aug. 1 to act upon the question of leasing to the Columbus, London & Springfield Railway Company the right to operate its through cars on the tracks of the Central Market Street Railway Company in Columbus, and to act upon a proposition of the Columbus, London & Springfield Railway Company "to guarantee the payment of principal and interest of 500 twenty-year 5 per cent gold bonds of $1,000 each, issued by the Central Market Company.

PHILADELPHIA, PA.—A 5 per cent mortgage for $5,000,000 by the Union Traction Company, of Indiana, to the Girard Trust Company, payable thirty years from July 1, to cover electric railways in eight counties of Indiana, has been filed.

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AMONG THE MANUFACTURERS

H. F. SANVILLE, of Philadelphia, Pa., has been fortunate in securing the services of A. E. Meixell to sell his various lines of street railway supplies on the road. Mr. Meixell was until very recently superintendent of the Fairmount Park Transportation Company. He has just returned from his maiden trip, on which he met with very decided success.

C. HUDSON MACHEN, sales engineer, representing the Cutter Electrical & Manufacturing Company, of Philadelphia, announces that he is prepared to submit blue prints and give any information required relative to I-T-E circuit breakers and Keystone measuring instruments. His office is at 120 Liberty Street, New York City; telephone No. 1130 Cortlandt.

C. J. HARRINGTON will open within the next few days a Southern office and sample room at Richmond, Va., in charge of F. Boykin Jacobs. As is well known, Mr. Harrington is handling an excellent line of electric railway material and supplies, and this fact, coupled with Mr. Jacobs' wide acquaintance throughout the South, will doubtless result in a very satisfactory increase in Mr. Harrington's business through the Southern States.

THE TAYLOR ELECTRIC TRUCK COMPANY, of Troy, N. Y., has recently engaged Frank M. Nicholl, of Rochester, N. Y., to represent the company as salesman of the well-known Taylor trucks in the Central and Middle West. Mr. Nicholl is the son of T. J. Nicholl, president of the Rochester Railway Company, and has had considerable experience in railway work, having been associated with his father for some time in the Rochester Railway Company.

THE BURT MANUFACTURING COMPANY, of Akron, Ohio, recently received its twelfth order for exhaust heads from the Baldwin Locomotive Works. The order this time was for twelve heads, making a total of thirty-three now in use by the Baldwin Works. The Burt exhaust head is an appliance made to fit over the end of the exhaust steam pipe, and while allowing the dry steam to escape, effectually prevents oil, water or wet steam from getting out to rot roofs and disfigure walls. A booklet, describing the Burt exhaust head, will be sent by the Burt Manufacturing Company to anyone asking for it.

THE HELENA LIGHT & TRACTION COMPANY is building a new power house at Helena, Mont., which will be equipped with Westinghouse apparatus throughout, a portion of which has recently been ordered from the Westinghouse Electric & Manufacturing Company, the remainder having been in use for some time. The electrical equipment consists of two 75-kw direct-current generators, each to be direct coupled to a 100-hp type C induction motor; two 15-hp motor-generator sets; nine 10,000-volt transformers—six of 150 kw and three of 125-kw capacity; also two 175-kw rotaries. Three 150-kw and three 125-kw transformers will be equipped with a face plate for obtaining different voltages from the transformers, this dial being connected to the low tension circuit to give variation of voltage between 2400 volts and 2050 volts. Seventeen low-tension leads are brought out from the secondary winding, one lead directly connected into the line, and another lead connected to the spark gap, the remaining fifteen connected to the regulator face plate outside of the transformer case. This allows the purchaser to secure proper voltage regulation for extreme variation in load without changing the voltage at the Missouri River Company's station, 14 miles distant.

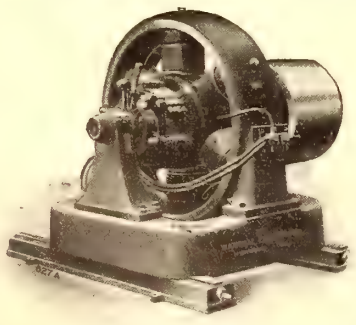
EDGAR PECKHAM, president of the Peckham Manufacturing Company, has written an open letter to the Kingston Daily Freeman, of Kingston, N. Y., disposing of the labor trouble rumors which have been current regarding the Kingston works of the company. It appears that about two months ago, when the company's works were very busy and working nights, a number of the blacksmiths organized a labor union. They tried to get other employees to do likewise, but had small success. The situation became so strained, however, that it was necessary to take some action to sustain the loyal employees. When the works were re-opened, after taking the annual inventory, notice was given to the men that they might apply for work by signing printed applications. Most of the employees applied for reinstatement, and in choosing the men the company selected those who had remained loyal to the company and who belonged to no labor union. The works are now running in all departments, and will continue to run all summer with non-union employees. The employees of the Peckham Manufacturing Company work under very favorable conditions and have no cause for dissatisfaction. The whole trouble appears to have been caused by a few "loafers." The company is determined, however, that it will manage its works in its own way, and will accept no dictation from any labor unions.

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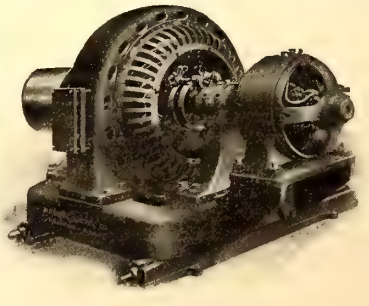
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RICHMOND, IND.—A survey is being made of the Eastern Indiana Traction Company's line from here to Marion by way of Ridgeville.

SEYMOUR, IND.—Mark Storen, of Scottsburg, and Joseph H. Shea, of Seymour, have been granted a franchise for an electric railway through Scottsburg. They hold a franchise through Scott County, and promise to have a line in operation within three years.

SOUTH BEND, IND.—The County Commissioners have granted a franchise to the Northern Traction Company, of Indiana, formerly the Hobart & Western Electric Railway Company, to operate in St. Joseph County. The company proposes to build an electric railway between South Bend and Laporte. The company has not as yet accepted the franchise, but has ten days in which to file a written acceptance.

TERRE HAUTE, IND.—The Terre Haute Electric Company has purchased a lot on the river front between Mulberry and Eagle Streets, and will soon erect a new power plant. The new location will enable the company to build a much larger plant than the present one, and will be on the railroad.

DAVENPORT, IA.—Rumor has it that a contract has been let to the J. P. Calnan Construction Company, of Clinton, for building what has been known as the John U. May interurban line, which is to extend from Le Claire to Clinton.

MARSHALLTOWN, IA.—The Toledo Electric Railway Company is figuring on an extension of its system to Grinnell on the south and through Traer to Waterloo on the north. Part of the surveys have been made.

MUSCATINE, IA.—The Citizens' Railway & Light Company has made a proposition to the lighting committee of the city in which it proposes rates for gas and electricity to the public and to private consumers, stating, if an acceptance is made, that the street car service will be extended to Weed Park; that an extension will be made on Lucas to Newell Avenue, and also to a school house in Musserville.

WICHITA, KAN.—The Arkansas Valley Interurban Railway Company has been chartered to build an electric railway from Wichita, southeasterly to Oxford, 37 miles, thence east to Winfield, 10 miles; west to Wellington, 14 miles; south to Geuda Springs, 12 miles, and to Arkansas City, 10 miles farther. The total length of the line will be 83 miles. The main power station will be at Oxford, where it is believed there is sufficient water-power to run the whole line, unless it may be a month or two in summer, when they will possibly need a small steam plant as an auxiliary. The water-power is to be taken from the Arkansas River, which is estimated to furnish 2200 hp at ordinary low water, and 1500 hp is the amount estimated to run the road. The company is capitalized at $1,000,000, and most of the stock is subscribed. Local capital alone is interested so far. The company expects to carry both passengers and freight, and furnish electric lights and power for the towns along the line. Mr. Boyle, the president of the company, is also the general manager, and he is pushing preparations as fast as possible toward completion of specifications, which it is hoped will be ready in a few weeks. The officers of the company are: O. A. Boyle, president; William Allison, vice-president; J. E. Howard, secretary; C. L. Davidson, treasurer. All the officers are residents of Wichita.

FRANKFORT, KY.—W. S. Louge, of Cleveland, Ohio, said to be representing Pennsylvania capitalists, has purchased of the city a twenty-year franchise for the operation of an electric street passenger and express railway in Frankfort. He paid $300 for the franchise.

THIBODAUX, LA.—It is said that within sixty days work will be begun upon the proposed third-rail electric railway between Thibodaux and Donaldsville and the important towns down the Gulf Coast. The road will be 124 miles long. C. P. Young, at one time connected with the Milwaukee Electric Railway & Light Company and later connected with the Galveston Electric Street Railway, is said to be the principal promoter of the project.

PRESQUE ISLE, MAINE.—The town has voted to purchase $10,000 of the preferred stock of the Aroostock Valley Railroad, which assumes the building of the electric railway to Washburn and Perham.

BOSTON, MASS.—The work of laying the tracks for the cars of the Boston Elevated Railway on South Huntington Avenue, Jamaica Plain, has been completed. This avenue connects Centre Street, Jamaica Plain and Brookline village, and is a great convenience for the residents of Jamaica Plain and Roxbury. The actual running time from the stables at Jamaica Plain to the corner of Massachusetts Avenue and Huntington Avenue is about 25 minutes, and from there to the subway station at Boylston Street the run is made in about 15 minutes.

FITCHBURG, MASS.—A director of the Leominster, Ayer & Shirley Street Railway is authority for the statement that that line will be built from North Leominster to Ayer this year. The line is 9 miles long. It is also stated that the Lowell & Ayer Street Railway, in which the same persons are interested, will be built this year.

SPRINGFIELD, MASS.—The Aldermen have granted to the Springfield Suburban Street Railway Company locations from Indian Orchard into the center of the city, for which a petition was brought several months ago. The locations are entirely independent of the Springfield Street Railway Company, which controls all the existing street railway inlets to the city. Fred T. Ley, for the company, has made a cash deposit of $10,000, and has filed a bond of $50,000 to insure the building of the new line within eighteen months after the franchise has been accepted. Strenuous opposition was made to the granting of a franchise to the Springfield Suburban Company by the Springfield Street Railway Company, and the matter aroused a great deal of public interest during the months it has been under consideration. The Springfield Street Railway Company petitioned for locations over practically the same territory in an effort to forestall the granting of the locations to the new company, but so far no action has been taken on this petition, except to give a hearing. It is intimated that the old company will not give up its fight now, but will oppose the approval of the franchise by the Railroad Commission. To carry out the conditions stipulated in the franchise the Springfield Suburban Street Railway Company will have to spend $60,000 outside of the actual construction of the road. The conditions imposed in the original draft of the franchise called for an expenditure of $112,000, according to the estimates made, but this was reduced on the claim of the company that the conditions were prohibitive. The Aldermen were not unanimous in granting the franchise, three out of the eight members voting against it. It is announced in Springfield that the Springfield Street Railway Company is likely to make an extension of its line into Wilbraham, which is in the general direction of the line proposed by the Springfield Suburban Street Railway Company and the existing line of the Springfield & Eastern Street Railway Company, an allied company.

WORCESTER, MASS.—The Worcester & Providence Street Railway Company has come to an agreement with the Selectmen of Millbury in regard to locations. This was the only Massachusetts town in which the company had failed to secure locations, and the delay has been such that extensions of time will have to be asked for in other towns.

WORCESTER, MASS.—The Worcester Consolidated Street Railway Company has petitioned the Selectmen of West Boyleston for locations in that town for a new line between Worcester and Leominster.

WORCESTER, MASS.—Locations have been granted the Hartford & Worcester Street Railway Company in the towns of Holland and Brimfield, and the company has petitioned the Railroad Commissioners for approval of locations.

HOUGHTON, MICH.—The Houghton County Street Railway Company has been granted a franchise through Torch Lake for a line from Lake Linden to Tamarack City.

LANSING, MICH.—The Lansing, St. Johns & St. Louis Electric Railway Company is now trying to secure a new franchise in St. Johns.

RICHLAND, MICH.—The Township Board has granted a franchise to the Grand Rapids & Southern Michigan Traction Company by the terms of which if accepted, Richland will be assured of an electric railway to Kalamazoo on or before the first of July next.

MINNEAPOLIS, MINN.—Henry C. Hanke and Edwin J. Forster have petitioned the County Commissioners for a franchise for the construction of an electric railway from Minneapolis through Robbinsdale, Osseo and Champlin to Anoka. It is the intention of the promoters to connect with the Twin City Rapid Transit Company's line now running to Robbinsdale.

MINNEAPOLIS, MINN.—The Journal says that the Twin City Rapid Transit Company will build an office and power building on the lots recently bought of C. G. Goodrich at Wabasha Street and College Avenue, St. Paul. According to the Journal, it is expected that the improvements to this corner by the street railway company will cost $100,000.

HATTIESBURG, MISS.—The Hattiesburg Power & Light Company has applied for a fifty-year franchise for a street railway system.

KANSAS CITY, MO.—The Board of County Commissioners of Wyandotte County has granted William Lackman an extension of five months in the time allowed him in his franchise to complete the electric railway he is building between Rosedale and Olathe. The road is known as the Kansas City & Olathe Electric Railway, and Mr. Lackman was granted a franchise through Wyandotte County by the Commissioners on Aug. 25, 1902. Under its terms the road was to be in operation by Jan. 1, 1904. In his application for an extension Mr. Lackman told the Commissioners that he had graded the roadbed through all of Wyandotte County and for 8 miles in Jackson County: that he had built all the bridges and culverts so far required in Wyandotte County, and all but one in Johnson County, but that it would be impossible to have the road completed within the specified time. The time allowed for the completion of the road is now June 1, 1904, and the same limit has been fixed in an extension granted by the Commissioners of Johnson County.

LINCOLN, NEB.—Articles of incorporation have been filed for the Sioux City, Homer & Southern Railway as a preliminary to the construction of an interurban electric railway beginning at Sioux City, Ia., and running to Homer, Dakota County, and on south if the promoters so desire. The capital stock is fixed at $500,000, although the articles provide for an increase to $1,000,000. The incorporators are largely Sioux City and Omaha people, including Senator Joseph H. Millard, Postmaster Crow and J. B. Haynes, of Omaha; R. A. Talbot, of Sioux City, and R. S. Hall and C. J. O'Connor, of Homer.

MILLVILLE, N. J.—Official information is lacking, but it is understood that surveys have been made for an electric railway to extend from Millville, paralleling the West Jersey & Seashore Railroad, to Belle Plain, Cape May Court House and Cape May, with branches to Anglesea, Sea Isle City and Ocean City.

ALBANY, N. Y.—The State Railroad Commission has granted authority to the Chautauqua Traction Company, of Jamestown, to build an electric road 14 miles long, from Lakewood to Mayville. The company has a capital of $500,000.

ALBANY, N. Y.—The opposition to the building of the Albany-Catskill Electric Railroad has been withdrawn, and Highway Commissioner Oliver, of the town of Bethlehem, Albany County, who had previously denied the application of the company, has reversed his decision upon the company's modification of its former plan to utilize the highway. The road will begin construction next Spring, and will run its line just west of the highway. The distance is about 35 miles.

ALBANY, N. Y.—The Albany & Hudson Railway Company has secured permission from the State Railroad Board to issue $150,000 in bonds for making improvements to its line.

BROOKLYN, N. Y.—Plans have been filed in the Building Bureau at Long Island City for new car houses to be erected at the corner of DeKalb and Covert Avenues, Ridgewood, by the Coney Island & Brooklyn Railroad. The building will be of brick, and will cover a space of 105 ft. by 700 ft., and will be one story high.

BROOKLYN, N. Y.—The new elevated structure of the Long Island Railroad on Atlantic Avenue, from Manhattan crossing to the borough line, where it descends to the surface, has been opened to the regular traffic of the road. This is the first section of the big Atlantic Avenue improvement to be completed.

BUFFALO, N. Y.—Seven persons were killed and a score injured in a trolley accident between Lockport and Olcott Beach on July 4.

COHOES, N. Y.—At a meeting held at Crescent, N. Y., for the purpose of forming an electric railway company to connect Schenectady and Cohoes by trolley 250 shares of stock were subscribed for and the following board of directors was selected: William K. Mansfield, E. H. Stiles, D. C. Fry, Peter Smith, Freeman Guyer, James A. Buck, E. H. Shear R. E. Dedrick, C. L. Van Slyke. Subsequently the board of directors elected the following officers: President, James A. Buck; vice-president, Wm. K. Mansfield; secretary and treasurer, R. E. Dedrick. Steps will be taken at once to secure the right of way and franchise, and it is expected that active operations will be commenced in the near future.

CORTLAND, N. Y.—Commissioner of Highways Clarence A. Knapp, of Homer, has decided to grant a franchise to the Cortland County Traction Company to extend its tracks through Homer from its present terminus to a point north of Little York, where the company will locate a new park upon the shore of the lake.

GENEVA, N. Y.—The Geneva, Waterloo, Seneca Falls & Cayuga Lake Traction Company has been granted a franchise in Auburn.

GLENS FALLS, N. Y.—It is said that Plattsburg men have formed a syndicate which has quietly secured the rights of way for an electric railway up the Saranac Valley from that city to Clayburgh, a distance of 20 miles, connecting Morrisonville, Cadyville, Saranac, Moffettsville, Redford and Claysburgh. It is proposed to do both a freight and passenger business.

HEMPSTEAD, N. Y.—The South Shore Traction Company and the New York & Long Island Traction Company have applied to the Highway Commissioners for a franchise through certain sections of the south side of Nassau County. The New York & Long Island Company desires a small grant from Freeport to the easterly line of the town of Massapequa, while the South Shore Company desires a franchise from the city line of the Greater New York, at Valley Stream, through the entire section of the south side of the county, passing through the villages of Lynbrook, Valley Stream, Rockville Centre, Baldwin, Freeport, Merrick, Seaford and several smaller places.

JAMESTOWN, N. Y.—Five gangs of men have begun work at different points between Jamestown and Mayville on the construction of the Chautauqua Traction Company's proposed road. A new power house is being erected in Jamestown and power plants or distributing stations will be erected at Asheville, Stowe and Mayville. The track is already completed between the village of Celoron and Lakewood.

NEW YORK, N. Y.—The contract for sinking the Weehawken shaft of the Hudson River Tunnel of the Pennsylvania Railroad has been filed in the Hudson County Clerk's office at Jersey City. The contracting parties are the Pennsylvania and New Jersey & New York Railroad Companies and the United Engineering & Construction Company, of New York. The work is to be completed by Dec. 8, 1903, the contractors to forfeit $250 for each day's delay.

NEW YORK, N. Y.—Because of objections made by Mayor Low to the form of franchises to be granted to the Manhattan & Hudson Railroad Company, which seeks permission from the Rapid Transit Commission to operate a tunnel under the Hudson River from Jersey City to Cortlandt Street, final action at the meeting of the Board last week was not taken, but the application went over to this week.

ROCHESTER, N. Y.—The construction of the Rochester & Eastern Electric Railroad has been completed from Rochester to Canandaigua, with the exception of the crossover near Victor. The poles are being set at the rate of a mile a day. The power station is completed and is ready for the installation of the machinery. It is expected that the road will be opened from Rochester to Canandaigua by Sept. 1. It will be some time later before the line from Canandaigua to Geneva can be put in operation, but it will probably be officially opened by Nov. 1.

WATERTOWN, N. Y.—The St. Lawrence International Electric Railroad & Land Company is about to begin the extension of its tracks in the village of Alexandria Bay, in order to cover all the territory allowed it by the terms of its old franchise.

CLEVELAND, OHIO.—The Kingsville & Southern Railway Company, of Cleveland, has been incorporated, with $20,000 capital stock, by E. F. Pegg, L. F. McAuley, F. M. Nowak, C. W. Sailtzer and Thos. H. Bell. The company plans to build an electric railway from Kingsville to North Kingsville.

COLUMBUS, OHIO.—The Urbana, Mechanicsburg & Columbus Railway Company has completed its track from the city loop to the bridge over the Scioto River, on Dublin Avenue, and is operating cars over that portion of its line. The grading is finished and ties and rails strung to Arlington, 4 miles out, but the County Commissioners have stopped the company from laying its tracks over the Dublin Avenue bridge until the company has paid the money demanded for the privilege.

LOGAN, OHIO.—The Lancaster, Logan & Nelsonville Traction Company has filed papers of incorporation. The headquarters of the company are to be at Logan, Ohio, and the purpose is to establish an electric railway between the points named. The company incorporated with a capital stock of $10,000, the incorporators being A. Magoon, J. W. Jones, D. A. Bannells and others.

The Climax Stock Guard

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Over 3,000 Guards sold last season

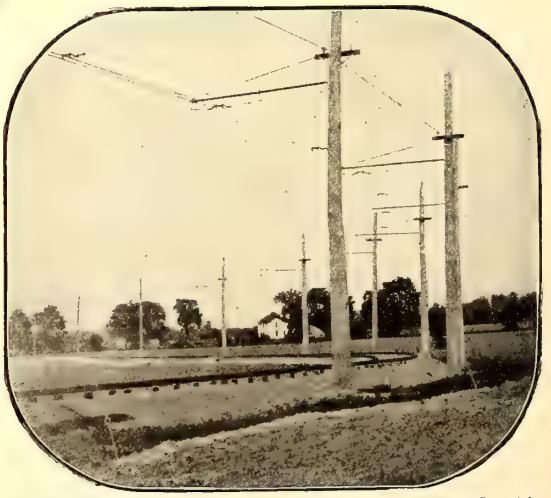
SALES IN MARCH AND APRIL, THIS YEAR:

Aurora, Elgin & Chicago Ry., Elgin Branch	120 Guards
Stark Electric Ry. Alliance, Ohio	120 "
Canton & New Philadelphia R.R., Ohio	90 "
Rochester & Eastern Rapid Ry.	70 "
Long Island Railroad Co.	40 "
Vandegrift Construction Co., Kennett Square, Pa.	25 "
Rock Island System	50 "
	515

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OKLAHOMA CITY, OKLA.—A. H. Claussen, president of the Metropolitan Electric Railway Company, has announced that work on the Guthrie line will be commenced in that city at once.

GUTHRIE, OKLA.—H. G. Beard has been granted a franchise to construct a street railway in Shawnee. Several similar franchises have been granted, but none of them have materialized, but this last is to be started within three months, according to the promise of the promoter.

BAKER CITY, ORE.—Letson Balliet, of San Francisco, owner of the Baker City Traction Company, has placed orders for rails, ties and the necessary grading for 3 miles of electric railway in the city. T. B. Whitted, of Denver, Col., has been retained as consulting engineer, and will make the installation and supervise the erection of the machinery. Power will be obtained from the Baker Gas & Electric Company in the form of alternating current, and will be converted by means of rotary converters to direct current. It is planned to have the railway in operation this summer, and next year extensions will be made to the mining camps in the vicinity.

SALEM, ORE.—The Salem Light, Power & Traction Company, operating a steam-driven plant, has been purchased from the London and San Francisco Bank by Joseph J. Henry, of Denver, owner of ten or twelve other electric properties in the West, who has also purchased the Salem Gas Company and merged the two into the Citizens' Light & Traction Company. A contract has been entered into for a period of years to secure power from the Union Light & Power Company, of Silverton, Ore. T. B. Whitted, of Denver, has been retained as consulting engineer, and contracts have been let for motor-generator sets and complete switchboard equipment for controlling the railway and lighting circuits. The 10 miles of street railway are being rebuilt and the entire system is being brought fully up to date. It is hoped that the improvements will be completed by Jan. 1.

BEAVER, PA.—Ordinances granting franchises to the Beaver & New Brighton Electric Street Railway Company and the Bridgewater Electric Street Railway Company have been presented to the Council and referred to committee. The first-named company desires to build a line between this place and Bridgewater, and the latter company wants to build over a number of the town streets and continue its line across the Ohio River on a bridge to be erected by the Beaver & Monaca Bridge Company.

BRISTOL, PA.—The last move in the famous Croyden fight has been made, and, as forecasted in the STREET RAILWAY JOURNAL some time ago, the Philadelphia, Bristol & Trenton Street Railway will pass in front of the Pennsylvania Railroad station at Croyden at grade. After a long and bitter fight, covering a period of eight years, the Philadelphia, Bristol & Trenton Company won a signal and final victory over the steam railroad company by securing a favorable decision from the Supreme Court as to the validity of the law under which the Bristol & Neshaminy Elevated Railway Company was incorporated. It was proposed to erect an elevated line 1800 ft. long over lands condemned by the Bristol & Nashaminy Elevated Company, and part of the structure was placed in position. Since being bested in all the courts, the Pennsylvania Company has withdrawn its objections to a surface line, and the track is now laid in position. Within a few days cars will be running through without change from the city line of Philadelphia to Morrisville, opposite Trenton. The Pennsylvania Railroad tracks will be changed in Morrisville Borough within the next sixty days, and the Philadelphia, Bristol & Trenton line will then be extended to the New Jersey & Pennsylvania Traction Company's line, a distance of about 400 ft. from the present terminus. If traffic arrangements are made it willl be possible to run cars directly into the center of Trenton.

CHAMBERSBURG, PA.—The Chambersburg & Gettysburg Electric Railway Company will soon begin construction of the remainder of its lines in this city.

CORRY, PA.—The Erie, Cambridge, Union & Corry Traction Company has purchased the abandoned Clark & Warren refinery site, where its power house and car houses will be built. This road has accepted the local franchise, and cars will probably be running between Corry and Erie by July, 1904.

EASTON, PA.—About 8 miles of the Philadelphia & Easton Street Railway remain uncompleted between Durham Furnace and Tohickon Park, the northern terminus of the division extending from Doylestown. The two ends of the line will be connected up late this year or early next, it is expected.

GETTYSBURG, PA.—It is said to be the intention of the new owners of the Gettysburg Transit Company, operating the Battlefield trolley line, to extend the line to Littlestown and Westminster, Md. C. Taylor Leland, of Philadelphia, and Thomas V. Cooper, of the Westinghouse Company, recently secured almost the entire stock issue of the company.

JOHNSTOWN, PA.—The Johnstown & Geistown Electric Railway Company has purchased a site at Jacob's Hollow for a power house. Right of way for the line between Johnstown & Geistown has been secured from Walnut Grove to Geistown.

MILLERSVILLE, PA.—Grading for the electric railway between Millersville and York Furnace is about completed, and upward of 6 miles of track will be laid. The line will be 12 miles long, and will be completed in eight weeks. It crosses the Pequea and Conestoga Creeks on substantial bridges. The Conestoga Traction Company will furnish the power for the road.

NAZARETH, PA.—The Town Council has passed the ordinance granting a franchise to the Easton & Belvidere Electric Railway Company. It is stated that those citizens opposing the ordinance will test its validity in court, taking the ground that the Council cannot legally pass a measure on three readings at a single session.

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ON ABOVE MATERIAL

PHILADELPHIA, PA.—The new Fifty-Eighth and Sixtieth Street line of the Philadelphia Rapid Transit Company has been placed in operation. The new route is the westernmost one of the entire traction system, and extends within only three squares of the Philadelphia County line. The line is double tracked throughout the entire route.

PITTSBURG, PA.—The Pittsburg, McKeesport & Connellsville Street Railway has asked the McKeesport Council for a franchise for tracks on Shaw Avenue from Walnut to Locust Street. The company agrees to sell thirty-three tickets for $1 over the line in the city limits. The franchise would complete the company's loop in McKeesport, connecting with the Connellsville line from the Pittsburg Railways Company.

SCRANTON, PA.—A route has been surveyed for an electric railway from Scranton to the summit of Bald Mountain, and a charter will soon be applied for. Local capitalists are backing the venture.

SCRANTON, PA.—The Dalton Street Railway Company proposes to go ahead with the construction of its line along West Market Street, even if the Common Council should defeat the ordinance granting the company a franchise. West Market Street is owned by the Northern Boulevard Company, and the Dalton Company has an option on it. The road is owned in fee simple by the company, even to the coal underlying it. It can sell the street outright to the trolley company, so it is claimed, and the trolley company will thereby be vested with the same kind of title. Having this title, it will have a right to use the street for whatever purpose its charter prescribes. The fact that the Wilkesbarre & Wyoming Valley Company built its road on a private right of way through the city without consulting the city authorities is pointed out by the Dalton Company as a precedent for its contemplated action.

WEST CHESTER, PA.—Thomas E. O'Connell has been given the contract for the completion of the Kennett extension of the West Chester Street Railway.

WOONSOCKET, R. I.—E. K. Ray, who recently obtained a franchise to build, equip and operate a double-track passenger and freight electric line between North Smithfield and Lincoln, from the city of Woonsocket to the town of North Providence, has engaged engineers to begin preliminary work and by fall the work of grading for the road will be begun. The proposed new line will connect with the Woonsocket Street Railway tracks in this city at the city line, and with the tracks of the Philadelphia Company at North Providence.

CHATTANOOGA, TENN.—An ordinance has been passed giving the Chattanooga Rapid Transit Company a franchise over Eighth Street from the corner of Broad and Cedar Streets, and north to the Cedar Street terminus, and from the corner of Sixth and Cedar Streets westwardly to the terminus of Sixth Street.

KNOXVILLE, TENN.—A survey has been made for the extension of the Central Avenue line of the Knoxville Traction Company to the junction of Chickamauga Avenue and the K., C. G. & L. Railway. The extension is practically a mile in length, and will serve a large population and a growing portion of the city.

SEATTLE, WASH.—A franchise has been granted to the Arctic Railway to lay tracks and operate a railway on Fourth and Fifth Streets, and to build spurs and side tracks to the water front. A. Simpson has been granted a franchise to operate a street trolley line on Front Street, and the Pioneer Mining Company, J. W. Kelly and the Wild Goose Company have been granted the right to build a depot and line out to Dexter Creek, to connect by a spur with the Anvil Railroad of the Wild Goose Company.

SPOKANE, WASH.—A contract has been let by the Cœur d'Alene & Spokone Railway Company for the entire equipment required for connecting the two cities with an electric railway service. Over 300 men are now at work on the grade, and this division of the work is almost completed. A 60-lb. rail will be laid and the track will be thoroughly ballasted.

BLUEFIELD, W. VA.—The Bluefield & Hinton Electric Railway Company has applied for amendments to the franchise to permit it to build an electric railway in Bluefield.

GRAFTON, W. VA.—The Taylor County Electric Street Railway & Supply Company has organized by electing directors as follows: A. J. Wilkinson, George L. Jolliffee, James W. Holt, L. E. Ward, Dr. A. S. Warden, B. F. Bailey and T. E. Joyce. The County Court has granted the franchise asked by the company to build through the county.

WHEELING, W. VA.—The County Commissioners have given a franchise to the Wheeling & West Liberty Belt Line Railway.

EAU CLAIRE, WIS.—The Chippewa Valley Electric Railway Company is planning extensive improvements of its system.

FOND DU LAC, WIS.—A new electric railway will be built to Appleton and Kaukauna by the new Fond du Lac & Northeastern Railway Company, which is being incorporated.

KAUKAUNA, WIS.—Grading for the Kaukauna-Green Bay Electric Railway was begun at Kaukauna on July 13, and if the weather permits will be completed in about ninety days. When this line is completed the Twin Cities will be connected by interurban with Fond du Lac, Oshkosh, Appleton, Kaukauna and Green Bay, all the cities in the valley.

MADISON, WIS.—The Superior & Southeastern Railway, whose incorporation was noted in the Street Railway Journal of July 27, is to be a logging railway. It will extend from Pratt, Bayfield County, to a junction with the Chippewa Valley & Northwestern Road, 60 miles.

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E. E. NAUGLE, President. C. B. SHAW, Vice President. J. P. ODELL, Treasurer.

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NEWS NOTES

SAN BERNADINO, CAL.—The San Bernardino Valley Traction Company, Redlands Street Railway Company and San Bernardino & Highlands Electric Railway Company, recently consolidated as the San Bernardino Valley Traction Company, have elected officers as follows: President, Henry Fisher, of Redlands; vice-president and general manager, A. C. Denman, Jr., of San Bernardino; secretary and treasurer, C. W. A. Cartlidge, of San Bernardino.

COLUMBUS, GA.—The strike of the employees of the Columbus Railroad & Light Company has not inconvenienced the company. New men were secured at once to fill the strikers' places, and the regular service was resumed in full a few hours after the old employees went out.

AURORA, ILL.—The motormen and conductors in the employ of the Elgin, Aurora & Southern Traction Company who have been in the service more than one year have had their wages increased 10 per cent.

ROCKFORD, ILL.—The directors of the Rockford & Interurban Railway Company have ratified a proposition by the directors of the Rockford & Freeport Electric Railway by which the latter line is to be leased to the Rockford & Interurban Railway Company for one year, and at the expiration of that period to consolidate the two lines. Under the plan of consolidating the lines there will be no change in the headquarters, and the work of the two companies will be left with the president and general manager of the Rockford & Freeport Electric Railway, T. M. Ellis, who will retain the offices in Rockford.

NEW ALBANY, IND.—The stockholders of the New Albany Street Railway Company, at their annual meeting, elected the following board of directors for the ensuing year: Samuel Insull, of Chicago; R. W. Waite, James W. Dunbar, Louis Hartman and Alexander Hartman, New Albany. Samuel Insull was elected president; Louis Hartman, vice-president; R. W. Waite, secretary and treasurer.

BOSTON, MASS.—The Old State House station of the East Boston Tunnel is completed with the exception of a portion of the north side entrance and the surfacing on the platforms. The granolithic surfacing will be laid within a few days. The State Street section of the tunnel is nearly ready for the laying of tracks, as the tunnel will shortly be clear from the Old State House to Atlantic Avenue, where 30 ft. of core remain to be taken out and 40 ft. of invert to be laid. Connection has already been made with the harbor section, which runs through to East Boston. By the early part of August the Boston end from Washington Street to Atlantic Avenue will be completed, and the East Boston section may also be finished about the same time. The recent explosion or escape of compressed air has delayed the work somewhat on that section, as some of the walls and steel work had to be replaced. State Street is now being resurfaced in places, the excavation and wall work in the Atlantic Avenue station are completed and everything is ready for the insertion of steel girders and beams for the station house. Restoration of the Old State House has been already started. Walls are being rebuilt, and the interior is being remodeled. A part of the first floor has been laid also. Contracts will soon be awarded for the construction of the last important section; that from Scollay Square to Washington Street, under Court Street.

JERSEY CITY, N. J.—The Corporation Counsel of Jersey City has filed with Sheriff John Zeller papers in the suits instituted by Mayor Mark M. Fagan to recover from the Jersey City & Bergen Railroad Company, the Consolidated Traction Company, and the North Jersey Street Railway Company a license fee of $10 a year for each car used on each line for a period of about thirty-five years. The companies paid this fee to the city until 1868, when they refused to pay it longer on the ground that they were exempt under a law passed by the Legislature in that year. The Corporation Counsel says the fees in question will amount to about $250,000. The defendant companies have thirty days in which to file their answer. If they do not dispute the validity of the act of 1868 the suit will be tried in Jersey City. If they do it will be heard by the Supreme Court at Trenton.

NEWARK, N. J.—Chief Justice Gummere has instructed Sheriff William Nicoll to draw a special panel of 500 jurors from whom to select a jury to try the nine officials and subordinates of the North Jersey Street Railway Company who were indicted in connection with the fatal Clifton Avenue grade crossing accident of Feb. 19. The trial will take place during the September term.

NEW YORK, N. Y.—A decision in the matter of the third, or express, track on the West Side lines of the Manhattan Elevated Railway has been handed down by Supreme Court Justice Truax, who holds that though Henry B. Auchincloss, the plaintiff, is not entitled to have the extra track removed, yet he is entitled to receive both fee and rental damages, amounting in his case to $9,000 for fee and $8,000 for rental. Mr. Auchincloss objected to the third track on the ground that it was unauthorized by law, and contended that the building of the express track in short sidings was only an evasion of the statute which prohibited a continuous third track. When the suit was first brought Justice Bischoff dismissed it, but the Appellate Division reversed him and ordered a new trial, holding that the construction of the track was unauthorized, and imposed an extra burden on the plaintiff's property. Justice Truax in his decision says that it is unnecessary to consider whether the third track was a siding, as had been claimed, or not.

NEW YORK, N. Y.—The Rapid Transit Commissioners have sent a letter to John B. McDonald, the subway contractor, in which it is declared that he is responsible for the damage done by the Park Avenue cave-in. This was in response to a letter from Mr. McDonald, in which he said that he could not be held liable for such damages.

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THE COLUMBIA TROLLEY POLE
Electric Railway Supplies
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WRITE FOR PRICES

ROCHESTER, N. Y.—The Monroe County Electric Belt Line Company has elected the following directors: G. D. Beebe, Syracuse; Andrew H. Bown, Despatch; Percy R. McPhail, Charles T. Chapin, Merton E. Lewis, Rochester; William Nottingham, Syracuse; Walter A. Paroe, Fairport; F. C. Soule, Syracuse; inspectors of election, George S. McMillan, George P. Baker, Rochester. The officers of the board of directors are: Andrew H. Bown, president; DeWitt C. Becker, vice-president; Merton E. Lewis, secretary; Percy R. McPhail, treasurer. The road will not be in operation to Rochester for a year.

ROCHESTER, N. Y.—Through application to the Supreme Court at Albany the Rochester Railway Company and the Rochester Gas & Electric Company have succeeded in having their franchise taxes for the year reduced $25,000. Of this amount the reduction secured by the Rochester Railway Company amounts to $7,014.

TOLEDO, OHIO.—The Findlay, Fort Wayne & Western Railway has been sold at Master's sale at Ottawa to Judge J. J. Moore, of New York, who, it is said, represented the Cincinnati, Hamilton & Dayton Traction Company, which has been in control of the property for the past year.

OKLAHOMA CITY, OKLA.—The Metropolitan Railway Company has notified its employees that commencing August they will all be given an increase of 1 cent per hour. The increase was not asked for or even expected by the employees, and they were much pleased and surprised when they received the notice of the increase.

COLUMBIA, PA.—It is stated that the by-laws of the Lancaster County Railway & Light Company will be amended so as to provide for a vice-president who shall also be a controller of the company. The identity of the new official has not as yet been revealed. William B. Given will remain as president.

EASTON, PA.—The Northampton Traction Company has increased the wages of conductors and motormen in service a year or more to 20 cents an hour, and others from 17½ cents to 18 cents an hour, taking effect July 1.

FLOURTOWN, PA.—The Philadelphia & Lehigh Valley Traction Company and Philadelphia & Reading Railway Company have concluded an agreement whereby the former will be allowed to cross the tracks of the latter at this place at grade. This will allow the trolley cars to run through from Allentown to Chestnut Hill without a break. The crossing has been completed.

HARRISBURG, PA.—At a meeting of the incorporators of the new Central Pennsylvania Traction Company, held July 15, Frank B. Musser, for several years superintendent of the Harrisburg Traction Company, was chosen president; Edward Bailey, president of the Harrisburg Traction Company, whose lines will be absorbed by the new company, declining to take the office. He will remain president of the Harrisburg Traction Company and a director and member of the executive committee of the new company. B. F. Myers was chosen vice-president; W. J. Calder, secretary and treasurer, and the fifteen directors of the Harrisburg Traction Company were continued as directors of the new company. The meeting lasted until after midnight, important extensions to the system being under consideration. It was decided to present an ordinance in Councils for a franchise for certain streets not now occupied by the company's lines and for the double tracking of Second, Derry and Thirteenth Streets. Arrangements were also made for taking over the lines of the Harrisburg Traction Company.

SCRANTON, PA.—The Scranton Railway Company has entered into a three-year contract with Division No. 168 of the Amalgamated Association of Street Railway Employees, in which provision is made for every contingency that might arise in the relation of the company and its employees. It goes into effect July 20, and remains in force until April 1, 1906. The agreement provides for a board of five arbitrators, one of whom shall be a neutral. Motormen and conductors are to receive 18 cents an hour for the first year, 19 cents for the second, and 20 cents thereafter.

COLUMBIA, S. C.—The City Council of Columbia has passed an ordinance providing separate seats on street cars for whites and blacks. The ordinance was in effect the same as that in force in Augusta, Ga., and other cities in the South having a heavy negro population. Since the passage of the ordinance the negroes of the city have virtually determined upon a boycott against the street railway company.

BEAUMONT, TEX.—The strike of the employees of the Beaumont Traction Company has been broken. The company succeeded in filling the places of the strikers, and cars are now being operated on regular schedule time.

BURLINGTON, VT.—On July 8, at the Crescent Beach County Club, Louis H. Turk tendered a dinner to Hon. Elias Lyman, in celebration of his fourteenth annual election as president of the Burlington County Traction Company. Among the guests present were the following officers of the company: Elias Lyman, president; John J. Flynn, vice-president; W. F. Handee, treasurer; A. E. Richardson, A. O. Humphrey, A. W. Brownell, directors.

CHARLESTON, W. VA.—Employees of the Kanawha Valley Traction Company are on strike, and the cars are being run by officers of the company. The company refused to accede to a demand for increased wages and recognition of the union.

FINANCIAL NOTES

LOS ANGELES, CAL.—A few days ago the Times said the long-talked-of sale of the traction company of Los Angeles has been consummated and money put up. The amount was $1,515,000, and this sum, together with over $200,000, which has already been paid, completes the purchase price. It is said the money was put up by the Southern Pacific in accordance with an agreement made some time ago, whereby Huntington and Hillman are the major parties in interest.

Air Brake Prejudice

Only a good power brake can overcome the almost universal prejudice in favor of air brakes. And yet the following railroads have purchased the ***Neal Brake*** after testing out one or two trial brakes:

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Jersey City, Hoboken & Paterson Street Railway Company
Union Traction Company of Indiana
Indianapolis Street Railway Company
Scranton (Pa.) Railway Company
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Why? Write, and we will tell you. Our longest test is on one car of the Boston Elevated Railway, where it has been in the passenger service for over two years.

The Neal Brake is not an air brake—it is a hydraulic brake

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Our device will increase the efficiency of the present brake 300 per cent. without changing present mode of equipment. It will do away with slipping wheels and with the use of sand. We substitute magnetism for dead weight to increase adhesion between drive wheels and rails.

THE WABASH RAILROAD COMPANY
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MR. JAMES WOOD, Engineer C. R. I. & P.

MY DEAR JIM:—Thought you would be glad to know the Magnetic Equipment Company have their engine equipped with their device, and that it is a decided success.

I had the satisfaction, as well as the pleasure of handling the engine while making the tests, which were made on May 28th. The tests showed an increased efficiency of almost 30 per cent. with device operative.

The C. M. & ST. P. R.R. officials are going to make a practical test about the 15th of this month. I feel sure the stock we bought will soon be worth many times what it cost us.

Tell all your friends the good news and have them get some of the stock before it goes out of sight. It can be got now for $1.50 a share. Yours very truly,

A. T. WHITSEL, Wabash Engineer.

SHALL WE SEND YOU OUR PROSPECTUS?

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CHICAGO

NORWICH, CONN.—It is reported that the controlling interest in the Norwich Street Railway Company and the Montville Street Railway Company, which has been held by Tucker, Anthony & Company, of Boston, has been purchased by Stillman F. Kelley, of that city.

CHICAGO, ILL.—The Northwestern Elevated Railroad Company reports traffic for year to date as follows:

	1903	1902
January	2,116,232	1,922,310
February	1,956,775	1,813,280
March	2,172,179	2,026,220
April	2,140,190	1,962,911
May	2,076,692	1,959,176
June	1,997,144	1,824,393
Six months	12,459,212	11,508,290

CHICAGO, ILL.—The South Side Elevated Railway Company reports traffic for the year to date as follows:

	1903	1902
January	2,685,741	2,453,151
February	2,478,448	2,222,808
March	2,727,659	2,489,703
April	2,626,590	2,430,270
May	2,569,404	2,357,953
June	2,557,860	2,293,470
Six months	15,645,702	14,247,356

The following figures are also given:

	1903	1902
Daily average	86,440	78,715
Gross passenger receipts	$782,285	$712,368
Gain over last year	69,917	43,410

CHICAGO, ILL.—The Chicago & Milwaukee Electric Railway Company reports earnings as follows:

	Gross Earnings	Operating Expenses	Net Earnings	Increase per Cent
January	$12,035	$6,570	$5,465	7.5
February	10,644	5,817	4,827	24.0
March	13,356	6,318	7,038	40.0
April	15,161	6,242	8,918	25.0
May	20,042	7,156	12,886	42.0
June	22,482	7,742	14,740	38.0
Totals	$93,720	$39,845	$53,874	....

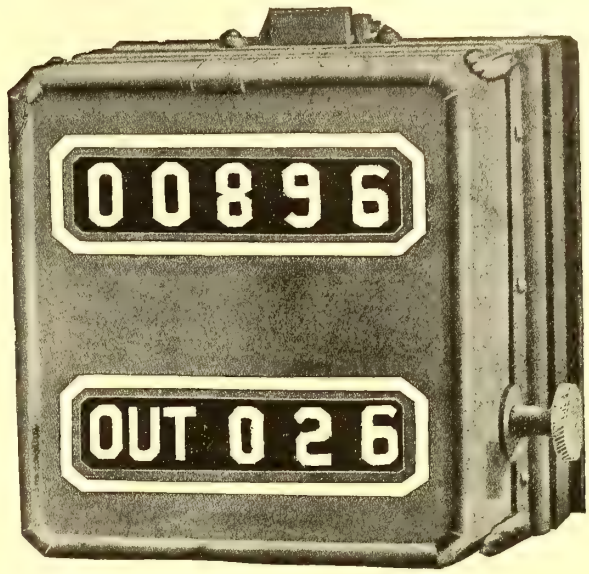
ELKHART, IND.—A. R. Beardsley, of Elkhart, has been appointed receiver of the Winona, Warsaw, Elkhart & South Bend Traction Company, which had in contemplation the construction of an electric railway to connect Winona, Warsaw, Elkhart and South Bend. The application was made by Major S. A. Collins, of Troy, the promoter who has had charge of the securing of right of way, franchises, etc. The plan is to reorganize the company and then, interesting new capital, prosecute the construction of the road so as to secure advantage of the valuable franchise rights which the company holds.

INDIANAPOLIS, IND.—The Indianapolis, Shelbyville & Southeastern Electric Railway will make a new $600,000 bond issue to cover the cost of building the extension from Shelbyville to Greensburg. The bonds will bear 5 per cent interest.

INDIANAPOLIS, IND.—The Indianapolis, Martinsville & Southern Railroad Company has filed with the Secretary of State a certificate of the change of its name to the Indianapolis & Southwestern Traction Company, and articles certifying to an increase of capital stock from $50,000 to $900,000, of which $600,000 is to be common and $300,000 6 per cent preferred stock. The company will build to Evansville, through Martinsville and Vincennes. When the company first organized the purpose was to build only to Martinsville. Under the new organization Evansville will be the southern terminus, with Indianapolis the northern.

LOUISVILLE, KY.—Circulars setting forth the terms of transfer of the stock of the Louisville Railway Company for that of the new Louisville Traction Company are being sent out. The date of delivery of the new stock is fixed at April 1, 1904. Shareholders who desire their stock will receive interest at the rate of 5 per cent from July 1, 1903, to April 1, 1904, and also interest at the rate of 5 per cent on the cash deposits for the additional share of common stock to which each holder of a share of old common stock is entitled on payment of $55. This cash deposit is to be paid in three instalments as follows: $25, Sept. 1, 1903; $15, Dec. 31, 1903, and $15, April 1, 1904. The stock will be deposited with the Fidelity Trust Company.

BALTIMORE, MD.—It is stated in Cleveland that the appointment of a receiver for the Washington, Baltimore & Annapolis Electric Railway Company was due indirectly to the financial embarrassment of the Everett-Moore syndicate. The syndicate members were the underwriters for a very considerable portion of the securities of the company, and the failure of these gentlemen made it impossible for them to take up their portion of the underwriting. Acting in the interests of the Cleveland security holders, the Cleveland Construction Company obtained a receivership for the road. A new financial plan has been prepared, and it will be placed in operation as soon as possible. The officials of the road claim there is no occasion for alarm, and state that there is little doubt that the road will be completed and placed in operation on the lines originally laid down by the promoters.



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BOSTON, MASS.—An order has been issued by the Railroad Commissioners authorizing the Newton Street Railway Company to issue 1850 additional shares of capital stock, which at par would amount to $185,000, for the purpose of paying floating indebtedness and the purchase of real and personal property. The order provided that this additional stock shall be offered proportionately to stockholders at $125 per share.

GREENFIELD, MASS.—The stockholders of the Greenfield & Deerfield and the Greenfield, Deerfield & Northampton Street Railway Companies have voted to merge the former company into the latter. The companies must get the approval of the Railroad Commission.

WORCESTER MASS.—A hearing has been given by the Railroad Commissioners on the petition of the Worcester & Holden Street Railway Company for authority to issue additional capital stock of $50,000 and bonds of $100,000. The appraisal of the company's property showed it had cost $273,563. The treasurer's statement, made by E. S. Douglas, showed total assets of $274,942.

WORCESTER, MASS.—The trustees of the Worcester Railways & Investment Company have declared a semi-annual dividend of $2.25 per share, payable Aug. 1 to shareholders of record at the close of business July 20.

DETROIT, MICH.—The Detroit United Railway Company reports earnings as follows:

June	1903	1902
Gross earnings	$381,900	$333,624
Operating expenses and taxes	222,797	183,171
Net earnings	$159,103	$150,453
Other income	3,036	3,126
Total income	$162,139	$153,573
Charges	82,823	78,594
Surplus	$79,316	$74,979
Jan. 1 to June 30	1903	1902
Gross earnings	$2,011,488	$1,806,228
Operating expenses and taxes	1,217,487	1,038,997
Net earnings	$793,999	$767,231
Other income	22,701	15,038
Total income	$816,700	$782,269
Charges	490,765	462,572
Surplus	$325,935	$319,697

BINGHAMTON, N. Y.—The Binghamton Street Railway Company reports earnings as follows:

June	1903	1902
Gross earnings	$22,774	$20,242
Operating expenses	11,021	10,645
Net earnings	$11,753	$9,597
For the year ended June 30	1903	1902
Gross earnings	$226,702	$207,900
Operating expenses	126,600	114,630
Net earnings	$100,102	$93,270
Deductions from income	68,100	65,318
Net income	$32,002	$27,951

ROCHESTER, N. Y.—The Rochester Railway Company reports earnings as follows:

June	1903	1902
Gross earnings from operation	$105,377	$89,669
Operating expenses	51,338	47,618
Net earnings from operation	$54,039	$42,051
Income from other sources	425	375
Gross income from all sources	$54,464	$42,426
Fixed charges	25,647	24,754
Net income	28,817	$17,672

CLEVELAND, OHIO.—The first official statement of the earnings of the Aurora, Elgin & Chicago Railway has been issued. For the month of June the gross earnings were $39,101; operating expenses, $18,082; net earnings, $21,019. The operating expenses were 46.24 per cent of the receipts, which indicates that the management will come close to carrying out the prediction that the road will be operated the first year 45 per cent of the gross. The cost of operating was 10.46 cents per car-mile. In connection with the foregoing statement it is interesting to note that the interest on the funded debt and the dividends on preferred stock amount to $20,000 per month, so that the road is already showing a small surplus.

COLUMBUS, OHIO.—The Scioto Valley Traction Company has increased its capital stock from $1,000,000 to $3,000,000. Of the increase $800,000 is common and $1,200,000 5 per cent preferred stock. W. F. Burdell is president of the company, and E. R. Sharp, secretary.

DAYTON, OHIO.—The Lebanon & Franklin Traction Company, of which Charles H. Bosler is president, and R. E. Kline secretary, has increased its capital stock from $10,000 to $160,000.

DAYTON, OHIO.—The Dayton & Southern Railroad Company has increased its capital from $10,000 to $150,000. Of the increase $40,000 is common

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stock and $100,000 5 per cent preferred. M. L. Mourer is president, and F. E. James, secretary.

HAMILTON, OHIO.—The Cincinnati, Dayton & Toledo Traction Company reports earnings as follows:

May	1903	1902
Total gross earnings	$46,173	$40,113
Operating expenses	25,021	21,922
Net earnings	$21,152	$18,191
Deductions from income	16,050	16,798
Net income	$5,101	$1,393

HARRISBURG, PA.—The directors of the Harrisburg Traction Company on July 13 declared a regular cash dividend of 3 per cent and a scrip dividend of 5 per cent, both payable Aug. 1. Another meeting will be held shortly to consider plans for extensions of the lines.

PHILADELPHIA, PA.—The American Railways Company reports gross earnings for June, 1903, at $114,742, against $101,154 for June, 1902. From July 1, 1902, to June 30, 1903, the gross earnings were $1,240,807, as against $1,009,504 for the corresponding period of the previous year.

PITTSBURG, PA.—The Philadelphia Company reports earnings as follows:

June	1903	1902
Gross earnings	$1,206,999	$1,076,849
Operating expenses and taxes	755,334	692,702
Net earnings	$451,665	$384,147
Miscellaneous income	18,825	14,016
Charges	319,201	307,070
Total income	$151,290	$91,093
Preferred dividends	$23,936	$23,935
Net income	$127,353	$67,158

WILKESBARRE, PA.—Keyboldt & Company, of New York, have purchased $500,000 of first mortgage bonds of the Wilkesbarre & Hazleton Traction Company.

NORFOLK, VA.—The plan for uniting under the management of the Norfolk, Portsmouth & Newport News Company a number of street railway, gas and electric light companies has been abandoned. According to General Manager Hathaway, of the company, the organization of the company was a tentative one and based on the supposed saving that could be made by having one set of officers. Mr. Hathaway also says that it was the diversity of the interests and the distance separating the Newport News, Hampton and Danville properties that resulted in the decision to abandon the project. None of the securities had been sold to the public.

SPOKANE, WASH.—The Spokane Traction Company has filed for record the mortgage for $1,000,000 recently given to the Title Guarantee and Trust Company.

MILWAUKEE, WIS.—The Milwaukee Railway & Light Company has declared the quarterly dividend of 1½ per cent on its preferred stock, payable Aug. 1.

AMONG THE MANUFACTURERS

CATALOGUE NO. 19 has just been issued by the Jeffrey Manufacturing Company of Columbus, Ohio. The greater part of this publication is devoted to mining machinery, but there are also numerous cuts of Jeffrey bucket, trough and belt conveyors for economically conveying coal or other material.

THE NATIONAL ELECTRIC COMPANY, of Milwaukee, successor to the Christensen Engineering Company, of that city, has just closed the contract for the World's Fair Exposition at St. Louis for the entire air-brake equipments for the intramural road. It was a very keenly contested contract, and the company feels quite elated over its success.

THE STANLEY ELECTRIC MANUFACTURING COMPANY has just published Bulletin No. 135, which contains descriptions and illustrations of its hot-wire voltmeters and ammeters. These instruments are not affected by changes of wave form, frequency, or electrical disturbances due to the presence of foreign circuits or magnets. They measure correctly both alternating and direct currents. The manufacturer states that many instruments of this type are now in use and that they are giving very satisfactory service.

"EQUIPMENT OF A RAILWAY SHOP" is the title of an interesting and valuable pamphlet just issued by the Crocker-Wheeler Company, of Ampere, N. J. The publication is devoted to a detailed description of the new Collinwood (Ohio) locomotive and car shops of the Lake Shore & Michigan Southern Railway. The well-known Crocker-Wheeler two-wire multiple-voltage system has been installed in these shops with very satisfactory results. In designing the motors for driving the machine tools a careful study was made of the exact requirements of each tool. Not only is this installation proving very economical, but it deserves to be ranked among the finest of its kind.

THE COMPOSITE PULLEY & CLUTCH COMPANY, of Boston, Mass., has just issued a pamphlet which contains a very interesting description of this company's method of using natural cork inserts for pulleys, friction clutches and braking mechanisms. This company does not manufacture pulleys or friction clutches, but aims to introduce its cork inserts into every well

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THE AMERICAN CONDUIT COMPANY has recently been organized for the purpose of taking over the business, good will, the manufacturing plants, patents, orders, etc., of the Electrolysis Proof Conduit Company, of Chicago. The latter company is well known to the electric and street railway public as a manufacturer of bituminized fibre conduits. The new company is prepared to commence extensive operation in the manufacturing of conduits. It has factories in Chicago, Ill.; Los Angeles, Cal., and Chester, Pa. The company has also offices in New York, Chicago, Los Angeles and Philadelphia. Several million feet of its electrolysis-proof conduits have been installed within the past few years, and have given excellent service and satisfaction. With the record of the old company behind it, and with the active pushing business management at the head of the new company, good success may be predicted.

THE FRANKLIN ROLLING MILL & FOUNDRY COMPANY, of New York, N. Y., and Franklin, Pa., has purchased the Tripartite Steel Pole Company's patent rights, and is now prepared to furnish tripartite high-carbon rolled-steel poles any length for all overhead construction. This is claimed to be the only pole that will not take a set when extra load is put on, by heavy winds, snow and ice, and if pulled over or bent by accident can be straightened without removing from setting. All parts are solid, and as these poles have positive anchorage they require to be set only 3 ft., thereby saving cost of digging and cement. They can be transported in parts and assembled on ground along the line, and they can be painted internally, as well as externally, thus insuring longevity. This company is prepared to contract, according to customers' specifications, for all overhead work, including tripartite steel poles, span, trolley, feed-wire, all fixtures, bonds and bonding, set and "lined up," complete in working order.

DIFFERENT TYPES OF THE ROOT SPRING TRACK SCRAPER AND FLANGER are described in detail in the latest publication issued by the Root Track Scraper Company, of Kalamazoo, Mich. This company's cleaners are guaranteed to give perfect contact on all conditions of track. The steel springs used are warranted not to break or bend for one year. Any of these scrapers may be operated alone by the motorman, and need no attention after being placed in position to work, as they pass over all obstacles, such as crossings and uneven pavements, without injuring the scraper. The flanger shovel used is independent of the main shovel. As it is of the same width as the rail, it follows any elevation or depression of the same readily, being always on the rail, even when it is several inches below the pavement. This assures at all times a clean rail and groove. The "Kalamazoo" scraper made by this company deserves special attention. It is raised and lowered by the same device as the single scraper, and is easily handled by the motorman alone. It is designed to clean all the snow from between the rails and 9 ins. outside the same, throwing it each way from the center. It also cleans the top of rail and groove. The company claims that by using this scraper more practical work can be done and more track can be cleaned than with a sweeper, as it can be run much faster. Among the many railways now using this company's scrapers successfully are the following: American Railways Company, Philadelphia, Pa.; South Chicago City Railway Company, Chicago, Ill.; Detroit United Railway, Detroit, Mich.; Indiana Railway Company, South Bend, Ind.; Lehigh Valley Traction Company, Allentown, Pa.; Fitchburg & Leominster Street Railway, Fitchburg, Mass.; Binghamton Railway Company, Binghamton, N. Y.

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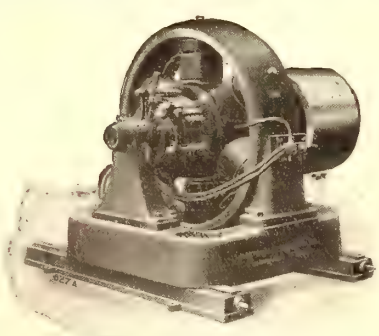
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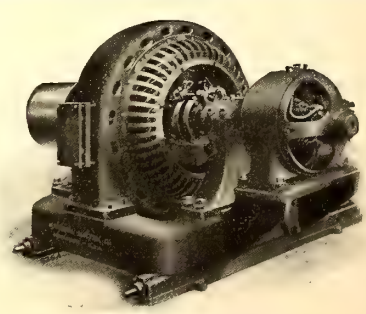
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NEWS OF THE WEEK

CONSTRUCTION NOTES

EUREKA, CAL.—Articles of incorporation of the Humboldt Transit Company have been filed. The purpose of the company is to build 20 miles of electric railway in the city of Eureka and an additional 54 miles to other towns in Humboldt County. The capital stock is $300,000, of which $75,000 has been subscribed. The directors for the first year are: J. C. Bull, Jr., of Eureka; George Henderson, of Oakland; R. W. Bull and John C. Bull, of Arcata, and Charles P. Cutten, of Eureka.

LOS ANGELES, CAL.—The Los Angeles Railway Company has begun laying six miles of track under a franchise beginning at Main and Twelfth Streets, and running to the southern city limits.

LOS ANGELES, CAL.—The West Second Street line of the Los Angeles Railway Company is being extended about two miles over a private right of way to the popular Bimini baths.

LOS ANGELES, CAL.—The Los Angeles Railway Company is building a new car house, 263 ft. x 400 ft., on South Park Avenue, between Fifty-Third and Fifty-Fourth Streets. It will cover twenty tracks and will be the largest in the city. Tracks and structure will cost about $75,000.

LOS ANGELES, CAL.—Work will be commenced at once on the extension of the main line of the Pacific Electric Railway Company from San Gabriel to Covina, Pomona, Ontario and Riverside. The Board of Trustees of Covina has sold a franchise for one mile along Badillo Street to the company for $100, covering the only gap in this county for the proposed Los Angeles-Riverside electric road. Chief Engineer George Pillsbury says cars will be running into Riverside before Christmas.

LOS ANGELES, CAL.—The Los Angeles & Pacific Railroad Company has begun the erection of a new sub-station at Sixteenth and Bush Streets, to have a capacity of 300 hp. This sub-station is about three miles from the large power house being built on Sixteenth Street outside the city limits, and will greatly increase the service of the Santa Monica, Ocean Park, Playa del Rey and Redondo lines from the center of the city out to Bush Street.

LOS ANGELES, CAL.—Plans are being worked out for an electric road between Stockton and the Yosemite Valley, according to Charles Gage, of Denver, representing a syndicate of Chicago, New York and Cleveland capitalists. Interested with Mr. Gage in the project is Edwin De Haven, a Tonopah mining man. The present plan is to build a standard-gage road from Stockton to the valley by way of Chinese Camp, to Big Oak Flat, to Merced, to Hamilton, to Crocker.

LOS ANGELES, CAL.—Since the Los Angeles Traction Company was purchased by Southern Pacific money and passed into Huntington control, the management of the enterprise is in charge of S. B. McLenegan, superintendent under the regime of the Hooks. Mr. McLenegan has inaugurated a series of improvement in tracks, power and rolling stock. The double-tracking of the interurban line to San Pedro is being considered. This will probably mean new cars for the system, as the blue cars from St. Louis for the Hooks have proved too heavy and unwieldy for the grades.

RED BLUFF, CAL.—The Board of Supervisors of Tehama County has adopted an ordinance granting a franchise to the Tuscan Mineral Springs Corporation to construct and operate an electric railway on the public highways from Red Bluff to Tuscan Springs, also the privilege of crossing the county bridge across the Sacramento River at Red Bluff. Work shall be commenced within three months and shall be completed within two years.

SANTA CRUZ, CAL.—R. Gorley, constructing engineer for an electric road from San Jose to Los Gatos, says an electric railway from San Jose to Alviso is assured. Preliminary surveys have been started. The projectors are said to be backed by Pennsylvania capitalists, who propose to open up a line of steamers for passengers and freight between Alviso and San Francisco. It is also a part of the scheme to build a hotel, bath house and docks at Alviso, where the above capitalists own thirty acres of land.

SANTA MONICA, CAL.—The City Trustees have denied the application of J. R. Taylor for an electric electric railway franchise on Colorado and Ocean Avenues. This franchise was wanted by the Los Angeles, Ocean Park & Santa Monica Railway Company.

HARTFORD, CONN.—The Crystal Lake Railway Company, chartered at the last session of the Legislature, has organized and $50,000 of capital stock has been subscribed for. Charles E. Perkins is president of the company and Judge Arthur Perkins is secretary and treasurer. It is the intention to build an electric railway from Crystal Lake to run north to the Massachusetts line, a distance of nine or ten miles. This road will make connection with the Stafford Springs Street Railway Company in Ellington and with the Enfield & Somers Street Railway Company in Somers. Tucker, Anthony & Company, of Boston, who own the Hartford & Springfield Street Railway Company, operate the Endfield & Somers line, although it is another corporation.

STAMFORD, CONN.—The extension of the New York & Stamford Railroad from Greenwich to the Stamford town line is completed, and cars are making regular trips between New Rochelle and that point. This is the last link in the direct line of trolley between New York and New Haven, and there is a saving in time of forty minutes between Stamford and New Rochelle by this route over the Sound Beach way.

PENSACOLA, FLA.—The Pensacola Electric Terminal Railway Company will shortly submit a proposition to the City Council asking for additional privileges. It is the desire to extend all of the lines and electrify the present steam division to Fort Barrancas. The Council recently granted these privileges, but the terms were such that the company refused to accept them.

AUGUSTA, GA.—A meeting of the directors of the Augusta Railway & Electric Company will be held Aug. 15, at which the question of improvements in the rolling stock will be considered. R. L. Williams was re-elected president of the above company at a recent meeting of stockholders.

ATLANTA, GA.—The Georgia Railway & Electric Company has purchased $250,000 of machinery for the equipment of two sub-stations. One of these stations will be erected near Decatur and the other will be built on the Marietta line. By means of these sub-stations the Georgia Railway & Electric Company will be in a position to furnish current for a distance of fifty miles from Atlanta. Work on the trolley line to Marietta has already begun and an extension of the Decatur line at some time in the near future is contemplated. The Decatur line will probably be extended as far as Lithonia.

ATLANTA, GA.—Application has been made to the Secretary of State for a charter for the Atlanta, Buford & Gainesville Electric Railway Company. The plan of the company is to build to connect Gainesville and Flowery Branch, in Hall County, Buford, Suwanee, Duluth and Norcross, in Gwinnett County, and run through the upper portion of DeKalb and Fulton Counties "into or near" Atlanta. From Buford there will be a branch line in a northwesterly direction to the Winding Shoals on the Chattahoochee River, the evident intention being to establish the power station at that point. The charter is applied for by H. D. Jacquish and C. C. Sanders, of Gainesville, Ga.; M. S. Garner, George W. Thompson and J. O. H. Brown, of Buford, Ga.; E. J. Michael, of Bayhorse, Idaho; J. W. Peterson, W. W. Gorman and George W. Winslow, of Chicago, Ill., and D. B. Stancliff, of Atlanta.

CHICAGO, ILL.—The public service committee of the county board has postponed action on the ordinance of the Chicago, Milwaukee Avenue & Inland Lakes Traction Company until Sept. 7.

CHICAGO, ILL.—John M. Roach, general manager of the Chicago Union Traction Company, has assured Corporation Counsel Tolman that the Union Traction Company will lay grooved rails in all its permit work so far as possible.

CHICAGO, ILL.—Plans have been divulged by the Chicago & Milwaukee Electric Railway Company for building two additional tracks from Lake Forest to Wilmette by the side of the two tracks now used by the line. At Wilmette, where the present line now turns east to connect with the Chicago, Milwaukee & St. Paul Railroad, the proposed tracks will turn from the electric road's right of way and follow the Chicago & Northwestern Railroad to Ravenswood, where it is said the line will connect with the Northwestern Elevated Road.

EAST ST. LOUIS, ILL.—Articles of incorporation for the Southern Illinois Electric Railroad Company have been filed in the Recorder's office. The company is to build an electric railway from East St. Louis through the counties of St. Clair, Clinton, Washington, Marion, Jefferson, Hamilton and White to a point on the Wabash River near Maumee, Ill. The incorporators are: J. R. Piercy, G. F. M. Ward, Sam Casey and others, and the capital stock is placed at $50,000.

QUINCY, ILL.—At the annual meeting of the Quincy & Western Illinois Railway Company, which has franchises for building interurban lines in Quincy, the franchises voted the company by the city of Quincy were accepted, and General A. B. Nettleton, S. H. Bracey, F. E. Lonas, James Potter, W. A. Howard, L. J. Highland and John Tierse were elected directors. It was voted to increase the capital stock from $500,000 to $3,500,000, and to authorize a bond issue of $3,500,000.

BLOOMINGTON, IND.—It has become known that W. H. Schott, president of the electric light and heating plant in Bloomington, and also interested in the Indianapolis plant, will ask for a franchise from the Bedford City Council at the next meeting for an electric railway through the quarry districts of Monroe and Lawrence Counties. He hopes to begin work within a few months. The plan is to include all the small settlements in and about Bedford, beginning at the cement mills; from Bedford to extend north to Oolitic, thence to the P. M. & B. quarries, thence to the Victor and Smithville districts, thence to Bloomington and the Hunter districts. It is estimated that no less than 5,000 people go to and from work daily, in addition to traffic that would naturally arise from the cities and half a hundred settlements within the stone districts.

CHESTERTON, IND.—The Council has granted a franchise to the Chicago, Indiana & Michigan Raillway Company, which proposes to build an electric railway from Michigan City through Chesterton and other towns in Northwestern Indiana. The company received a blanket franchise, with the right to lay tracks on any street.

ELWOOD, IND.—In speaking of the incorporation of the Union Traction Coal Company, President McCulloch, of the Indiana Union Traction Company, says that the company was simply organized to hold extensive coal leases and properties that have been acquired in Sullivan County. Mr. McCulloch says that no plans have yet been made to run a coal line to the coal fields. It is understood, however, that the plans of the Indiana Union Traction Company and its allied Indianapolis Traction & Terminal Company, both of which are interested in the new Plainfield line that is to be pushed through to Brazil, propose to penetrate not only the Sullivan County coal fields, but also those of City and Park Counties. There is a probability that the line will run north to Rockville. With such a coal feeder the traction lines will be able to serve themselves with coal and give Indianapolis and the gas belt a coal service from the company's mines.

INDIANAPOLIS, IND.—The Indianapolis, Danville & Rockville Traction Company has asked for a franchise to enter the city on West Washington Street.

INDIANAPOLIS, IND.—Indiana Union Traction interests have incorporated the United Traction Coal Company, with $100,000 capital stock, to buy and develop coal lands in Indiana. Among the directors of the company are: George F. McCollough, Hugh J. McGowan, Arthur J. Brady.

INDIANAPOLIS, IND.—The Tipton, Frankfort & Attica Traction Company, which is to furnish connections with the Indianapolis, Northern & Northwestern trunk lines, has been incorporated; capital stock, $50,000. The directors are: J. H. Fear, J. G. Clark, J. C. Shanklin, W. R. Dunham, G. M. Shortle, L. M. Green and Samuel Clark.

INDIANAPOLIS, IND.—The Indianapolis Terminal & Traction Company has taken out a building permit for the new terminal passenger station for which the foundation is now being laid. The permit names $500,000 as the cost of this branch of the structure. Another branch of equal cost will be built next.

INDIANAPOLIS, IND.—The Indianapolis, Danville & Rockville Traction Company has filed a petition with the County Commissioners for a franchise over and along the Rockville gravel road in this county. The request was filed by G. T. Patterson, of Danville, attorney for the road, and is signed by Everett Wagram, president, and John W. Trotter, secretary. Contracts for the work have been let and the construction of the road will commence as soon as the right of way is obtained. The road was incorporated last January, and it is the intention to extend it west through Rockville. A private right of way has been obtained over nearly all the line.

INDIANAPOLIS, IND.—An electric railway to connect this city with Toledo is being promoted by J. Morgan and J. L. Weadock, of Toledo, who recently held a conference in this city with J. P. MacGeath, of Hartford City; Mayor Coffee, W. E. Fulk and W. H. Niblack, of Decatur; John Corry, of Pennville, and other interurban promoters and builders from Matthews, Fort Wayne and Dayton. Mr. Morgan is president of the Dayton, Ohio, Traction Company, and has been instrumental in building the network of lines about Dayton. He insists that a line from Indianapolis to Toledo would be a paying investment, and has already secured estimates on the cost of construction. The line will parallel the Wabash for some distance, connecting Toledo, Defiance, Napoleon and Van Wert, Ohio; Decatur, Hartford City, Alexandria and Noblesville, Ind. A portion of this route is occupied by the Union Traction Company, but Mr. Morgan said arrangements could be made with this company to use its tracks in return for connection with Toledo by the Union Traction Company.

MADISON, IND.—Work has been begun on the Southern Indiana Traction Company's line between Madison and Hanover.

MICHIGAN CITY, IND.—Col. Russell B. Harrison has confirmed the rumor that the Lake Cities Electric Railway Company has been transferred to the Michigan City Electric Company.

MUNCIE, IND.—The Indiana Union Traction Company bought ground for the location of an interurban terminal to be used by six interurban railways.

NEW CASTLE, IND.—G. M. Hodges has sold to the Indiana Union Traction Company his right of way secured for the Richmond & Northwestern Interurban Company between New Castle and Middletown.

RICHMOND, IND.—The Indiana Eastern Traction Company will be the first electric line in this State to use the third-rail system. The overhead trolley will be used only in passing through cities. In the country the line will have its own enclosed right of way. Construction on this line, which will extend from Hamilton, Ohio, to Marion, Ind., via Richmond, will begin soon. It is the ultimate purpose of the company to build from Marion to Chicago.

RUSHVILLE, IND.—The Indianapolis & Cincinnati Traction Company has awarded contracts for the construction of its power house at this place, work to begin at once. The contracts include in their specifications the erection and equipment of five sub-stations along the road. The Westinghouse Electric & Manufacturing Company secured the contracts for the electrical apparatus, and the Babcock & Wilcox Company was given the boiler contract. The engines will be installed by the Fulton Foundry & Machine Company, of St. Louis. The work of grading this line is progressing rapidly.

SPIELAND, IND.—The Indianapolis & Eastern Electric Railway Company is now spiking the rails to complete the branch from Duluth, via Spieland, to New Castle. The poles are in place on most of the right of way, and it looks as though the 10½ miles of branch line would soon be in operation.

TERRE HAUTE, IND.—The Terre Haute & Clinton line of the Terre Haute Electric Company has been completed and opened as far as Ellsworth, about half of the distance of sixteen miles to Clinton. The entire line will be open for regular service in two weeks.

WINCHESTER, IND.—Surveys have been made here by the Eastern Indiana Traction Company for its line, which extends from Hamilton, Ohio, to Marion, Ind. Construction will be begun about Sept. 1.

DAVENPORT, IA.—The Davenport & Suburban Railway Company has filed amended articles of incorporation with the Scott County Recorder, increasing its capital stock from $500,000 to $1,400,000. The company intends to build an interurban line of railroads from Davenport to Muscatine. A contract is said to have been let to the International Construction Company, of Detroit, for constructing the lines.

DES MOINES, IA.—There is a project on foot for the construction of an interurban electric railway from Greenfield to Winterset, a distance of 26 miles. It is stated that Chicago capitalists are interested, and after looking over the field, have decided to construct the line. The route of the proposed road follows what is known as the "Cherry Surveys" from Winterset to Greenfield, said surveys having been made for the Des Moines Southern and later abandoned by the Rock Island, which acquired the franchises and property of the road.

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Stark Electric Ry. Alliance, Ohio	120	"
Canton & New Philadelphia R.R., Ohio	90	"
Rochester & Eastern Rapid Ry.	70	"
Long Island Railroad Co.	40	"
Vandegrift Construction Co., Kennett Square, Pa.	25	"
Rock Island System	50	"
	515	

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DES MOINES, IA.—The Council Bluffs, Tabor & Southwestern Electric Railway Company has filed articles of incorporation. The headquarters are in Tabor, Fremont County; capital, $200,000; William J. Dobbs, president; Arthur S. West, secretary. The company is authorized to construct an interurban railway in Iowa, Missouri and Nebraska, and it is designated that the main line shall run through Pottawattamie, Mills and Fremont Counties in Iowa, and Atchison, Nodaway, Holt, Andrews and Buchanan in Missouri.

RUSSELLVILLE, KY.—The Southern Kentucky Interurban Railway & Power Company, capitalized at $125,000, has been incorporated to build an electric railway from Russellville through Logan, Simpson, Warren, Allen, Butler, Muhlinberg, Todd and Christian. The incorporators of the company are: C. W. Courts, J. M. McCutcheon, J. C. Browder, J. R. Crewdson, R. P. Manly, R. R. Clark, J. W. Clark, H. S. McCutcheon, of Russellville; W. P. Bainbridge, of Trenton. The New Jersey office of the company is at 4 Broad Street, Trenton.

CARIBOU, MAINE.—At a special meeting Caribou voted to appropriate $25,000 toward the construction of an electric railway from Caribou to Washburn and Perham.

ELKTON, MD.—The Kent & Cecil Light, Power & Railway Company has awarded the Tennis Construction Company, of Philadelphia, the contract for building its new line from Chesapeake City to Elkton, Newark and Stanton.

ELKTON, MD.—At a meeting of the board of directors of the Elkton & Chesapeake City Electric Railway Company the contract for the construction of the railway was awarded to the Tennis Construction Company, of Philadelphia, which will commence work within a few days.

LAUREL, MD.—The Laurel Traction Company has received a franchise permitting it to build an electric railway through Laurel to connect with the outlying towns of Sandy Springs and Savage, Md. The company will use the Purris closed conduit system, owned by the Union Electric Construction Company, of Philadelphia, Pa.

BOSTON, MASS.—The Old Colony Street Railway Company has petitioned for authority to issue new stock amounting to $27,600, the proceeds to be used for the purchase of the Lakeside Park Company's park property in Freetown, Mass. The company's outstanding stock amounts to $6,786,700.

FITCHBURG, MASS.—The Leominster, Shirley & Ayer Street Railway Company has been organized, with these officers: George W. Clifford, of Fitchburg, president; Wesley W. Sargent, superintendent; Charles F. Baker, of Fitchburg, clerk; Manson D. Hawes, of Leominster; George N. Proctor, of Fitchburg; Thomas H. Shea, of Fitchburg; Thomas L. Hazen, of Shirley; George L. Clifford, Charles F. Baker and W. W. Sargent, directors. The directors voted to make a 10 per cent assessment on the stock subscriptions and to begin at once the construction of the road. The company holds franchises for a line forming a connection between the Fitchburg & Leominster Street Railway and the proposed line from Ayer to Lowell. The franchises expire June 1, 1904.

HOLYOKE, MASS.—The Holyoke Street Railway Company will equip its line to Westfield with block signals, and is making additional safety provisions on its other lines.

IPSWICH, MASS.—The Board of Railroad Commissioners has issued an order approving the locations granted to the Haverhill, Danvers & Ipswich Street Railway Company in Topsfield, Ipswich, Rowley, Georgetown, Groveland and Boxford, and allowing the company to operate over private land in those towns. The approval of the Commissioners may be followed by the beginning of the work of building the railway, which will bring Haverhill and the towns of that part of the county into closer communication with Salem.

NAHANT, MASS.—The members of the Board of Selectmen have deemed it advisable to defer action on the matter of granting a franchise to one or the other of the recently organized corporations intending to connect Nahant with the city of Lynn by a trolley line until the town shall pass upon the electric railway project. They have therefore issued a call for a special town meeting to be held early in September for the purpose of voting on the matter.

NAHANT, MASS.—The Selectmen of Nahant have received two petitions asking for a franchise for street electric rights, one being from the Lynn & Nahant Street Railway Company, backed by Walter H. Southwick, a Lynn attorney, and the Carahar Brothers, who conduct an amnibus line between the two places. The other is that of the Nahant Street Railway Company with Ellerton James at the head of the subscribers, who include United States Senator Henry Cabot Lodge and the wealthiest of the summer residents of the peninsula. In September a special town meeting will be called to decide the question.

NORTHAMPTON, MASS.—The Northampton Street Railway Company will double track its line between Northampton and Florence.

SPRINGFIELD, MASS.—The Hoosac Valley Street Railway Company has received a decree granting a location for the railway on the west side of the State road south of the city. The location was first granted on the east side, and the change is the result of a remonstrance from abutters on that side. The company must do its work in a way not to injure the State road, and must widen the road wherever necessary.

WILLIAMSTOWN, MASS.—The Selectmen of Williamstown, Mass., have received an application from Dr. S. L. Lloyd, of that town, for a franchise for an electric railway from Williamstown station to the Vermont State line, a distance of nearly three miles. It is an important piece of road, since it is the link for the connection of the proposed roads from Troy to the State line, and Bennington, Vt., to the State line, with the Hoosac Valley Company for North Adams and points in the southern part of the county. The Selectmen have taken the matter under consideration. The survey has been begun for the proposed railway from Pownal, Vt., to Williamstown, to connect with the

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Hoosac Valley Street Railway to North Adams. The survey includes the route over which Dr. Lloyd and his company wishes to get a franchise.

WORCESTER, MASS.—A block-signal system is to be installed on the Worcester & Webster division of the Worcester & Connecticut Eastern Street Railway, and later, it is announced, it will be extended over the entire system.

WORCESTER, MASS.—The Worcester & Southbridge Street Railway Company announces its intention of double-tracking its entire system, a small part of which it is now operating with double tracks.

WORCESTER, MASS.—The Boston & Worcester Street Railway Company has issued orders to double-track its road between Worcester and Whites Corner, Southboro. This will make a double track all the way to Boston, except five miles between Whites Corner and Framingham.

WORCESTER, MASS.—Improvements are being made along the line of the South Middlesex Street Railway between Hopkinton and Westboro, with the intention, it is announced, of running through cars between Worcester and Newton, if not into Boston. The Westboro & Hopkinton and the Worcester & Westboro lines would be used west of Hopkinton.

WORCESTER, MASS.—The Hartford & Worcester Street Railway Company has petitioned the Railroad Commission for a location in the town of Oxford under the "missing-link" law, the Oxford Selectmen having for three months refused to act on the company's petition. Locations are held in the adjoining towns.

WORCESTER, MASS.—The Selectmen of West Boyleston have been instructed by a vote of the citizens of the town to grant a franchise in West Boyleston to the Worcester Consolidated Street Railway Company for a line between Worcester and Leominster.

WORCESTER, MASS.—The Hartford & Worcester Street Railway Company has petitioned the Massachusetts Harbor and Public Land Commission for permission to fill in a portion of Wales' Pond, in the town of Wales, and to build a trestle there. A hearing has been given.

HOUGHTON, MICH.—The Houghton County Street Railway Company proposes a new extension from Lake Linden to Tamarack-Osceola Mills, and possibly to Hancock. This extension will make the last link in a loop which includes Houghton, Hancock, Laurium, Red Jacket and Lake Linden.

IONIA, MICH.—Local capitalists are planning an electric railway from Ionia to Crystal Lake, Montcalm County. The distance is 35 miles, and it is estimated that the railway can be built for $125 per foot, or $230,000. Ionia's Common Council has guaranteed a bonus of $5,000.

VICKSBURG, MISS.—Vicksburg Street Railway Company proposes extending its system to Wattersville, two miles. An act of Congress will first be necessary to get right of way over National Cemetery road.

ST. LOUIS, MO.—Three cars were placed in commission Aug. 4 on the Central Traction division of the St. Louis Transit Company. The new route is from the corner of Fourth and Pine Streets to Jefferson and Chouteau Avenues, via Pine and Twenty-First Streets. The new division is less than three miles long, and is of little importance to the public. The tracks have been laid for some time.

ST. LOUIS, MO.—The certificate of incorporation of the Southern Illinois Electric Railway Company has been filed. The company is capitalized at $50,000, and its principal offices will be at Mount Vernon. The electric railway projected by the company will run from East St. Louis through the counties of St. Clair, Clinton, Washington, Marion, Jefferson, Hamilton and White, to a point at or near Maumee, on the Wabash River. The incorporators are John R. Piercy, George F. Ward, Samuel Casey, Louis G. Pavey, Samuel T. Maxey and Albert N. Johnson, all of Mount Vernon.

ST. LOUIS, MO.—The directors of the Alton Railway, Gas & Electric Company, and those of the Alton & East Alton Railroad & Power Company, at a recent meeting voted to merge the companies into a new corporation, to be known as the Alton Light & Traction Company. The capital stock of the new company will be $1,000,000. The directors elected were J. F. Porter, James Duncan, C. A. Caldwell, O. S. Stowell and George M. Ryrie. The new corporation will have control of the electric street lines in the Altons, as well as the heating, power and lighting plants. The new company will complete the constructions of the new line to East Alton, which was commenced several months ago.

ST. LOUIS, MO.—It is said that J. D. Houseman, general manager of the St. Louis, St. Charles & Western Railroad, intends extending that line to Ferguson shortly, thereby beginning the first active work toward consolidating all the street railway systems in St. Louis County under one management. By virtue of an arrangement with the St. Louis Transit Company he has secured control of the tracks of the St. Louis County Railway, running from Wellston to the junction of Lucas and Hunt and Natural Bridge roads. By direct cut it is not more than a mile to Ferguson, and the country over which the line would be built is level. It is Mr. Houseman's intention to push more actively the scheme of consolidating the various lines in the county as soon as the highway bridge across the Missouri River at St. Charles, which is under way, is completed. After the consolidation of the Transit, Suburban and St. Charles lines in the county a terminal for the World's Fair is contemplated somewhere in the vicinity of Wellston.

BILLINGS, MONT.—The Montana Construction Company, with a capital of $500,000, has filed articles of incorporation. The directors are: P. B. Moss, W. H. Rowley and T. D. O'Donnell, all prominent citizens of Billings. The company is behind the movement for the new electric railway from Butte to the Salmon River country in Idaho.

BUTTE, MONT.—The Butte & Salmon River Electric Railway Company has been incorporated. The new concern is capitalized at $2,000,000, of which $200,000 has already been subscribed. The incorporators are all Billings men and are: T. B. Moss, W. H. Rowley, M. A. Arnold, T. D. O'Donnell and O. F. Goddard. The new road will traverse Silver Bow and Beaverhead Counties, starting from Butte. It will run to Horse Prairie and thence through the Lemhi Pass into Idaho.

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OMAHA, NEB.—The Omaha Street Railway Company has let the contract for the construction of its new power house at the foot of Jackson Street to Rochford & Gould, of Omaha. Work on the structure will be commenced at the earliest practicable moment, and it is expected that the walls will be up by the time snow flies, so that the machinery can be installed during the winter. The contract for the structural iron work for the power house was let some time ago to a Minneapolis firm. An award for the boilers was let to a Pittsburg firm; that for generators to the General Electric Company; that for the engines to a St. Louis firm; that for the condensers to a New Jersey firm, and that for furnaces to a Pittsburg firm.

SOUTH SIOUX CITY, NEB.—The company that proposed to build an electric railway between Sioux City, Ia., and Homer, Neb., has not yet completed its organization and plans. It will be a standard gage road, and will be 16 miles long, passing through South Sioux City, Neb., Dakota City, Neb., the county seat of Dakota County, and on to Homer, Neb., on the edge of the Winnebago Indian Reservation. The whole 16 miles is perfectly level and will require no grading. The road will be operated for both freight and passengers. Steam locomotives will be used during the construction of the road. The high tension system of power distribution will be used, the plan being to erect one main station and necessary sub-stations.

PATERSON, N. J.—The Paterson State Line Traction Company expects to build a line from Paterson to the State line near Suffern, and although it has secured the right of way through the major portion of the route, considerable opposition has been met in some quarters, and it has had to apply to have commissioners appointed to assess the damages the company will have to pay. The company intends to run through Hawthorne, North Paterson, Midland Park, Ridgewood, Allendale and other villages, but will not begin the work of construction until the right of way over the entire route has been obtained.

ALEXANDRIA BAY, N. Y.—The St. Lawrence Electric Railway & Land Improvement Company, which owns and operate the trolley road between Alexandria Bay and Redwood, is preparing to build a large recreation park before next season on the William Avery farm, midway between Alexandria Bay and Redwood. Work on the park will commence this fall, and it is hoped to have it nearly completed before next year. On the park it is planned to build a baseball and football ground and to erect pavilions and swings and all the conveniences of a big recreation park. The officers of the company are also seriously contemplating building a 20-mile extension of the road to Watertown, taking in the route along Indian River and Butterfield Lake.

BROOKLYN, N. Y.—Notwithstanding the request of Bridge Commissioner Lindenthal that trial of the Poulson plan, as a means of relieving the congestion at the Manhattan end of the Brooklyn Bridge, be made by the Brooklyn Rapid Transit Company, that company declared that the request will be denied. It is pointed out that the request for another trial of the Poulson plan is manifestly unfair just at this time, because of the work being prosecuted on the proposed four additional trolley loops at the Park Row bridge approach in Manhattan.

BROOKLYN, N. Y.—Plans for the proposed improvement of the Brighton Beach division of the Brooklyn Rapid Transit Company have been submitted to the Grade Crossing Commission. The proposition made by the engineers of the company is to erect an embankment along the line, from Church Avenue to the end of the road. This will do away with the rumored steel elevated structure, against which there has been so much opposition. To carry out this work it will be necessary for the company to raise its right of way to a considerable height, so that the various streets crossing the line can be cut through the embankment.

BINGHAMTON, N. Y.—The Binghamton Railway Company is to be granted a franchise over the Tompkins Street Bridge, through Tompkins Street to Conklin Avenue, connecting at this point with the Orphans' Home line. The company is also to be granted a franchise on Conklin Avenue extending from the end of the present Home system to the eastern city limits.

NEW YORK, N. Y.—Work on the elevated structure of the underground rapid transit system, which will extend from Forest and Westchester Avenues in the Bronx to 180th Street, has been begun.

NEW YORK, N. Y.—The spur of the subway at 104th Street has been broken through, thereby opening the connection between the main line and East Side branch. The opening is not very important, but it is interesting to know that the eastern branch of the subway is open from the main line to the Harlem River. From Sixtieth Street to King's Bridge there are four tracks in the subway, two of them, in the middle, lower than the others. The middle tracks turn at 104th Street, and go under the east side track, in order to connect with the east side branch. The tunnel which goes under Central Park at this point was finished a year ago. It remained to open the spur at 104th Street to have the road open the entire length.

OSWEGO, N. Y.—Quit-claim deeds from Christopher Brackin, Sr., to the Syracuse & Ontario Railroad Company transferring the Fulton & Oswego Falls Street Railway Company, have been filed in the county clerk's office. The deed from William H. Enos to Christopher Brackin, transferring the same property, has also been filed.

SENECA FALLS, N. Y.—The Geneva, Waterloo, Seneca Falls & Cayuga Lake Park Traction Company is actively engaged in securing rights of way between Cayuga and Auburn for the proposed extension of its line, and work on the Auburn city line will be begun at once.

UTICA, N. Y.—It is said that arrangements have been made by the Clinton Electric Company to furnish additonal power for the Utica & Mohawk Valley Railway Company. It will be used in operating the Clinton line, and will greatly improve the service. The contract will necessitate the continuous operating of the local power house, and, according to local gossip, will necessitate the installation of additional machinery.

CLEVELAND, OHIO.—The Cleveland, Painesville & Ashtabula Railway Company will complete its line between Painesville and Ashtabula about Oct. 1. Arrangements have been made with the Pennsylvania & Ohio Rail-

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way to furnish current until the new station at Painesville can be completed. This will complete through traffic between Cleveland and Erie, Pa., and except for a very few miles at the western portion of the State, it will be possible to travel entirely across Ohio by electric cars.

CLEVELAND, OHIO.—Applications for street railway franchises are coming thick and fast in Cleveland. A. E. Green, representing John B. Hoefgen, has made application for four new 3-cent fare routes as follows: On Denison Avenue, from Rhodes Avenue to the city limits; on Summit Street, from Erie to Seneca Streets; on Edgewater Boulevard, from Taylor Street to Lake Avenue; on Doan Street, from Wade Park Avenue to Ansel Avenue. The Cleveland Electric Railway has also asked for a franchise on Woodland Hills Avenue, Fairmount Street, Cedar Avenue, Doan Street, to the city limits, or by way of Quincy Street instead of by way of Cedar Avenue.

COLUMBUS, OHIO.—The Central Market Street Railway Company, which is the city system of the Appleyard lines, has applied for a franchise to extend its line on Summit Street to Ninth Avenue, to Grant Avenue, and thence to Woodruff Avenue, to a point opposite the State fair grounds. The franchise calls for eight tickets for 25 cents, 33 for one dollar and transfers on its own lines. This would give the company a portion of the State fair business, now handled by the Columbus Railway Company.

DAYTON, OHIO.—The Dayton & Lebanon Traction Company has been incorporated with temporary capital stock of $1,000 by James P. Wolf, Wayland P. Sunderland, Frank M. Hamilton, W. C. Ely and O. F. Davidson. The line is to extend from Dayton to Lebanon. Work has already been done in Montgomery and Warren Counties.

TOLEDO, OHIO.—Contractors have been invited to bid on the construction of the Ohio & Michigan Traction Company's line. Contracts will be awarded Sept. 1, and work will start as soon as possible thereafter. The line will be 48 miles long, and will extend from Toledo to Ann Arbor, by way of Dundee, Milan and Petersburg.

TOLEDO, OHIO.—J. Morgan and J. L. Weadeck, of Toledo, promoters of the proposed electric railway from Toledo to Cincinnati, by way of Greenville, are planning to build a branch line from a point near Van Wert to Decatur, Ind., and eventually to Indianapolis. They have had several conferences with Indianapolis capitalists relative to financing the Indiana end of the proposition.

YOUNGSTOWN, OHIO.—The Youngstown & Southern Railway Company has placed a contract with William Ripley & Sons, of Boardman, Ohio, for 130,000 ties to be used in the construction of the road from Youngstown to East Liverpool. Work of grading for the line is now being pushed.

BUTLER, PA.—A charter has been granted to the East Butler Street Railway Company to operate between Butler and Bonny Brook. The officers are: D. Harper Sutton, president; J. F. Anderson, J. H. Troutman, J. S. Campbell, Frank H. Murphy and W. D. Brandon, directors.

BUTLER, PA.—The Butler Passenger Railway will extend its lines to the edge of the new town of East Butler, three miles up the Bonnie Brook Valley, and a company composed of the promoters of the new town will run the line up to the old Bonnie Brook mill. The officers and directors of the new company are: D. H. Sutton, president; J. F. Anderson, J. H. Troutman, J. S. Campbell, F. H. Murphy and W. D. Brandon, directors.

CHARLEROI, PA.—The Pittsburg & Charleroi Street Railway Company has bought the property between Eleventh and Twelfth Streets for the purpose of constructing large car houses. The company is now preparing plans to erect the buildings at once.

JEANNETTE, PA.—An electric railway from Jeannette through Adamsburg, Madison, Arona and other coal mining towns to West Newton has been planned and will be built by Jeannette capital. Franchises at Adamsburg and other towns have already been secured, and very little difficulty, it is expected, will be met with at Arona and Madison. The length of the line will be 14 miles. It is estimated that the new line is to be in reality a part of the Pittsburg, McKeesport & Connellsville line, and that it will ultimately be connected with the Greensburg & Southern Company's line at Ludwick, west of Greensburg. W. A. Cribbs, of Jeannette, is interested.

PHILADELPHIA, PA.—Newspaper reports say that the statement is made in well informed quarters that the Susquehanna Power Company, which was recently incorporated for the purpose of harnessing the water power of the Susquehanna River, changing it into electric energy and conveying it for use in Baltimore, has secured subscriptions to nearly $10,000,000 of its capital and is about to sign a contract with the General Electric Company for electrical machinery involving, before the apparatus shall all have been installed, the expenditure of from $2,500,000 to $3,000,000.

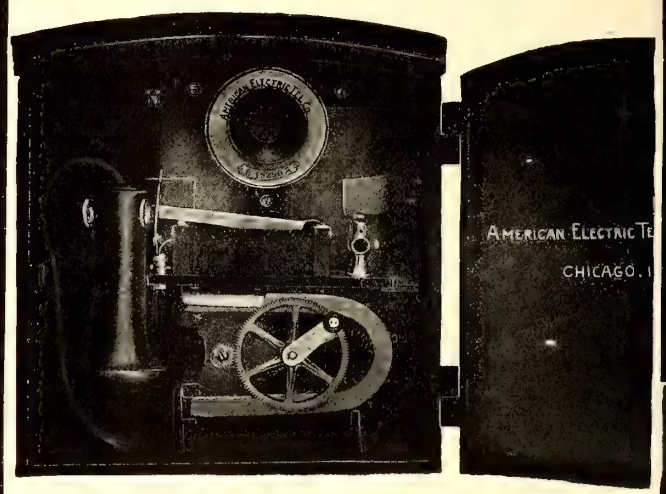
READING, PA.—Extension papers for the construction of a line of the Pottstown & Suburban Street Railway Company from Pottstown to Boyertown have been filed. The new line, when completed, will furnish the connecting link between Reading and Philadelphia by trolley.

READING, PA.—Another electric railway is to be built between Birdsboro, Berks County, and Reading, by the Reading & Birdsboro Street Railway Company. It will be a part of the United Traction Company's system, and will start from the terminus of that company's line at Black Bear. From there it will run down the east side of the Schuylkill River, crossing the Big Dam, and go on through Seyfert's, Naomia, Gibraltar and Clingan to Birdsboro. The company is capitalized at $12,000, at $50 a share. Work will be begun in the fall and pushed rapidly.

PROVIDENCE, R. I.—E. K. Watson, of Warren, has been awarded the contract for building the sub-station for the Warren & Bristol branch of the Rhode Island Company. It has been decided to locate the station at Barrington. The new station, for which plans have recently been drawn, is to cost about $13,000 and will be a sightly structure of brick, with Smithfield

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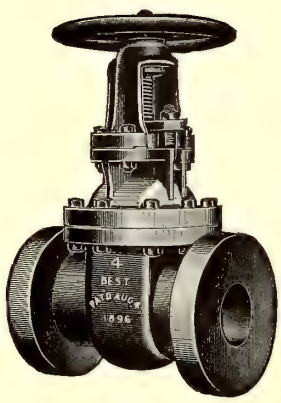


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granite trimmings, the foundation walls to be of concrete formed of Portland cement.

NASHVILLE, TENN.—A charter has been granted the McMinnville, Woodbury & Nashville Railroad Company, with $10,000 capital stock. The incorporators are: John M. Gant, Thomas S. Weaver, W. E. Gamble, M. D. Smallman and Walter S. Anderson. The line of the proposed road is from McMinnville through Woodbury, Jefferson, Smith's Springs to Nashville, with a branch from Smith's Springs to Donelson.

LAREDO, TEX.—The Laredo Electric & Railway Company is about to build a 2¼-mile extension, and plans to add to its power station equipment a new 250-hp engine and a 150-kw alternator. Grading for the extension has been started.

HOUSTON, TEX.—Work has just been begun on the addition to the power house of the Houston Electric Company. The addition, with the new machinery that is to be installed, will entail an expenditure of $100,000. The present plant is being enlarged primarily to provide power for the line to Harrisburg, which the company plans to construct next year.

NORTON, VA.—The Wise County Electric Light, Power & Transportation Company has been organized to build an electric railway from Norton, via Jones' Creek, Coeburn, Wise Courthouse, Glanmorgan, Dorchester and Blackwood, to Norton, and from Norton via Looney Creek, Stonega, Preachersville, Dooley, Inman and Big Stone Gap to Norton, connecting practically all of the Wise County mining regions.

BENNINGTON, VT.—Preliminary surveys for the North Adams & Bennington Electric Railway have been recently made. The road will run via Pownal and Williamstown, the length being 20 miles. Several Bennington capitalists are among the incorporators.

SNOHOMISH, WASH.—Local interests plan to build an electric railway from Snohomish to Monroe and Cherry Valley, a distance of 15 miles. W. M. Snyder, cashier of the First National Bank, is interested.

SPOKANE, WASH.—The Adams County Electric Transit Company expects to build a railway between Spokane and Washtucna.

SPOKANE, WASH.—The Cœur d'Alene & Spokane Railway has completed 85 per cent of the grading of its roadbed. The bridge across the Spokane River near Post Falls is about completed, and it is expected that the line will be in operation by Nov. 1. The plans for securing power for operating the line in the day time provide for two sub-stations. For the first 6.6 miles east from the city power will be furnished directly for operation of the cars from the city power plant of the Washington Water Power Company. In East Spokane the Cœur d'Alene transmission line will be tapped, and power will be carried to a step-down station on the new line located near Trent, where the voltage will be reduced from the 45,000 volts carried on the mining transmission line to 22,000 volts. From the step-down station the current will be carried to two sub-stations, located 13.2 miles apart, the more eastern of which will be 6.6 miles west of Cœur d'Alene City. These sub-stations are to be 35 ft. x 40 ft. in size, and built of either brick or stone. Each will be equipped with a rotary converter; arrangements are to be made so that a second unit may be installed later. Plans for the pole lines provide that the poles shall be 40 ft. apart, or 20 ft. from the center of the tracks. The trolley wire will be suspended 22 ft. above the rails. One line of poles on one side of the track will carry the high-potential circuit and the other pole line will carry the feeder wires and the telephone line.

WHATCOM, WASH.—By the unanimous vote of the City Council the city granted the Whatcom-Skagit Interurban Railway Company a franchise over certain streets desired to connect with 70 miles of electric railway which the company is to build between Mount Vernon and Deming, on the Noosack River, in Whatcom County.

WHEELING, W. VA.—The County Commissioners have granted the Wheeling, West Liberty Belt Line Company a franchise to build from Stackyards to Greggsville, with a few spurs and branch lines on the side.

NEWS NOTES

HARTFORD, CONN.—The action taken by the Selectmen of North Haven with reference to approving the plans and layout of the part of the street railway line which the Wallingford Tramway Company proposes to build in that town may seriously delay the building of the connecting link of a continuous trolley line between New York and Boston. The proposed road of the company is to run from the centre of the town of Wallingford to Montowese, in the town of North Haven. But the Selectmen of North Haven in approving the layout of the road impose many conditions which are obnoxious to the company. They insist that the company shall establish and maintain, without expense to the town, electric lights along the highway through which the road runs, that it shall macadamize the road, cobble the gutters, maintain the bridges and be responsible for all damages. The tramway company will not accept any such conditions, and the case will be appealed to the State Railroad Commissioners. Considerable surprise is expressed over the radical attitude assumed by the North Haven Selectmen.

ALTON, ILL.—On July 30 the Alton Railway, Gas & Electric Company and Alton and East Alton Railway & Power Company were consolidated as the Alton Light & Traction Company. The authorized capital of the company is $1,000,000, of which $500,000 is preferred stock and $150,000 common stock. All the stock has been issued.

EAST ST. LOUIS, ILL.—A new scale of wages went into effect with the employees of the East St. Louis & Suburban Electric Railroad August 2. By the new scale the trackmen will receive $1.57½ per day, for nine hours' work.

This is the Sterling Safety Brake.

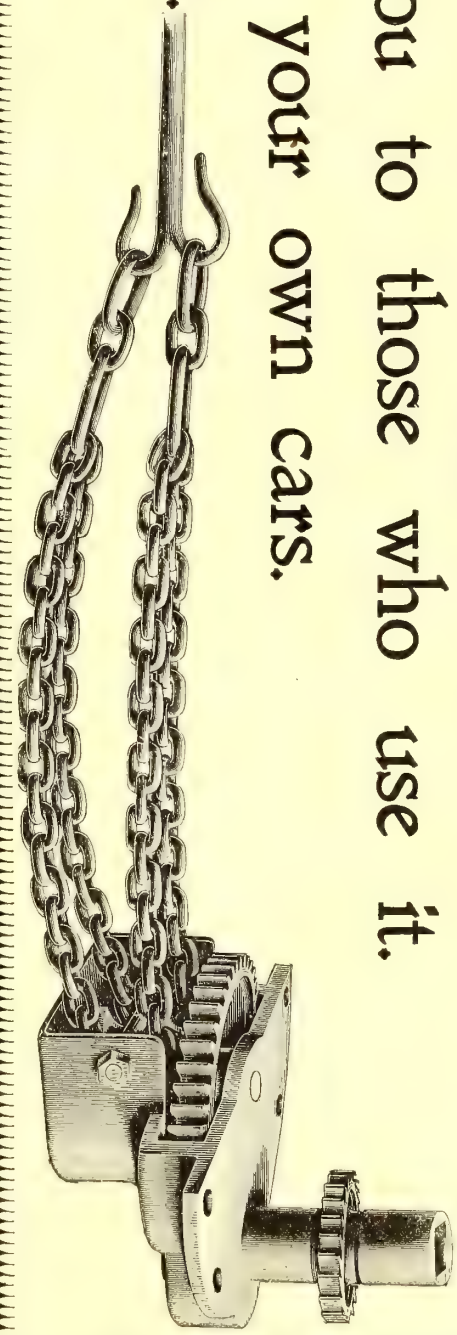
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DIXON, ILL.—The Dixon, Rock Falls & Southwestern Electric Railway, which is engaged in the preliminaries for an electric railway from Dixon to Rock Falls and nearby points, has elected officers as follows: G. H. T. Shaw, of Dixon, president; A. C. Hanley, vice-president; R. L. Leitch, secretary; O. E. Maxon, treasurer; H. L. Sheldon, attorney. The company has recently been granted a franchise in De Kalb.

BELLEVILLE, IND.—The ordinance committee of the City Council has favorably reported an ordinance to grant the Morrison Express Company, of East St. Louis, a franchise to run freight and express cars over the tracks of the Belleville Railway system.

INDIANAPOLIS, IND.—Behind time and running at a high rate of speed, a south-bound car on the Indianapolis & Martinsville Rapid Transit Company's line crashed into a north-bound car three miles south of Mooresville, Aug. 2, injuring over thirty people.

INDIANAPOLIS, IND.—After three weeks of labor the Indiana State Tax Board announces its assessment list for electric railroads as follows:

	1902	1903
Main track	$8,218,980	$10,313,795
Second main	40,060	68,890
Side track	54,455	75,657
Rolling stock	1,023,747	1,177,135
Improvements on right of way	302,070	378,285
Increase	$2,347,450	

LOUISVILLE, KY.—St. John Boyle has been elected vice-president and general counsel of the Louisville Traction Company and Samuel G. Boyle has been elected secretary and treasurer of the company. Both occupied similar positions with the Louisville Railway Company.

WORCESTER, MASS.—The hearing as to the cause of the recent accident on the Boston & Worcester Street Railway will be continued at Boston on Aug. 21 by the Railroad Commissioners. Reference to the hearings that have been held was made in the Street Railway Journal of Aug. 8.

NEWARK, N. J.—The Public Service Corporation has denied the request of Alderman Young, of Paterson, for a three-cent fare in that city during the hours of 6 to 8 o'clock in the morning and 5 to 7 o'clock in the evening.

BROOKLYN, N. Y.—Corporation Counsel Rives has sent to the Board of Aldermen an opinion saying that the Board has a right to regulate by ordinance the surface railroad traffic in Jamaica Avenue, between Cypress Hills and Jamaica, wher the Brooklyn Rapid Transit Company is operating three-car elevated trains in a manner objectionable to some of the people. The elevated tracks are conected with those on the surface in Jamaica Avenue by an incline, and the elevated cars run from the Bridge or Broadway ferry right through to Jamaica.

POUGHKEEPSIE, N. Y.—A few days ago the bumper at the foot of Main Street to stop runaway cars was given the first test it has had since it was erected by the Poughkeepsie City & Wappingers Falls Electric Railway Company after the car went in the river in December, 1901. The test was accidental, but it was entirely satisfactory and convinced the officials of the company that the bumper will serve its purpose. A car got beyond the motorman's control after leaving the railroad station. The rain had just started falling and the rails were slippery. The brakes were put on, but the wheels began to slide and the motorman couldn't stop the car. About 5 ft. of the car ran upon the bumper and it was not damaged in any way. The car did not carry any passengers.

TOLEDO, OHIO.—The Toledo Railways & Light Company is experimenting with a new testing car, the invention of A. B. Herrick, of New York. The car shows the alignment of the track and also the power developed at any point on the line. As the car passes over the line it makes a record on a roll of paper. By consulting this roll the track superintendent can determine the condition of the track.

COLUMBIA, PA.—The directors of the Lancaster County Railway & Light Company have elected the following officers: William B. Given, president; Charles B. Keller, vice-president; O. M. Hoffman, secretary and treasurer; executive committee, President Given, Vive-President Keller, P. Eckert Slaymaker, P. B. Shaw and W. W. Griest.

PHILADELPHIA, PA.—The American Railways Company report that the gross receipts of the subsidiary companies for July show an increase of about 15 per cent over July of last year.

FINANCIAL NOTES

PUEBLO, COL.—The Pueblo & Suburban Traction & Light Company reports earnings as follows: Gross earnings for June, $41,867; operating expenses and interest, $34,840; net for dividends, $7,026.

CHICAGO, ILL.—The Aurora, Elgin & Chicago road reports earnings $53,338 for its passenger traffic for July. The May receipts were $28,002, and those of June $38,848, June being the first month in which the Elgin branch was operated. The gain of over $5,000 for July shows how the traffic of the new road is growing.

BOSTON, MASS.—The Boston News Bureau quotes a director of the Massachusetts Electric Companies as saying that the gross earnings of the company for July exceeded those of any previous July in the history of the company. "The net showing," says the News Bureau, "was not quite so good, but as a whole it was very satisfactory. It is understood that the gross for the month for all of the companies was considerably above $500,000." Taking the highest quotation of the year for the preferred stock, 96, and the common at 37¾, the shrinkage in market values, so the News Bureau says, would amount to $8,281,969, of which the preferred has suffered a decline of $4,094,569, while the common has shrunk $4,187,969. Says the News Bureau

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in concluding: "If the company was to be liquidated at present prices it would require only $16,239,003 for the preferred stock, leaving $5,383,497 for the common stock, or approximately $21.50 per share. In addition to this the company has bills receivable in excess of $4,000,000, which would provide another $13 per share for the common stock. This is in addition to the earning capacity of the company and its future development."

GREENFIELD, MASS.—The Greenfield, Deerfield & Northampton Street Railway Company and the Greenfield & Deerfield Street Railway Company have petitioned for authority to consolidate.

WORCESTER, MASS.—The Worcester, Rochdale & Charlton Depot Street Railway Company has given a mortgage in trust to the International Trust Company, of Boston, for $100,000, to run twenty years and drawing 4½ per cent interest, payable semi-annually. This is to protect a bond issue of $40,000, which is to be made at once. This company forms a part of the Worcester & Southbridge Street Railway system and has been making extensive improvements this year to facilitate the handling of its heavy traffic between Worcester and Pinehurst, an amusement park.

BOSTON, MASS.—The Railroad Commissioners have authorized the Blue Hill Street Railway Company to issue 1200 additional shares of stock for funding its floating debt.

ST. LOUIS, MO.—The statement issued August 7 by the auditor of the St. Louis Transit Company shows the gross earnings for July to be $632,704, as against $575,173 for the same month in 1902. The gain for July this year over July, 1902, is $64,531. The gross receipts of the company for the first seven months of this years are $4,099,953, as against $3,589,859 for the same period last year, a gain of $535,591.

BUFFALO, N. Y.—The International Traction Company reports earnings as follows:

June	1902	1903
Gross earnings	$271,245	$323,098
Operating expenses (excluding taxes)	147,613	176,935
Net earnings	123,631	146,163
Fixed charges (interest, taxes, rentals, etc.)	126,141	130,528
Net income	2,509	15,634
Net income, July 1 to date	*763,457	176,065
Operating cost, per cent of earnings (exclusive of taxes)	.554	.557

* Includes earnings of Pan-American Exposition period.

INTERNATIONAL TRACTION COMPANY SYSTEM INCOME ACCOUNT

For quarter ending June 30	1902	1903
Gross earnings	$786,280	$945,556
Operating expenses (excluding taxes)	436,914	519,061
Net earnings	349,365	426,494
Fixed charges (interest, taxes, rentals, etc.)	375,039	389,393
Net income	25,673	37,100
Net income, July 1 to date	*763,457	176,065
Operating cost, per cent of earnings (exclusive of taxes)	565	558

* Includes earnings of Pan-American Exposition period.

For year ending June 20	1902	1903
Gross earnings	*$4,566,402	$3,728,173
Operating expenses (excluding taxes)	2,254,084	2,013,624
Net earnings	2,312,418	1,714,549
Fixed charges (interest, taxes, rentals, etc.)	1,548,969	1,538,483
Net income	763,457	176,065
Net income, July 1 to date	*763,457	176,065
Operating cost, per cent of earnings (exclusive of taxes)	.509	.549

* Includes earnings of Pan-American Exposition period.

CLEVELAND, OHIO.—The Cleveland, Painesville & Eastern Railroad Company reports earnings as follows for June, 1903: Gross earnings, $19,765, as against $18,715 for June, 1902; operating expenses, $11,486, as against $10,488; net earnings, $8,278, as against $8,227. For the six months ending June 30, 1903, the company reports as follows: Gross earnings, $91,405, as against $84,144 for the same period last year; operating expenses, $55,909, as against $49,287; net earnings, $35,494, as against $34,857.

YOUNGSTOWN, OHIO.—The Youngstown-Sharon Railway & Light Company reports earnings as follows: Six months ending June, gross earnings were $246,182; operating expenses, $152,636; net earnings, $93,546; June gross earnings were $42,831; operating expenses, $25,268; net earnings, $17,562.

CLEVELAND, OHIO.—W. S. Louge, representing Cleveland interests, has purchased the franchises and property of the Frankfort & Suburban Railway. The line comprises 7 miles of road, which has not been in operation for about a year because certain freight carrying rights were withdrawn. The new owners have posted a forfeit of $1,000 to have the road in operation within four months. It is claimed that several miles of new track will be built.

ALTOONA, PA.—The Altoona & Logan Valley Electric Railway Company and the Tyrone Electric Railway Company have been consolidated as the Altoona & Logan Valley Electric Railway Company. The total authorized capital stock of the united company is $800,000. Both companies were controlled by the American Railways Company.

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AMONG THE MANUFACTURERS

DALLETT & COMPANY, Philadelphia, Pa., have just issued their August bulletin. This comprises a list of new and second-hand railway and trolley supplies, which they have ready for immediate shipment. Railway men when needing material quickly should find such bulletins very convenient.

CLIMAX FENCE POSTS are illustrated and described in a neat booklet just issued by the Climax Fence Post Company, of Chicago, Ill. The base of this fence post is made of vitrified shale clay. Into this base a high carbon steel angle is inserted and cemented, thus making a solid, strong and durable post which will not rot, rust or burn.

THE LAGONDA MANUFACTURING COMPANY, of Springfield, Ohio, has received a letter which speaks very highly of its No. 8 water-power boiler cleaner. It is from O. E. Randolph, general superintendent of the Union Waxed & Parchment Paper Company, of Franklin, Ohio, who states that since using this device to clean a battery of four Babcock & Wilcox boilers his company is saving 20 per cent on fuel, and that he considers it a great machine.

RIDLON'S REPRESENTATIVE has just made its appearance for August. Typographically it is as neat as a first-class magazine, and its literary contents smack of both philosophy and humor. "What Ben Franklin Never Did" is a skit which deserves to be widely quoted, yet it is only one of similar sallies in this publication. The magazine is published by the Frank Ridlon Company, the repair experts of Boston, Mass., who will send it regularly to all readers of the Street Railway Journal desiring it.

THE PEERLESS RUBBER MANUFACTURING COMPANY, of New York, has just published a new catalogue, No. 58, describing its Rainbow packing, which the company states is especially adapted for very high pressure, and is not affected by any degree of steam heat. Nor is it affected by oils, ammonia, liquors, steam or alkalies. This publication also describes the company's Germane sheet and flange packing, besides its other specialties. Readers of the Street Railway Journal, by writing the company, will be furnished with a copy of this catalogue.

THE KUHLMAN CAR COMPANY has delivered to the Eastern Ohio Traction Company, of Cleveland, eight very fine cars to take the place of a number of cars which were destroyed by fire some months ago. They are 47 ft. over all, interior finished in mahogany with black and white marquetry and elaborate inlaid work. All metal work is of oxidized bronze finish, and the lights are mounted on beautiful electroliers manufactured by the Cleveland Gas & Electric Fixture Company. The cars are equipped with four 50 hp Westinghouse motors mounted on Peckham trucks. Wilson trolley catchers, Christensen air brakes and Smith hot water heaters are other items of equipment.

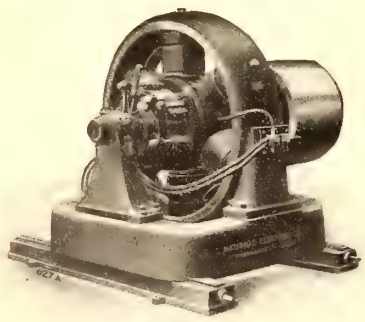
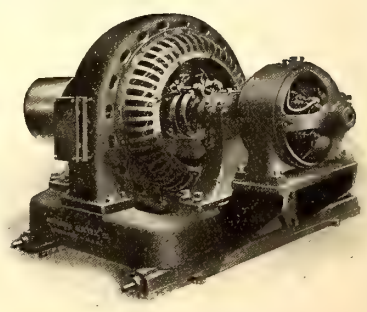
THE GENERAL ELECTRIC COMPANY has just issued the following circulars: No. 4327, Small Continuous Current Stationary Motors; No. 4328, Direct Connected Railway Generators, containing complete description and numerous cuts of the same, together with sizes, voltages, dimensions and a list of railways and power stations using this type; No. 4329, Motor Starting Rheostats; No. 4330, Automatic Carbon Brake Circuit Breakers, Type C, Form G, for 125 volts to 250 volts direct current circuits; No. 4331, Portable Torque Balance, for measuring the torque of any motor meter; No. 4332, Arc Lamps of interchangeabue types; Price List No. 5111 covering snap, pendant and punched clip switches; Supply Catalogue No. 7579, covering parts of Thomson recording wattmeters; Supply Catalogue No. 7580, parts of Form 2, direct current power circuit enclosed arc lamps.

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Pittsburg: GELLATLY & CO.
Seattle and San Francisco } KILBOURNE & CLARK CO.

INDIANAPOLIS, IND.—A new company, organized to engage in building steam and electric railroads, has been incorporated with the Secretary of State. The title of the company is the Southern Construction & Equipment Company. The capital stock is $50,000. The directors are: Frederick Cline, Frank N. Fitzgerald, William H. Lacey, and others. The principal offices of the new company will be in this city.

INDIANAPOLIS, IND.—The Appleyard syndicate is reported to have perfected a plan to build its own track through Indiana, connecting Indianapolis with its system in Ohio.

INDIANAPOLIS, IND.—The directors of the Indianapolis & Shelbyville Traction Company are receiving bids for the construction of 28 miles of road between Shelbyville and Greensburg. Robert C. Light is president of the company.

INDIANAPOLIS, IND.—A franchise has been granted to the Indianapolis, Danville & Rockville Traction Company by the Marion County Commissioners. It permits the company to enter the county by way of the Rockville Pike. A short distance west of the city the railway will approach the National Road over a private right-of-way and enter the city by way of Washington Street.

LA PORTE, IND.—The Northern Traction Company, with a capitalization of $100,000, has filed articles of incorporation. The incorporators are Samuel A. Wight, John L. Devine, Walter C. Nelson, Francis M. Case and William J. Root, of Cook County, Illinois, and the purpose of the company is to build an electric railway system connecting South Bend, La Porte, Valparaiso and Hammond. The Northern Traction Company already has secured considerable right of way for which cash was paid and has secured a number of franchises in the several counties which it will traverse with its lines.

LEBANON, IND.—Work on the Crawfordsville division of the Northwestern Traction Company has been suspended, and the men employed on the line have been transferred to the Lafayette division above Frankfort. Work on the Lafayette division has not progressed as rapidly as expected and as the line must be completed by January, in order to comply with the franchise granted by the City of Lafayette, it was decided to quit work on the Crawfordsville division and rush the work on the Lafayette division.

MONTPELIER, IND.—A company of oil men, headed by James West, has projected an electric railway to connect this city, Portland and Warren, to be known as the Oil Belt Traction Line. The right of way is being secured.

RICHMOND, IND.—Construction of the Eastern Indiana traction road has been begun near this city. The line will run from Hamilton, Ohio, to Marion, Ind., via Richmond. The third-rail system will be used. The Lamar Contracting Company, of New York, is doing the work.

RICHMOND, IND.—Construction has been begun on the Eastern Indiana Traction Company's railway, which will extend from Hamilton, Ohio, to Marion, Ind., passing through Richmond, Fountain City, Lynn, Winchester and Gas City. The work will be done north of Richmond. The surveyors have completed their work as far north as Ridgeville.

ROCKPORT, IND.—The right of way for the Evansville, Boonville & Rockport Electric Railroad has been secured from Boonville to within 6 miles of Evansville, and the right of way for the entire line between Boonville and Evansville will be secured within a short time. J. F. Britton and E. C. Henning, having charge of that work, are pushing it as rapidly as possible. Further than Boonville nothing definite has been determined upon as to the extension of the line.

SHELBYVILLE, IND.—The survey for the extension of the Indianapolis & Shelbyville line to Greensburg has been completed.

WAVERLY, IND.—The Indianapolis & Southwestern Traction Company, which is getting a right of way for a line from Indianapolis to Evansville, has purchased 227 acres of land here for a park and pleasure resort. The river is to be dammed at this point, and a large generating plant is to be built. It is the purpose of the company to make the park the finest pleasure resort in the State.

BURLINGTON, IA.—Articles of incorporation for the Burlington Interurban Railway Company have been filed here. The capital stock is $200,000. The officers are all well known Burlington capitalists, including Carl Leopold, president; I. W. Copland, vice-president; Charles Blaut, second vice-president; Charles Armknecht, treasurer, and J. W. Topping, secretary. The new line will be built from Burlington to Keosauqua.

BURLINGTON, IA.—The Burlington Interurban Railway Company has been incorporated with $200,000 capital.

DAVENPORT, IA.—The Iowa & Illinois Interurban Railway Company has commenced the work of constructing its projected line between Davenport and Clinton. Thomas J. Wilcox, of Des Moines, the promoter of the line, states that the right of way has all been secured and that the company has completed arrangements for the capital to build and equip the line.

IOWA CITY, IA.—The City Council has granted an extension of time to the Cedar Rapids, Iowa City & Southern Railway Company for the completion of the line from Cedar Rapids to Iowa City. The franchise granted by Iowa City to the company called for the completion of the line by Dec. 31, 1903. The City Council has now extended the time limit to March 31. Colonel Dows, of Cedar Rapids, promoter of the line, states that the work of grading is progressing rapidly and that the request for more time was due to the fact that the company is having some trouble in securing material for the bridges. The work of laying the rails will commence soon.

LE MARS, IA.—The Sioux City & Le Mars Interurban Railway Company will commence the survey of a route for the line between Sioux City and Le Mars within the next few days. General Manager B. B. Josselyn, of the Union Terminal Railway Company, of Sioux City, is one of the principal promoters of this line.

MARION, IA.—Capitalists of Linn County have organized the Marion & Northwestern Interurban Railway Company, for the purpose of building an electric railway from Marion in an easterly direction to Springville, and from Springville in a northerly direction through Whittier, Waubeek and Prairiesburg, all inland towns in Linn County, to Manchester, the county seat of Delaware County. The line will be about 36 miles in length, and will pass through a rich agricultural country, about midway between the Marion & Calmar division of the Milwaukee and the Cedar Rapids-Manchester branch of the Illinois Central. The line has already been surveyed as far north as Prairiesburg, and the surveyors are now at work between Prairiesburg and Manchester. The money to construct, equip and operate the line has already been arranged for, and the work of construction will commence this fall. Senator J. S. Alexander is interested in the project.

SIOUX CITY, IA.—It is said that the Sioux City, Homer & Southern Electric Railway, which is to run from Sioux City to Homer, a distance of 16 miles, has placed the contract for the equipment of the line. Capt. Richard A. Talbot is the promoter of the company.

TOPEKA, KAN.—An application for a charter for the Topeka, Lawrence & Kansas City Electric Railway Company, with a capital of $4,000,000, has been applied for to the States Charter Board, and a forfeit of $25 put up for the payment of the $1,225 charter fee which will have to be paid if the charter is granted. The survey for this road was made about a year ago, and extends through Jackson County, Mo., Wyandotte, Johnson, Douglas and Shawnee Counties, in Kansas, to Topeka. The survey ended at Vinewood Park, and although the officials of the Vinewood Railway, and now of the Topeka Railway, deny it emphatically, it is generally believed that the Kansas City-Topeka line, if built, will enter Topeka over the Vinewood line of the Topeka Railway Company. It is also remarked that as there is nothing specific in the charter applied for with regard to the motive power to be used, this may be a scheme of the Rock Island Railway to get a right of way to Kansas City. It now uses the Union Pacific line between Kansas City and Topeka. The new line is to be chartered by T. S. Salathiel, J. B. Adams, H. M. Levan, C. L. Bloom and A. P. McBride, all of Independence, Kan., and will build, including switches and turnouts, 75 miles of track, and will carry on a freight and passenger service, with all the privileges of a steam railway. The company also asks for the right to mine coal and other minerals, to drill oil and gas wells, and to pipe gas.

LOUISVILLE, KY.—Colonel J. D. Powers, of the United States Trust Company, and a number of other bankers have been asked to go to Columbia, Ky., and inspect the route of a proposed electric railway between Columbia and Lebanon. The road will connect Columbia with the Louisville & Nashville Railroad at that point, and will pass through Elkhorn, Akron, Mannsville and Merrimac. The proposed road is to be 40 miles long, and the promoters are very anxious to finance it with Louisville capital.

VERSAILLES, KY.—Application will soon be made to the Woodford Fiscal Court by the Municipal Bond & Securities Company, of Cincinnati, for a right of way franchise along the Versailles and McCracken's Mill Turnpike, in this county, for an electric railway to be built from Frankfort to Versailles. The company recently bought the local street railway.

AUGUSTA, MAINE—The Rockland, Thomaston & Camden Railway Company proposes to have its central station changed from Rockport to Belfast, using its Rockport buildings as auxiliary. The survey from Camden to Belfast is nearly completed. This line will be 18 miles long. W. B. Getchell, of Augusta, Maine, is the engineer.

BELAIR, MD.—The Town Commissions of Belair have passed an ordinance authorizing the Baltimore & Belair Electric Railway Company to lay tracks and operate an electric railway in Belair. The ordinance provides that the work shall be commenced by Dec. 31, 1905, and the road be in operation by Dec. 31, 1906, and the work, when once begun, is to be continued with reasonable expedition. On and after Dec. 31, 1910, the company is to pay the town of Belair, in addition to the usual property tax, an annual amount, to be determined every five years by arbitration, as a franchise tax for the use of the streets.

ARLINGTON, MASS.—A hearing has been held here on the application of the Middlesex Street Railway Company for a franchise. The plan of the company is to build a high-speed electric railway between Arlington Heights and Billerica, a distance of 10 miles, about 3000 feet in the town of Arlington, 2½ miles in Lexington and 4 miles in Burlington. It is proposed to acquire a location on private land and maintain an average speed of from 35 to 40 miles an hour. George E. Morgan, of Lexington; Charles F. Remington, of Woburn, and Fernald E. Ham, of Woburn, are interested.

BOSTON, MASS.—The Boston & Northern Street Railway Company is purchasing land along Highland Avenue, Salem, for a new electric line which will connect Town House Square, Salem, with Scollay Square, Boston, by an almost direct route, enabling cars to make the distance in an hour's run.

MARLBORO, MASS.—Extensive improvements are planned for the Marlboro Street Railway, which has recently passed into the hands of James F. Shaw, of the Boston & Worcester Street Railway Company. The Boston & Worcester system of safety appliances, by the use of telephones, flags, lights and torpedoes, is to be adopted. The line runs from Marlboro Junction to Hudson, and through cars are operated between Hudson and South Framingham over the Framingham, Southboro & Marlboro Street Railway.

MT. WASHINGTON, MASS.—The construction of the New York & Berkshire Railway has been begun here. The Taconic Power & Construction Company, which proposes to finance the enterprise, has options on more than 6000 acres of the most desirable real estate in town, will construct a first-class hotel and cottages, and will improve old and lay out new roads to desirable points of interest now inaccessible to any but pedestrians.

NILES, MICH.—The South Bend-Niles interurban line of the South Bend & Southern Michigan Railway Company has been placed in operation. The South Bend & Southern Company is a consolidation of the South Bend & Northern Railway Company and the South Bend & Southern Michigan Railway Company. The former extends from South Bend to the Michigan State

line, and the latter extends from the Michigan State line to St. Joseph, Mich. The construction of the line between South Bend and Niles completes the first division of the proposed line between South Bend and St. Joseph, Mich.

MANKATO, MINN.—M. G. Willard and others contemplate forming a company to build an electric railway to St. Clair.

ST. PAUL, MINN.—The St. Paul City Railway Company will soon commence work on its new terminals at Como Park. For ground on which to build the new terminals, the company has already invested $10,000, and this is to be further increased by an addition of $30,000 which will be used in the improvement proper. Two bridges of fancy cut stone are provided in the plans, and these will be supplemented with viaducts which will allow vehicle and passenger traffic without crossing the tracks. The tracks will be elevated the same as at Lake Harriet and Wildwood. This will do away with the present loop and remove the confusion which always has existed in the handling of east and west-bound traffic.

KANSAS CITY, MO.—The Metropolitan Street Railway Company has let the contract for altering the Eighth Street tunnel through the West bluff to the General Construction Company, of this city. The contract price for the work is about $200,000. The grade in the tunnel will be lowered from 8.8 per cent to 5.3 per cent. In doing this the tunnel will be extended eastward several hundred feet. It is expected that the work of altering the tunnel will take about four months.

MARYVILLE, MO.—A certificate of incorporation has been issued to the Maryville & St. Joseph Electric Railway Company, of Maryville. The company is capitalized at $700,000. The proposed road will be 70 miles in length and will run from Parnell, in Nodaway County, to St. Joseph, in Buchanan County, traversing the counties of Nodaway, Andrew and Buchanan. The incorporators are: Richard Kuchs, Richard M. Bradbury, Stephen H. Kemp, Clarence E. Bartlette, Adolphe Lippman, Charles C. Donnell, John W. Thompson, all of Maryville.

ST. LOUIS, MO.—H. M. Crane, of Oneida, Ill., president of the Galesburg & Kewanee Electric Railway Company; W. D. Godfrey, of Galesburg, Ill., attorney for the same company, and Charles A. Hart, of Staten Island, N. Y., were in the city recently conferring with St. Louis people, with a view to interesting local capital in the enterprise. The line was only recently completed, and the first trip over it was made a few days ago.

ST. LOUIS, MO.—At a recent meeting of the East St. Louis City Council the East St. Louis & Suburban Company was given an ordinance permitting it to lay a double-track electric railway, beginning at Tenth Street and Missouri Avenue, out Missouri Avenue to Fourteenth Street; north on Fourteenth Street to Cleveland Avenue; east on Cleveland Avenue to Eighteenth Street; north on Eighteenth Street to Illinois Avenue, and east on Illinois Avenue to the city limits.

ST. LOUIS, MO.—It is generally understood in the southern part of St. Louis County that a new street railway will be in operation out the Gravois Road by next summer. A petition for a franchise is said to have been already drafted and will be presented to the County Court within the next few weeks. The road, it is said, is to be built as far as the old U. S. Grant farm, 4 miles from the city limits. Later, it is said, the line will be extended through Fenton to Morris Mill, in Jefferson County. The prime object of the road, according to report, is to furnish transportation to the Grant farm, a part of which was recently purchased by August A. Busch. A large number of men are now at work on the Busch property, which it is thought is to be converted into a pleasure resort.

ST. LOUIS, MO.—Articles of incorporation of the St. Louis & Olivette Railroad Company have been filed in the Recorder's Office in Clayton. The capital stock is $100,000, divided into 1000 shares. The incorporators are: W. Carl Feld, S. S. Senne, E. H. Daves, A. H. Werrenmeyer and W. E. Heapes. The company is a successor to the West End Railway Company, to which the Secretary of State objected on account of its name. A franchise to construct and operate an electric railway has been granted by the County Court to the company. The company will grade all streets for a width of 40 ft. before laying single tracks, or a width of 52 ft. before laying double tracks. It will macadamize the highways over which it travels on the outside of the outer rails. Girder rails are to be used. Cars will be run on a thirty-minute space during the day and an hour apart from 7 p. m. until midnight. Work will begin by May 15, 1904. A 5-cent fare will be charged. A $5,000 bond is to be filed, $1,000 for repairs, deposited in the County Treasurer's office, and $500 a year given to the county after the first ten years.

BROOKLYN, N. Y.—It is said that the Brooklyn Rapid Transit Company contemplates lengthening platforms at elevated stations so as to permit the running of longer trains.

BUFFALO, N. Y.—The International Traction Company has purchased property on Morley Place adjoining its Cold Spring car houses, and on Michigan Street adjoining its Hertel Avenue car houses. It is said that the company plans to build extensions to both of these car houses.

JAMESTOWN, N. Y.—It is said that a new survey of the route of the Jamestown & Warren Street Railway Company has been ordered because of opposition to the line from obdurate property owners. D. N. Siggins, of Jamestown, is president of the company.

LOWVILLE, N. Y.—A meeting of those interested in the proposed electric railway between Lowville and Croghan was held here a few days ago, and the question was gone over thoroughly. The company is to be organized at $150,000, and the statement is made that $100,000 of this stock has been subscribed. The road will extend through New Bremen and Beaver Falls. Frederick S. Eaton, of Lowville, is interested.

NEW YORK, N. Y.—Last week one of the dailies worked up into a "spread" story about the electrical equipment of the Long Island Railroad, an interview that has been given by a Pennsylvania official on the subject of electricity in Atlantic Avenue, Brooklyn, where the company is now completing a tunnel and an elevated structure to take trains off the street surface.

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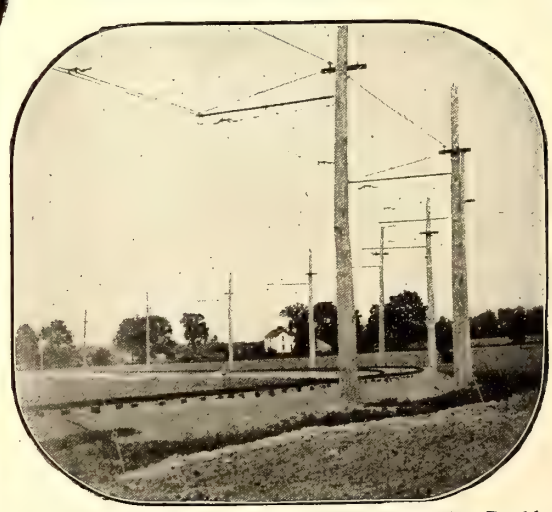
SALES IN MARCH AND APRIL, THIS YEAR:

Aurora, Elgin & Chicago Ry., Elgin Branch	120	Guards
Stark Electric Ry. Alliance, Ohio	120	"
Canton & New Philadelphia R.R., Ohio	90	"
Rochester & Eastern Rapid Ry.	70	"
Long Island Railroad Co.	40	"
Vandegrift Construction Co., Kennett Square, Pa.	25	"
Rock Island System	50	"
	515	

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Early in the year the STREET RAILWAY JOURNAL published a map showing the lines the company proposes to equip with electricity, and gave a summary of the distances.

SCHENECTADY, N. Y.—It is said that the Schenectady Railway Company has practically decided to extend its lines from Albany to Schodack Landing, assing through Brookview and Castleton.

CLEVELAND, OHIO.—W. F. Stanley, vice-president of the Pennsylvania & Ohio Traction Company, is said to be interested in a plan to build an electric railway from Cleveland to Pittsburg. Mr. Stanley wants a private right of way into the heart of the city, although the proposed line will use the public streets for a short distance and will reach the Public Square. It is said that two routes have been suggested and surveyed. One of them goes to Akron, passes across to the Mahoning Valley, and then down to Pittsburg over some lines which are already in process of construction or which are projected in that territory. The other plan is to have the road built on a private right of way direct from Cleveland to the Mahoning Valley points.

CINCINNATI, OHIO.—Work on the Cincinnati, Hillsboro & Columbus Railway is progressing rapidly, and a large force of men is at work on the Ohio River & Columbus line. The latter road is projected from Maysville, Ky., to Columbus, and the link of the same from Ripley to Georgetown will soon be completed.

CINCINNATI, OHIO.—A deal is now pending between the officers of the Cincinnati, Lawrenceburg & Aurora Traction Company, the Cincinnati Interurban Terminal Company and the Indianapolis & Shelbyville & Southeastern Traction Company, which, if completed, will link Cincinnati and Indianapolis with a direct line. Col. J. H. Woodward, president of the Interterminal lines, in a statement to the City Council, confirms the report made some months ago that the Cincinnati, Lawrenceburg & Aurora is seeking entry into this city over its own tracks, in order to make fast time for the proposed through run.

DAYTON, OHIO.—It is said that the Dayton & Northern Traction Company has in contemplation the construction of a branch line from Greenville to Versailles.

GENEVA, OHIO.—Surveys have been made here for the electric railway between Geneva and Meadville. The line, as surveyed, comes into the county east of Pierpont and to Jefferson through the center of Denmark. The road will be over private right of way, except through the villages and Jefferson, where it will run the length of Jefferson Street, and on to Geneva.

LIMA, OHIO.—Walter Toy, a local stockholder, has secured an injunction restraining the directors of the Toledo, Columbus, Springfield & Cincinnati Electric Railway Company from holding a stockholders' meeting on Sept. 7, and was further granted a hearing for a receiver on Friday, Sept. 4. The petition of plaintiff alleges that President Ellis Bartholomew and the directors have conspired to transfer right of way and franchises to another company, and have fraudulently placed to their credit, without consideration, large blocks of stock and bonds. The company is incorporated for $10,000,000, most of which stock has been sold.

MASON, OHIO.—The Rapid Railway, a branch of the Interurban & Terminal Company, has been put into operation to Kings Mills, a distance of five miles. The road is being pushed to completion between Kings Mills and Lebanon, and it is hoped to have cars in operation from Cincinnati to Lebanon before the fall festival opens.

NAPOLEON, OHIO.—The First National and the Citizens' banks of Napoleon and a number of prominent citizens have taken the bonds of the Lake Erie, Bowling Green & Napoleon Electric Railway. Thirteen miles of the road have already been built between Bowling Green and Pemberville, and have been in operation for some time. It will run from Port Clinton through Bowling Green to this town, which has been made the western terminus. The route lies through one of the richest agricultural districts in Ohio.

NEWARK, OHIO.—The Newark, Martinsburg & Mt. Vernon Traction Company has just been organized by the election of the following officers: Edward H. Everett, president; Dr. J. W. Shromtz, vice-president; John A. Chilcote, treasurer; F. E. Elliott, secretary; Edward Kibler, counsel. Messrs. Chilcote and Kibler are Newark men, while Dr. Shromtz and Mr. Elliott are from Martinsburg. The company has secured practically the whole right of way from Newark to Martinsburg and from Gambier to Mt. Vernon.

TOLEDO, OHIO.—The capital stock of the Toledo & Michigan Electric Railway is to be increased from $450,000 to $4,500,000, to extend the line from Adrian to Coldwater, a distance of 60 miles, passing through Quincy and several other important Michigan towns.

BERWICK, PA.—The Berwick & West Nanticoke Electric Railway Company has purchased the old Pennsylvania Canal Company's dam at Nanticoke, where it will build a power plant for the purpose of operating not only its own cars, but those of the Columbia & Montour Traction Company. The company has also acquired the right to use such sections of the old towpath as may be available in getting its tracks from Berwick to West Nanticoke. It is expected that by next summer there will be a continuous electric line paralleling the Lackawanna tracks from West Pittston to Catarussa. The new line will connect with the Columbia & Montour line at Berwick and extend to West Nanticoke, a distance of 27 miles, making a trolley system of 43 miles. Negotiations are also pending for an extension to Plymouth, where connections will be made with the Wilkesbarre & Wyoming Valley Traction system.

COATESVILLE, PA.—The action of Borough Council in granting a franchise to the Brandywine Trolley Company promises to stir up legal troubles. The management of the Westchester Street Railway Company is more determined than ever that their Coatesville extension shall be pushed to a successful completion, and say that they have always stood ready to comply with every reasonable condition imposed by Coatesville Council.

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DOYLESTOWN, PA.—Bucks County is to have another new trolley road, which will run from Tohickon Park to Bedminsterville, about 2½ miles, as a branch of the Philadelphia & Easton Street Railway Company's line. It is estimated that the road will cost between $35,000 and $50,000.

DOYLESTOWN, PA.—Rights of way for the extension of the Philadelphia & Easton Railway's line from Tohickon Park to Bedminster, 3 miles, have been secured, and the directors expect to let the contract within a few weeks. The extension will cost about $50,000.

DOYLESTOWN, PA.—It is the intention of the New Jersey & Pennsylvania Traction Company to extend its line from Newtown to Willow Grove and make a connection with the lines of the Union Traction Company, of Philadelphia within a year. The line is to be built via Richboro, Southampton, Davisville and Hatboro.

HARRISBURG, PA.—The directors of the Harrisburg & Lewisberry Street Railway Company have decided to extend the line from Lewisberry to Bowmansville by way of Lisburn. Work will be started shortly. The final merger of the Harrisburg & Lewisberry Street Railway Company and the Star Street Railway Company is expected in a few weeks.

MECHANICSBURG, PA.—The Borough Council is considering an ordinance granting the White Hill & Mechanicsburg Street Railway Company a change of route in that town.

PHILADELPHIA, PA.—The Philadelphia Rapid Transit Company has opened its new line on Torresdale Avenue.

PITTSBURG, PA.—E. H. Converse & Company, 515 Times Building, Pittsburg, have secured the contract for preparing plans and specifications for the Paulsboro Traction Company, whose proposed line is to extend from Woodbury to Paulsboro and Billingsport, and thence to Swedesboro, via Clarksboro, in New Jersey. Surveys will be commenced at once, and construction will commence as soon as possible. Messrs. Converse & Company will be pleased to hear from parties interested.

SCRANTON, PA.—The Central Labor Union, having demanded that the employees of the Lackawanna & Wyoming Valley Electric Railway in this city become members of the Amalgamated Association of Street Railway Employees, and the employees having said that they would prefer to join the Trainmen's Union, the matter was finally referred to the company with a request that it direct its men to become members of the Street Car Men's Union. The answer of the company was delivered to the Central Labor Union Saturday, Aug. 29, and was a refusal of the request. The company says that the men can join any union that they please, but that their employers prefer the Trainmen's Union.

ASTORIA, ORE.—E. M. Ormen, an electrical engineer of Cincinnati, Ohio, has been making an examination of the country between Astoria and Seaside in the interest of the projected electric railway to connect the two towns. Local reports say he represents the Oregon Railway & Navigation Company.

PORTLAND, ORE.—A. L. Stone and others of Fairview are securing right of way for an electric railway along the Columbia slough through Fairview, possibly to Troutdale. The plan is to offer the right of way to the Portland Railway Company, which, it seems, has agreed to build the road.

PORTLAND, ORE.—Efforts are being made to induce the City & Suburban Railway Company to extend its Montavilla line to Fairview and Troutdale.

PROVIDENCE, R. I.—The Providence & Taunton Street Railway Company, it is said, is considering the extension of its tracks to Hunt's Mills, or as near there as possible.

WOONSOCKET, R. I.—A second survey is being made by the Providence & Burrilville Street Railway Company of the route of its proposed line between Woonsocket and Providence. The route is through North Smithfield, Lincoln and Smithfield to Centerdale, and will be several miles shorter than the present steam railroad route, which is 16 miles long. President Ray, of the Woonsocket Street Railway Company, is interested in the project.

MEMPHIS, TENN.—The Memphis Street Railway Company has completed the extension of its Union and Spring Street line to the Raleigh Avenue line. The company is aggressively pushing a large number of extensions and improvements in all parts of the city.

BEAUMONT, TEX.—The Beaumont Traction Company has presented to the County Commission another proposition in which it asks for a franchise and a right of way for an electric railway from this city to Spindle Top.

CORPUS CHRISTI, TEX.—The Council has granted Edgar Watkins, of Houston, a street railway franchise providing for work to commence on same within eighteen months and to be completed in three years. Mr. Watkins has also been granted a franchise for the construction of an electric lighting system.

CORPUS CHRISTI, TEX.—The City Council has passed ordinances granting Moling Brothers franchises to build an electric street railway and light plant. The franchises run for fifty years. Work on the railway must begin within eighteen months and must be completed and in operation within three years. Additional voltage power was granted the Corpus Christi electric light plant.

DALLAS, TEX.—The Council has granted a franchise to Robert McCart, A. T. Byers, M. Sanguinett, C. S. Mitchell, Stuart Harrison and associates for the construction of a street railway to Arlington Heights.

FORT WORTH, TEX.—The City Council has granted the Northern Texas Traction Company a franchise to lay its tracks from the intersection of Main Street and Central Avenue, out North Main Street to the city limits. The company will build its track in the center, and have poles placed on each side of the street.

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SALT LAKE CITY, UTAH.—The County Court has under consideration the petition of D. R. Roberts for an electric railway franchise. Mr. Roberts wants the right to build from Richmond to Wellsville, thus traversing the county from end to end. It is understood that he will next apply for a franchise in Logan City.

NORTON, VA.—The Wise Coal Company is said to be interested in a scheme to build an electric railway system to the coal fields of Southwest Virginia, connecting Norton, Big Stone Gap, Tom's Creek, Appalachia and a half-dozen other mining towns.

CHELAN, WASH.—An electric railway is projected to connect Chelan with Chelan Falls. The men behind the enterprise are: R. D. Johnson, of Chelan, and E. O. Burdon, of Seattle. The company is to be known as the Chelan Railway & Navigation Company, with a capital stock of $350,000.

FAIRHAVEN, WASH.—The County Commissioners have granted the Whatcom-Skagit Interurban Railway Company a franchise over a specified route in Whatcom County. The company plans to build 36 miles of road in the county.

APPLETON, WIS.—The Wisconsin Traction, Light, Heat & Power Company will extend its interurban line to the city limits.

EAU CLAIRE, WIS.—The Chippewa Valley Electric Railroad Company, through its president, Arthur E. Appleyard, and assistant secretary, George B. Wheeler, has filed an amendment increasing its capital stock from $200,000 to $400,000, and enlarging the scope of its business so as to enable it to furnish electric power for manufacturing and commercial purposes.

STOUGHTON, WIS.—The Stoughton Mill Company, at its annual meeting, adopted a resolution to the effect that an electric railway be constructed ffiby the company to connect Stoughton, Cambridge and Oregon, providing franchises can be obtained through these places. The officers were instructed to apply to the Common Council of Stoughton without delay for the right to construct, build and maintain an electric railway through and over the streets and alleys. The backers of the enterprise are men of financial responsibility.

CANADIAN NOTES

LONGUE POINT, QUE.—The Chateauguay & Northern Railway Company has, in a communication to the Municipality of Longue Point, offered to proceed with the construction of an electric railway on the main road of the municipality, and to connect the road with the lines of the Chateauguay and Terminal Railways. The courts recently held that only the Chateauguay & Northern could legally build the line.

HAMILTON, ONT.—The Cataract Power Company and the City Council have come to terms about the proposed extension of the street railway. The company has agreed to double track the line from Barton Street to the Deering Harvester Works, and give eight limited tickets to workingmen for 25 cents. In consideration of this, the city agrees to throw off the percentage on the extension for twelve years.

VANCOUVER, B. C.—Dalton & Eveleigh, architects, have taken tenders on a car barn for the British Columbia Electric Railway Company.

ORANGEVILLE, ONT.—A proposal to construct an electric railway from Guelph to this town is being considered.

PETERBORO, ONT.—The city has granted a franchise to the Peterboro & Ashburnham Electric Railway Company. Five miles of line are to be ready for operation not later than July 1, 1904.

CHATHAM, ONT.—The Radial Railway Company has secured its charter from the Dominion Government, and will proceed at once to build the railroad. The first section to be built will be from Chatham to Wallaceburg. N. H. Stevens, William Ball and David Gordon are interested.

HAMILTON, ONT.—The Hamilton & Caledonian Electric Railway and the Finance Committee of the City of Hamilton have about come to an agreement on the question of what route the line should follow within the city limits. The by-law gives the company until July 1, 1906, to complete its line to Caledonia, a distance of fourteen miles. It also provides that a 5-cent rate be given within the city limits, and that workmen's limited tickets be sold eight for 25 cents, and the company is to furnish the material to keep the streets between the tracks in proper repair.

NEWS NOTES

SAN FRANCISCO, CAL.—The Board of Supervisors has passed for printing an ordinance giving notice that a special election will be held on Thursday, Oct. 8, for the purpose of voting on the issue of bonds for constructing and operating the Geary Street, Park & Ocean Railway under municipal ownership. This step in the proceedings is demanded by the charter, which says that the date shall be formally announced by ordinance. The cost of the electric railway, fully equipped, as estimated by the city engineer, is $710,000. The total maximum cost given in the bill, including interest, to be raised by a tax levy for forty years, is $1,219,425, and the maximum interest to be paid in any one year is $42,600.

CHICAGO, ILL.—The Board of Review has cut the assessment for taxes of the Union Traction Company to the amount of $1,149,400 from the assessors' valuation.

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FACTORY AND MAIN OFFICE DETROIT.

CHICAGO, ILL.—Fire in the motor car of a train on the Metropolitan Elevated inconvenienced thousands of patrons of that road Saturday morning, Aug. 29, by completely paralyzing the service for more than an hour. Trains on the Douglas Park and Garfield Park branches were blocked west to the Laflin Street station, and on the Logan Square and Humboldt Park lines the congestion extended to Marshfield Avenue. Many of the passengers left the cars and walked along the elevated structure to the nearest stations.

BOSTON, MASS.—A 20-foot section of the foundation wall of the Adams Building, on Court Street, collapsed Aug. 26, and fell into the East Boston Tunnel excavation, crushing three men.

PLYMOUTH, MASS.—The following officers have just been elected by the Plymouth & Sandwich Street Railway Company for the coming year: Horace B. Taylor and Eben Kimball, of Boston; T. Everett Cornish, of Philadelphia; Thomas Arnold and William B. Arnold, of North Abington, and Walter L. Boyden and John H. Marshall, of Plymouth. The board has organized with H. B. Taylor as president, T. E. Cornish as vice-president, and Walter L. Boyden as secretary and treasurer.

WORCESTER, MASS.—Motormen and conductors of the Boston & Worcester Street Railway have petitioned for an eight-hour day with a uniform wage scale of $2.50 per day with 35 cents an hour for overtime work. The men ask that spare men be paid $1.50 a day while on waiting time, and that the schedule be arranged so that the regular men may complete their eight hours' work within a period of ten hours. The company has refused to grant the demands, and the local papers say the men have under consideration the question of striking.

WORCESTER, MASS.—The hearing in regard to the fatal accident on the Boston & Worcester Street Railway, July 25, in Shrewsbury, was continued at Boston, Friday, Aug. 21. The company was represented by ex-President William M. Butler, and P. S. Cunniff appeared for Leon B. Downs, the motorman of one of the cars, who was arrested for his part in the catastrophe. Mr. Cunniff said that in view of the fact that the motorman and conductor had been indicted for manslaughter by the Grand Jury, it was deemed inadvisable for Downs to appear before the commission at this investigation. Mr. Butler then filed a written statement in behalf of the railway company. It was very long, and showed in detail the dispatching system of the company, the method of running the cars by telephone, the time-table, the road's instructions to employees, etc. Signed statements by Motorman Downs and Conductor Daley were presented covering the material features of the accident. Chairman Jackson, of the commission, said that the commission would take all the evidence into consideration; that it was not for the commission to do anything to punish the persons responsible for the accident, but to act for the protection of the public in the future. The evidence, so Mr. Jackson said, should be used in shaping the general policy of the Board toward the public.

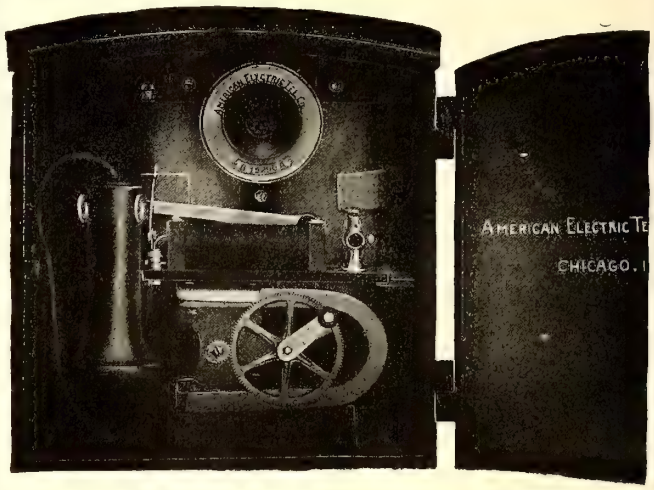
NEWARK, N. J.—The eleven officials and directors of the North Jersey Street Railway Company indicted for manslaughter in connection with the Clifton Avenue grade crossing accident of Feb. 19 last, in which nine pupils of the Newark City High School were killed, were placed on trial before Chief Justice William S. Gummere in the Circuit Court here Aug. 31. The defendants were represented by Joseph Coult, who was assisted by ex-Governor George T. Werts, Richard V. Lindabury, and James B. Vredenburgh. The entire morning was consumed in the selection of a jury out of the special panel of 250 names. In his opening, Prosecutor Chandler W. Riker said that all of the defendants were under indictment, charged with manslaughter, for the death of Ernestina Miller, one of the nine school children victims of the accident. He retold the story of the wrecking of the Clifton Avenue car by the Bernardsville express on the Lackawanna Road on the morning of Feb. 19, and of the mangling of the riders on the crowded car, with nine high school pupils killed and a score or more seriously injured.

BROOKLYN, N. Y.—It is said that the Brooklyn Rapid Transit Company proposes to prosecute every conductor who may be caught acting dishonestly, instead of simply discharging each man and putting him on its blacklist, as has been the policy heretofore.

STATEN ISLAND, N. Y.—A decisive step toward the final settlement of the ferry approach dispute which has agitated Staten Island for the past six months was taken Friday, Aug. 28, at the Special Term of the Supreme Court, in the County Court House, Brooklyn, when application was made by the City of New York for the appointment of Commissioners of Estimate and Assessment to acquire title to the property required for the plan of approach to the St. George Ferry devised by Borough President Cromwell, of the Borough of Richmond, and known as the Cromwell plan. The matter of the approach to the ferry is one of the street openings entirely and is distinct from the matters of an improved ferry service, upon which there is no division of opinion. The changes proposed are almost entirely in the approach to the ferry from the south, no change being made in the northerly approach, except to widen it. At present, vehicles approaching the ferry from the south pass up a 6 per cent grade on Central Avenue. Returning from the ferry all vehicles have to ascend South Street, which has a grade of 12 per cent. The trolley cars approaching from the south take a more easily graded but much more circuitous route, making some nine turns to enter the viaduct through which they reach the ferryhouse. The cars from the north have practically a level approach to the viaduct. The Cromwell plan proposes to make a wide curve into South Street through the corner of the United States Lighthouse property, and, further, purposes to widen Stuyvesant Place from the present width of 30 ft. to 100 ft., and then to reduce the 6 per cent grade of Central Avenue to 3 per cent. The carrying out of this plan would entail a very heavy expense, as the route passes through the best residential section of St. George. The ferry and railway terminal situation was reviewed in the Street Railway Journal for May 30, 1903.

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PHILADELPHIA, PA.—The Philadelphia Rapid Transit Company has caused the arrest of five men who are said to be implicated in a gigantic scheme to defraud the company by the exchange of transfer tickets.

WILKESBARRE, PA.—Counsel for the Lehigh Valley Railroad has petitioned the Court to restrain the city of Wilkesbarre from interfering with or preventing the construction of the railway tracks on the old canal bed of the new electric line, which seeks to enter the city over that route. The city has policemen stationed at all crossings, and refuses to allow the employees of the company to proceed with the laying of the tracks under the threat of arrest.

BEAUMONT, TEX.—The officers elected for the Beaumont, Sour Lake & Port Arthur Electric Railway are: G. W. Meeker, president; Captain William Weiss, vice-president; J. B. Linn, of Springfield, Ohio, second vice-president; Theodore Weyant, secretary; B. R. Norvell, treasurer.

FINANCIAL NOTES

BAKERSFIELD, CAL.—The Power, Transit & Lighting Company has made a mortgage with the Mercantile Trust Company of San Francisco, as trustee, to secure $2,500,000 of 5 per cent gold bonds, of which $750,000 have been issued. These bonds are dated June 1, 1903, and are due June 1, 1933; are subject to call at the company's option "on the basis of 4½ per cent, reinvestment;" denomination, $1,000; interest due June 1 and Dec. 1; sinking fund, 10 per cent of earnings after 5 years. The company owns in fee and its mortgage covers the properties of the former Power Development Company, the Bakersfield Gas & Electric Light Company, and the Bakersfield & Kern Electric Railway, subject to $175,000 existing bonds, namely, $125,000 on the street railway and $50,000 on the gas and electric light plant, to retire which at the date of maturity a like amount of the new issue is reserved.

CHICAGO, ILL.—R. H. Donnelly, of Knight, Donnelly & Co., is quoted as saying: "The protective committee of Lake Street Elevated wanted a majority of Lake Street stock and they have got it. That is all the news in the Lake Street Elevated situation. The fables to the effect that the committee will appoint a receiver and seize control of the annual meeting is nonsense. Nothing has been done or decided on beyond strengthening the voting power of the party in favor of some new plan of reorganization. The annual meeting is too far away and no one can tell what will happen in half a year's time."

KOKOMO, IND.—A. W. Thomson and Newton Todd, both of Indianapolis, offer at 95 and interest, with $300 stock bonus to each $1,000 bond, $250,000 of the company's first mortgage 5 per cent thirty-year gold bonds, dated July 1, 1903. The interest is payable January and July at the office of the Security Trust Company, of Indianapolis, Ind., trustee. The total authorized bond issue is $1,000,000, of which $250,000 is reserved to retire Kokomo Railway & Light bonds, and $750,000 for the construction of an interurban railway between Kokomo and Marion, Ind., a distance of about 30 miles, with 11 miles in Kokomo, making a total of 41 miles of lines, $500,000 of bonds have been sold.

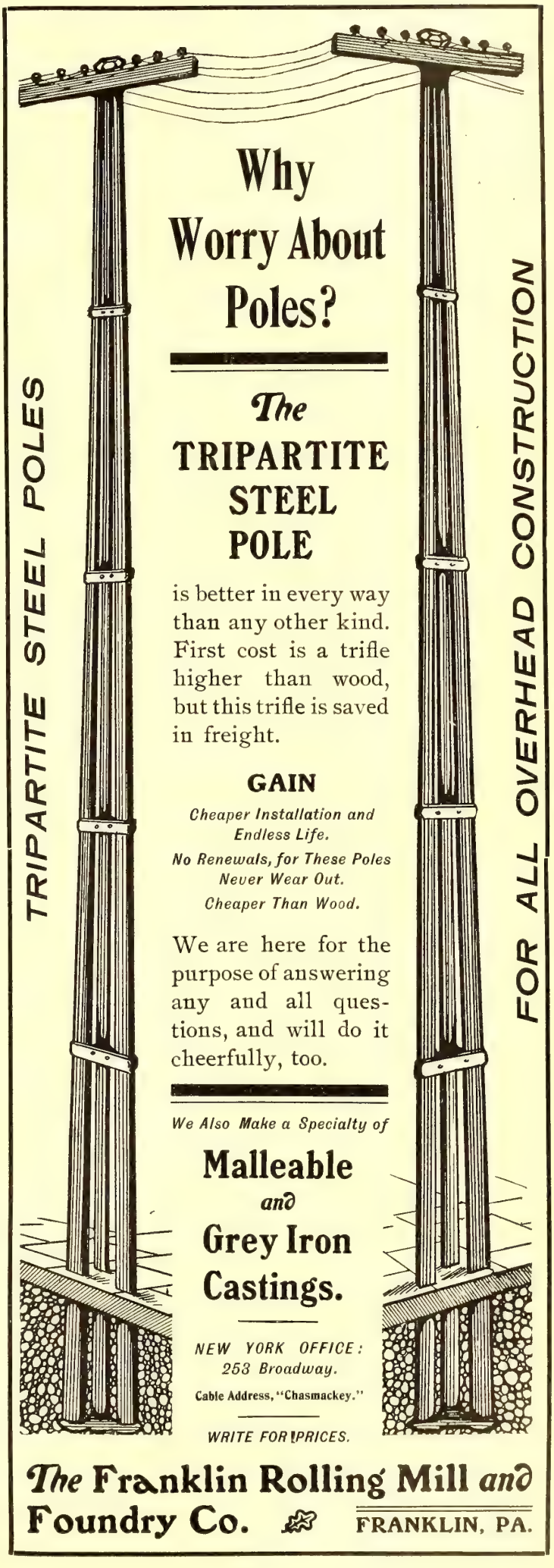
NEW ORLEANS, LA.—The Times-Democrat quotes L. Carroll Root, third vice-president of the New York Security & Trust Company, who has been making a critical examination of the New Orleans Railway Company's properties, as saying that he is well pleased with the physical condition of the property and the results obtained. Quoting Mr. Root, the Times-Democrat says: "My attention has been called to a rumor that the Railways Company is not earning the interest on its bonds. This I most emphatically deny. For the purpose of effectually quieting all such rumors, I have suggested to Mr. Foster that he prepare and issue as soon as possible a brief semi-annual report, showing just what has been accomplished in the last half year. Mr. Foster has consented to get up such a report, and has it already well under way. The facts are, as Mr. Foster's report will show, that notwithstanding the increased cost of both fuel and labor, the largely increased taxes and the decreased price for municipal lighting, the company has fully earned the interest on its bonded debt and has a surplus left over."

WORCESTER, MASS.—Eight claims, aggregating $100,000, have been filed against the Worcester & Southbridge and the Worcester, Rochdale & Charlton Depot Street Railway Companies. Five of the claims are liens filed by Willis E. Putnam on the Worcester & Southbridge Road, amounting to $15,000. These are for work done at Hotel Overlook and on property belonging to the company in Charlton. Mr. Putnam is a contractor. Oliver W. Rugg attached the Worcester, Rochdale & Charlton Depot Company in a $20,000 action on contract. A similar attachment was recorded against the Worcester & Southbridge line. The third attachment was that of the Trust Company of the Republic of New York City in a suit of $40,000 against Wilford A. Bailey, the general superintendent of the two railways.

BROOKLYN, N. Y.—The Brooklyn Rapid Transit Company reports earnings as follows:

Year ended June 30	1903	1902
Gross receipts	$12,357,041	$11,525,202
Operating expenses	7,553,939	7,717,129
Net earnings	$4,803,102	$3,808,073
Other income	222,389	331,524
Total income	$5,025,491	$4,139,597
Fixed charges	4,289,907	4,268,753
Surplus	$735,584	*$129,156

*Deficit.



MINNEAPOLIS, MINN.—The Twin City Rapid Transit Company reports earnings as follows:

July	1903	1902
Gross receipts	$364,471	$337,452
Operating expenses	164,037	142,369
Earnings from operation	$200,434	$195,083
Deductions	78,437	76,233
Surplus	$121,997	$118,850
Seven months		
Gross receipts	$2,283,124	$2,003,892
Operating expenses	1,086,409	922,740
Earnings from operation	$1,196,715	$1,081,152
Deduction	548,755	532,767
Surplus	$647,960	$548,385

GLENS FALLS, N. Y.—On Aug. 20 the loan of $400,000 obtained for the construction of the Saratoga extension of the Hudson Valley Railway fell due, and the $500,000 bonds and $100,000 stock pledged as collateral were nearly all promptly taken up by the underwriters on the basis of 80 for the bonds. Underwriters of $70,000 of the bonds and $14,000 of the stock sought to enjoin the enforcement of their subscriptions, on the ground that the rate of interest was usurious, but their application for a permanent injunction was denied by Justice Stover at Amsterdam on Aug. 22.

CINCINNATI, OHIO.—The report of the receivers of the Miami & Erie Canal Transportation Company has been filed in the Superior Court, as per the order of court made at the time the receivers were authorized to borrow $5,000 for certain work necessary to be done on the line of the railway. At that time it was shown to the court that it was necessary to ballast and otherwise put into condition the track between Middletown and Hamilton, and to make some repairs between this city and Hamilton. The court allowed the receivers to borrow the money they needed. At that time, the judge remarked that it seemed strange to him what had been done with the large amount of money at which the company was capitalized, and which capital was probably largely paid in. The report of the receivers shows what was expended in equipping the line, and the assets on hand and the receipts and disbursements to date under the receivership. The report shows first the expenditures for material, labor, equipment, etc., by the company, as shown by the books. They are as follows: Track and roadway, $577,382; bridges, trestles and culverts, $149,217; electric line equipment, $307,784; tools and machinery, $14,620; power plant equipment, $50,468; cars or locomotives, $61,242; boats and equipments, $64,821; real estate, $10,095; buildings and fixtures, $46,701; special account, engineering, for making surveys and plans, $3,118. Total, $1,285,550. Then follows a long list of the material, equipment, tools and machinery on hand, to which no value is given in that list. Then follows the inventory of the power plants and equipments, the cost of which is given as $50,339, which, together with the cost of the locomotives, $55,840, makes a total of $106,179. The dry-dock material is valued at $36,088. The value of boats purchased from other companies is placed at $29,900, this being the amount paid for the boats. The real estate as inventoried, giving the purchase price, shows that $9,255 was paid for it. There is also a gravel pit valued at $650. The value of the fixtures, etc., in the buildings at Main and Canal Streets, is placed at $2,379. There is also a statement of all the work completed, to be completed, material on hand and that necessary to complete the road. There is no value placed on this, as a whole, but there is an estimate of the amount that will be required to complete the line and put it in first-class condition from Cincinnati to Dayton. The total is $217,200. Included in this is one item of $50,000 for raising and lengthening bridges; for a bridge over Mad River, $25,000; for concrete walls and trestles in Dayton, $25,000; for ballasting, $28,000, and for completing twenty new boats, $18,000. There is no statement of the liabilities of the company, but the receivers say they are preparing a statement of them and will file them as soon as they are completed and verified. The report contains a statement of the receipts and disbursements from the date of the receivership, July 3, to Aug. 8. It shows that the receipts for the entire period were $6,270, and the disbursements, $10,214, a deficit of $3,945. This does not include the $5,000 borrowed, though the report includes that sum in the receipts of the period from Aug. 1 to Aug. 8. With that included, the receipts exceed the disbursements.

SEATTLE, WASH.—The Seattle Electric Company reports earnings as follows:

June	1903	1902
Gross earnings	$175,513	$151,317
Operating expenses	117,745	109,332
Net earnings	$57,967	$41,985
Fixed charges	24,052	21,557
Net profit	$33,914	$20,428
Year ending June 30		
Gross earnings	$2,018,906	$1,655,128
Operating expenses	1,429,737	1,134,300
Net earnings	$589,169	$520,828
Fixed charges	282,473	249,554
Net profit	$306,696	$271,274

NEWPORT NEWS, VA.—R. I. A. Mason has been appointed receiver of the Hampton Roads Railway & Electric Company. The appointment of a receiver was brought about by a suit against the company entered by John G. Powell & Bro., of Philadelphia, who are among the principal bondholders, and assert that the three years' time limit for completion of the building of the road has nearly expired, and that it is impossible to complete the road on

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time. They say that their interests are jeopardized. The Vandergrift Construction Company, which is building the road, is made a party to the suit. The capitalization of the company is about $1,000,000, and its bonded indebtedness is $1,500,000. It was organized to build a line from Newport News to Old Point Comfort to compete with the Newport News, Hampton & Old Point Railway, owned by the Payne syndicate.

MONTREAL, QUE.—The directors of the Montreal Street Railway have decided to ask the shareholders for the power to make an issue of $1,000,000 additional stock. A special meeting of the shareholders has been called for Sept. 10, and if the power is given the issue will be offered to the shareholders at par. The first instalment of 10 per cent will be payable Nov. 1, and the remainder at such time as the directors may deem most advisable. The object of the directors in asking for new capital is to improve the roadbed and construct new lines and cars. With the new stock the company will have a capital of $7,000,000 in stock.

MONTREAL, QUE.—The Montreal Street Railway Company reports earnings as follows:

July	1903
Gross earnings	$216,236
Operating expenses	116,157
Net earnings	$100,079
Fixed charges	24,696
Surplus	$75,383
Ten months	
Gross earnings	$1,788,178
Operating expenses	1,109,810
Net earnings	$678,368
Fixed charges	189,363
Surplus	$489,005

AMONG THE MANUFACTURERS

THE ALLGEMEINE ELEKTRICITATS-GESELLSCHAFT, Berlin, Germany, has issued Circular No. 30, describing certain insulating materials of its manufacture.

GEORGE C. EWING has just been appointed the New England representative of the Cooper Hewitt Electric Company, of New York. This position is in connection with Mr. Ewing's other business (Nernst lamps, etc.), and is not a change—simply an addition.

W. T. WATSON, of Newark, N. J., has just issued a neat publication describing the advantages of his automatic fender and automatic wheel guard. An extended description of Mr. Watson's life-saving devices was presented in the STREET RAILWAY JOURNAL for June 6.

A LAMP FOR YOUR FEET is the suggestive title of the latest advertising card sent out by the Wilson Trolley Catcher Company, of Boston, Mass. This company's trolley catcher is now made in three sizes—for city, suburban and high speed, and extra high speed service.

THE AMERICAN BLOWER COMPANY, of Detroit, Mich., is supplying an extensive heating apparatus for the St. Louis Transit Company's new repair shop, to consist of a 15,000-ft. heater and two 160-in. three-quarter housed fans. This contract was secured by Jos. McWilliams & Co., of Louisville, Ky., to whom the American Blower Company furnished the apparatus.

THE R. D. NUTTALL COMPANY, of Pittsburg, Pa., reports that a large number of street railways are taking advantage of its very liberal offer to sell union standard trolleys and take as part payment one old or obsolete trolley for each new one ordered. By this arrangement the Nuttall Company believes that the trolley equipment of street railways can be modernized at a minimum expense.

GROUND WAS BROKEN Aug. 25, at Barberton, Ohio, for extensive additions to the factory of the National Drill & Manufacturing Company, whose business has grown so rapidly during this season as to necessitate doubling its manufacturing space and adding to its equipment new machinery and tools valued at $75,000. This company manufactures a line of contractors' earth-handling machinery, well-drilling machinery, and road-grading machinery and tools.

AMONG A NUMBER OF OTHER ORDERS recently received by the Apex Equipment Company, of New York, are the following: Specially constructed standard-gage hopper-bottom cars, and 6-yd. capacity standard-gage two-way dump cars, for the Ballston Terminal Railway Company; special flat cars for the Conneaut & Erie Traction Company. It is also building for export to the Philippine Islands, to be used in harbor improvement work, for the United States government, twenty specially constructed all-steel flat cars. One feature of these cars is that they are equipped with the John W. King patent steel underframe.

THE INTERBOROUGH RAPID TRANSIT COMPANY has contracted with the Otis Elevator Company for an escalator to be installed at the Thirty-Third Street Station of the Sixth Avenue elevated road division. The escalator will be placed on Broadway just north of Thirty-Third Street, and will carry passengers direct to the downtown station. A foot-bridge will extend over the tracks to the uptown station, and it is anticipated that a majority of the north-bound passengers will avail themselves of the escalator and foot-bridge, thus avoiding the laborous climb up the stairway used at present. In connection with this installation, the commendable action of the owners of the department store on this corner in surrendering much of their sidewalk and part of their basement space should be noted.

ORDERS for car bodies have been placed by the Stone & Webster management, of Boston, to increase the rolling stock of its various lines, viz., with the St. Louis Car Company for fifteen 20-ft. closed car bodies for the Dallas (Texas) Consolidated Electric Railway Company, and six 26-foot

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closed car bodies for the Metropolitan Street Railway Company, of the same city; with the Chicago Car and Locomotive Company for ten flat freight cars for the Tacoma (Wash.) Railway & Power Company; with the American Car Company for two open car bodies, of ten-bench capacity, for the El Paso (Texas) Electric Railway Company; with the Ottawa Car Company for three 20-foot car bodies for the Cape Breton Electric Company, Ltd., of Sydney, N. S., and two 20-foot car bodies for the Glaco Bay Railway Company, Ltd., of Sydney.

THE WESTERN ELECTRICAL SUPPLY COMPANY, of St. Louis, Mo., is preparing to enlarge its business by increasing its capital stock from $300,000 to $1,000,000. It is stated that the company will be reorganized and that a number of New York capitalists will be interested in it. Howard K. Gilman, president of the company, is to retire from that office, but will retain an interest in the company and be a director. It is not known who is to succeed him as president. The plant of the company is located at the southwest corner of Seventh Street and Clark Avenue. For a number of years it has been known as one of the largest companies of its line in the West. It is understood that Roger Scudder is to become an active participant in the affairs of the company. The company's trade-mark is "Wesco," made from the first letter of each word comprising the name, and it is said this word will be prominently used in devising a new name for the corporation if such a step is decided upon. Mr. Gilman, it is said, is now organizing a construction company, of which he will be president. The company will carry on electrical railway and light construction work.

THE STOW MANUFACTURING COMPANY, Binghamton, N. Y., has just issued Bulletin No. 52, describing the construction and operation of its motors, showing a number of applications to machine tools, and containing instructive data on different methods of securing speed control. The motors described are said to carry their full rated load at any speed within in their range at practically uniform efficiency; in other words, the horse-power capacity of the motors is not increased by increasing the speed, and the capacity is not reduced by reducing the speed. This results from the special construction of the pole pieces, which are made hollow. Each pole piece is provided with a large iron core or "plunger," which may be adjusted by means of a screw-threaded hand wheel. The pole pieces are stationary and only the "plungers" are adjusted to secure the speed changes by varying the reluctance of the magnetic circuit of the motor. This method permits a range of speed in the ratio of 1 to 2½. The absence of any auxiliary controlling resistances and also the fact that the motor requires but one voltage, makes the motor especially desirable in many installations where compactness, ruggedness and simplicity are required. The Stow Manufacturing Company will be pleased to mail Bulletin No. 52 to anyone interested in this subject.

THE STANDARD VITRIFIED CONDUIT COMPANY has recently made a change in its official staff, R. W. Lyle having resigned as president, on account of the great volume of business on his hands in the future, he being president of several other corporations. B. S. Barnard, vice-president and secretary, has been made president of this company. The success of the company has been somewhat phenomenal, due to Mr. Barnard's efforts and standing in the trade. He is as well known throughout the country as he is at his desk in the home office. The capacity of the company's factories has been greatly increased, and it is producing, at the present time, upward of 100,000 feet of conduit daily. The Interborough Rapid Transit Company is using this conduit, and the contract has just been awarded to the Standard Vitrified Conduit Company for 55,000 third-rail insulators, covering the entire traction system of the New York subway. The insulator purchased is of the Manhattan type, with slight alterations. The Scioto Valley Traction Company, of Ohio, has placed an order for 29,000 Manhattan-type insulators, and the United States Steel Corporation has also equipped several of its plants with this insulator.

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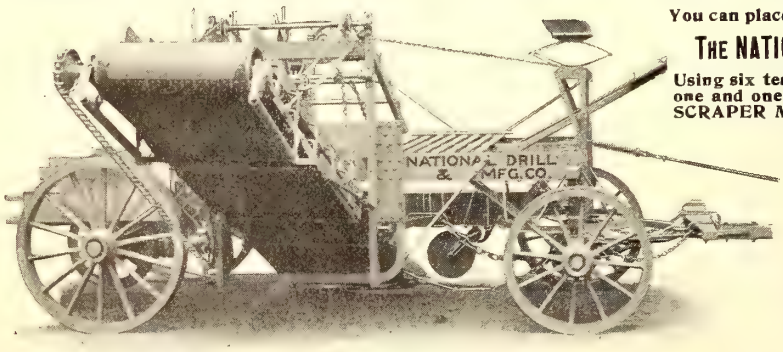
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NEWS OF THE WEEK

CONSTRUCTION NOTES

LOS ANGELES, CAL.—The new branch of the Pacific Electric Railway Company from Long Beach to Alamitos Bay was completed on Aug. 26, and formally opened on the following day. This extension adds 2 miles of double track.

LOS ANGELES, CAL.—The Los Angeles & Pacific Railroad Company has plans under way for the erection of car houses, shops and a depot at Redondo. To this end a condemnation suit has been begun to obtain possession of five lots in a whole block that is to be used for the purpose. The balance of the block the company already owns.

LOS ANGELES, CAL.—The Ninth Street line of the Los Angeles Railway Company has been extended a mile and a half over new track built from Grand View Avenue to Vermont Avenue. This division was built largely to improve the transit facilities of Westmoreland.

LOS ANGELES, CAL.—A large number of superannuated cars of the old Pasadena city system, which have been used here for many months on the Pacific Electric Railway Company's "belt line," have been overhauled in the local shops and are being repainted, reupholstered and fitted with new end mirrors and other interior fixtures. Natural wood colors are being used on the inside finish, while the cars on the outside will be maroon in body, trimmed with black and gold.

LOS ANGELES, CAL.—It is reported that money of the Pacific Electric Railway Company is to used in building a new steel wharf at Long Beach, shipping privileges being desired by that company. The structure will cost about $30,000, and, when built, will take the place of the present wharf of wood. While the city of Long Beach is to control the wharf, the railway company will buy the bonds at a low rate of interest. A large pavilion is to be included in the improvement.

LOS ANGELES, CAL.—It is reported that the new road between Los Angeles and Santa Monica, being built by Abbot Kinney and others in opposition to the system of the Los Angeles-Pacific Railroad Company, is rapidly nearing completion, only seven miles more of track remaining to be laid. The Hooks, former owners of the Los Angeles Traction Company, which was recently acquired by Huntington and Hellman, were interested with Mr. Kinney in the new project, but now it is understood that in the agreement to purchase, the Huntington-Hellman syndicate assumed all the outstanding obligations entered into by the Hooks. In this event it looks as if Huntington were bound up with Mr. Kinney in the new road, and Mr. Kinney refuses to sell, wherefore it may transpire that the former will be compelled to break an agreement with Gen. M. H. Sherman, of the Los Angeles-Pacific Railroad Company, not to invade the Santa Monica field. In this connection the further rumor is afloat that Harriman proposes to electrify the Southern Pacific branch to Santa Monica.

SAN BERNARDINO, CAL.—The San Bernardino Valley Traction Company is preparing to build a line along Pacific Avenue, in Highland, to connect with several large packing houses, in an endeavor to capture the lion's share of citrus fruit freight, hauling it to the Southern Pacific main line at Colton.

SAN BERNARDINO, CAL.—The San Bernardino Valley Traction Company has begun a half-hour service over its new line to Highland. It is hoped that the proposed line to Rialto will be operating by Christmas. Surveys have been made.

SAN DIEGO, CAL.—William Clayton, general manager of the San Diego Electric Railway, states that the company is considering an extension of its lines in San Diego.

TROPICO, CAL.—The Los Angeles, Tropico & Glendale Electric Railway Company has secured right of way through the ranch of Q. C. B. Richardson, extending from Los Angeles River, south of Griffith Park, to Tropico. This takes the line through Tropico across the Southern Pacific Railroad. At Tropico, after crossing the Southern Pacific, to which point it is understood the road is to be the Santa Barbara main line; the road will probably diverge westerly in the direction of Santa Barbara and traverse the San Fernando Valley.

COLORADO SPRINGS, COL.—The Monument Park Cemetery Association has been incorporated. It is proposed to spend between $500,000 and $750,000 on the investment, which may include also the building of an independent street railway line from the property acquired by the company. One hundred and fifty acres 1½ miles southwest of Edgerton have been acquired within the last month, which will form the cemetery.

BOISE, IDAHO.—The question of building an electric railway from the Pearl mining district down to the Payette River has been revived, and the matter is being seriously considered by those interested in properties in that district. The rapid development of the mines makes it almost imperative that some other means than wagons be secured for transporting the ore to some water supply where mills can be erected. At the present time the mines are handicapped by not being able to get their ore out except at great expense. By erecting mills on the Payette, there would be a sufficient water supply for all purposes. The distance from the summit to the river is about 2½ miles, and is not a difficult country through which to construct a road.

SPRINGFIELD, ILL.—The Decatur, Tuscola & Champaign Railroad Company has been incorporated. The capital is $5,000. The incorporators are: J. H. Culver, Charles S. Hankins, William H. Black, J. M. Clokey, D. L. Campbell, J. L. Ray, Ashton Campbell, Charles Eckhart and A. W. Wallace.

ANDERSON, IND.—Wm. B. Campbell has asked for franchises in Noblesville, Lebanon, Lapel and Westfield for his proposed electric cross line paralleling the Old Midland Railroad. Crawfordsville will be the western terminal at present. Mr. Campbell denies that either the Indianapolis & Northwestern or the Indiana Union Traction Company is behind the project to connect the two great systems with a cross-State line.

BLUFFTON, IND.—The Kokomo, Marion & Western Interurban Company is to construct an east and west line through the city immediately after the Kokomo and Marion branch is completed.

MARTINSVILLE, IND.—W. M. Nees, of Brazil, at the head of a company of Indiana men, is trying to obtain franchises for an interurban electric railway between Independence, Coffeyville and Cherryvale, in Southern Kansas. A. A. Anderson, of the Indiana Union Traction Company, is also asking franchises of the same cities. The Mayor of Cherryvale has vetoed the franchise voted to Mr. Anderson by the Council of that city. He favors the Nees company on the ground that its proposed franchise is more liberal. Mr. Nees has received a franchise at Independence.

PRINCETON, IND.—The Evansville & Princeton Traction Company has elected these officers: Joseph Hestone, president; Jonah Legrange, vice-president; William Sontag, general manager; E. J. Baldwin, secretary and general passenger and freight agent; Sam Weston, treasurer. These officers were elected as a board of directors. Perry Freeman, of Indianapolis, who is a heavy stockholder, is not represented. The capital stock is placed at $600,000, of which $50,000 has been sold. The road is completed from Princeton to Darmstadt, a suburb of Evansville.

BURLINGTON, IA.—The organization of the Burlington & Interurban Railway Company, mention of which was made in these columns recently, has been completed by the filing of articles of incorporation with the Secretary of State. The articles state that Burlington shall be the principal place of business, and that the authorized capital stock shall be $200,000. The nature of the business to be transacted is the construction and operation of interurban railways and electric power plants; also the construction and operation of an interurban line running west from Burlington, through Des Moines, Henry, Lee and Van Buren Counties, to Keosauqua, the county seat of Van Buren County. Carl Leopold, president; W. W. Copeland, first vice-president; Charles Blaul, second vice-president; Charles Armknecht, treasurer; J. W. Topping, secretary, of Burlington, Ia. These officers, with the following-named parties, constitute the board of directors; H. Weinrich, C. H. Mohland, W. G. Mercer, W. W. Parsons, James A. Guest, W. E. Blake, F. S. Churchill and H. W. Chittenden, of Burlington.

CEDAR RAPIDS, IA.—R. A. Wallace, A. T. Averhill, John T. Hamilton and John M. Redmond, well-known capitalists of this city, have made application to the City Council for a franchise permitting them to construct and operate an entirely new street car system in Cedar Rapids. The new company, if granted the franchise, will build to all the parks and all parts of the city. The work of construction will commence next spring.

DES MOINES, IA.—The Des Moines Street Railway Company has let the contract for a new bridge over the Des Moines River on what is known as the Belt Line, to J. B. Marsh & Company. The exact contract price is not known, but is approximately $12,000. The work is to be commenced at once and finished by Feb. 1, 1904.

OTTUMWA, IA.—The business men of this city are considering plans for the construction and operation of a railroad from Ottumwa, in a southwesterly direction through Moravia and Corydon to Allerton, to a point on the Southern Iowa division of the Rock Island in Wayne County. The name of the company will be Corydon, Moravia & Kansas City Railroad Company. The business men of the towns through which the road will pass have expressed a willingness to assist in the enterprise. The promoters have not yet decided whether to use steam or electricity as motive power. The line will be about 45 miles in length.

TABOR, IA.—Articles of incorporation of the Tabor Construction Company have been filed with the Secretary of State. The articles of the company state that the general nature of the business to be transacted shall be the construction and building of steam and electric railways. The capital stock is fixed at $50,000. The immediate object of the company is the construction of the road projected by the Council Bluffs, Tabor & Southern Railway Company, of Tabor, which was organied recently. The officials of the later company are also interested in the Tabor Construction Company.

HUTCHINSON, KAN.—The Commercial Club has taken up the matter of an interurban electric railway from Hutchinson to Sterling, through Nickerson. President Charles Williams spoke of the proposition as being a feasible one.

FRANKFORT, KY.—The Frankfort Street Railway Company is preparing to extend the line to Versailles, and has had a new route surveyed to pass over the Glens Creek Road. It is proposed to build the line by next spring.

PADUCAH, KY.—Ground for the power house and transfer station for the proposed electric railway between Paducah and Cairo, Ill., has been bought at Bandana, the central point on the proposed line. While full facts have never been given out regarding this line, it is known that the promoters are Paducah, Louisville and other outside capitalists. Mr. Pall, of Louisville, is interested. The plan is to conduct a passenger and freight business. An effort is on foot to get the use of the tracks of the Paducah City Railway Company here.

GREENFIELD, MASS.—The Conway Street Railway Company has petitioned the Selectmen of Greenfield for an extension from Sept. 1, 1903, to January, 1905, of franchises it holds for locations in Greenfield.

NORTH ADAMS, MASS.—The Aldermen have a petition from the Hoosac Valley Street Railway Company asking for a franchise for a line over the extension of Ashland Street, toward which the company contributed $10,000, and for double-track locations on Main Street.

NORTH ADAMS, MASS.—The Berkshire Street Railway Company has purchased 100 acres adjoining the Berkshire Park on the east. This tract will give the company about 300 acres, which will constitute the Berkshire Park, and will be developed into one of the greatest places for outing and picnic parties in Western Massachusetts. The new purchase comprises the top of the hill, from whence can be secured an unparalleled view up and down the county. On the highest point of the hill the company will erect a steel tower 100 ft. high; a circuitous road will be built to the summit and a 'bus line established, while later the company expects to build a cog railway to the top similar to that on Mount Tom. This purchase will enable the company to develop the park in a way that it has desired for the past two years. It has, in fact, wanted more room; especially did it want to acquire the summit of the hill, which in many ways is the most attractive part of the entire tract, and this purchase will enable it to develop along the lines first laid out by prominent landscape gardeners.

WORCESTER, MASS.—The Worcester & Connecticut Eastern Street Railway Company has completed its power station at Wauregan, Conn., where it can develop 3000 hp by water-power. The addition gives the company a total of 5000 hp.

IONIA, MICH.—An enthusiastic meeting of the projectors of the electric railway between Ionia and Crystal Lake was held here a few days ago. The question was gone over thoroughly, but no definite action was taken. N. B. Hayes, H. B. Slocum and E. Kendall, of Ionia, are interested.

WINONA, MINN.—Work has been started for rebuilding the plant of the Winona Railway & Light Company at a cost of $100,000.

SAUK RAPIDS, MINN.—The Watab Dam Improvement Company has under advisement the project of establishing an electric railway from here to Watab, a distance of 3 miles, and also a line to the granite quarries 2 miles north of town. The plans are being prepared by engineers of the company, and a report will be ready in a few weeks.

MINNEAPOLIS, MINN.—Thomas Lowry, president of the Twin City Transit Company, has agreed to survey the route proposed by the Park Board for the Fort Snelling line from the end of the Minnehaha line. According to the plans of the Board, it is desired that the line be extended from the end of the present Minnehaha line through the park property along the river for ½ mile, and then over the Milwaukee tracks by an overhead bridge and across the reservation to the fort.

ST. LOUIS, MO.—The uncompleted Farmington & Delassus Electric Railroad, in St. Francis County, has been sold to Ward & Vaughn on condition that cars will be running over the now completed track within sixty days. The purchasers have undertaken to fulfil that agreement, and now have men at work preparing for the starting of traffic. The road was organized several years ago among Farmington capitalists, but the money gave out after the track had been built from Delassus to the power house, 1½ miles north of Farmington. The finances were then taken charge of by the courts and a receiver appointed. Nothing was done until a few days ago, when propositions for the sale of the road were received. Mr. Ward is a Colorado capitalist identified with copper mining interests. Mr. Vaughn is connected with the Irish-American in St. Louis. They hope to extend the lines to Broad River without loss of time.

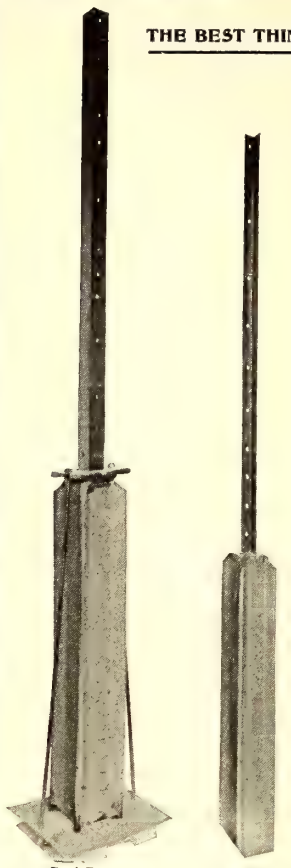
ST. LOUIS, MO.—The St. Louis & Valley Park Railroad Company has filed a petition in the St. Louis County Court, asking for a franchise to construct and operate an electric railway from St. Louis to Valley Park by way of Fenton. The proposed route begins on the Gravois Road and city limits and runs in a southwesterly direction to the Jefferson County line. Another branch is to begin at the intersection of the city limits and the Watson Road, running southwest to the McKenzie Road and over the McKenzie Road to the Gravois Road. Another spur will run from the intersection of the Fenton and Smizer Mill Road with the Gravois Road, near Fenton, over and along the Fenton and Smizer Mill Road to its intersection with the Vandover Road; thence north over the Vandover Road, through Valley Park to the right of way of the Missouri Pacific Railroad Company, and east to the Frisco Station. The tracks will also run from Fenton at the intersection of the Lackin Williams Road north to the Vandover Road. The tracks will be constructed on each side of the road, except in towns and villages, where they will be laid in accordance with orders from the County Court. The company offers $1,000 for the franchise, to complete the road within three years after its acceptance, and to run cars every thirty minutes during the day and every hour at night to midnight. The fare will be 5 cents to Affton; another 5 cents to Fenton, and a third 5 cents to Valley Park. A $5,000 bond is offered.

JEFFERSON CITY, MO.—The Excelsior Springs & Missouri City Electric Railway Company has been granted a certificate of incorporation by the Secretary of State. The new company is capitalized at $200,000, and proposes to build a standard-gage electric railway from Excelsior Springs to Missouri City, both in Clay County, a distance of 10 miles. The incorporators are: John W. Creech, of Harrington, Kan.; Charles S. Curry, Sidney P. Allen, Elmore S. Truitt and Willard E. Winner, of Kansas City, and Maurice A. Wogan, of St. Joseph, Mo.

CAMDEN, N. J.—The General Traction Company, which has filed articles of incorporation in the County Clerk's office, with a capital stock of $1,000,000, of which $26,000 is said to be paid in, is formed for the purpose of building and operating trolley lines between this city and seashore resorts. One of the lines, it is said, will run to Atlantic City, and another to Cape May, tapping other resorts along the South Jersey Coast. The president of the General Traction Company is W. W. Benson, of Philadelphia. President Benson is a director of the Palmer Concrete Block Company, of Washington, D. C., and the representative of the company in Philadelphia. He has been con-

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nected with various trolley enterprises in the South and in New Jersey. He said recently: "We are not yet prepared to announce our plans fully. We shall build about 85 miles of lines in South Jersey and connect many important places with seaside resorts. The capital to build the lines is assured, and our engineers have been at work many weeks on the plans."

TRENTON, N. J.—The Burlington & Mount Holly Traction Company has filed a map in the office of the Secretary of State showing that it is the intention to use the Pennsylvania Railroad Bridge. Crossing the Delaware River on the new trolley bridge, the tracks are to connect with the Camden & Trenton Railroad to allow passengers to be landed in the center of this city. The Pennsylvania route from Burlington has been filed with the Secretary of State at Harrisburg.

TRENTON, N. J.—The Pennsylvania Railroad Company has commenced its efforts to prevent the Camden & Trenton Company frim crossing its Cass Street crossing at grade on the branch which extends the trolley to the center of the city. The railroad company has ordered a freight train to stand on the track at the crossing to prevent the laying of the trolley tracks. On Saturday, Sept. 5, the Camden & Trenton Company successfully strung its feed wires, using a sewer under the canal for the purpose. Counsel for the Camden & Trenton Company will apply to the courts for designation of the method of crossing if the railroad company persists in its opposition.

TRENTON, N. J.—After a delay of nearly three months the Delaware Valley Traction Company has obtained a franchise in Ewing Township. The ordinance empowers the company to construct a road, beginning at the city line, near the State Hospital, and proceeding out the Birmingham road through Trenton Junction to Birmingham. Near this point the line will take the Somerset road and run to the township line. This franchise, together with the Hopewell franchise, gives the company a continuous line through Mercer to the Hunterdon County line. The company already has a franchise in Lambertville, and the only break in the route is about a mile and a quarter in West Amwell Township, in Hunterdon County. It is probable that a petition will soon be sent to Common Council for permission to extend the road into the city from the State Hospital to the entrance of Cadwalader Park. As soon as all the franchises are obtained, work of construction will be begun.

ALBUQUERQUE, NEW MEX.—The City Council has granted an electric street railway franchise to a company headed by Col. W. H. Greer, manager of the Victoria Land & Cattle Company, with headquarters in Deming. It is a fifty-year franchise, with a purchase clause inserted, enabling Albuquerque to secure control of the line within twenty-five years.

BROOKLYN, N. Y.—The Brooklyn Rapid Transit Company plans soon to begin the construction of new car barns and sheds, some of which are to replace old ones destroyed by fire and others of which are to furnish additional storage room for extra cars recently acquired by the company. The largest of the new barns will be built at Thirty-ninth Street and Second Avenue, where it is intended to furnish coverings for at least 200 cars. The building is to be constructed of a patent fireproof material approved by the fire underwriters. At Ridgewood the old sheds are to be rebuilt and new ones added. At Flatbush and Vernon Avenue the building which was partially destroyed by fire some time ago will be reconstructed and extensions will be made which will admit of the proper storage and care of all cars that are housed there.

NEWBURGH, N. Y.—The Common Council has granted a franchise to the Intervale Traction Company to construct, maintain and operate an electric street railway along Lake Street from South William Street to Robinson Avenue, thence along Robinson Avenue to Washington Street, thence along Washington Street to Johnston Street, thence along Johnston Street to Ann Street, thence along Ann Street to Washington Place, along Washington Place to Colden Street, thence northerly on Colden Street to the tracks of the Orange County Traction Company at Broadway, thence northerly along Colden and Water Streets over the tracks of the Orange County Traction Company from Broadway to Third Street, thence easterly along Third Street to Front Street, thence southerly along Front Street to Second Street, thence easterly along Second Street and through private propery to the ferry house and the docks of the Central Hudson Steamboat Company.

NEW YORK, N. Y.—The Board of Aldermen has granted the Union Railway a franchise to extend its line across McComb's Dam Bridge. The franchise does not give the Union Railway a monopoly in the use of the bridge tracks. It will enable the Union Railway to give residents of the Bronx a direct connection with the Eighth Avenue line of the Metropolitan Street Railway Company.

NEW YORK, N. Y.—The franchise granted by the Board of Aldermen to the Ocean Electric Railway Company, which gives it permission to operate cars over the Boulevard and Park Avenue, Rockaway Beach, has been signed by the Mayor. For a long time the Ocean Electric Railway Company, which is controlled by the Long Island Railroad Company, has sought a franchise giving it the right of way over the route, beginning at the termination of its present tracks at Washington and Eastern Avenues, Rockaway Park, and thence along the Boulevard, through Sea Side, Hollands, Hammels, to Park Avenue, the eastern limits of Rockaway Beach, and thence along Park Avenue northerly to the present right of way and tracks of the company.

NEW YORK, N. Y.—Excavations were started on Thursday night, Sept. 3, on the lower Broadway spur of the Rapid Transit Subway. Before daylight Friday morning the hole made was boarded over with a platform of 6-in. planking, and the daily traffic went on unobstructed. The work was started on the northerly end of the west side of the block facing St. Paul's Chapel, where the overhead structure of the contractors stood ready to bear the cranes and other loading apparatus. Unless all the plans fail, the entire block will be tunneled and the subway completed with no further obstruction

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of traffic conditions than exists now. The contract approved by the Rapid Transit Commissioners forbids the opening of one section of the street until the preceding section is completed.

ROCHESTER, N. Y.—The Rochester & Easton Railway, which is being built between Rochester, Canandaigua and Geneva, N. Y., is expected to be completed and ready for operation about Sept. 15. Forty-one miles of track have been laid, the poles and brackets have been placed, and the remainder of the work is confined to stringing wires. The road connects with the Rochester Railway at the end of the Monroe Avenue line, and cars will run over the Monroe Avenue route to Main Street, and will turn through State, Church and Sophia Streets in the same manner as the cars of the Rochester & Sodus Bay Company are now operated into the city. The cars for the line are in process of construction in the Jewett Car Works in Newark, Ohio. They are of the regular interurban type, equipped with double trucks. They will be equipped with cross-seats, finished in rattan, and will be equipped with air brakes. A few combined freight and passenger cars, eventually, are to be operated. There are two power houses, one at Canandaigua and the other at Geneva. A large car house has also been built at Canandaigua, where the offices of the company will be located.

SALAMANCA, N. Y.—The Berney Traction Company, which has recently obtained a franchise to build an electric railway in Salamanca, has opened an office, and the preliminary work for the commencement of the work of construction is well under way. Much of the material for the road will be placed on the grounds without delay, but it is doubtful if the road will be ready to be operated before another spring.

CINCINNATI, OHIO.—There has been constructed, by interests indentified with the Cincinnati Traction Company, a fourteen-story office building, in which will be located the general offices of the company. The building is at the southeast corner of Fifth and Walnut Streets, and towers above all the fine buildings in that immediate vicinity. The walls are of what is known as raindrop brick, which has the advantage of never losing its color. The first two floors are of solid stone, and above them to the fourteenth is structural iron. There is nothing that can burn, and the building is, in every way, fireproof. There are five elevators. They open and close automatically, and a complete signal system is provided. The finish is beautiful. Each floor is different in finish and design. The officers of the traction company are on the ninth floor. The private office of President Schoepf is finished in magnificent style, and shows the splendid taste of the company's president. Henry Shenk, of Pittsburg, was the general contractor for the building.

CINCINNATI, OHIO.—The Town Trustees of Liberty, Ind., have passed an ordinance granting the Ohio & Indiana Railway Company a franchise to operate over the streets of Liberty, provided the road is completed by Jan. 1, 1905. The company was organized six months ago to build an electric railway from Hamilton to Indianapolis. Its office is in the Union Trust Building, Cincinnati.

COLUMBUS, OHIO.—The Southeastern Ohio Railway, Light & Power Company, of Zanesville has been incorporated, with a capital stock of $10,000, by M. W. Hissey, E. R. Meyer, W. W. Harris, N. P. Shurtz and F. M. Ransbottom. The company proposes to build an electric railway from Zanesville through Roseville, Crooksville and Sayre to New Lexington, and to develop and sell electricity for light and power. Dr. Hissey, the leading promoter of the enterprise, is a close friend of Senator Hanna, and it is presumed that the Senator is intersted in it.

NEWARK, OHIO.—Officers elected on Aug. 27 by the Newark, Martinsburg & Mount Vernon Traction Company are: Edward H. Everett, president; Dr. J. F. Sprontz, vice-president; John Chilcote, treasurer; Frank Elliott, secretary; Edward Kibler, counsel. The company intends to build immediately. This line will complete the Cincinnati-Cleveland line.

YOUNGSTOWN, OHIO.—Local interests are talking over the advisability of building an electric railway from Youngstown to Niles.

YOUNGSTOWN, OHIO.—The Youngstown, Park & Falls Street Railway Company has amended its charter so as to be permitted to construct and operate an electric railway from Central Square in Youngstown to Idora Park, in Youngstown Township, with lineal or lateral extensions, as the owners see fit.

DARBY, PA.—The Philadelphia, Morton & Swarthmore Trolley Company is making rapid progress with its extension into Darby. The work of building the bridge over Darby Creek has been commenced, and tracks have been laid across Springfield Avenue in the borough.

WEST CHESTER, PA.—The West Chester Street Railway Company has completed negotiations for a much-desired right of way on the Coatesville extension. Thus the several links in the chain of opposition to the construction of the new line to Coatesville are gradually wearing away, and if everything in prospect is carried out, as expected, there will soon be no rights unsecured between Downingtown and Coatesville.

WESTERLY, R. I.—The directors of the Groton-Westerly Street Railway Company have decided to offer $200,000 of preferred stock to the public and to engage counsel to present the matter of public convenience and necessity before a judge of the Superior Court. Senator Hamilton, of Groton, president of the company, states that the company is not yet ready to consider contracts for the construction of the road. A committee consisting of President Hamilton, A. H. Chappell, Charles B. Noyes and B. F. Williams has been appointed to secure locations for a power plant and obtain the right of way where needed. Conditions are reported as progressing satisfactorily for the new company.

MEMPHIS, TENN.—The railroad committee of the City Council has decided to recommend that a franchise for a street railway be granted Fletcher R. Harris and associates, of St. Louis, for $150,000, one-third of which is

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payable on the day the contract is signed. In addition, Mr. Harris must deposit $5,000 as a guarantee that 10 miles of the road will be completed within twelve months.

BEAUMONT, TEX.—The County Commissioners' Court has granted the right of way to the Beaumont Traction Company for a railway along the side of the county road to Spindle Top.

NEWPORT NEWS, VA.—The route of the projected Jamestown, Youngstown & Old Point Electric Railway has been determined upon. The line will have terminals at Newport News and Old Point. The route will be from Jamestown Island to Williamsburg, to Yorktown, to Little Bethel, branching out there to Newport News and also to Old Point. The statement is made that the first car will run into Newport News from Jamestown before Jan. 1. This line is regarded as the first step toward a peninsular electric line to Richmond. Double tracks will be laid and modern suburban cars will be used. Rights of way have been secured for most of the route.

RICHMOND, VA.—A charter has been granted to the Nelson & Albemarle Railway Company to build and operate an electric railway from the soapstone quarry to the Southern Railway, a distance of 6 miles to 8 miles. The capital stock is $250,000. The incorporators are: J. W. Foster, H. L. Lane, D. J. Carroll, F. V. Elsom, D. H. Pitts, J. G. Hopkins and George W. Bostwick.

SPOKANE, WASH.—A 60-mile electric railway to run from Spokane via Newman Lake to Rathdrum, then looping back to Cœur d'Alene City and Liberty Lake, with a spur to Steamboat Landing, on the Pend d'Oreille River, and a branch to Harrison, is proposed. Eastern capital is behind the enterprise. James Edwards, a civil engineer, formerly with the Northern Pacific, is preparing data to be submitted to the promoters.

JANESVILLE, WIS.—The Janesville Traction Company announces that it will not build the proposed $1,000,000 line from Janesville to Madison, owing to the clause in the franchise which makes its life thirty-five years instead of fifty years.

LA CROSSE, WIS.—The proposed electric railway between Sparta and Melrose may be begun this fall. An Eastern bonding firm is expected to finance the road. W. Sarles and J. Kemp, of Sparta, who have been in the East, have succeeded in interesting Eastern capitalists, and as a result several men representing Simonds & Aldrich, bond brokers of New York, and Mr. Sawin, chief engineer for the McGrath Construction Company, of Pennsylvania, are in La Crosse examining the proposed route. Mr. Sawin will base his estimate on a better roadbed, better rails and a more substantial line in every respect than was formerly proposed, as he thinks the possibilities of the road warrant it. If the electric road to Melrose is built it will be completed next summer. La Crosse has voted $25,000, Melrose $15,000, Little Falls $10,000, and Lafayette $5,000.

MADISON, WIS.—The Chicago & Northwestern Lakes Electric Railway Company, which proposes to build an electric railway from Chicago to Kilburn City, has filed articles of incorporation with the Secretary of State. The route in Wisconsin is from a point on the State line in Kenosha County, through Kenosha, Walworth, Jefferson, Dane and Columbia Counties. The capital stock is $50,000, in 500 shares of $100 each. The incorporators are: Alexander Clark, Charles S. McIlvain, Samuel M. Hamilton, of Chicago; Fred Kull, E. P. Wheeler, of Lake Geneva.

WHEELING, W. VA.—It is stated that in the near future the Wheeling & Elm Grove Traction Company will build another power house. The new building will be situated in Elm Grove, although the exact location has not yet been selected.

CANADIAN NOTES

STRATFORD, ONT.—The Council is prepared to negotiate with parties who would be willing to establish an electric railway here.

PRESTON, ONT.—The Berlin & Preston Railway Company is excavating for a power house at this place.

PETERBOROUGH, ONT.—At the meeting of the City Council, the franchise to the Peterborough & Ashburnham Radical Electric Railway Company, which is practically the American Cereal Company, was agreed upon. The principal clauses of the franchise provide that 5 miles of railway within the town are to be equipped and in operation not later than July 1, 1904. The plans of the company include extensions to Ashburnham, Lakefield, Young's Point and Chemong.

ST. BONIFACE, MAN.—The by-law for an electric railway has been passed, and the Winnipeg Street Railway Company has signified its willingness to run its cars into St. Boniface over the Norwood Bridge and along Rue Marion, north of Avenue Tache to Rue Provencher, and thence to Avenue Thisault, where the end of the line would be opposite St. Boniface College. The company is also prepared to furnish the town with electric light.

NEWS NOTES

SAN FRANCISCO, CAL.—The State Board of Equalization has assessed for the first time the United Railways, of San Francisco. No such assessment has ever before been made, but the decision in the San Mateo electric road case settled the matter, and, as lines running into two or more counties may now be merged for assessment purposes, the new rule gives the State Board jurisdiction over the whole system of street railways. The Board has valued the franchises, rails, rolling stock, etc., of the United Railways at $20,150,000.

CHICAGO, ILL.—The city has called on the Union Traction Company to pay $200,000 as license fees on the grip cars used by the company since the installation of the grip-car system. The Traction Company has been calling the grip car and the first trailer as one car for license purposes, while the

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FACTORY AND MAIN OFFICE DETROIT.

Chicago City Railway, it is said, has paid for each grip car making trips, the same as the trailers. The city now insists the Traction Company shall pay the $50 license for each grip car, in addition to that for the trailer.

BOSTON, MASS.—The explosion of a gasolene torch in the East Boston Tunnel under Court Street, Saturday afternoon, Sept. 5, set fire to the planking which covered the hole, seriously injured one workman and imperilled scores of others. With the exception of the one workman burned, all the others escaped with little more than fright, the pedestrians, who crowded the street at the time, escaping likewise. The accident was the second of the kind within a week, three men being badly burned in the first. It was necessary to fill in the trench with sand to smother the flames.

WORCESTER, MASS.—The Boston & Worcester Street Railroad Company is held to be "seriously at fault" by the Railroad Commissioners for the collision in Shrewsbury on July 25, 1903, in which one person was killed and several received serious injuries. The Board, in its report, which was filed Sept. 3, says: "Inquiry shows the company seriously at fault in respect to the management of its railway. It had adopted a method of car despatching by telephones. This system, when properly used, is a safe one. The mistake, as far as the public safety was concerned, was in the failure to provide for its proper use. In brief, investigation of this accident disclosed ineffective management. The remedies for evils of careless management have been found in the civil liabilities to which it exposes the stockholders of the company and in the criminal prosecution of those personally responsible for carelessness, whether they be officials or employees. It is questionable whether accidents that arise from a failure to manage properly a railway can be prevented by any other means than the enforcement of laws of this kind."

NEWARK, N. J.—Chief Justice Gummere, in the Essex County Court of Oyer and Terminer, has granted the motion for dismissal of the indictments for manslaughter against eleven officials of the North Jersey Street Railway Company, who were accused of having caused the death of Ernestina Miller, the high school pupil, killed with eight others in the Clifton Avenue, Newark, crossing accident of Feb. 19. It was alleged that their neglect of duty was responsible for the fatality. The motion to dismiss the indictment was made at the trial by Richard V. Lindabury, of counsel for the defendants, after the State had presented all its evidence and had rested its case.

BROOKLYN, N. Y.—On Sunday evening, Sept. 6, a car of the Myrtle Avenue line of the Brooklyn Rapid Transit Company was in collision with a car of the Seventh Avenue line of the same company at Myrtle Avenue and Adams Street. Twenty persons were injured.

BROOKLYN, N. Y.—H. Milton Kennedy, of Brooklyn, has secured the contract for the removal of ashes in Brooklyn. It is announced that he had transferred the contract to the American Railway Traffic Company, and that ashes will hereafter be taken away in trolley cars. Carts will be used in gathering the ashes, which will be carried to the stations, where the cars will be loaded. Mr. Kennedy formerly was connected with the Brooklyn Rapid Transit Company, and his system of handling ashes and refuse was described in the Street Railway Journal some time ago.

BROOKLYN, N. Y.—Bridge Commissioner Lindenthal and President Winter, of the Brooklyn Rapid Transit, have turned down the application of Nels Poulson for a thirty-minute test of his plan of running cars on the Brooklyn Bridge. Mr. Poulson recently applied to President Winter for a special thirty-minute test to be held some time during the day, just to show how his plan would work. Mr. Winter referred the request to Commissioner Lindenthal. Mr. Poulson tried to persuade the Commissioner that a little test would be a good thing. Commissioner Lindenthal could not see it that way and so informed Mr. Poulson. He also wrote to President Winter that he thought a thirty-minute test would be useless.

NEWBURGH, N. Y.—A head-on collision on the Orange County Traction line, near the city boundary, Saturday afternoon, Sept. 5, severely injured five persons.

NEW YORK, N. Y.—Opposition on the part of the Broadway merchants to the construction of a subway spur on that thoroughfare from Forty-Second Street to Union Square by the "open-ditch" method has formally been made known to Mayor Low.

ROCHESTER, N. Y.—Announcement was made Aug. 31 by General Manager T. J. Nicholl, of the Rochester Railway Company, that the company had granted an increase in the wages of its motormen and conductors of 1 cent an hour over the present scale of wages. The increase went into effect Sept. 1. The present scale of wages is 17 cents an hour for the first six months; 18½ cents for the second six months, and 20 cents after the first year. With the advance the men will receive 18 cents for the first six months; 19½ cents for the second six months, and 21 cents an hour after the first year.

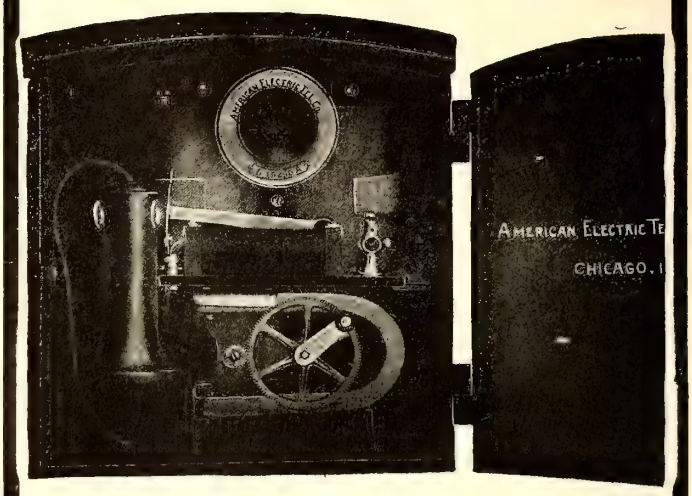
EASTON, PA.—A score of persons were hurt Monday afternoon, Sept. 7, in a head-on collision on the Easton and Bethlehem branch of the Lehigh Valley Traction Company, 2 miles west of this city.

HARRISBURG, PA.—The control of the West Fairview & Marysville Electric Railway has passed into the hands of the Harrisburg & Mechanicsburg Railway, the trolley company operating the lines into Harrisburg from various towns over the Susquehanna. George R. Alleman, the largest shareholder, is said to have admitted that control had passed, but declined to give figures. It is said that the Harrisburg & Mechanicsburg Railway has taken over almost three-fourths of the stock, paying $20 for the majority shares and $15 for the others. The stock amounts to $110,000 all told, and there is an equal amount of bonds. The acquisition of this line gives the Harrisburg & Mechanicsburg Railway control of the roads between Mechanicsburg, Camp Hill, White Hill, New Cumberland, Marysville and Harrisburg.

HOUSTON, TEX.—The City Council has adopted an ordinance which has for its object the regulating of the street car hog. It makes it an offense punishable by heavy fine for a passenger to occupy the end seat of a street car and refuse to move to make room for other passengers.

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BROOKLYN, N. Y., U. S. A.

FINANCIAL NOTES

SAN BERNARDINO, CAL.—The stockholders of the San Bernardino Valley Traction Company have authorized the issuance of $1,000,000 in bonds. While the Traction Company will have power to issue the entire amount of bonds called for, it is probable that only about $400,000 of the total will be placed at present. This amount will be sufficient to pay off outstanding bonds and the floating indebtedness of the corporation, and as this was the purpose which the company had in view, just now they do not deem it advisable to sell the entire $1,000,000 of securities.

CHICAGO, ILL.—The Chicago City Railway Company has declared a quarterly dividend of 1¼ per cent, payable Sept. 30.

SAVANNAH, GA.—The Savannah Electric Company reports earnings as follows:

Year ending July	1903	1902
Gross earnings	$50,311	$46,550
Operating expenses	27,193	24,449
Net earnings	$23,118	$22,101
Fixed charges	9,831	9,583
Net profit	$13,286	$12,518
June		
Gross earnings	$503,230	$461,009
Operating expenses	297,611	275,243
Net earnings	$205,618	$185,766
Fixed charges	115,500	.....
Net profit	$90,118	.....

CHICAGO, ILL.—Receiver Edwin J. Zimmer, of the Chicago General Railway Company, has petitioned the Circuit Court at Chicago to compel Erskine M. Phelps, Orson Smith, E. F. Bryant, Frank O. Leroy and A. Goddard Lowden, John S. Runnells, D. B. Scully, E. M. Fowler and Leroy A. Goddard to pay to the company $400,000 on account of $1,000,000 bonds which it is alleged they purchased prior to April 17, 1900, for $600 per bond. The receiver understands the constitution of Illinois to forbid that bonds shall be issued except for their par value in money, labor or property.

LOUISVILLE, KY.—The directors of the Louisville Traction Company have extended the time limit for depositing the stock of the Louisville Railway Company for exchange for the stock of the Louisville Traction Company until Sept. 10.

BOSTON, MASS.—Mason, Lewis & Company offer for subscription at 98½ and interest $3,000,000 first mortgage thirty-year 5 per cent gold bonds of the Puget Sound Power Company. The total authorized issue is $4,000,000, of which the amount issued to complete present developments is $3,000,000. The principal and semi-annual interest are payable at the office of the Old Colony Trust Company, Boston, which is trustee under the mortgage. The property on which the bonds are a first lien is a water-power plant situated on the Puyallup River, 45 miles from Seattle and 30 miles from Tacoma. The initial installation is 20,000 hp, with provision for additional power that will double the capacity of the station. The company owns the land on both sides of the river for over 11 miles, power station, reservoir site and transmission lines following right of way owned in fee for some 13 miles to where the line of the Interurban Railroad is met, and the lines are carried into Seattle and Tacoma over the property of that company under perpetual lease. The bonds are guaranteed, principal, interest and sinking fund payments, by the Seattle Electric Company, which acquires the entire property, rights and franchises of the Power Company, making the security an obligation of the Seattle Electric Company, and a first lien on a most important part of the property. The entire issue may be called at 110 and interest upon sixty days' notice, and may be called by lot at 110 and interest through the operation of the sinking fund, which provides for the retirement of 1 per cent of the total issue annually, beginning in 1906. The deed of trust covers also a thirty-five-year contract made with the Tacoma Railway & Power Company and the Seattle-Tacoma Interurban Railway Company, operating as the Puget Sound Electric Railway, for 6333 hp at $20 per horse-power per annum. This amount of power is practically the surplus available above the needs of the Seattle Electric Company for its own uses.

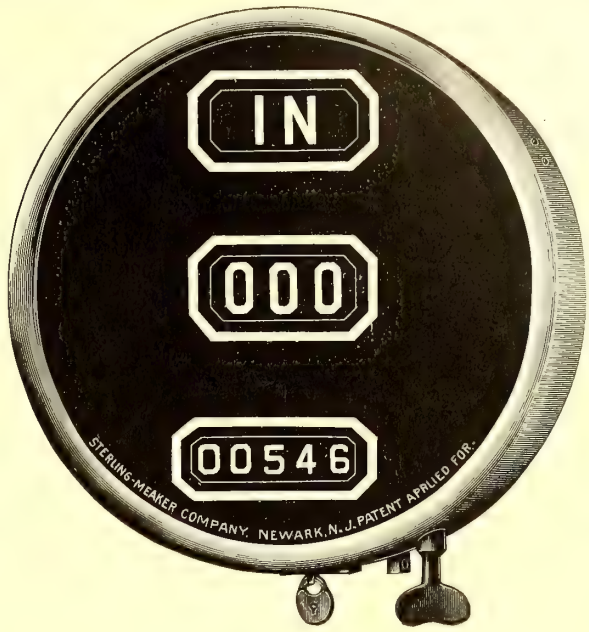
DETROIT, MICH.—The directors of Detroit United Railway have declared the regular quarterly dividend of 1 per cent on the capital stock of the company, payable Oct. 1.

LANSING, MICH.—The Lansing Street Railway has been sold by the Hawks-Angus syndicate to Nelson Mills, of St. Marys, and his associates, who are interested in the Lansing, St. Johns & St. Louis Railway Company. It is said that the Hawks-Angus syndicate has arranged for the entrance of its Lansing-Battle Creek line in the city over the Lansing Company's lines.

HACKENSACK, N. J.—The Newark & Hackensack Traction Company, which operates from Hackensack to Arlington, a distance of about 12 miles, is now owned by the New York & New Jersey Railroad & Ferry Company, whose tracks run from Fort Lee through Hackensack to Paterson, with a branch to Englewood.

BROOKLYN, N. Y.—The Coney Island & Brooklyn Railroad Company reports earnings as follows:

Quarter ended June 30	1903	1902
Gross receipts	$438,253	$423,276
Operating expenses	255,685	229,210
Net earnings	$182,568	$194,066
Receipts from other sources	621	2,847
Fixed charges	67,934	53,638
Surplus	$115,254	$143,273



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JAMAICA, N. Y.—Justice Albert H. Sewell, of the Supreme Court, and the New York State Railroad Commissioners have granted the petition of the New York & North Shore Railroad Company to change its name to the Long Island Electric Railway Company, the change to take effect Oct. 1. The latter title was the name of the company previous to its consolidation with the New York & North Shore Railroad under the name of the New York & North Shore Railroad. Subsequently the property and assets of the original New York & North Shore Railroad, the line connecting Flushing and Jamaica, were sold under foreclosure of a mortgage, and they were bought by the New York & Queens County Railroad Company.

MINEOLA, N. Y.—A mortgage for $1,000,000 has been entered to the Savings & Trust Company, of Cleveland, Ohio, by the Mineola, Hempstead & Freeport Traction Company, now the New York & Long Island Traction Company. The loan is for the purpose of extending the company's lines. The company now operates from Mineola to Freeport, and will soon have the extension from Rockville Centre to the New York city line finished. It also operates a line to Queens and contemplates lines to Babylon from Freeport; also routes on the north, central and southerly sections of the island into the city of New York, through traffic agreement with other lines or its own.

ROCHESTER, N. Y.—The Rochester Railway Company reports earnings as follows:

Year ended June 30	1903	1902
Gross receipts	$1,291,369	$1,044,006
Operating expenses	692,931	572,983
Net earnings	$598,438	$471,023
Receipts from other sources	32,983	24,216
Total income	$631,421	$495,239
Fixed charges	392,882	313,540
Surplus	$238,539	$181,699
Dividends	156,250	54,110
Surplus	$82,289	$127,589

PHILADELPHIA, PA.—The regular semi-annual dividend of $4 per share has been declared on Philadelphia Traction stock, payable Oct. 1, as registered Sept. 11.

CHATTANOOGA, TENN.—The Rapid Transit Company, of Chattanooga, operated by the United Railways, Light & Water Company, of Philadelphia, for the last fiscal year ending June 30, showed an increase in gross earnings of 36½ per cent over the previous year. July and August, 1903, show an increase in earnings over July and August, 1902, of about 40 per cent, and the gross receipts of August, 1903, show an increase of 112 per cent over August, 1901. The growth of the electric railway business in Chattanooga is wonderful, and with the new army post at Chickamauga Park, upon which the government is expending $1,000,000, and which will be ready for use next spring, and the national encampment of militia at Chickamauga Park next year should make the receipts in Chattanooga very heavy in the future, and especially so to the lines operated by the Rapid Transit Company, which is the only company that operates to Chickamauga Park and that has an incline up Lookout Mountain.

KNOXVILLE, TENN.—The Knoxville Traction Company and the Knoxville Electric Light & Power Company report jointly as follows:

Six months ending May 31	1903	1902
Gross earnings	$125,072	$100,455
Operating expenses	68,761	65,588
Net earnings	$56,311	$34,867
Interest and taxes	37,132	36,409
Surplus	$19,179	*$1,542

* Deficit.

The balance sheet as of May 30, 1903, shows:

ASSETS

Property and franchises	$1,553,612
Construction and betterment	311,942
Stock interest in other companies	54,782
Accounts receivable	18,624
Supplies	15,389
Cash	53,168
Reserve for insurance	4,740
Total	$2,012,257

LIABILITIES

Capital stock	$750,000
First mortgage 5 per cent bonds	850,000
Debenture 6 per cent certificates	300,000
Accounts and vouchers payable	18,537
Interest accrued on bonds	7,083
Taxes accrued	6,441
Surplus and undivided profits	80,196
Total	$2,012,257

HOUSTON, TEX.—The Houston Electric Company reports earnings as follows:

June	1903	1902
Gross earnings	$37,237	$31,899
Operating expenses	21,976	16,679
Net earnings	$15,261	$15,220

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Fixed charges	6,712	6,250
Net profit	$8,548	$8,970
Year ending June		
Gross earnings	$398,219	$322,569
Operating expenses	246,216	187,730
Net earnings	$152,003	$134,829
Fixed charges	77,240	
Net profit	$74,763	

SALT LAKE, UTAH.—A. W. McCune, of Salt Lake, has transferred all of his interest in the Consolidated Railway & Power Company, which owns and operates the entire street railway system of the city, to the Utah Light & Power Company. The deal includes a transfer of $6,000,000, Mr. McCune receiving $3,000,000 and the other $3,000,000 being represented by the bonded indebtedness of the company, which is assumed by the purchasers. This is really a transfer of the property to the Mormon Church, and is the second largest deal ever consummated in Utah.

NORFOLK, VA.—Proceedings have been instituted before Federal Judge Waddill in the form of an application for a co-receiver for the Hampton Roads Railway & Light Company, recently placed in the hands of R. I. Mason, third vice-president of the Hampton Roads Company, as receiver. In the absence of Attorney R. G. Bickford, of Newport News, who asked for the appointment of Mr. Mason as receiver, Judge Waddill declined to hear. W. J. Nelms, whom the court is asked to name as co-receiver, is president of the Hampton Roads Company.

AMONG THE MANUFACTURERS

STONE & WEBSTER, of Boston, Mass., have moved their offices to the ninth, tenth and eleventh floors of the newly-constructed India Building, State Street, corner of Merchants' Row. Their address now is No. 84 State Street.

THE JOHN A. STEWART ELECTRIC COMPANY, of Cincinnati, is now handling an excellent line of second-hand electric railway apparatus. John A. Stewart, president of the company, is very widely known in the electrical field, and has been conducting an extensive repair shop in Cincinnati for some time past. Mr. Stewart will continue to handle repair work, in addition to managing the company which he has recently organized for the sale of second-hand electrical and steam apparatus.

THE WALTER A. ZELNICKER SUPPLY COMPANY, of St. Louis, with branches at Chicago, Seattle, Mobile, New Orleans and Houston, issue a daily bulletin showing rails, railroad equipment, machinery, etc., which it has at various points in the United States. This company operates a rail and equipment department second to none, and is in a position to furnish rails, either for cash or time, new or second-hand. At the present time it has a large quantity of 50-lb. and 60-lb. relayer rails for prompt shipment.

J. P. PROVOST, for the past twelve years prominently connected with the R. D. Nuttall Company, will hereafter be associated with George W. Provost in the management of the General Railway Supply Company, Park Building, Pittsburg. J. P. Provost, while with the R. D. Nuttall Company, made many friends in the electrical field, and his knowledge of the trade in general and his pleasing personality will without doubt be an important factor in handling successfully and promptly the increasing business his company is enjoying. It is the intention to add many new lines, and when this is accomplished orders will be accepted for anything pertaining to the electrical trade.

THE ELECTRICAL INSTALLATION COMPANY, of Chicago, has closed a contract for a 12-mile electric railway for Trinidad, Col., and the adjacent towns of Starkville and Sopris. The contract provides for the complete construction and equipment of the railway, including buildings for power house and car house, complete steam and electric plant, track, overhead work, cars, trucks and motors. The power plant will be a combined electric railway and lighting plant of about 900-kw capacity, two-thirds of which will be for the railway and one-third for lighting. The specifications provide for water-tube boilers, direct-connected steam and electrical machinery, and the entire installation will be of the highest class throughout. Work has already been started, and it is expected the entire plant will be ready for operation Feb. 1, 1904.

P. & F. CORBIN, of New Britain, Conn., are distributing to their friends a beautiful colored litho of the lower and older portion of New York as it is approached from Jersey City. In this section the greater portion of the business is done that has made New York the commercial and financial center of the world. It is here that the great corporations, with factories in various parts of the country, have their offices. Since the photograph was taken from which the engraving was made several very tall buildings have been erected, upon which Corbin hardware has been used. Corbin hardware, by the way, has been used upon New York's highest buildings, and this is also true of the highest buildings in Chicago, Philadelphia, San Francisco, Cleveland, Pittsburg and other large cities. The most pleasing thing about the picture is that it is not stamped with the name of the givers and gentle reminders of their "fifty-seven varieties." Friends who are fortunate enough to receive one of these pictures will have no trouble in remembering who their kind benefactors were.

THE NEW BUILDINGS of the Westinghouse Electric & Manufacturing Company, at Pittsburg, are now rapidly approaching completion. The main building is 1650 ft. long, and, like all the other buildings to which it is

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Designers and Builders of Complete
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Transit Building, NEW YORK. Marquette Building, CHICAGO.

H. M. BYLLESBY & CO.
INCORPORATED
Engineers
Design, Construct and Operate Railway Light, Power and Hydraulic Plants
EXAMINATIONS AND REPORTS
New York Life Building CHICAGO, ILL.

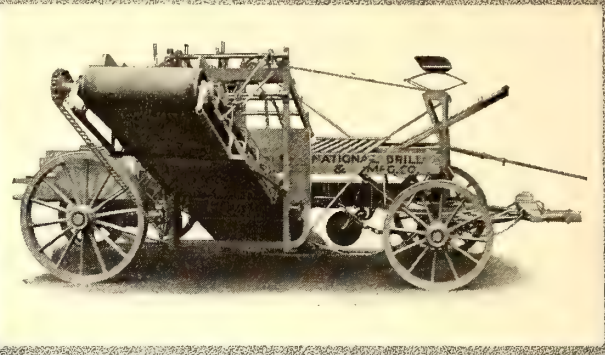
Archbold-Brady Company,
Engineers and Contractors
Electric Railways Electric Light Plants
High Tension Power Transmission
Structural Iron and Steel
918-920 University Bldg., Syracuse, N. Y.

parallel, is composed of three bays. The two side bays are 80 ft. wide, having gallery floors, and the center bay is 70 ft. wide with clerestory and is traversed by several traveling cranes of thirty tons' capacity, all operated by alternating current furnished by two 1000-kw turbo-generators. The addition of this building to the older group allows of a complete change of method in manufacture. While at present a certain class of generator or motor is begun and completed in its individual department, in the future the manufacture of the detail parts of these appliances will be specialized, and each department will be devoted to the manufacture of one class of detail only, from its largest to its smallest size. This change is in conformity with the tendency toward the factory system of manufacturing even very large and complicated products, which, during the past few years, has made this country pre-eminently the leader in the industrial world.

THE WESTERN ELECTRICAL SUPPLY COMPANY, of St. Louis, announces that owing to the constant growth of its business during the past ten years, it has found it advisable to increase its cash capital and divide the business into two parts. That portion relating to electrical supplies, good will and stock of goods, the company has sold to The Wesco Supply Company, a new company just organized, with ample capital to continue that business, under the personal management of R. V. Scudder. The Wesco Supply Company has a large cash capital, and pays the Western Electrical Supply Company cash for all merchandise and a bonus for good will. The other part of the business, the building of electric light plants and electric railroads, will be retained by the Western Electrical Supply Company. It will hereafter restrict itself to this branch, and now has on hand contracts calling for orders for nearly a million dollars. All liabilities of the company will be liquidated by the Western Electrical Supply Company, which expects shortly to increase its capital to $300,000, and will discount all future purchases. The company will continue to be personally managed by H. K. Gilman, with offices at Chemical Building, St. Louis, Mo. H. K. Gilman, of the Western Electrical Supply Company, will retain an interest in The Wesco Supply Company, and will serve as one of its directors. Both companies will be officered by old employees of the Western Electrical Supply Company, and, with ample cash and better facilities than ever before, will undoubtedly continue the record of success made by the old concern.

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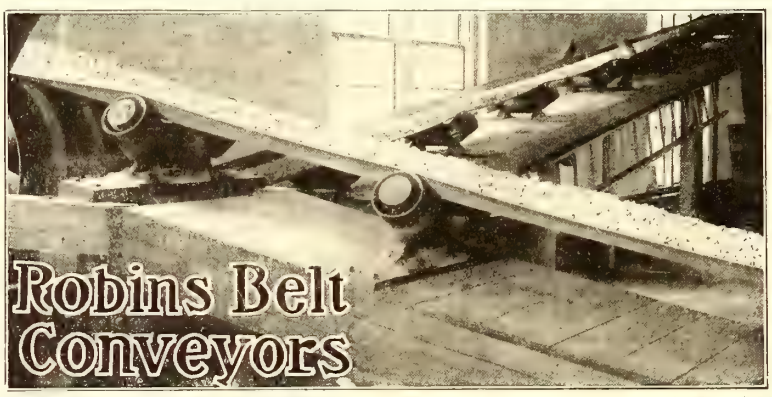


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The National Elevating Grader, Ditcher and Wagon Loader
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The above illustration shows direct draft chain, plow-regulating bar, elevator adjustment, and trussed frame.

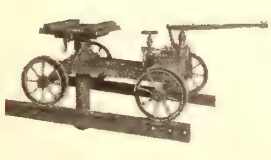
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CEDAR RAPIDS, IA.—R. A. Wallace, A. T. Averill, John T. Hamilton and John M. Redmond, well-known capitalists of this city, have made application to the City Council for a franchise permitting them to build and operate an entirely new street railway system for Cedar Rapids. If the Council passes the ordinance, work will be commenced next spring.

WASHINGTON, IA.—Articles of incorporation of the Iowa City, Kalone & Washington Railway have been filed with the County Recorder of Washington County. The company is organized for the purpose of constructing an interurban electric railway from Iowa City, the county seat of Johnson County, via Kalona to Washington, the county seat of Washington County, a distance of about 24 miles. The capital stock is $50,000, and Washington is named as the principal place of business. The officers are: George Rodman, of Washington, president; W. P. Coast, of Iowa City, vice-president; Willard J. Welch, of Iowa City, secretary; G. M. Kacvk, of Washington, treasurer. The board of directors is composed of above-named officers and G. W. Wagner and E. G. Smith, of Kalona; G. S. Carson, of Iowa City; Amos Alberson and S. W. Brookhart, of Washington.

LOUISVILLE, KY.—The Kentucky Traction Company has filed amended articles of incorporation. The capital stock is increased to $5,000,000 and the bonded indebtedness to the same amount. The company is given the right to build a line from Rock Haven to Owensboro and one from Hopkinsville to Bowling Green.

LOUISVILLE, KY.—The Louisville & Southern Indiana Traction Company has decided to authorize a bond issue of $1,000,000, the proceeds of which are to be used in extending and equipping the company's lines in New Albany and Jeffersonville and its interurban lines, and in acquiring and purchasing other lines. The company has already projected an interurban line from New Albany to Corydon, Wyandotte Cave and Leavenworth, and another from New Albany to French Lick and West Baden Springs. Still another interurban line that the company has in contemplation will extend from Jeffersonville to Madison, along the Indiana side of the Ohio River. These lines the company expects ultimately to build. In addition to the new lines the company has in contemplation, it will make vast improvements in the lines it already has in operation between New Albany and Jeffersonville. The company expects to double track a good portion of this line, and the Big Four Bridge will have to be equipped when the line is extended to Louisville. Improvements will also be made in the New Albany Street Railway system, a portion of which will be double tracked. There will also be some extensions to the New Albany Street Railway lines.

NEW ORLEANS, LA.—A large contract has been closed by Knox, George & Company, with offices at 602 Tulane-Newcomb Building. The contract comprises the construction of an interurban railway line at Birmingham which will cost when completed about $800,000. The new company, which will be known as the Birmingham & Steel Cities Railway & Power Company, will construct 40 miles of road, which, while operated in the same general district as that covered by the older company, will open up entirely new territory. The line will run from Birmingham to such outlying cities as Ensley, Pratt City, Bessemer and surrounding towns and factory districts. The territory covered has a population of 113,000 people, and the monthly pay-roll of the 45,000 workmen, who are mainly engaged in the mines and furnaces that line the city of Birmingham, is about $3,000,000 per month. In addition to being the largest contract of the kind ever let to a New Orleans firm, the line, when completed, will be the longest interurban line in the South. Work will begin next week, when the preparation of plans and the surveys will be inaugurated. Construction will begin the latter part of this year or the beginning of next, as soon as the details can be arranged.

NORTH ADAMS, MASS.—The Hoosac Valley Street Railway Company has begun excavation on its new line to Adams.

NORTH ADAMS, MASS.—The Hoosac Valley Street Railway Company has asked the Railroad Commission for the approval of new locations which will permit the improvement of curves and grades.

PITTSFIELD, MASS.—The Pittsfield Board of Aldermen has under consideration petitions of the Pittsfield Street Railway Company for franchises in Morningside and other sections of the city, and for a double-track location on Waconah Street to Pontoosuc Lake.

SPRINGFIELD, MASS.—The Springfield Street Railway Company has received petitions from the towns of Hampden, Mass., and Stafford Springs, Conn., for an extension of its lines to those places. The petitions have the support of the Springfield Board of Trade.

SPRINGFIELD, MASS.—The Springfield Suburban Street Railway Company has been given a hearing by the Railroad Commission on its petition for the approval of locations granted by the Aldermen of Springfield. The Springfield Street Railway Company, which asked for similar locations, has appeared in opposition. The Suburban Company asks for the approval of certain private-way locations also.

WORCESTER, MASS.—A case under the "missing-link" law has been brought before the Railroad Commission by the petition of the Hartford Street Railway Company for a location in the town of Oxford. Oxford Selectmen have refused to act on the company's petition, and the Commission is asked to grant a location that will connect locations in adjoining towns.

CADILLAC, MICH.—W. J. Cornwell, of Cadillac; F. N. Gaffney, of Lake City, and J. N. Orr, of Warren, Ohio, have presented a petition to the Council for franchises over twelve streets in this city. It is proposed to build summer resorts at Lake Mitchell and Lake Cadillac, and connect them with electric lines.

DULUTH, MINN.—It is said that the Duluth-Superior Traction Company will spend $40,000 on new machinery to be installed in the power house in Duluth.

KANSAS CITY, MO.—The City Council of Kansas City, Kan., has passed an ordinance granting the Metropolitan Street Railway Company the right of way across the James Street Viaduct for the stock yards line, for which the company is to rebuild the Seventh Street Viaduct. This viaduct is across the Union Pacific and Missouri Pacific tracks, a concession which the Metropolitan has been endeavoring to secure for some time.

ST. LOUIS, MO.—Fifteen new cars, fifty more of which are to be delivered this week, and with which the St. Louis & Suburban Railway Company will make up its quota of 200 additional cars for the World's Fair, were delivered to the company last week. The new coaches are similar to those recently placed in service on the suburban lines. They have olive-green bodies, ample platforms, lights and seating capacity. Superintendent Jenkins says there are many details of construction which might not appeal to the public, but will add to the utility of the cars. There is more space beneath the seats to permit of readier and more thorough cleaning. All attempts at ornamentation have been avoided. There is no nickel-plating. The mahogany finish is in the Pullman light construction style.

DECATUR, NEB.—The survey of the first section of the Omaha, Decatur & Northern Electric Railway Company from Decatur to Tekamah has been completed.

NEWARK, N. J.—The Public Service Corporation has ordered derailing switches to be installed at all the points in Essex to where the tracks of the Erie and Delaware, Lackawanna & Western Railroad cross the trolley lines at grade.

TRENTON, N. J.—A map has been filed with the Secretary of State by the Burlington & Mount Holly Railroad Company, covering the route of a proposed line from Morrisville into Trenton, to connect with the line of the Camden & Trenton Company, the connection to be made at Bridge and Union Streets, and from that point over Union and South Warren Streets to the center of town. No papers were filed with the map, but it is generally understood that the company is the Pennsylvania Railroad, which was formed two years ago to equip with electricity the Pennsylvania's branch lines in Burlington County.

BINGHAMTON, N. Y.—The Common Council has granted a tranchise to the Binghamton Railway Company to run its cars over the Tompkins Street Bridge and through Tompkins Street.

ITHACA, N. Y.—The Ithaca-Horseheads Electric Railway Company will soon file letters of incorporation at Albany. The capitalists interested in the road are: W. H. McFarland, of Toledo, and M. D. Baly, of the Standard Oil Company, of Cleveland. The company has been able to extend the originally proposed line from Horseheads over Grand Central Avenue to Elmira Heights, and thence over private right of way into Elmira. The road will extend to Enfield Glen, through Newfield, Pony Hollow and Alpine, where the power house is to be built, to Odessa and to Horseheads. It is proposed to lay a double-track system from Ithaca to Newfield. The entire length of the line will be 59 miles. The Chemung River will be crossed at Big Flats by a 350-ft. span.

SYRACUSE, N. Y.—It is stated that the Auburn & Syracuse Electric Railroad Company has decided to proceed at once with the work of double tracking its road as far as Mauellers.

ASHEVILLE, N. C.—W. A. Smith, attorney at Hendersonville, has received from Charles B. Thompson, Hotel Marlborough, New York City, a proposition to build a trolley line from Asheville to Hendersonville and Rutherford. Mr. Thompson proposes to build by way of West Asheville, Mills River, Reedy Patch Gap, Bat Cave and Chimney Rock, and states that his engineers and attorneys have in the past four months carefully investigated the matter. He asks that Henderson County issue $100,000 bonds, for which preferred stock shall be issued to the county, and that his company will grade the road and lay rails between Hendersonville and Rutherford before the bonds are required to be delivered to the company.

AKRON, OHIO.—The Northern Ohio Traction & Light Company has placed contracts for the installation of a 2500-hp engine and generator to be delivered about Jan. 1. The company has placed a contract for ten new cars. It is the intention to install limited service on the line between Cleveland and Akron.

CINCINNATI, OHIO.—At a recent stockholders' meeting of the Traction Terminal Company, of Cincinnati, George B. Cox and George Warrington were elected directors to succeed N. S. Keith, of Cincinnati, and H. B. McGraw, of Cleveland. Mr. Keith retains his position as secretary. J. B. Foraker was elected president; F. N. Wilcox, vice-president, and Dana Stevens, treasurer. This is the company which was formed to build a standard-gage entrance into Cincinnati for interurban lines.

CINCINNATI, OHIO.—Construction has been started on the west end of the Indianapolis & Cincinnati Railway between Rushville and Indianapolis. The survey from Rushville to Connersville is completed, and the line from Hamilton through Oxford to Connersville is well under way. The line will be built for high speed, and it will aim to compete with the steam roads for through traffic. Charles L. Henry is president and general manager of the company.

CINCINNATI, OHIO.—It is announced that the Interurban Railway & Terminal Company is planning to extend its Rapid Railway from Lebanon to Xenia. In connection with the Springfield & Xenia Railway, already in operation, this would form a new through system between Cincinnati and Springfield.

CLEVELAND, OHIO.—The Eastern Ohio Traction Company is planning extensive improvements for its Garrettsville Division. It is probable that the power equipment will be improved and that new rolling stock will be added. George L. Bishop, the newly elected president, is formulating the plans.

CLEVELAND, OHIO.—The Westinghouse Electric & Manufacturing Company has commenced the erection at the Elyria power station of the Cleveland & Southwestern Traction Company of the two 1000-kw alternating-current Parsons turbine sets ordered some time ago. Three 500-hp Heine boilers, a new switchboard and static transformers are also to be installed.

CLEVELAND, OHIO.—Property owners on West Madison Avenue, in Lakewood, have signed a petition which will be presented to the Lakewood Council, requesting them to give a franchise to the Cleveland Electric Railway to run to Rocky River out West Madison Avenue. R. B. Martinetz, who is one of those interested in getting signatures to the petition, stated that the railroad committee had promised, if a twenty-five-year franchise is obtained from the Lakewood Council, to extend the road out that way inside of two years.

CLEVELAND, OHIO.—A meeting of the stockholders of the Muncie, Hartford & Fort Wayne Traction Company has been called for Sept. 25 for the purpose of financing the company. It is announced that an outside banking house has agreed to take the entire issue of bonds providing some of the issue is retired. The bonds are now held to secure a loan over and above that paid on the original underwriting for the construction of the road. It is understood that after the bonds are placed and the debt paid there will be something like 35 per cent of the original amount subscribed for distribution among the underwriters, in addition to which they will receive an allotment of preferred and common stock. It is generally believed that under the new financing plan the control of the road will pass into the hands of interests closely allied with those which control the Indiana Union Traction Company's system.

COLUMBUS, OHIO.—W. H. Luchtenberg, contractor for the Columbus, Marysville & Bellefontaine Railway, states that actual construction work on the line will start within thirty days. Practically all the right of way has been secured.

DELAWARE, OHIO.—The Delaware & Magnetic Springs Railway Company has commenced the erection of a power house on the Scioto River, near here. The plant will be completed shortly after the first of the year.

DELAWARE, OHIO.—The Columbus, Delaware & Marion Railway is building a spur line from Prospect to Richwood. The farmers along the route are so anxious to secure the line that they are doing much of the grading free of charge.

LIMA, OHIO.—The annual meeting of the stockholders of the Western Ohio Railway was held recently, and the following officers were re-elected: A. E. Aikens, L. J. Wolf, M. J. Mandelbaum, H. C. Lang, J. R. Nutt, Will Christy, F. T. Pomeroy, F. D. Carpenter and L. M. Coe, directors; A. E. Akins, president; L. J. Wolf and J. R. Nutt, vice-presidents; M. J. Mandelbaum, treasurer; H. C. Lang, secretary, and F. D. Carpenter, general manager.

MARION, OHIO.—The Columbus, Delaware & Marion Railway Company has completed its line into Marion, and cars are now running in regular service between Columbus and Marion.

NEWARK, OHIO.—The Newark, Martinsburg & Mount Vernon Traction Company has organized with the following officers: Edward H. Everett, president; J. W. Shromtz, vice-president; J. A. Chilcote, treasurer; J. E. Elliott, secretary; Edward Kibler, counsel. The company has secured practically all the right of way from Newark to Martinsburg and from Gambier to Mount Vernon.

SPRINGFIELD, OHIO.—Grading for the Springfield, Troy & Piqua Railway, the Bushnell line, has been completed, and track laying and overhead work will start at once. General Manager Green states that the line will be in operation in January. Work on the power house at Springfield is progressing rapidly. Owing to the inability to secure the prompt delivery of the Curtis turbo-generators, with which it was originally proposed to equip the station, the company has ordered and will install other types of units.

WASHINGTON C. H., OHIO.—The Ohio River & Columbus Railway Company has filed a mortgage for $1,000,000 in favor of the Union Savings Bank & Trust Company, of Cincinnati. The mortgage secures bonds for the construction of a steam and electric road through Franklin, Madison, Fayette, Pickaway, Highland and Brown Counties, Ohio. The line will extend from Maysville, Ky., to Washington C. H., where connection will be made for Columbus. Over a portion of the route the road will follow an abandoned grade which was laid out fifty years ago. Plans have been perfected for coal elevators at Maysville and Aberdeen. The road will be constructed for handling freight trains by steam. The officers of the company are: G. Baumbach, president; E. E. Galbreath, vice-president; W. G. Wagenthals, general manager. W. G. Wagenthals & Company, of Cincinnati, are the contractors for the road.

ZANESVILLE, OHIO.—The Southern Ohio Railway, Light & Power Company has been incorporated by M. H. Hissey and others. Temporary capital stock is $10,000. It is proposed to build an electric line from Zanesville to Roseville, Crooksville, Sayre and New Lexington.

ALLENTOWN, PA.—The Lehigh Valley Traction Company began running cars through from this city to Bangor Sept. 6. The present hourly service between Easton and Bangor has been discontinued and a half-hourly service between Easton and Nazareth established, reducing the running time between the last-named points to forty minutes.

CANONSBURG, PA.—The Washington & Canonsburg Electric Railway, connecting these towns, was placed in operation Sept. 7. Cars will run every hour. The road is 7 miles in length and cost about $600,000. It is to be extended to East Canonsburg, about a mile east of its present terminus.

CHAMBERSBURG, PA.—The Town Council has granted the Chambersburg & Gettysburg Electric Railway Company a franchise to build a line on East Queen Street between Main and Second Streets, thus reducing the running time between Chambersburg and Fayetteville when the line is completed.

CONNELLSVILLE, PA.—The Pittsburg, McKeesport & Connellsville Railway Company has closed the last gap in the coke region trolley system between Alverton and Hunker. Fairchance and Irwin are now connected by

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Climax Stock Guards on the Lackawanna & Wyoming Valley Railway between Pittston and Scranton, Pa.

Over 3,000 Guards sold last season

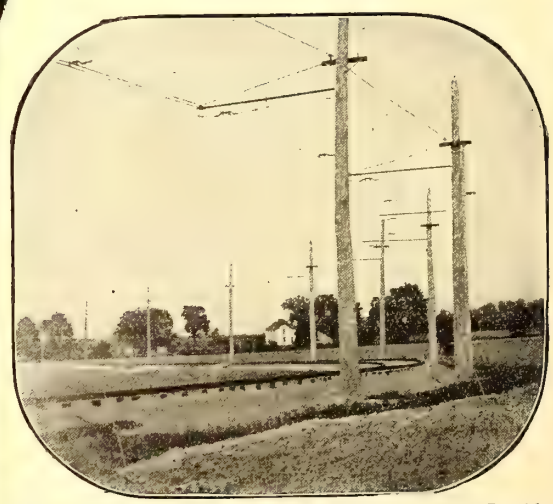
SALES IN MARCH AND APRIL, THIS YEAR:

Aurora, Elgin & Chicago Ry., Elgin Branch	120	Guards
Stark Electric Ry. Alliance, Ohio	120	"
Canton & New Philadelphia R R., Ohio	90	"
Rochester & Eastern Rapid Ry.	70	"
Long Island Railroad Co.	40	"
Vandegrift Construction Co., Kennett Square, Pa.	25	"
Rock Island System	50	"
	515	

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trolley. The main portion of the system runs parallel with the southwest branch of the Pennsylvania Railroad, and with the exception of the Redstone Railroad branch, touches every town along that road. In addition to the main line, branches run out from the most important towns along the trolley system. The system connects at Hunker with the Pittsburg, McKeesport & Greensburg Railway.

DANVILLE, PA.—Two petitions have been presented to the Commissioners of Montour and Northumberland Counties, one asking that the right to use the river bridge be granted to the Danville & Riverside Street Railway Company, and another opposing this request. Burgess Shepperson, of Riverside, favors the petition of the trolley company, and the Riverside Town Council has passed on first reading an ordinance granting the company a franchise. The Commissioners will await an opinion from their County Solicitors before taking any action on the petitions.

DARBY, PA.—Cars of the Philadelphia, Morton & Swarthmore Electric Railway are running into this place. Springfield Avenue is the temporary terminus, but the line will be extended to Main Street, between Ninth and Tenth Streets. A connection will then be made with the line now in operation to Lansdowne, which is intended to extend to Angora. The work now being completed was delayed for nearly three years by adverse litigation in the Delaware County courts by another company, which sought to prevent the Philadelphia, Morton & Swarthmore line from entering this town over the Chester Pike.

DOYLESTOWN, PA.—Plans are progressing for the extension of the New Jersey & Pennsylvania Traction Company's lines now running from Newtown to Trenton, from Newtown to Willow Grove. It is thought the road will be in operation within a year. President Charles M. Bates, of the company, said: "It is the intention to extend the road from Newtown to Willow Grove, and it is planned to run from Newtown to Richboro, Southampton, Davisville, Hatboro and thence to Willow Grove, where connections will be made with the Rapid Transit Company's system. The proposed road will open up a section that is without adequate transportation facilities."

ERIE, PA.—The Erie Motor Company has petitioned for a franchise to extend the double line of track laid from State to Peach Streets on West Twelfth Street westwardly to the city limits.

JOHNSTOWN, PA.—The Johnstown, Woodvale Heights & Conemaugh Street Railway Company has been incorporated to build a 4-mile electric railway here. The company is capitalized at $30,000, and the president is Joseph H. Berlin, of Johnstown.

JOHNSTOWN, PA.—Surveys have been completed for the new Johnstown, Woodvale Heights & East Conemaugh Street Railway, which was chartered Aug. 31. The new line will be about 4 miles long, crossing the Pennsylvania Railroad by means of an overhead bridge.

MECHANICSBURG, PA.—Burgess Underwood has signed the ordinance granting the White Hill & Mechanicsburg Trolley Company the right of way on York Street.

PALMYRA, PA.—Surveys have been made for a 4-mile electric railway between this place and Valley Glen Park, in which Philadelphia capitalists are interested.

PHILADELPHIA, PA.—The Northern Street Railway Company has been incorporated to build 5 miles of electric railway in Beaver County. William Redwood Wright, of Philadelphia, Pa., is president of the company.

PHILADELPHIA, PA.—The Germantown & Chestnut Hill Belt Line Railway has been incorporated to build an electric railway at Germantown. F. C. Eberhardt, John McConley and W. B. Eltonhead, 131 Washington Lane, Germantown, are interested.

WASHINGTON, PA.—The 7-mile Washington & Canonsburg Electric Railway connecting these two towns was put in operation Sept. 7. The line will soon be extended about 2 miles east of its present terminus to East Canonsburg.

WILKESBARRE, PA.—The Lackawanna & Wyoming Valley Electric Railway Company began operating cars between Hancock Station (Plains) and Scranton on Sept. 15. The current was turned into the third rail Sept. 12. Hancock Station is but a mile north of this city's limits, but considerable work remains to be done before the line will be finally completed between Scranton and this city. A cut 1000 ft. long, 40 ft. deep at the highest point, and 30 ft. wide the entire distance, has been started below Plains, while there will be a smaller cut at Midvale, and near this point a large concrete wall is being built to protect some of the workings of the Lehigh Valley Coal Company. The roadbed is graded from Midvale to the bridge crossing the roadway and Lehigh Valley tracks near North Wilkesbarre. The new bridge near North Wilkesbarre is almost completed. It is not expected that the line will be in operation to the proposed terminal in this city before Jan. 1, 1904. The company has erected a brick and concrete power and passenger station at Hancock.

CHATTANOOGA, TENN.—At a meeting of the stockholders of the Chattanooga Electric Railwany Company to be held in the latter part of September or early in October definite decisions will be reached on the construction of an electric railway up Lookout Mountain and a line to Chickamauga Park. For the past several months the company has been giving its entire attention to the perfection of the lines now in preparation, but it proposes to look to the extension of its system, and will probably undertake ventures representing the expenditure of several hundred thousand dollars.

CLARKSVILLE, TENN.—The Clarksville Street Railway Company will, it is reported, build an extension to Dunbar's Cave, 3 miles, and possibly other extensions will be built to New Providence and through South Clarksville.

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BEAUMONT, TEX.—Track laying on the Beaumont, Sour Lake & Port Arthur Traction Company's proposed line was begun Sept. 1. The line will run from Beaumont to Sour Lake and Saratoga, and from Beaumont to Port Arthur, in all about 55 miles. The general contractors are the Beaumont & Sour Lake Construction Company. The rails have been purchased from the Carnegie Company, but the rolling stock and the motors have not yet been contracted for.

SALT LAKE CITY, UTAH.—T. P. Steffey, Milando Pratt and F. M. Lyman, Jr., have applied for a franchise to build an electric railway through the county. It is proposed by them to build an electric railway from Springville to Logan via Provo, Salt Lake and Brigham. The promoters have already secured a franchise in Utah County, and will apply for the same rights in Davis and Weber Counties at once. They have petitioned the City Council of Salt Lake City for a similar grant through the metropolis, but no action has yet been taken on the matter by that body. It is understood that United States Senator Smoot, State Senator C. E. Loose and others, with the Telluride Power Company, are behind the project.

RICHMOND, VA.—It has been definitely decided to extend the Seven Pines line of the Virginia Passenger & Power Company to Mechanicsville, which is 10 miles beyond the present terminus of the line. Work is to be started as soon as the work of rebuilding the Seven Pines line is completed. The latter has already been begun. The company contemplates the building of a line from Richmond to Ashland also. Authorization for the commencement of this line has not been made, but it is said to be practically certain that the line will be built and that shortly.

MILTON JUNCTION, WIS.—Three hundred citizens have petitioned the Rockford, Beloit & Janesville Railroad Company to extend its road to Milton Junction.

NEWS NOTES

LOS ANGELES, CAL.—On Aug. 28, about 9 o'clock, three highwaymen boarded a San Pedro car of the California-Pacific Railway Company at a point about a mile and a half south of the city limits and robbed trainmen and passengers of several watches and over $100 in cash. The desperadoes have not yet been captured, and the company offers $500 for them taken dead or alive.

NEW HAVEN, CONN.—H. M. Kochersperger, of New Haven, has been elected president of the Meriden Electric Railroad Company; J. G. Parker, secretary, and A. S. May, treasurer. Mr. Kochersperger is the controller of the Consolidated Railroad. Mr. Parker is private secetary to President Hall, and Mr. May is the new treasurer of the Consolidated.

TAMPA, FLA.—Stone & Webster report that the damage from the cyclone to the property of the Tampa Electric Company was limited to the prostration of wires, which shut off car service for twenty-four hours. There was no damage to buildings. Service was crippled only a few hours.

EVANSVILLE, IND.—At the annual meeting, Sept. 2, of the stockholders of the Evansville & Princeton Traction Company the following directors were elected: J. S. Heston, S. T. Heston, Jonah Legrange, E. J. Baldwin and W. L. Sontag. Their directors thereupon elected the following officers: Joseph S. Heston, president; E. J. Baldwin, secretary; S. T. Heston, treasurer; W. L. Sontag, general manager.

MARLBORO, MASS.—A voluntary increase in wages has been granted the motormen and conductors of the Marlboro Street Railway Company, which is controlled by the Boston & Worcester Electric Company. The increase is 2 cents an hour for continuous service of four years or less; 3 cents an hour for over four and less than seven; 4 cents an hour for over seven and less than ten, and 5 cents an hour for over ten years' service.

WESTBORO, MASS.—A hearing has been given by the Railroad Commission on the petition of the Selectmen and other citizens of Hopkinton for an order compelling the Westboro & Hopkinton Street Railway Company to issue workingmen's tickets, making a reduction in fare of from 20 cents to 15 cents.

WORCESTER, MASS.—As an additional safeguard against accidents the Boston & Worcester Street Railway Company has installed in the office of the despatcher at South Framingham a device by which the despatcher can shut off the power instantly on the section of the road between Worcester and South Framingham, where there is a single-track line. By means of the telephone service the despatcher keeps track of the cars, and he is now able, if a car runs by a meeting point, to avoid a collision by cutting off the power.

CLEVELAND, OHIO.—The new express station of the Electric Package Company was formally opened for business last weeek. The building is 267 ft. long and 30 ft. wide. The opening ceremony was in the form of a banquet to officers and employees of the company. Covers were laid for ninety. President Barney Mahler, of the Electric Package Company, acted as toastmaster. A. Lewenthal, attorney for the company, made a speech on the "Benefits to Be Derived by Cities and Urban Towns from Electric Traction." F. T. Pomeroy, president of the Cleveland & Southwestern Traction Company, spoke on "The Necessity of the Electric Package Company's Employees Co-operating with the Employees of the Traction Company." C. A. Kenworthy, superintendent of the Electric Package Company, responded to the toast, "The Necessity of Traction Company Employees Co-operating with the Employees of the Electric Package Company."

COLUMBUS, OHIO.—There was a two-hour strike on the system of the Central Market Street Railway recently. Both the motormen and conductors left their work because of an order requiring the motormen to stand while operating cars. The matter was compromised, and the men went back to work with the understanding that they would be supplied with stools, which

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Elwood, - - " — Connorsville, - "

might be used in the residence portions, but not in the crowded business sections of the city.

TOLEDO, OHIO.—The City Solicitor has informed the Mayor that he must veto the entire ordinance of the Toledo Railways & Light Company for franchise extensions if he objects to any clause of the new grant. Section 1667, of the Ohio laws, defining the Mayor's duty as to ordinances, etc., provides among other things "that the Mayor may approve the whole, or any item, or any part of any such ordinance, resolution, order, or contract, presented to him for his signature."

YOUNGSTOWN, OHIO.—The employees of the Pennsylvania & Mahoning Valley Railway Company have effected a compromise with the company on the wage question. The men demanded 22 cents, 23 cents and 24 cents an hour in place of the present scale of 18 cents, 19 cents and 20 cents. The compromise was on a basis of 20 cents an hour for the first six months, 21 cents an hour for the next six months and 22 cents for more than one year of service. The runs will be divided so that each shall not exceed nine and one-half hours.

CHATTANOOGA, TENN.—The Chattanooga Electric Railway Company has issued to its employees a circular of recognition for faithful and efficient service, especially on July 4 and Labor Day, Sept. 7. This circular says in part: "Never before in the history of this company or this city have such large numbers ridden upon the street cars, and seldom, if ever, have such large masses of people been carried from point to point so successfully, so expeditiously and so safely as was done on these two occasions by the careful and zealous work of our employees. It is safe to say that many accidents entailing death and injury were avoided, and if the number of people so saved was known and realized by the general public it would be something startling. The management, therefore, takes this method of expressing its warmest thanks and commendation to the officers and especially to the motormen, conductors and other employees for the noble and satisfactory work done upon these two occasions. The management is proud of such men, and the public, the management knows, are bound to have for you a latent regard and appreciation. The position held by the conscientious motormen and conductors in charge of electric cars, who incidentally have in their keeping the comfort and safety of thousands, is one of honor and trust. It is even more than that in an abstract sense, for the public expect and receive at your hands many attentions that effect their interest and happiness."

HOUSTON, TEX.—The Houston Electric Company has announced that it will carry all students under seventeen years old and all children, whether students in the public schools or not, on half-fare tickets, said tickets purchasable at the headquarters of the company in books of twenty tickets each. This reduction in fares results from the passage of the State law by the last Legislature requiring all persons or corporations owning or operating street railway systems in the State of Texas in cities of more than 40,000 inhabitants to carry all persons under twelve years of age at half the regular charge, and all students under seventeen years of age in the same cities for the same fare.

LYNCHBURG, VA.—The Lynchburg Traction & Electric Company is one of the most enterprising railways of the South, and is doing a great deal to attract manufacturing enterprises to Lynchburg. The company is advertising the railway facilities of Lynchburg and its advantages for manufacturing purposes, including good, level building land and unlimited power, hydraulic and electric, at low rate.

FINANCIAL NOTES

JACKSONVILLE, FLA.—The Jacksonville Electric Company reports earnings as follows:

Year ending June	1903
Gross earnings	$223,464
Operating expenses	153,850
Net earnings	$39,614
Fixed charges	34,746
Net profit	$34,868

SAVANNAH, GA.—The Savannah Electric Company has declared a regular semi-annual dividend of 3 per cent on the preferred stock, payable Oct. 1, to stockholders of record Sept. 17.

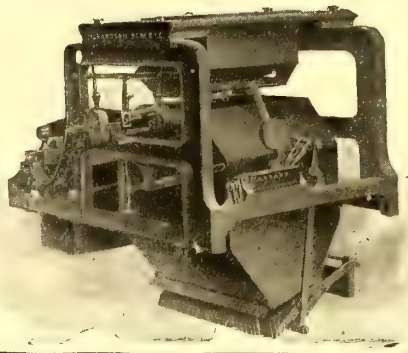
CHICAGO, ILL.—Metropolitan Elevated gross receipts for the six months ended Aug. 31 were $1,006,981, an increase of $56,022.

DIXON, ILL.—The board of directors of the Northern Illinois Electric Railway Company has decided to increase the capital stock of the company from $700,000 to $1,250,000.

TERRE HAUTE, IND.—The Terre Haute Electric Company reports earnings as follows:

July	1903	1902
Gross earnings	$42,044	$27,802
Operating expenses	25,257	21,268
Net earnings	$16,787	$6,534
Fixed charges	6,558	6,429
Net profit	$10,228	$105
Year ending July 31		
Gross earnings	$424,587	$306,821
Operating expenses	283,877	265,,771
Net earnings	$140,710	$41,050
Fixed charges	78,187	70,400
Net profit	$62,523	$29,350

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FACTORY AND MAIN OFFICE DETROIT.

MARION, IND.—By the sale of the Indiana Northern Traction Company to the Trenton Savings & Trust Company, of Trenton, N. J., the bit of interurban track which connects the Union Traction Company with the Fort Wayne, Logansport & Lafayette Interurban line passes into the hands of a company which is known to be friendly to the Indiana Union Traction Company. By the completion of this link interurban travel may be established between Logansport and Indianapolis through Fort Wayne, Marion and Anderson.

BOSTON, MASS.—The Boston & Northern Street Railway Company has petitioned the Railroad Commissioners for authority to issue 4000 additional shares of stock at $95 per share to reduce its floating debt incurred for construction purposes.

BOSTON, MASS.—The Boston News Bureau says that earnings of the Boston & Worcester Street Railway Labor Day were $2,825, an average of $157 for each of the eighteen cars used. "Officials of the road," says the News Bureau, "figure that about 65 per cent of the road's traffic is through business between Boston and Worcester, that 20 per cent is business between Boston and South Framingham, and 15 per cent local."

BOSTON, MASS.—The Boston & Worcester Street Railway Company has applied to the Railroad Commissioners for authority to issue $250,000 of bonds. President Butler stated that the money was needed to take up indebtedness, and that the company held that its property, according to the appraisal of Sept. 1, was sufficient to cover the stock and bonds already outstanding, and also the proposed new issue. It was desired to leave out the double tracking involved in the extension of the long turnouts now in progress, in order to come before the board for a new issue of stock later.

SPRINGFIELD, MASS.—The Springfield Street Railway Company has filed a mortgage to the Springfield Safe Deposit & Trust Company, as trustee, to secure $1,700,000 of 4 per cent gold bonds of $1,000 each, dated April 1, 1903, due April 1, 1923, without option of earlier redemption. Only $1,500,000 have been authorized to be issued by the Massachusetts Railroad Commission; the remainder will be reserved for future requirements.

WORCESTER, MASS.—Receivers of the Worcester & Southbridge Street Railway Company have issued a call for all stockholders to report their holdings immediately. There is believed to be an overissue of stock. This action may delay the report of the receivers, which they say will contain all the information on the point of fraudulent notes as well as all matters connected with the failure.

DETROIT, MICH.—The Hawks-Angus syndicate has sold the Lansing Street Railway to Nelson Mills, of St. Marys, and his associates. The consideration is said to have been $200,000. They will merge it with the Lansing, St. Johns & St. Louis Railway, running 20 miles north from Lansing. The sale agreement gives the Hawks-Angus syndicate entry over the Lansing system for the Lansing-Battle Creek line.

HANCOCK, MICH.—The Houghton County Street Railway Company reports earnings as follows:

Year ending June		
Gross earnings	182,576	$158,580
Operating expenses	121,202	90,394
Net earnings	$61,374	$68,185
Fixed charges	33,200	28,310
Net profit	$28,174	$39,875

DULUTH, MINN.—The Duluth-Superior Traction Company reports earnings as follows:

June	1903	1902
Total gross earnings	$59,012	$48,496
Operating expenses	29,512	26,361
Net earnings	29,499	26,361
Deductions from income	10,518	9,655
Net income	$18,980	$16,706
Six months ending June 30		
Total gross earnings	$294,391	$245,406
Operating expenses	173,531	132,414
Net earnings	120,859	112,992
Deductions from income	61,512	57,844
Net income	$59,347	$55,148

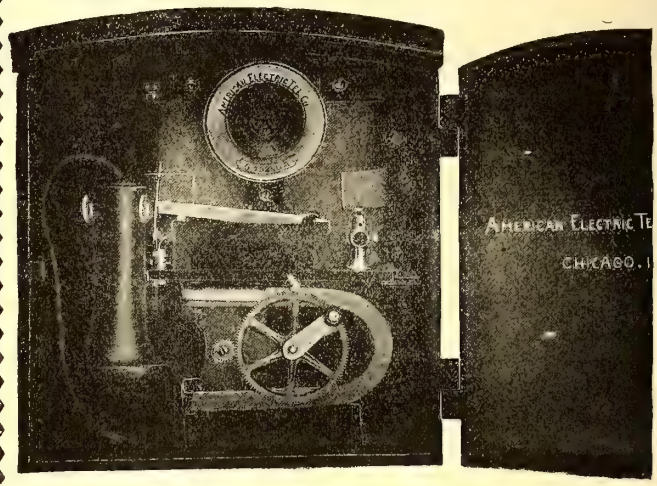
ST. LOUIS, MO.—According to the statement issued by Auditor Frank R. Henry, of the St. Louis Transit Company, the gross earnings of that corporation for the month of August were $659,535, as against $579,575 for the same month last year. This is a gain for the month of $79,959. The gross receipts of the company for the first eight months of this year were $4,759,417, while for the same period last year the receipts were $4,169,433. These figures show a gain of $615,186 in the operations of the company up to Sept. 1, this year, over the same period last year.

JERSEY CITY, N. J.—The directors of the United Traction & Electric Company, of New Jersey, have declared the regular quarterly dividend of 1¼ per cent on the capital stock, payable Oct. 1.

NEWARK, N. J.—It is announced that the Public Service Corporation has leased the South Orange & Maplewood Street Railway. The terms of the lease have not been made public, nor has any announcement been made as to how long the lease will run. It is said, however, that $250,000 was paid for the line. The deal has been under consideration for some time. The South Orange & Maplewood Road runs from Main Street, Orange, to South Orange.

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BUFFALO, N. Y.—The International Traction Company reports earnings as follows:

July	1903	1902
Gross earnings	$390,414	$328,628
Operating expenses (excluding taxes)	190,490	162,179
Net earnings	$199,924	$166,449
Fixed charges (interest, taxes, rentals, etc.)	134,990	127,393
Net income	$64,934	$39,056
Net income, July 1 to date	64,934	39,056
Operating cost, per cent of earnings (exclusive of taxes)	.503	.497

MINEOLA, N. Y.—The New York & Long Island Traction Company reports earnings as follows for August: Gross earnings, $5,462; operating expenses, $4,085; net earnings, $1,378. The road has 8 miles in operation and uses four cars. It will open 5 miles more track and put on two more cars this month. Next year it will have 20 miles in operation, and will reach Belmont Park, the new suburban racing park owned by Aug. Belmont.

NEW YORK, N. Y.—The directors of the Metropolitan Street Railway Company have declared the usual quarterly dividend of 1¾ per cent, payable Oct. 15; books close Sept. 24 and reopen Oct. 16.

SYRACUSE, N. Y.—The stockholders of the Auburn & Syracuse Electric Railway have increased their capital stock from $800,000 to $1,000,000, and there is an authorized bond issue of $2,000,000, of which $1,050,000 is outstanding.

CLEVELAND, OHIO.—The $3,000,000 6 per cent bonds of the South Side Street Railway Company and the $600,000 6 per cent first-mortgage bonds of the Brooklyn Street Railway Company, which matured Sept. 1, have been retired by the Cleveland Electric Railway Company. Of the $900,000 Cleveland Electric Consolidated 5s held to retire these underlying bonds $342,000 were exchanged therefor at par, and $300,000 were sold to Denison, Prior & Company, of Cleveland, leaving $252,000 on hand to provide for the floating debt, which was increased to pay the remainder of the maturing 6 per cents. The refunding will save the company $9,000 yearly.

LIMA, OHIO.—The Western Ohio Railway Company has announced the following statement for August: Gross earnings, $25,941; operating expenses, $10,947; net earnings, $14,994.

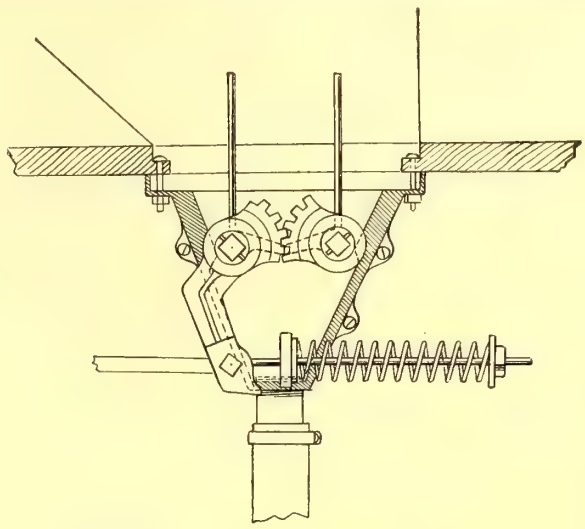
TOLEDO, OHIO.—The Toledo Railways & Light Company reports earnings as follows:

July	1903	1902
Gross earnings	$153,224	$131,492
Operating expenses and taxes	75,500	62,315
Net earnings	$77,724	$69,177
Charges	41,790	37,854
Surplus	$35,934	$31,323
Jan. 1 to July 31		
Gross earnings	$925,402	$802,776
Operating expenses and taxes	476,707	414,698
Net earnings	$448,695	$388,078
Charges	283,861	264,887
Surplus	$164,834	$123,191

ALLENTOWN, PA.—The receivers of the Lehigh Valley Traction Company have paid all fixed charges maturing in September, amounting to $70,000. During August the passenger receipts amounted to $113,182, an increase of $9,084 over the same month last year.

HARRISBURG, PA.—Walter Stewart, secretary and treasurer of the Carlisle Trust Company and interested in the Harrisburg & Mechanicsburg Electric Railway Company and Cumberland Valley Traction Company, has made an offer to buy all the stock of the People's Bridge Company, this city, at $52.50 per share, 51 per cent to be delivered, with interest at the rate of 6 per cent from Sept. 1, 1903, not later than Jan. 1, 1904. This is taken by many to foreshadow the early consolidation of the Harrisburg & Mechanicsburg Electric Railway with the new Central Pennsylvania Traction Company, of this city, although President Frank Musser, of the latter company, denies that there is anything in this story. The Harrisburg & Mechanicsburg Company, which recently acquired the West Fairview & Marysville Electric Railway, with which it connects at West Fairview, has a lease on the bridge for its tracks, which will not expire for some years to come. Two propositions have been issued to the bridge company stockholders by the directors. One is the acceptance of Mr. Stewart's offer. The other is that the stockholders take a sixty-day option on the purchase of their stock at $53 per share, with interest dating from Sept. 1, 1903. The People's Bridge Company is capitalized at $200,000, and the stock has been selling slightly above par value, which is $50.

HARRISBURG, PA.—Another local trolley merger has been accomplished, the necessary papers being granted at the State Department, by which the Star Street Railway Company and the Harrisburg & Lewisberry Railway Company are consolidated under the name of the Steelton, New Cumberland & Mechanicsburg Street Railway Company. The first meeting of the new company was held at Mechanicsburg Sept. 11, when the following officers were chosen: M. P. Hillyer, of New York City, president; J. E. Philips, of York, Pa., vice-president; H. W. Smith, of Mechanicsburg, general manager; J. H. Foreman, of Carlisle, treasurer; Henry Hertzler, of Carlisle, secretary; Col. J. W. Andrews, of New York City, chief engineer; C. B. Miller, of Harrisburg, general solicitor. The above-mentioned officers and Samuel Hertzler, of Carlisle, and E. P. Stonesifer, of Lewisberry, directors. It is the intention



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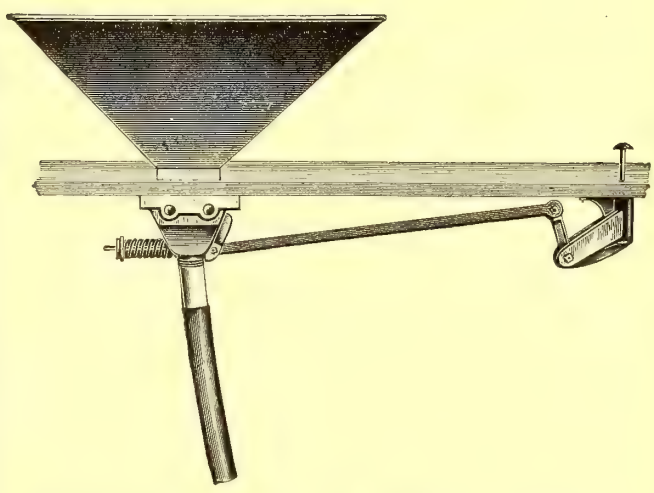
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NEWARK, N. J., U. S. A.

of this company to begin at once the construction of a system connecting the towns of Steelton, 3 miles south of Harrisburg, with New Cumberland, Bowmansdale, Dillsburg, Lisbon, Lewisberry and Mechanicsburg. The company's charter gives it the right to build a bridge over the Susquehanna River between Steelton and New Cumberland. This will be a steel structure and will likely be built by the Pennsylvania Steel Company. Col. Andrews has been engaged in making up his estimates of the cost of the road, which he places at $20,000 per mile. A considerable sum will be expended on crystal Lake Park and Bishop's Park. This company's lines will connect with those of the Central Pennsylvania Traction Company at Steelton. The City Council has reconsidered and unanimously passed the ordinances granting extensions and double tracks to the Central Pennsylvania Traction Company, and providing for payment to the city of 3 per cent of the annual earnings of the company. These ordinances are satisfactory to the company, and will be promptly signed by Mayor McCormick.

PHILADELPHIA, PA.—A dividend of $3 a share has been declared on Ridge Avenue Passenger stock, payable Oct. 1. Books will close Sept. 9, and reopen Oct. 2.

PHILADELPHIA, PA.—The Interstate Railways Company reports an increase in gross passenger earnings for the month of August of $47,141.

HOUSTON, TEX.—The Houston Electric Company reports earnings as follows:

July	1903	1902
Gross earnings	$40,132	$30 835
Operating expenses	22,669	17,333
Net earnings	$17,463	$13,502
Fixed charges	6,773	6,250
Net profit	$10,690	$7,252
Year ending July 31		
Gross earnings	$407,516	$327,896
Operating expenses	251,551	190,200
Net earnings	$155,965	$137,696
Fixed charges	77,764	.....
Net profit	$78,201	.....

RICHMOND, VA.—Arrangements have been made for the arbitration of the claims and counter-claims, aggregating about $1,000,000, between the new interests in the Virginia Passenger & Power Company and George E. Fisher, one of the former owners of the road. Winslow S. Pierce is the arbitrator for the Goulds and their associates, the new owners, but Mr. Fisher has not as yet named his arbitrator. Both the new interests and Mr. Fisher will agree upon a third arbitrator.

SEATTLE, WASH.—The Seattle Electric Company has declared a regular semi-annual dividend of 3 per cent on the preferred stock to stockholders of record Sept. 17.

SEATTLE, WASH.—The Seattle Electric Company reports earnings as follows:

Year ending July 31	1903	1902
Gross earnings	$2,046,000	$1,684,274
Operating expenses	1,445,273	1,162,916
Net earnings	$600,727	$521,358
Fixed charges	285,838	250,490
Net profit	$314,889	$270,868
July		
Gross earnings	$184,931	$157,838
Operating expenses	123,781	108,245
Net earnings	$61,150	$49,593
Fixed charges	23,064	19,699
Net profit	$38,086	$29,894

EAU CLAIRE, WIS.—The Chippewa Valley Electric Railway Company has filed with the Secretary of State an amendment increasing the capital stock from $2,000,000 to $4,000,000 and enabling the company to furnish electric power for manufacturing and commercial purposes.

MILWAUKEE, WIS.—The Milwaukee Electric Railway & Light Company reports earnings as follows:

August	1903	1902
Total gross earnings	$265,914	$243,345
Operating expenses	128,805	112,540
Net earnings	$137,109	$130,805
Deductions from income	74,440	68,676
Net income	$62,669	$62,128
For the eight months ending Aug. 31		
Total gross earnings	$1,973,090	$1,755,350
Operating expenses	993,021	835,772
Net earnings	$980,069	$919,578
Deductions from income	574,270	526,219
Net income	$405,799	$393,359

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SHEBOYGAN, WIS.—The Sheboygan Light, Power & Railway Company has made a new mortgage to the Mercantile Trust Company, of New York, as trustee, to secure $2,500,000 of $1,000 consolidated 5 per cent first-mortgage thirty-year gold bonds maturing July 1, 1933, but subject to call in whole or in part at 105 on any interest day. Interest is payable January and July at the office of the trustee. Of the bonds, $400,000 are reserved to retire a like amount of outstanding 5s dated April 1, 1896. The remaining $2,100,000 are issuable for improvements and extensions, including a line under construction from Sheboygan Falls to Plymouth, a distance of 10 miles.

AMONG THE MANUFACTURERS

THE FALL RIVER ELECTRIC LIGHT COMPANY, of Fall River, Mass., has placed a contract for a large Green Economizer for immediate delivery with the Green Fuel Economizer Company, the sole makers in the United States.

THE CLEVELAND ELECTRIC RAILWAY COMPANY is installing at a number of downtown corners automatic electric switches manufactured by the Cheatham Electric Switching Device Company, of Louisville, Ky. Several of these switches have been in use for some weeks and have proved very satisfactory.

THIS WEEK'S ISSUE of the daily bulletin issued by the Walter A. Zelnicker Supply Company, of St. Louis, contains many items of interst to street railway managers and contractors, among which is an extensive line of steam shovels, motor cars and Charter Oak car stoves, all said to be in excellent condition, and to be had at very low prices.

THE AMERICAN SCHOOL OF CORRESPONDENCE, with headquarters at Armour Institute of Technology, Chicago, Ill., publishes an interesting catalogue giving detailed information of the courses taught. The work which this school carries on is productive of much good to those who have not been fortunate enough to enjoy a college education, but are obliged to seek technical knowledge while earning their daily bread.

"MICHIGAN WHITE CEDAR—A STORY IN TWO CHAPTERS"—is the title of a booklet that the Maltby Lumber Company, of Bay City, Mich., cedar dealers, is sending out to all its customers. Considerable information and some rather instructive pictures are contained in the folder. The company will be glad to send a copy of the folder to anyone interested in the purchase of cedar ties or poles.

THE MILLER MACHINE COMPANY, of Norwalk, has been incorporated under the laws of Delaware, with $20,000 capital stock. The incorporators are: J. B. Miller, George H. Miller, N. D. Miller, A. E. Rowley and H. F. Jackson. The company will manufacture anchors and chains used in anchoring telephone and electric railway poles. The devices were exhibited at the recent Saratoga Convention.

THE MANY ADVANTAGES of the Hart convertible car are concisely set forth in a little pamphlet which has been prepared by the Rodger Ballast Car Company, of Chicago, Ill. The particular feature of this type is that it can be used as a construction, ballast, gondola or freight car, the conversion from one style to another being effected in a few minutes with no tools other than monkey wrenches. An extended description of this car, with illustrations, was published in the STREET RAILWAY JOURNAL of Aug. 29.

THE J. G. BRILL COMPANY, of Philadelphia, Pa., has recently issued an interesting publication devoted to its famous convertible cars. A brief history of the development of this type is given, together with descriptions and illustrations of cars built for the Butler Passenger Railway Company, Butler, Pa., and the Washington Water Power Company, of Spokane, Wash. The Brill convertible cars, which were introduced to the street railway world but five years ago, are now extensively used and giving excellent service in all kinds of weather.

THE MOMENTUM BRAKE COMPANY, LTD., of Toronto, reports that its momentum brake is giving very satisfactory service, as evidenced by the numerous testimonials which the company has received from users of this brake. The principal features of this brake were described in the STREET RAILWAY JOURNAL of June 13, 1903. The following orders have recently been received by the company: Toronto Street Railway Company, 34; South Chicago Street Railway Company, 32; Trans-St. Mary's Traction Company, 3. Trial equipments have also been ordered by the Montreal Street Railway, and several railways in the United States, including the International Traction Company, of Buffalo.

THE WILKINSON MANUFACTURING COMPANY, of New York, reports through John A. Caldwell, general sales manager, the following recent sales of automatic stokers: Two 200-hp, Ridgway (Pa.) Machine Tool Company; four 175-hp, Reading (Pa.) Waterworks; ten 375-hp, Pittsburg Plate Glass Company; three 350-hp, Chamber of Commerce Building, Rochester, N. Y.; two 200-hp, New Willard's Hotel, Washington, D. C. All of above for use with soft coal. The Reading contract is the third order. Thirteen 300-hp, Federal Sugar Refining Company, Yonkers, N. Y.; two 300-hp, Schwarzschild & Sulzberger, New York; four 300-hp, the Bellevue & Stratford Hotel, Philadelphia, Pa.; ten 200-hp, the American Tube & Stamping Company, Bridgeport, Conn. All of the latter for use with anthracite buckwheat coal.

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CATALOGUE NO. 10, which has just been published by William Wharton, Jr., & Company, of Philadelphia, hardly deserves that title. It is really an epitome of many of the latest advances in street railway and steam railroad track work. Hundreds of excellent engravings serve to illustrate not only most of the standard forms of rails, curves, frogs, turn-tables, crossings, etc., now in use, but also a great deal of special work devised to meet unusual and severe conditions. The text explains the advantages of this company's integral work and the use of manganese steel in track construction. An extremely valuable feature of this publication is the portion devoted to engineering data for street railways, including numerous diagrams of typical track layouts, cross-overs, turn-outs, dimensions and weights of switches, mates and frogs, and tables of special value in street railway work.

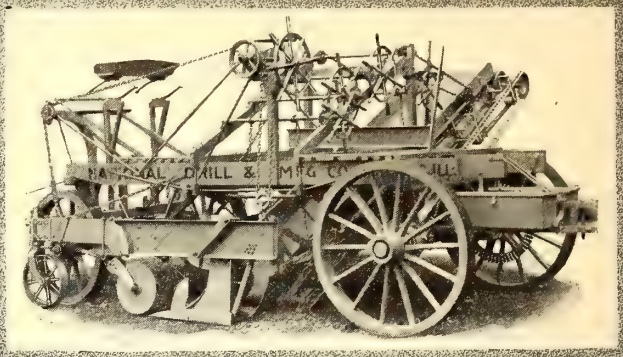
IN THE DESCRIPTION OF THE MECHANICVILLE HYDRAULIC PLANT of the Hudson River Power Transmission Company, published in the issue of this paper for Aug. 28, the statement should have been made that the station is equipped with fourteen pairs of 51-in. McCormick turbines, built by the S. Morgan Smith Company, of York, Pa., instead of machines of another manufacture. The McCormick turbines were installed last year. Each turbine consists of two pairs of wheels, each of which at the normal speed of 114 revolutions is rated at 250 hp. The total power of each set of turbines is, therefore, rated at 1000 hp. The S. Morgan Smith Company is also installing at Spier's Falls for the same company five pairs of wheels, three of which will develop 5300 hp per pair, while the other two will develop 4000 hp. At this plant two turbines will also be furnished to drive exciters, each of which will develop 400 hp.

THE STANDARD POLE & TIE COMPANY, of New York, is still pushing out. When the company began business it handled simply octagonal pine poles and a few cross-arms bought from the mill men in North Carolina. About four years ago it introduced in the Northern market the juniper pole. This is technically known as Southern white cedar; is a swamp growth, entirely free from butt rot, and has a remarkably small percentage of sap wood. The company advertised this pole extensively, and as a result it now claims the largest pole trade in the East. The company's best customers are the street railway companies, as the juniper pole is so tough and strong, besides being almost absolutely straight, that it is in great demand. The cypress is another tree which grows in the Southern swamps, and is very much like the juniper. In appearance the two are very nearly identical; in fact, after the bark has been removed it takes an expert to tell the difference. The cypress is superior to the juniper in one respect, for after seasoning the heart of the cypress gets very hard and tough. To offset this is its greater weight, which up to a short time ago caused the company to look upon the pole as unmarketable in the North on account of the very high freight rate. Not willing to give up, the company employed skilled foresters, and made many careful tests. It has found that by girdling the tree some three or four weeks before it is cut and then keeping it entirely out of the water and allowing it to season thoroughly, it loses one-third of its original weight. This enables the company to place the cypress pole in Northern New York, Ohio or New England at practically the same price as the juniper. The Standard Pole & Tie Company conducts its business very energetically, and expects a large sale of the cypress pole during 1904.

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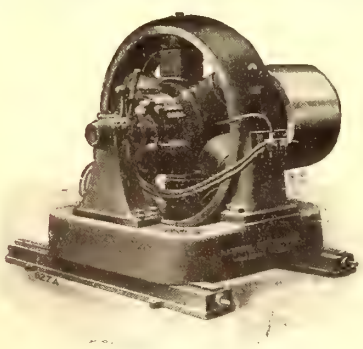
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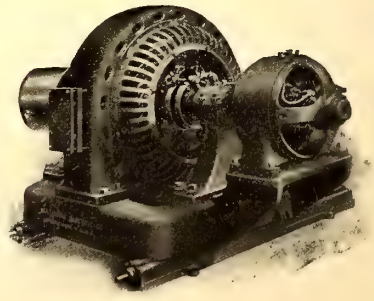
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NEWS OF THE WEEK

CONSTRUCTION NOTES

BERKELEY, CAL.—Franchises have been applied for in Contra Costa County for an electric railway to connect with Point Richmond and this city. The principal owners and backers of the new railway are John C. Black, superintendent of construction of the Richmond refineries of the Pacific Coast Oil Company; E. A. Gowe, of the same company; C. Kinney, an electrical contractor, and L. D. Dimm, a lubricating oil manufacturer.

LOS ANGELES, CAL.—The contract for erecting the switching tower to be built by the Los Angeles Railway Company at the corner of First Street and Spring Street has been awarded to the Union Iron Works, of San Francisco.

LOS ANGELES, CAL.—Bids are asked by the Los Angeles Railway Company for the reconstruction of the long viaduct on the Downey Avenue line. On this viaduct still remains about half a mile of old-style track, which will be removed when the structure is strengthened and rebuilt.

LOS ANGELES, CAL.—The Los Angeles Railway Company has just begun rebuilding 4¾ miles of track on its Maple Avenue line and 1 mile on Central Avenue. When these two little jobs are finished, General Manager Muir states, that all the trackage in the system at the time it was purchased by Mr. Huntington, less than two years ago, will have been replaced by new 60-lb. T-rails, instead of the old combination rails that used to lie all over the city. Moreover, every joint in all this trackage (comprising about 100 miles) has been cast-welded. In a total number of almost 300 cars there are only four single-truck combination cars, which are used only for emergency.

LOS ANGELES, CAL.—A part of the far-famed $110,000 franchise on Sixth Street is being utilized. Work has been begun by the Los Angeles Railway Company to extend its West Second Street line from Alvarado Street to Rampart Street. The ownership of this expensive franchise is yet withheld, but it is suggestive that the Los Angeles Railway Company is meeting no opposition in its present movements. General Manager Muir says he has simply been hired by the real owners to do enough work to keep the franchise from lapsing.

LOS ANGELES, Cal.—The first definite announcement as to the time of building the Pacific Electric Railway Company's proposed road between Santa Ana and Los Angeles was made at a meeting of the Santa Ana Chamber of Commerce on the evening of Sept. 8, when one of the engineers stated that his company stood ready to start active construction within thirty days after the right of way had been secured, and also that the entire double-track road would be completed within a year. Citizens are now busy assisting in a right-of-way fight.

POINT RICHMOND, CAL.—The Supervisors of Contra Costa County have passed an ordinance granting H. B. Kinney a franchise to construct an electric road from San Pablo, by way of Point Richmond, to West Berkeley.

REDWOOD CITY, CAL.—Charles U. Clark and Henry P. Bowie have been granted a franchise by the Supervisors to build electric and steam roads from San Mateo to Half Moon Bay and Pescadero.

COLORADO SPRINGS, COL.—An ordinance has been introduced in the City Council extending the life of the franchise granted the Colorado Springs & Interurban Railway for twenty-five years, and giving the company until Sept. 6, 1906, to construct certain lines of street railway which are covered in the franchise, but which have not yet been built.

LEWISTON, IDA.—The Idaho Water-Power Company has filed articles of incorporation at Lewiston, with a capitalization of $1,000,000. The company will build an electric railway system from Orofino to Pierce City, a distance of 30 miles, and one from Orofino to Nezperce. The company will also operate telephone and telegraph lines. The officers and directors are: William L. Cook, president; Elmer Waldrip, secretary; Frank A. Farrish, William T. Farrish and Simon P. Fitzgerald. The power plant of this company will be installed on Orofino Creek, a purchase at that point having been made of the holdings of the Cascade Lumber & Power Company. When the surveys are completed the company will solicit bids for the construction of a flume and the installation of a power plant. The flume will be 1100 ft. in length.

KEWANEE, ILL.—The Kewanee Short Line Electric Railway Company will probably begin the construction of its line this winter, as one link will run to the company's new mine between Kewanee and Annawan. Power to operate the road will be secured from the Kewanee Mining & Manufacturing Company. None of the other details have been worked out. The officers of the company are: F. H. Davis, president; H. S. White, secretary; W. V. Eddy, treasurer and electrician.

O'FALLON, ILL.—The new East St. Louis, O'Fallon & Lebanon Electric Railway has been completed to this place. The initial trip was taken Sept. 15, and regular service was begun Sunday, Sept. 20. The work of completing the line to Lebanon will now be pushed, and it is expected that complete service on the road will be inaugurated by Nov. 1.

ANDERSON, IND.—Wallace B. Campbell, of Anderson, has secured a franchise through the town of Lapel. Mr. Campbell states that he has been assured franchises in Noblesville and Lebanon and in the towns between the two cities. His road will parallel the Central Indiana steam railroad and connect the Indiana Union Traction Company's Gas Belt system and the system of the Indianapolis & Northwestern Traction Company at Lebanon.

COLUMBUS, IND.—Charles W. Wilson, representing the Appleyard syndicate in Ohio, is in Indiana negotiating for franchises and right of way for an electric railway from Columbus to Richmond via Greensburg.

BOGGSTOWN, IND.—The citizens of this town and of Greenwood are trying to revive the project of building an electric railway from Shelbyville to Greenwood, via Boggstown. Stock to the extent of $25,000 was subscribed. It is believed the road can be built on home capital. This road was begun over a year ago and several miles graded, after which the project was abandoned.

GREENSBURG, IND.—The City Council is to be asked to grant a franchise to the Columbus, Greensburg, Connersville & Richmond Traction Company, backed by the A. E. Appleyard syndicate. The proposed line will connect with the French Lick & West Baden line and the Indianapolis & Columbus line at Columbus, and with the Indianapolis, Shelbyville & Southeastern and the proposed Madison & Greensburg line at Greensburg, with the Indianapolis, Rushville & Cincinnati line at Connersville, and with the Dayton & Western and the Indianapolis & Eastern at Richmond.

GREENWOOD, IND.—Polk & Robinson, owners of a cannery at Greenwood, are endeavoring to revive the project of building the Indianapolis, Greenwood & Shelbyville Traction line, and a meeting has been held at Boggstown to that effect. A number of citizens in that vicinity have signified their intention of taking stock. It is understood that residents near Greenwood will take in the neighborhood of $25,000 in stock and that Indianapolis men are ready to assist in the venture. This is the road that was begun about a year ago and several miles of grade were built, after which the project was abandoned.

HAMMOND, IND.—A spirited meeting of the City Council of Hammond was held Sept. 15, at which Russell B. Harrison, representing the Chicago, Indiana & Michigan Traction Company, appeared in behalf of the franchise which his company is seeking in Hammond. This company is one in which President Hugh J. McGowan, of the Indianapolis Traction & Terminal Company, is interested. It proposes to build a line connecting Chicago with South Bend and Michigan City. A number of companies are working in this territory and have done considerable work upon their rights of way. The Chicago & Indiana Air Line Railroad Company is also seeking franchises in Hammond, and proposes to cover much the same route as the Chicago, Indiana & Michigan Traction Company. J. A. Hanna, of Cleveland, is one of those interested in the Air Line Company. The Indiana Union Traction Company, which proposes to build into Hammond from Logansport and the southeast, ultimately connecting Indianapolis and Chicago, has already secured franchises in Hommond.

INDIANAPOLIS, IND.—The work of grading the Indianapolis, Danville & Rockville Electric Railway began on Sept. 10, and the work will be pushed rapidly. The company announces that it will extend the line from Rockville to Terre Haute.

INDIANAPOLIS, IND.—The laying of the last rail at Carter Hill on the Indianapolis & Northwestern, joining this city with Lebanon and Frankfort, has been completed. Work on the big cut at White River has been going on for months, and in the meantime track laying to Frankfort had been completed. The power house at Lebanon is completed and the machinery has been installed. The overhead work is completed, grading is finished and track laid from this city to 5 miles beyond Frankfort. This is a distance of 47 miles.

MUNCIE, IND.—The long contention between the Council and the Indiana Union Traction Company ended with the granting to the latter of a fifty-year franchise for a double-track entrance over Howard Street and Seymour Street and the streets surrounding the site at Charles Street and Mulberry Street, on which the company will build a $100,000 terminal station. The franchise carries the right to furnish electric heat, light and power in the city.

MUNCIE, IND.—L. J. Schlessinger, superintendent of the Muncie, Hartford City & Fort Wayne Railway Company, says the company may have its line extended from Montpelier to Bluffton and cars running into the Wells County seat by Jan. 1. No cars will be operated north of Montpelier until the large power station at Bluffton is completed. Large car houses will be built near the power house. The steel rails have been laid from Montpelier to the corporation line at Bluffton. The poles have not all been set and the trolley wires are yet to be strung.

NEW CASTLE, IND.—The Indianapolis & Eastern Traction Company celebrated the opening of its line to this city on the 11th inst.

RICHMOND, IND.—It is announced that the Richmond Street & Interurban Railway Company has procured an option on the old steam road from Cambridge City to Connersville, and that the line will be purchased and converted into an electric railway.

SHOALS, IND.—The Indiana Hydraulic Power Company has incorporated, with a capital stock of $150,000, to erect a dam in White River, at Hindostan Falls, near this city. The company proposes to construct and install a power plant to furnish electric power for a new electric railway from Vincennes to Shoals.

SULLIVAN, IND.—The Commissioners of Sullivan County have granted the Western Indiana Traction Company, of Vincennes, the right of way over public highways and crossings north of this city to the Vigo County line. The line will be built from Vincennes to Sullivan, and then extended to Terre Haute.

SOUTH McALESTER, I. T.—The Indian Territory Traction Company has been placed in operation between South McAlester and Alderson. The line will be extended to Hartshore, I. T. It is the first electric railway in Indian Territory, and the first interurban electric railway in the Territories.

DES MOINES, IA.—The Burlington Interurban Railway Company has filed articles for the construction and operation of a line running west from Burlington through Des Moines, Lee, Henry, Van Buren and adjacent counties. It is capitalized at $200,000. Its officers are: President, Carl Leopold; first vice-president, W. W. Copeland; second vice-president, Charles Blaul; treasurer, Charles Armknecht; secretary, J. W. Topping.

CONWAY, MASS.—The Conway Street Railway Company has presented a petition to the Selectmen asking for an extension of its franchise from Sept. 1, 1903, to Jan. 1, 1905, that it may have time to market its securities and build the line. The Selectmen have taken no action on the matter.

BOSTON, MASS.—There is much local interest in the hearing before the Railroad Commissioners on the petition of the Springfield Suburban Electric Railroad Company for a right to build from Ludlow to Springfield. The proposed line will be an extension of the Palmer & Springfield line, and will give a through service. People in this section are very much in favor of it.

LOWELL, MASS.—The Boston & Northern Street Railway Company has begun preparations for a double track between Lowell and Lawrence. Surveys have been made and German rails have been ordered. It is expected that with the double track the trip between the two cities will be made in 45 minutes.

MAYNARD, MASS.—The Lowell, Acton & Maynard Street Railway Company has completed its line from Maynard to South Acton, and is operating cars over this portion of the line.

PITTSFIELD, MASS.—At a conference between Manager Dolan, of the Pittsfield Electric Street Railway Company, and the Board of Aldermen detailed plans for the double tracking of North Street from the car house to Pontoosuc Lake, and for the new trolley extension location asked for through Peck's Road were considered. The company's intention, in case it is granted a location, is to build a line from North Street down Linden Street to Onota Street, thence through Peck's Road to Onota Lake. In case this extension is built the one via New West Street will not be constructed. In the event of the location being granted, it is said that the line will be built within a year.

WORCESTER, MASS.—The Worcester Consolidated Street Railway Company has completed an extension of its line in Leominster, which was built to accommodate local traffic in the town.

MINNEAPOLIS, MINN.—Charles O. Straub and his associates, who secured the proposition from the County Commissioners to build electric lines to Shakopee and Anoka from Minneapolis, have secured the required bond of $5,000, and the franchise will be accepted. Land has been purchased on both sides of the Elk River, which will be dammed for securing water-power.

JOPLIN, MO.—An Eastern syndicate, headed by Major William Vincent, of the United States Guarantee Loan & Trust Company, of New York city, proposes to build an electric railway between Joplin and Kansas City. The line must parallel the Joplin-Kansas City line of the 'Frisco, and take in Galena, Columbus, Weir City, Scammon, Pittsburg and Fort Scott. The road will be 170 miles long. It is the intention of the company to do a general freight as well as passenger business.

ST. JOSEPH, MO.—The St. Joseph, Savannah & Northern Street Railway Company has filed articles of incorporation, with a capital stock of $10,000. The stockholders and directors are: Charles F. Booher, Isaac Williams, Collins F. Newton and Willis G. Hine. All live in Savannah and each has twenty shares of stock in the enterprise.

OMAHA, NEB.—The Omaha Street Railway Company has announced the construction of a new line between Omaha and South Omaha along Thirteenth Street. About 2 miles of new track will be built, connecting the present terminals on Thirteenth Street with the Missouri Avenue line in South Omaha.

BATTLE MOUNTAIN, NEV.—Articles of incorporation of the Reno Suburban Railway Company have been filed. The incorporators are T. F. Dunaway, W. J. Westerfield, H. J. Gosse, A. J. Clark and John Wagner. The capital stock is placed at $100,000, divided into 100,000 shares of the par value of $1 each.

HAMILTON SQUARE, N. J.—The Hamilton Township authorities have again postponed consideration of the ordinance giving the Camden & Trenton Railway the right to build and operate a line from the Trenton city line, at Olden Avenue, to a point where connections will be made with the Trenton & New Brunswick Railroad.

JERSEY CITY, N. J.—The Public Service Corporation of New Jersey has bought a tract of land on the Hackensack River, at Jersey City, for which it paid $12,500. The river frontage is 300 ft., the plot being 1140 ft. deep at the north end and 935 ft. deep at the south end. It will be used for a new power house in connection with an extension of lines on the west side of Jersey City Heights contemplated by the company.

PHILLIPSBURG, N. J.—The Easton & Washington Traction Company has now decided definitely that it will go through Greenwich Township, Warren County, by means of a steam railway charter. The township authorities refuse to grant the company the privilege of even crossing a highway unless it will carry its line through Stewartsville, which would necessitate crossing the Lackawanna Railroad twice and make the line 2 miles longer than the proposed route. With a steam charter no permission is necessary to cross a highway.

TRENTON, N. J.—The Trenton Street Railway Company now has its new 1500-kw generator in operation, and can take care of all the load in the city at one time, and have sufficient power left over to operate additional cars to the extent of 25 per cent of the number regularly in use.

TRENTON, N. J.—The Trenton Street Railway Company has moved its offices from Clinton Avenue and Greenwood Avenue, 1 mile from the center of the city, to the Fischer Building, corner State Street and Broad Street, opposite the City Hall. All men will be changed and transferred at this point in the future, instead of at two points—Clinton Avenue and Greenwood Avenue and Broad Street and Center Street, as in the past.

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YARDVILLE, N. J.—The Trenton Street Railway (or Mercer County Traction Company) has again taken steps looking to the crossing of the Camden & Amboy division of the Pennsylvania Railroad at this point. The matter has been fought through the courts for four years, the electric railway company winning in the lower courts and the steam railroad in the higher courts. Every victory for the Pennsylvania Company has been won on a technicality.

CENTERPORT, N. Y.—An agent representing a syndicate of capitalists is canvassing the property holders along the highway with a view to obtaining their consent to a right of way for the purpose of building an electric railway from Oyster Bay along the shore front through Centerport to Northport. Ultimately the road will be extended in both directions, starting at Flushing and reaching eastward as far as Orient, it is claimed. Papers of incorporation, it is said, are to be filed within a short time. The men back of the undertaking are, according to the agent, in no way allied with the Long Island Railroad.

GLOVERSVILLE, N. Y.—The Mountain Lake Electric Railroad Company, of Gloversville, which was reorganized after the wreck last year, is about to increase its capital stock in order to secure funds for extending the line into the city of Gloversville. The cost of the extension will be about $40,000. New cars and additional equipment for the power house will be purchased.

NEW YORK, N. Y.—The Board of Estimate and Apportionment has approved the granting of a franchise to the Union Railway Company for the extension of its lines in the upper part of New York. Under the ordinance, the proposed extension may begin from the intersection of Jerome and Sedgwick Avenues at the termination of the company's Jerome Avenue line.

NEW YORK, N. Y.—William Barclay Parsons was asked last Saturday as to when a definite agreement would be reached on a method of tunneling lower Broadway. He answered: "That agreement was decided when the contract was given out; it called for a method that would disturb traffic least; just how the work was to be done was left entirely to the contractor." When asked how long before the question of ditching upper Broadway from Union Square to Forty-Second Street would be decided, Mr. Parsons was emphatic in saying: "There will be no ditching at all. Soundings are being made at present in two or three different directions to determine the quality of the earth to be removed. Until that question is settled there can be nothing said, except to repeat that whichever route is finally decided upon the work will be carried on without interference to traffic."

NEW YORK, N.Y.—It is reported that the Pennsylvania Railroad Company is behind the Hudson & Manhattan Railroad Company and the two tunnels it proposes to build from Cortland Street and Fulton Street to Jersey City. This is indicated by the announcement that Albert C. Wall has been elected president and Marshall Van Winkle vice-president of the last-named company. They are members of the firm of Vredenburgh, Wall & Van Winkle, and Mr. Vredenburgh, the senior member, is counsel for the Pennsylvania Railroad Company. The new officers admitted that the Jersey City terminal of the tunnels would be on the Pennsylvania Railroad property at Hudson Street and Montgomery Street, south of and adjoining the company's train shed. They would make no further statement, but it is currently reported that transverse tunnels will be built to the Central and Erie Railroad stations. The tunnel as planned starts from Exchange Place, Jersey City, and its route in Manhattan is in the shape of a loop, a single steel tube containing one railway track to enter the city proper at Fulton Street, running thence up to Church Street, southward two blocks to Cortland Street, and back to the river. The tubes under the river will be distant from each other about 390 ft. The terminal station on this side will be so far underground as to not interfere with the proposed subway under Church Street, and will cover all the space under Church Street from Fulton to Cortland. The Hudson & Manhattan Railroad Company was organized under the New York laws with a capital stock of $3,000,000, and William G. McAdoo as president.

CLEVELAND, OHIO.—The promoters of the Muncie, Hartford & Fort Wayne Traction Company have placed the contracts for the construction of the Bluffton branch. It is the intention to have the branch in operation this winter.

CLEVELAND, OHIO.—The Eastern Construction Company, of New York, which has the contract for building the new line of the Cleveland & Sharon Traction Company, has sub-let the work of grading to Joyce, Heasley & Fawcett, of Youngstown, who are placing a large force of men at work. The line will extend from Middlefield, Ohio, to Sharon, Pa., and cars will enter Cleveland over the tracks of the Eastern Ohio Company.

DAYTON, OHIO.—The Oakwood Street Railway Company will lay new heavy rails on Main Street to accommodate the heavy interurban cars.

MARIETTA, OHIO.—The Parkersburg & Marietta Interurban Railway recently operated its first car over the new Ohio River Bridge into Marietta. The opening was attended with some difficulty. The bridge is practically completed, but the Ohio River Bridge & Ferry Company, owner of the structure, has refused to make the last payment on it pending the settlement of some difficulty with the American Bridge Company. The builders, therefore, attempted to prevent the use of the bridge until settlement had been made. The car displayed the sign "United States mail," but a chain blocked the way and a watchman endeavored to prevent the passage of the car. He was overpowered and the car continued to run throughout the day. Regular operation will probably start immediately.

TOLEDO, OHIO.—Track laying on the Toledo, Port Clinton & Lakeside is being pushed, and it is expected that a portion of the road will be placed in operation this fall. The power house at Genoa is almost completed.

TOLEDO, OHIO.—The Toledo Railways & Light Company has placed contracts for the erection of a large brick car house and repair shop. The building will be located in East Toledo on the Starr Avenue line, and will be 80 ft. x 240 ft. The structure will be erected on the same general plan as the new car houses on Central Avenue, which were recently illustrated in the STREET RAILWAY JOURNAL.

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YOUNGSTOWN, OHIO.—The Pennsylvania & Mahoning Valley Railway Company is installing a new unit of 300-kw capacity with which to take care of the increased load added through the building of the new Mahoning Avenue line and the new line to Struthers.

COATESVILLE, PA.—The trolley tangle in this borough thickens rather than clears. The Brandywine Street Railway Company apparently has the upper hand over the West Chester Street Railway, yet the latter is continuing its work between here and Downington. The Common Council passed the ordinance over the Mayor's veto in favor of the Brandywine Company, and the town has been in an uproar ever since. Probably no other place of the size in the country is so vitally interested in trolley matters as Coatesville. The Borough Council has been fighting the West Chester Company for some months, and the people of the town have been fighting the Council. The Lancaster & Coatesville Street Railway Company is the latest to appear upon the scene, and as to what the company will want from Coatesville is a favorite topic on the streets. The West Chester Company has talked of transferring passengers over the break existing in one place between here and Downington by an automobile bus line, but nothing definite has been done.

BANGOR, PA.—The Northampton Traction Company is installing a 200-cell battery near this place to help the cars on this end of the Easton line. The battery will be housed in a building 30 ft. x 70 ft., and the whole equipment will cost about $10,000. The power house is located along the Bushkill, below Tatamy, 12 miles away, and the additional current is needed on the long and heavy grades in this section. It is expected that the 18 miles between this place and Easton will be covered in 1 hour (instead of 1 hour 15 minutes as at present), which will be very rapid time considering the number of heavy grades encountered.

FREEDOM, PA.—The ordinance granting the Beaver Valley Traction Company the right to lay additional tracks on Third Avenue has been amended to require the payment by the company to the town of $1,200 cash indemnity, and the double-track system to be completed to the borough line in Rochester Township in two years.

HARRISBURG, PA.—The ordinances for the extension of the traction company's system and for the payment of 3 per cent of the gross receipts from traffic originating and ending in the city have been signed by the Mayor. The ordinances were passed Friday, Sept. 11.

HARRISBURG, PA.—Judge Weiss, of the Dauphin County Court, has filed two opinions in the injunction cases of the Cumberland Valley Railroad Company vs. the Chambersburg & Gettysburg Electric Railway Company. The steam road sought to restrain the electric railway from crossing its tracks at grade on Queen and King Streets in Chambersburg, and also from crossing its tracks in West Fayetteville either at grade or overhead. In the latter case the electric railway company asked permission to cross at a point south of the turnpike by a private right of way. Judge Weiss grants the first application for an injunction, but refuses an injunction in the Fayetteville case, taking the ground that the electric railway company's contemplated crossing overhead at a distance of 22 ft. is sufficient to assure the necessary property rights to the steam roads.

JOHNSTOWN, PA.—City Council's highway committee has recommended the passage of the ordinance granting a local franchise to the Johnstown and Scalp Level Street Railway.

MONONGAHELA, PA.—Donora capitalists have organized a new company, to be called the Monongahela & Clairton Street Railway Company. At Clairton the route will connect with the Frick line and make a complete service from Pittsburg to Donora. At Monongahela the line will make connections to Monessen, Bellevernon and Fayette City. The directors and officers are: President, J. M. Mullen; secretary, Oliver S. Scott; treasurer, Herbert Ailes; directors, William H. Burns, B. W. Castner, John Ailes, Paul McCully, John G. Parke, Jr.

WAYNESBORO, PA.—The Chambersburg, Greencastle & Waynesboro Electric Railway Company has decided upon the route of the low-grade line circling a large elevation west of town. This will necessitate the use of about 1½ miles of private right of way 20 ft. wide. Fifteen more carloads of T-rails for the new line have been received, and it is expected that the line will be completed to Greencastle by Tranksgiving Day. The new car house is almost finished. The new cars have arrived from the Jackson & Sharpe works, Wilmington, Del.

WEST CHESTER, PA.—The West Chester Street Railway Company has purchased a lot at the corner of Market Street and Warren Street, this borough, on which it will build a brick car house and storage building. The lot is 145 ft. x 194 ft. in size, and the price paid was $1,500. At present the cars are housed in the rear of the main depot, on another street, but the amount of room is limited.

WEST CHESTER, PA.—The Philadelphia & West Chester Street Railway has completed the building of additional long sidings and will soon be able to cut from 15 minutes to 20 minutes off the running time between this place and Sixty-Third Street, Philadelphia. Under the new schedule it will be possible to make it in from 1 hour 30 minutes to 1 hour 40 minutes, which is but from 5 minutes to 15 minutes longer than the accommodation trains on the Pennsylvania Railroad make the run in.

DALLAS, TEX.—The Metropolitan Street Railway Company will erect a large brick car house here. It will be 300 ft. by 457 ft. The land necessary for the structure has been purchased. It is stated that in addition to being used as a street car house shops would be fitted up in the building where all necessary repair work of the company's car houses would be done.

FORT WORTH, TEX.—The Northern Texas Traction Company has purchased a site on Front Street, where the company's new car houses will be erected. General Manager Haines says that the building will be 150 ft. x 320 ft., will be built of brick and that the improvements would cost something like $35,000. Work, he says, will be commenced within the next two weeks.

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Elwood, - -	"	Connorsville, -	"

HOUSTON, TEX.—The City Council has granted a franchise for twenty-one years for the interurban electric railway between Houston and Galveston. This was about the last obstacle in the way of the project, and it is expected that actual work will begin in a short time.

SALT LAKE CITY, UTAH.—The Salt Lake City & Suburban Railroad Company has notified the City Council that it has accepted the terms by which it was granted a year extension to its franchises. The new lease carries with it the compulsion of performing a certain amount of construction work in the next twelve months or forfeiting the franchise.

SNOHOMISH, WASH.—The City Council has passed an ordinance granting a franchise to W. M. Snyder for an electric railway through the city. Mr. Snyder represents the company of Snohomish citizens formed some time ago to build a trolley line from Snohomish to Cherry Valley, taking in the city of Monroe en route.

SPOKANE, WASH.—It is the intention of the Spokane Traction Company to build car houses and machine shops this fall and winter, but it has not been definitely decided as to the location. A proposal is now being considered for the location of these shops and car houses, and decision will probably be reached in the course of the next ten days.

WHATCOM, WASH.—Good progress has already been made upon the projected new line through "York Addition," a rapidly growing residence district of the city of Whatcom. Actual building is now under way, and it is stated that the cars will be running not long after Oct. 1. Besides this work of construction, a great deal of double tracking is being put in at points of the Whatcom County Railway & Light Company's system, under the management of Stone & Webster, Boston, Mass. In fact, the lines between the cities of Whatcom and Fairhaven are double tracked for the greater part of the distance.

FOND DU LAC, WIS.—Forty grants for right of way through the city of Waupun have been filed in the office of Register of Deeds by the Madison & Northeastern Railroad Company. The company proposes to build an electric railway from Madison to Fond du Lac. It will be almost an air line, and will pass through the cities of Columbus, Beaver Dam and Waupun.

CIENFUEGOS, CUBA.—The Cienfuegos, Palmira & Cruces Electric Railway & Power Company has been organized to construct about 43 miles of electric railway, to sell electric power and engage in electric lighting at Cienfuegos, and also at Caonao, Palmira, Cruces, Los Guaos and Cumanayagua, in Cuba. The company will develop a large water power on Hanabanilla River. F. W. Bennett, lately of the Guayaquil & Quito Railroad, in Ecuador, has been engaged as resident engineer, and will begin the final location and construction this fall. C. C. Vermeule, of 203 Broadway, New York, is consulting engineer.

NEWS NOTES

LOS ANGELES, CAL.—Another attempt has been discovered to unionize the trainmen of the Los Angeles Railway Company. There was a grand fiasco last spring when only 12 men walked out and almost 700 remained faithful, so that the agitators just now are having a hard time of it. President Mahon, of the Amalgamated Association of Street Railway Employees of America, is expected in Los Angeles some time in October, coming here from San Francisco.

WORCESTER, MASS.—Nineteen suits, with total ad damnum approximating $100,000, have been entered in the Superior Court against the Worcester & Southbridge Street Railway Company. All are to recover for alleged personal injuries, and most of them grow out of a collision at Charlton, May 30.

BOSTON, MASS.—Under the law passed by the last Legislature, by which officials of Massachusetts cities and towns are allowed to make speed regulations for street railways, subject to the approval of the Railroad Commissioners, many petitions for approval of such regulations have been filed. The first of these on which hearing is scheduled is that of the Selectmen of the town of Wellesley, and there is every prospect of an interesting contest, as the high rate of speed formerly allowed the cars of the Boston & Worcester Street Railway Company has been very materially reduced.

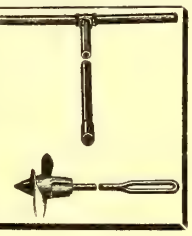
MANCHESTER, N. H.—All the directors of the Manchester Traction, Light & Power Company and the Manchester Street Railway Company were re-elected at meetings of these corporations held at the Manchester office Sept. 16. They are as follows: Traction, Light & Power Company—William A. Tucker, of Boston; George H. Hood, of Boston; Walter M. Parker, George B. Chandler, R. G. Sullivan, Harry E. Parker, J. Brodie Smith, of this city; S. Reed Anthony, of Boston; Stillman F. Kelley, of Boston; Billings P. Learned, of Boston; R. H. Hallowell, of Boston, and Charles M. Floyd, of Manchester. Manchester Street Railway Company—Philip L. Saltonstall, of Boston; Walter M. Parker, of Manchester; S. Reed Anthony, of Boston, and David A. Taggart, of Manchester.

NEWARK, N. J.—The Public Service Corporation, which controls all the electric railways in Essex, Hudson, Union and Passaic Counties, has entered into an agreement with the Amalgamated Association of Street Railway Employees of America providing for a uniform wage rate of 22 cents per hour for motormen and conductors, an increase of 3 cents.

NEW YORK, N. Y.—The power house of the Union Railway Company in New Rochelle was completely destroyed by fire Friday, Sept. 18. The fire broke out shortly after midnight, and spread with such rapidity that the building was completely enveloped in a sheet of flame by the time the firemen arrived. It is said that the fire drove the engineers from the building before they had time to shut off steam and stop the machinery. The origin of the fire is unknown.

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FACTORY AND MAIN OFFICE DETROIT.

NEW YORK, N. Y.—Corporation Counsel Rives has made public a memorandum of unpaid taxes due under the franchise tax law which was enacted in 1900. The law has been sustained by the Court of Appeals, and is now pending a final decision on its constitutionality in the United States Supreme Court. The local authorities have nothing to do with the assessment for special franchises, and are not parties to the litigation. The first class of unpaid taxes is said to amount to $9,727,528. The unpaid taxes of street railroad corporations due the city are said to amount to $5,000,000 or $6,000,000 for real estate and over $2,000,000 for personalty. "Since Jan. 1, 1902," says Mr. Rives, "I have collected very large sums from the street railroad companies for taxes imposed prior to 1900. In the case of the Manhattan Railway I collected the sum of $752,524, making, with the sum of $1,443,533 heretofore collected in litigated assessments between 1895 and 1899, considerably over $2,000,000 from that one corporation. The long-pending controversies between the company and the city in regard to its taxes are now adjusted." This statement of Mr. Rives, it is offered in explanation, does not mean that the Manhattan Company has paid its franchise taxes, which are a State tax. The company claims exemption from the latter on the ground of certain special considerations.

CLEVELAND, OHIO.—As the result of the change of control of the Cincinnati, Dayton & Toledo Traction Company the general offices of that company have been removed from Cleveland to Cincinnati. The executive committee of the company held a meeting recently and decided to enter into negotiations with the Interurban & Terminal Company for the use of that company's terminal station on Sycamore Street for the freight and express department of the Cincinnati, Dayton & Toledo. It was also decided to bring the Cincinnati, Dayton & Toledo cars directly into the city either by building a new line on a street not now occupied by the Cincinnati Traction Company or by laying a third rail on one of the city lines.

CLEVELAND, OHIO.—On Sept. 15 sleeping cars were placed in commission on the interurban line between Indianapilis, Ind., and Columbus, Ohio. Orders have been placed for twenty-four cars, sleeper and combination sleeper and diners, and within eighteen months the routes covering Ohio, Pennsylvania, New York, Wisconsin, Indiana, Michigan, Illinois and West Virginia will be equipped with the cars. Buffalo is at present the Eastern terminus of the Appleyard interurban electric roads; Milwaukee, the northwest terminus; St. Louis, the southwest, and Chicago, Terre Haute, Indianapolis, Cincinnati, Dayton, Springfield, Zanesville, Wheeling, Pittsburg, Columbus, Cleveland, Toledo, Detroit and Port Huron are the principal cities to be reached by the syndicate.

CHAMBERSBURG, PA.—Judge Weiss, of Dauphin, who heard the injunction suits brought against the Chambersburg & Gettysburg Electric Railway Company, which was trying to cross the Cumberland Valley Railroad at grade, sent in his opinion recently. He allows the electric railway to cross on an overhead trestle, at West Fayetteville, as it proposed, but makes permanent the injunction against crossing at grade at Queen and King Streets, Chambersburg.

HARRISBURG, PA.—Attorney-General Carson, on Sept. 10, held a private hearing on the application of the Pittsburg Railways Company for writs of quo warranto against the Bankers Street Railway Company and the Iron City Street Railway Company, of Pittsburg, to compel them to show by what authority they exercise a corporate existence. This application was argued before the Attorney-General several weeks ago, and subsequently he awarded the writs asked for by the Pittsburg Railways Company. Three days later Mr. Carson recalled his action and directed an argument solely on the question as to whether or not the Pittsburg Railways Company could secure the same remedy by a proceeding under the act of June 19, 1871, in the courts of Allegheny County, without the necessity of making the commonwealth a party to the proceeding. The argument on Sept. 10 was directed solely to that question, and it continued for several hours. William C. Farnsworth, of Harrisburg, attorney for the Pittsburg Railways Company, contended that quo warranto was absolutely the only remedy sought by his client. John S. Wendt, of Pittsburg, attorney for the Bankers and the Iron City companies, maintained that the act of June, 19, 1871, was remedy enough to cover a case of this kind. The Attorney-General reserved his decision.

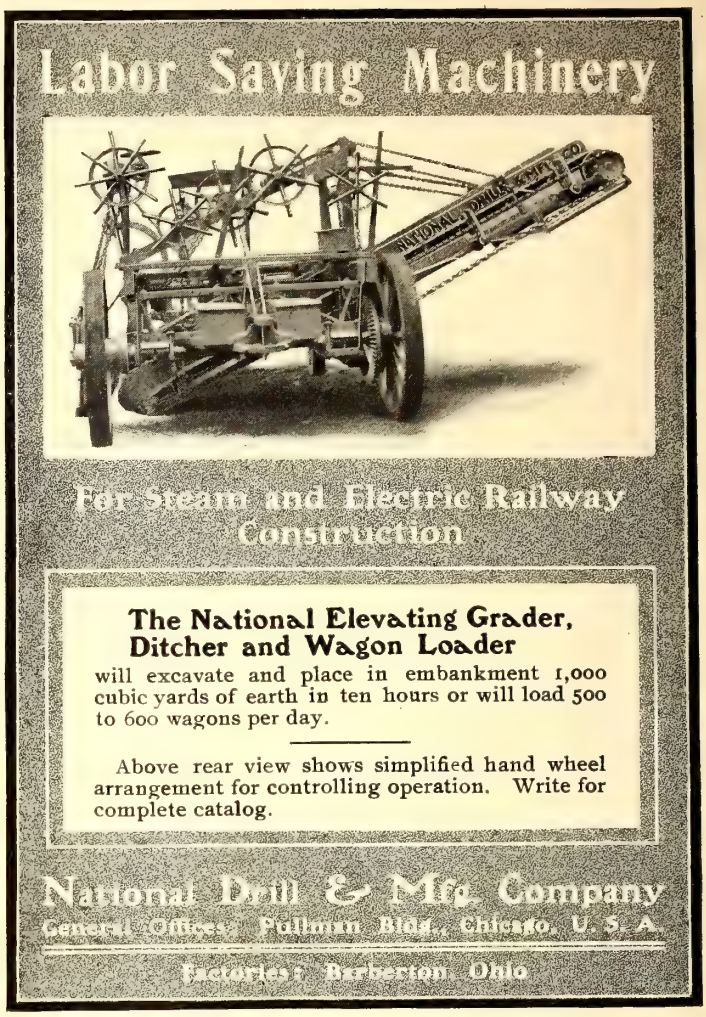
HOUSTON, TEX.—The City Council has postponed until Sept. 23 further consideration of the ordinance compelling the local street railway companies to place compartments separating the races in its cars.

FINANCIAL NOTES

BRISTOL, CONN.—The stockholders of the Bristol & Plainville Tramway Company have voted to authorize the directors to increase the capital stock from $100,000 to $150,000.

CHICAGO, ILL.—The Union Elevated Railroad Company has made the usual semi-annual statement of gross earnings by months, on which its bonus to the city is computed. The following is the report, with a comparison for 1902:

	1903	1902
January	$48,279	$43,828
February	44,639	40,193
March	49,663	45,580
April	48,442	44,893
May	46,990	44,554
June	46,245	42,198
Six months	$284,258	$261,245



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CHICAGO, ILL.—The reorganization committee of the Lake Street Elevated Railway Company has extended the time for the deposit of securities to Oct. 1. The committee is holding daily sessions working on a reorganization plan, but it is pointed out that each day the task becomes greater, instead of threshing itself down to a working basis. It is pointed out that the success of a 4 per cent bond is questioned now that the money situation has changed so. Again, the fact presents itself that no gain in traffic is being made, notwithstanding important improvements. This is said to be due to increased surface competition. The Chicago Economist even goes so far as to say that "but for the Northwestern guarantee of the interest the obvious plan would involve default and foreclosure, and as the case stands it may be necessary to resort to a receivership, which would, perhaps, involve a foreclosure in spite of the guaranty.'

ROCKFORD, ILL.—The Rockford, Beloit & Janesville Electric Railway Company has filed for record in the Winnebago County Circuit Court a trust deed for all its property running to the Illinois Trust and Savings Bank of Chicago, to cover an issue of $1,000,000 first mortgage 5 per cent gold bonds. Of this amount $600,000 is to take up an issue of the Beloit, Delaben Lake & Janesville Company, now owned by the mortgagor, and the remainder is for extension and improvements. It is believed this means the immediate extension of the road to Madison, Wis.

ROCKFORD, ILL.—The report has just been issued for the Rockford, Beloit & Janesville Traction Company for the month of August. It shows gross receipts of $15,084; operating expenses, $6,401; net earnings, $8,683; interest charges, $2,500, leaving surplus for stock of $6,183. This shows that despite the fact that proper charges were made against operating expenses for improvements, the road was still able to operate on 42.4 per cent of gross receipts.

MARION, IND.—Arrangements have been made for the merging of the Marion Light & Heat Company with the Indiana Northern Traction Company; that it is building an electric railway from this city to Wabash and other points south of Chicago. According to plans agreed upon, a mammoth power house will be erected in North Marion sufficient to furnish power for the traction lines and also to furnish to present and future patrons light, heat and electric power. A contract has been let for the building of the road, work to commence Oct. 1.

LOUISVILLE, KY.—The Louisville & Southern Indiana Traction Company has leased the New Albany Street Railway Company for twenty-five years. The consideration is that the Louisvillle & Southern Indiana Traction Company shall pay an annual rental of $500 a year, commencing Aug. 1, 1903; that the company is to assume the payment of $250,000 bonded indebtedness of the Street Railway Company guaranteed by the United Gas & Electric Company, of New Albany and Jeffersonville, together with the 5 per cent interest on such bonds which were issued Aug. 1, 1902, and that the company is to pay all taxes and fixed charges on the street railway system. It is further stipulated that the traction company shall pay to the holders of preferred stock issued by the New Albany Street Railway Company dividends accruing on such stock, and that such dividends shall be paid according to the terms of a certain contract entered into by the United Gas & Electric Company, the New Albany Street Railway Company and R. S. Veech, of Louisville. A deed has been filed conveying from the Southern Indiana Interurban Railway Company to the Louisville & Southern Indiana Traction Company the property of the first-named company, which includes the interurban line between New Albany and Jeffersonville. The consideration named is $2,000,000. This is only a formal matter made necessary by the change in the name of the company. The lease of the street railway is regarded as a step in the direction of consolidating the business of the companies and the operation of the lines of the New Albany Street Railway system, the interurban line between New Albany and Jeffersonville, and the Jeffersonville Street railway lines under one system, which will be extended over the Big Four Bridge at Jeffersonville to Louisville.

BOSTON, MASS.—The Boston & Northern Street Railway Company has petitioned the Railroad Commissioners for authority to issue additional capital stock to the amount of $380,000 for the payment of floating indebtedness and the purchase of additional equipment.

DETROIT, MICH.—The Detroit United Railways Company has declared a regular quarterly dividend of 1 per cent, payable Oct. 1.

DETROIT, MICH.—The Detroit United Railway Company reports earnings as follows:

August	1903	1902
Gross earnings	$428,071	$398,535
Operating expenses and taxes	245,180	212,112
Net earnings	$182,891	$186,423
Other income	2,288	3,508
Total income	$185,179	$189,931
Charges	84,167	79,583
Surplus	$101,012	$110,348
Jan. 1 to Aug. 31		
Gross earnings	$2,892,238	$2,582,163
Operating expenses and taxes	1,713,881	1,463,754
Net earnings	$1,178,357	$1,118,409
Other income	27,743	30,857
Total income	$1,206,100	$1,149,266
Charges	659,554	621,960
Surplus	$546,546	$527,306

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NEWARK, N. J., U. S. A.

NEW YORK, N. Y.—Last week the story was circulated in financial circles that the Rockefeller interests were buying Brooklyn Rapid Transit stock to secure control of the property. At first those implicated as being connected with tne deal refused to discuss the question, but later Henry Rogers authorized an official denial of the story.

ALBANY, N. Y.—The annual report of the United Traction Company shows the following statistics: Gross earnings from operations, $1,606,090; operating expenses, $1,076,847; net earnings from operations, $529,242; fixed charges, $299,138; 5 per cent dividend distributing, $249,997; deficit for the year, $1,678; surplus for next preceding year, $67,321; total surplus, $65,643. Number of passengers carried, including transfers, 31,680,601; number of transfers, 2,703,339. The operation of the Cohoes City Railway shows a deficit for the year of $36,149, or a total deficit of $40,929.

ROCHESTER, N. Y.—The Rochester Railway Company reports earnings as follows:

For the months ending Aug. 31	1903	1902
Gross earnings	$117,182	$102,095
Operating expenses	57,107	52,168
Net earnings	$60,075	$49,927
Income from other sources	425	325
Gross income from all sources	$60,500	$50,252
Fixed charges	25,942	25,063
Net income or deficit	$34,558	$25,189
Fixed charges, August, 1903:		
Interest		$19,743
Rentals		1,088
Taxes		5,111
Total		$25,942

CLEVELAND, OHIO.—Directors of Cleveland Electric Railway have declared a quarterly dividend of 1 per cent, payable Oct. 5. This is the first dividend since the merger with the Cleveland City Railway, and establishes a rate of 4 per cent.

CLEVELAND, OHIO.—The leading Cleveland and Cincinnati holders of the bonds of the Miami & Erie Canal Transportation Company, which is now in the hands of a receiver, have appointed committees from their respective cities with a view to securing a reconciliation between the warring factions in these security holders. It is arranged that all bonds shall be deposited with these committees before Oct. 1, and when this work is completed a line of action will be mapped out. The court in charge of the property is desirous of securing the best possible information as to what the bondholders desire, and, therefore, these committees have been appointed with a view to securing concerted action. The bondholders, of course, have the first lien on the property, and after their claims have been satisfied the other creditors will come in for their share of what is left.

COLUMBUS, OHIO.—An attempt is being made to throw the Toledo, Columbus, Springfield & Cincinnati Railway Company into the hands of a receiver. The petition is in the name of Walter Toy, a stockholder, but it is reported that the move is backed by the Columbus & Lake Michigan Railroad, a steam road, which is desirous of securing the right of way of the electric line to gain entrance to Columbus. The franchises of the road were taken out for an electric line, but the private rights read for either steam or electric. The application for receiver will be heard before the courts within a few days.

PROSPECT, OHIO.—The plant of the Prospect Electric Light Company has passed into the hands of the Columbus, Delaware & Marion Railway Company. The new owners are planning to enlarge the plant, with a view to providing power temporarily for the northern division of its railway system.

PHILADELPHIA, PA.—The $100,000 7 per cent bonds of the Thirteenth & Fifteenth Street Passenger Railway Company, maturing Oct. 1, 1903, will be paid on that date at the Fidelity Trust Company, of Philadelphia, but the holders are given the privilege until Oct. 10, 1903, of exchanging the same for 3½ per cent first mortgage bonds (part of an authorized issue of $500,000, due Jan. 1, 1934, of which $400,000 are 5 per cents), with coupon due Jan. 1, 1904, attached. A payment of $8.75 per $1,000 bond must be made at the time of exchange to adjust accrued interest.

NEWPORT NEWS, VA.—D. G. Porter, a sub-contractor on the Hampton Roads Railway, has filed a mechanics' lien against the property of that company for $11,785.

STAUNTON, VA.—The City Street Car Company has been placed in the hands of a receiver by Judge H. W. Holt, of the Corporation Court, on petition of E. H. Funkhouser. The company has outstanding bonds of $30,000, and defaulted July 1 on interest. The receiver is empowered to run the cars or stop them at his discretion.

CANADIAN NOTES

LONDON, ONT.—A mortgage deed for $1,250,000 has been filed with the Secretary of State at Albany, N. Y., by the London, Aylmer & North Shore Electric Railway Company.

MONTREAL, QUE.—By a vote which represented more than $5,000,000 out of a total capitalization of $6,000,000, the Montreal Street Railway Company has decided to increase its capital stock to $7,000,000, an increase of $1,000,000. The increase is to carry out a plan of extension of the lines and also to provide additional rolling stock.

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AMONG THE MANUFACTURERS

THE CROCKER-WHEELER COMPANY, of Ampere, N. J., has recently issued an interesting pamphlet in which the salient features of the company's generators for railway service are briefly summarized. This publication was distributed at the Saratoga Convention of the American Street Railway Association, where it attracted considerable attention.

THE SOUTHERN CAR COMPANY, of High Point, N. C., recently organized, will succeed the Briggs Car Company, of Amesburg, Mass. The capital stock of the new company is $250,000, and it is now completing a plant which will have a capacity of 300 car-bodies per year. This plant will be thoroughly equipped, and it is expected to have it in full operation this fall. Electric cars of all descriptions will be built, and both Northern and Southern trade will be sought. The officers of the company are: J. Elwood Cox, president; E. A. Snow, vice-president; E. R. Briggs, secretary and treasurer.

THE W. R. GARTON COMPANY, of Chicago, is calling especial attention to the wonderful results obtained from its Ereco insulation. While this material has been on the market for some three years, the manufacturers have devoted considerable time and attention to constantly improving the tenacious and insulating qualities of the material, until they feel that they have reached the point where Ereco insulation has no equal. They are also mailing to the trade a very helpful catalogue illustrating material for armature building and insulation. These are sent to those making application.

THE UNITED STATES LIGHT TRACTION COMPANY, H. L. Stillman, treasurer, West Acton, Mass., will send to readers of the STREET RAILWAY JOURNAL, on receipt of request, a circular describing Stillman's combination tire wheel. The greatest efficiency claimed for this wheel is in its adhesion to steel rails, and also that this and other features make it very suitable for railway companies by enabling them to greatly cheapen construction costs, permitting the installation of railways in places where they would not pay if built in accordance with ordinary methods.

THE COAL-HANDLING MACHINERY installed by the C. W. Hunt Company, West New Brighton, N. Y., at the Lincoln Wharf Power Station of the Boston Elevated Railroad Company, recently lowered the world's record for rapid unloading. The coal was raised 90 ft. above tide-water and delivered to the storage pockets at the rate of 320 tons per hour. The installation follows in general design the standard Hunt steeple tower rig, the moving gear and coal cracker being electrically driven, and the hoisting engine direct connected. The overhang of the folding boom is 40 ft., and the capacity of the shovel 2 tons.

GEORGE W. KNOX, A. M. A. I. E. E., and James Z. George, A. M. A. I. E. E., J. M. A. S. M. E., consulting engineers, Chicago and New Orleans, announce the incorporation of the Knox, George & Company, New Orleans, for the purpose of carrying on their engineering work in the Southern and Southwestern States, Mexico, Central America and the West Indies. Mr. Knox, the president of the company, will retain his offices in Chicago, while the principal offices of the company will be in New Orleans, under the direction of Mr. George, the vice-president and general manager. Knox, George & Company's work will be as consulting, constructing and operating engineers.

THE GOULD STORAGE BATTERY COMPANY announces the following recent contracts: Lexington Street Railway, Lexington, Ky., 256 cells, S-613 elements in S-17 tanks, with a capacity of 480 amps. and 640 amps., respectively. An automatic regulating booster of the Gould type will be installed with this battery. Easton Power Company, Easton, Pa., 255 cells of type S-617 in S-25 tanks, with a capacity of 640 amps. and 960 amps., respectively; also switchboard and regulating booster of the Gould type. This plant is the second installation for this company, after an extended use of the Gould battery and booster. Northampton Power Company, Easton, Pa., floating battery with a maximum discharge of 360 amps. and 600 volts.

A CURIOUS SPECIMEN OF ART IN ADVERTISING is that sent out recently by the Wheel Truing Brake-Shoe Company, of Detroit, Mich. The front page of this circular is covered with what appears to be a combination of Chinese laundry tickets, Egyptian hieroglyphics and Babylonian cuneiform inscriptions. The publishers spared no expense, however, to have the writings translated, and the joyous reader thus finds himself in receipt of a truly Oriental greeting from certain famed rulers of the East. The back of the publication exhibits three great camels stalking across a desert at top speed—probably to get another shipment of the company's noted brake-shoes—while two species of birds well known for their wisdom and gravity look on approvingly.

THE SPEER CARBON COMPANY AT THE CONVENTION.—In the report of the exhibits at the Saratoga Convention published in the issue of Sept. 12 an error was made in referring to the souvenirs issued by the Speer Carbon Company. The souvenirs were of two kinds, one consisting of a pack of cards contained in a handsome leather card-case, while the other was a set of sleeve-buttons. Both of these souvenirs attracted wide attention, and were greatly sought after. By a combination of errors also, the name of one of the representatives of the company at the convention was printed G. P. Tryling, instead of G. P. Fryling. Mr. Fryling is well known to all of the customers of the Speer Carbon Company, and he and Mr. Speer were greatly complimented upon the attractiveness of the exhibit, as well as upon the success which the company is meeting in the sale of its self-lubricating motor and generator brushes for railway work.

STONE & WEBSTER, of Boston, Mass., electrical engineers and managers of lighting, power and railway plants in the West, South and New England, have moved their offices to the India Building, at 84 State Street, Boston. Their former address was 93 Federal Street, which place was occupied by the firm after the disastrous fire which overtook them at 4 Postoffice Square. The

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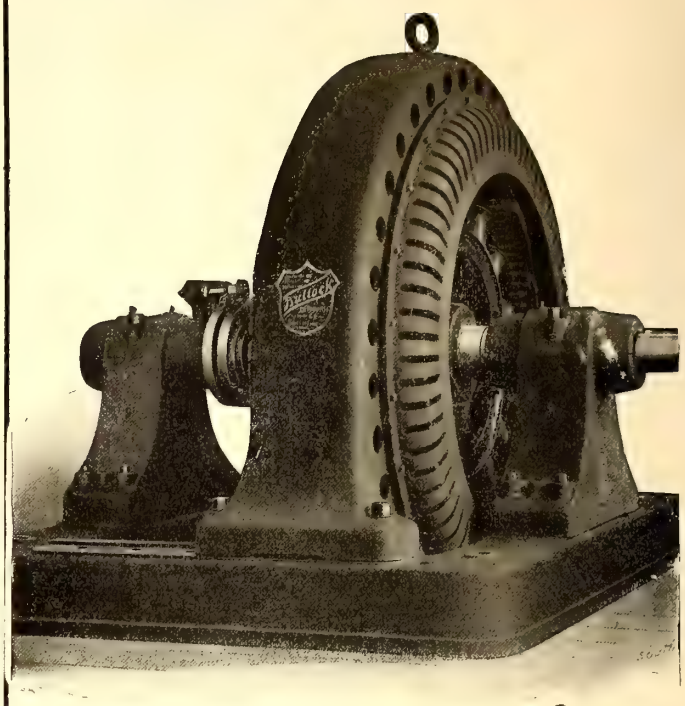
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new offices occupy the ninth and tenth and half of the eleventh floors of the building, and command a superb view of Boston harbor. The entrance is on the tenth floor, which contains the private office of the firm, members of the executive committee, securities, corporation and accounting departments, office boys, etc. The ninth floor contains the engineering and drafting departments, auditing, purchasing, insurance and department of investigation and statistics. On the eleventh floor are found the Fort Hill Chemical Company, the Columbia Improvement Company and the office library.

THE ELECTRIC STORAGE BATTERY COMPANY, of Philadelphia, has recently closed contracts for the installation of batteries of the "Chloride Accumulator" for the Indianapolis & Northern Railway at Sulphur Springs, Ind., making seven batteries operated by this company and an increase in the battery already installed for it at Broad Ripple, Ind.; an increase in the two batteries recently installed for the Los Angeles Railway, Los Angeles, Cal., and an installation for the Northwestern Elevated Railway, of Chicago, Ill. Four new batteries have been contracted for by the Chicago Edison Company, making thirteen batteries operated by this company; an installation for the Paterson Edison Company, Paterson, N. J.; the second battery for the Los Angeles Edison Company, Los Angeles, Cal., and an additional battery for the New York Edison Company, which makes twenty-two batteries operated by the last company. Isolated lighting and power plants are being installed for the Murphy Building, and for Wm. P. Stevenson, at Detroit, Mich.; Alexander Winton, Cleveland, Ohio; F. T. F. Lovejoy, Pittsburg, Pa.; the House of the Good Shepherd, Roxbury, Mass., and for the Irving Building, Louisville, Ky.

SUIT WON BY JOHN A. BRILL.—In the suit brought by John A. Brill against the North Jersey Street Railway Company in the Circuit Court of the United States for the District of New Jersey, for an injunction to prevent the use of trucks built by the Peckham Motor Truck & Wheel Company, which were claimed to infringe patents owned by Mr. Brill, a decision was handed down on Aug. 28 fully sustaining the patents. The defense of the case was assumed and carried on throughout by the Peckham Company through its own counsel, Duell, McGrath & Warfield. Mr. Brill was represented by Francis Rawle, Edmund Wetmore and Joseph L. Levy. The patents involved were No. 627,898 (thirty-nine claims) and No. 627,900 (four claims), both dated June 27, 1899, which patents cover the system of spring-suspended semi-elliptic spring equalizers of the Brill center-pivotal truck, No. 27-G. The Peckham trucks in controversy were those known as No. 14-B-3 and No. 16. The case was tried before Judge Bradford, district judge for the District of Delaware, to whom it was especially assigned. The argument lasted four days, and the case was thoroughly fought out. The court fully sustained all the claims of both patents that were urged on behalf of the complainant, and awarded a preliminary injunction enjoining the railway company from the use of the trucks, and directing an account of profits to be taken.

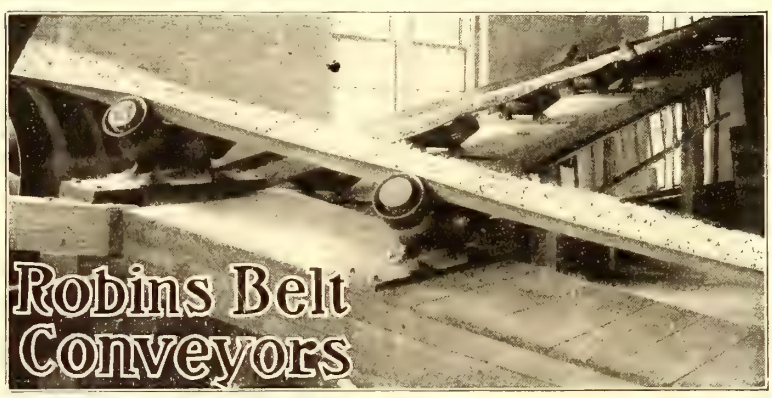
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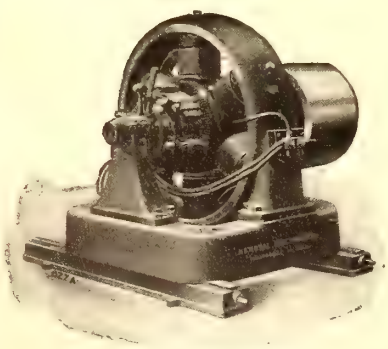
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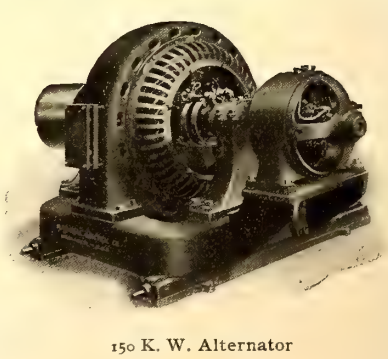
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NEWS OF THE WEEK

CONSTRUCTION NOTES

ANNISTON, ALA.—It is understood here that plans are forming for the construction of an electric railway from Pyriton to Lineville, a distance of 7 miles.

MOBILE, ALA.—It is stated that the special committee which has for some time had under consideration the application of W. K. P. Wilson and associates for a franchise for the construction and operation of an electric railway had drafted and adopted by unanimous vote an ordinance granting said franchise to the best bidder.

LAKEPORT, CAL.—A franchise for the proposed electric railway has been ordered granted to L. H. Boggs. The ordinances will be submitted at the October meeting of the Supervisors.

LOS ANGELES, CAL.—Bids are to be asked for the sale of a franchise for an electric railway beginning at the corner of Main and Jefferson Streets and running south on Main Street to Moneta Avenue, and thence along Moneta Avenue to the south city limits. Property owners have asked that the franchise be offered for sale.

LOS ANGELES, CAL.—The Los Angeles & Glendale Electric Railway Company has petitioned the City Council to offer for sale an electric railway franchise on Los Angeles Street, from Sixth to Ninth Streets. Such a franchise would tap the heart of the wholesale district.

LOS ANGELES, CAL.—The property recently acquired by the Huntington syndicate from the Los Angeles Traction Company is to be completely rehabilitated. An idea of the thoroughness of the work to be done is shown by the fact that an authoritative estimate of the changes places the cost at $1,000,000. Work has already begun.

LOS ANGELES, CAL.—From Ventura comes the information that Mr. Huntington's electric railway surveyors are in that vicinity. It is reported that Huntington interests have acquired all the property of Ventura's little horse car line, with 1½ miles of track, from its long-time owner, George C. Power. This line runs through the main street of Ventura. It is also known that the Power people have within the past year secured most of the race track property on the ocean front near town, comprising over 20 acres, and ideally adapted to shop and power-house uses.

LOS ANGELES, CAL.—Contracts for grading and other construction have been let by L. C. Brand for the Los Angeles & Glendale Electric Railway Company, and the completion of the line is promised within five months. The contractors are Robert Sherer & Company, who have been doing work of a similar character for the Pacific Electric Railway Company. The contract price is said to be about $47,000. The road will be double track, standard gage, and about 10 miles long. About 3 miles of the road will lie outside the city. Power will be supplied by the Kern River Power Company. The road traverses a great berry district, and its franchise allows it to carry freight. H. E. Huntington is reported to have his watchful eye on the project, inasmuch as it reaches off toward Santa Barbara. Work on the line is now under way.

LOS ANGELES, CAL.—Los Angeles capitalists are heavily interested in the Fresno Traction Company, which has just been organized and incorporated in Fresno County, with a capital stock of $5,000,000. The incorporators are: W. G. Kerckhoff, A. C. Balch, H. P. Baumgartner, W. E. Durfee, of Los Angeles; A. G. Wilson, of Fresno. From this list of organizers it may be presumed that H. E. Huntington is vitally interested in the venture. Mr. Kerckhoff is the president of the Huntington-Hellman Pacific Light & Power Company, of Los Angeles, and Mr. Balch is his principal lieutenant, while Mr. Wilson is manager of the syndicate's Fresno street railway properties, recently acquired. When completed it is said that the new lines will be part of the Huntington Electric Railway system from Los Angeles to San Francisco. According to the charter, the promoters propose to build 196 miles of electric railway. Besides several extensions to the present city lines of Fresno, there are planned interurban lines as follows: From Fresno to Wawona, 79 miles long, via Clovis and Crane Valley (it is in this latter place that the San Joaquin Power Company has its storage reservoirs); from Fresno to Selma, via Reedley, Sanger and Dinuba, and back to Fresno; from Fresno to Trimmer's Springs, near the mouth of King's River Canyon; from Fresno, out Cherry Avenue, through Fresno, Central and Washington Colonies.

PASADENA, CAL.—The Pacific Electric Railway Company wants to build an extension on Illinois Street between Los Robles and Lake Avenues, and a citizens' petition begs the City Council to grant a franchise.

SANTA BARBARA, CAL.—The Santa Barbara Consolidated Railway Company has been granted a franchise to operate an electric railway between Santa Barbara and Ortega. The line to Summerland will be but a small part of a system which the company intends to place in operation in Santa Barbara County. Within a short time an application will be made for a franchise for a road from Santa Barbara to the Hope Ranch, it being the intention of the company to run its line along the foothills in the western limits of the city and connect with the old Southern Pacific right of way, along the Modoc Road, to the ranch. The company, it is announced, will shortly make application to the City Council for a franchise along the East Boulevard to the eastern limits of the city.

SAN JOSE, CAL.—The contractors are making rapid progress in constructing the electric railway from San Jose to Saratoga and Los Gatos. Ballasting to Saratoga has been completed; the big cut through the hill near Saratoga is finished, and the graders have reached a point 2 miles beyond in the direction of Los Gatos. All the material for construction is here ready for use.

PUEBLO, COLO.—The Rapid Transit Company has let a contract to the Beulah Construction & Realty Company for the construction of an electric railway to Beulah, 30 miles west of Pueblo. The survey for the road has been completed to within a few miles of Beulah. The road will be standard gage, so that the cars will be interchangeable with the other roads entering the city. It is expected that the work of construction will begin at an early date.

ANSONIA, CONN.—The contract for extending the double-track of the Naugatuck Road from Ansonia northward has been awarded to the J. J. O'Brien Contracting Company. The tracks are to run north 3 miles from Ansonia, and the work will be started in about a month. It will be six or eight months, it is expected, before the work is completed.

NORWICH, CONN.—At an important meeting of the directors of the Groton-Stonington Street Railway Company, held in Norwich, a committee was selected to engage an engineer to begin the construction of the road, and another committee was appointed to secure the necessary rights of way. The subscription books were closed, as it was decided that all the stock had been taken up, with the exception of a few individual shares. The working plans and specifications will be prepared immediately when it is expected there will be no further obstruction in the way of beginning the road. The street railway company has secured the Randall wharf property at Mystic, owned by the Standard Machine Company, as a site for the new power house. It consists of a tract of land 225 ft. in length, and 150 ft. in width.

DOVER, DEL.—A contract has been awarded to the Tennis Construction Company for building the electric railway from Chesapeake City to Elkton, Md. The ultimate aim of the parties who control the line is to build a connection at the State line, with an extension via Newport, Del., Stanton and Newark, Del., and from Chesapeake City to Fredericktown, across the Sassafras River, to Chestertown, Md., with a branch probably from Chesapeake City to Middletown, Del., thus completing a circuit via Delaware City and New Castle to Wilmington, Del. If this last arrangement is carried out, the line will undoubtedly be continued down the State to Smyrna, and thence on through to Rehoboth, giving the entire peninsula a complete electric railway for freight and passenger business.

CARNESVILLE, GA.—John S. Dortch, of this city, is interested in the construction of the proposed electric railway from Athens to Carnesville. The people of Carnesville have already raised $15,000 for this road, and Athens is expected to raise $10,000.

BUFORD, GA.—The Winding Shoals Electric Power Company was recently incorporated at Buford, to install a 6000-hp hydro-electric plant on the Chattahoochee River, 4 miles west of Buford. A portion of the power will be utilied by the local factories in Buford, which is the center of the largest leather manufacturing district in the South. The Atlanta, Buford & Gainsville Railway, for which a survey is now being made, may take some of the power; the balance of the power, it is intended to transmit to Atlanta and surrounding towns. J. W. Peterson, president of the Electric Equipment Company, 939 Monadnock Block, Chicago, is one of the officers of the company, and has personal charge of the engineering details in connection with the work. The Electric Equipment Company is preparing the plant, and specifications, and will soon be ready to receive bids for the machinery, equipment and construction work.

CHARLESTON, ILL.—Articles of incorporation have been filed at Springfield by the Charleston, Champaign & Northern Interurban Railway Company. The principal offices will be at Charleston, and the capital is $10,000. The road is to be constructed from Charleston, Coles County, to Homer, Champaign County. The incorporators and first board of directors are: W. R. Patten, W. F. Jenkins, J. B. Mitchell, C. L. Lee and J. L. Shisand, of Charleston.

EAST ST. LOUIS, ILL.—Articles of incorporation have been issued in Springfield, Ill., for the East St. Louis & Columbia Electric Railway Company, of East St. Louis. The capital stock is $25,000. The incorporators are: Thomas M. Chase, J. P. Meyer and John Pickham. It is said to be the intention of the incorporators to increase the capital stock to $2,800,000, and to build a railway from East St. Louis to Columbia and later to extend it to Chester, Ill.

MARSEILLES, ILL.—The Streator Manufacturers' Railway has been incorporated to build a railroad from Ottawa, Ill., to Marseilles and to Streator. The capital stock is $25,000, and the incorporators are: Frank R. Davidson, John F. Clark, Charles H. Adams and others.

MOLINE, ILL.—The Mississippi Valley Traction Company has been incorporated, with a capital stock of $600,000; the line is to be constructed from Moline to and around Campbell's Island, Rock Island County, and to Sterling, Whiteside County, and Genesco, Henry County. Incorporators and directors: William P. Kopf, E. Scott, H. W. Nichols, Jr., Frederick W. Hill and Albert J. Claussen, Chicago.

BLOOMINGTON, IND.—The Bloomington & Bedford Traction Company is surveying a line through the Oolitie stone belt to connect Bloomington and Bedford. The company has secured franchises and rights of way for nearly the entire route.

CAMBRIDGE CITY, IND.—The Richmond Street & Interurban Railway Company will in the spring convert the Red Whitewater Division of the Big Four from Hagerstown to Connersville into a traction line. The officials of the interurban company, with several of the stockholders, took a trip over the line recently in a motor car, examining the bridges and roadbed, and were pleased with the condition of the road.

ELKHART, IND.—It is said that the work of grading for the St. Joseph Valley Traction Company's line from Lagrange to Elkhart will be begun about Oct. 1 at the Lagrange end.

INDIANAPOLIS, IND.—The Hoosier Power & Traction Company, of Vincennes, has been incorporated with a capital stock of $50,000, to construct an electric railway through Knox County, Daviess County, Martin County, and Orange County. Directors: O. N. Greist, H. H. Crooke, W. L. Stoy and others.

KOKOMO, IND.—It is stated that the City and the Union Traction Companies are having plans prepared, and will soon ask bids for constructing a bridge at Union Street. Probable cost $17,000.

LAFAYETTE, IND.—The building of the Northwestern Traction between this city and Frankfort is progressing rapidly. The ties are down and track laid from Lafayette to Dayton and a mile beyond. Only 6 miles of uncompleted track remain between Dayton and Frankfort. Ballasting and the stringing of wires are being kept right up with track laying. Mr. Reids says it is his intention to have cars running on this line by Dec. 1.

MUNCIE, IND.—A site has been purchased on South Mulberry Street by the Indiana Union Traction Company for a large union terminal station for the seven interurban roads centering in this city. The building will be a stone structure five stories high. The contract for construction has been let to Fred Illingsworth & Company and work is to begin at once.

NOBLESVILLE, IND.—Cars on the Indianapolis Northern Traction Company's lines are now running between Noblesville and Tipton. A gang of more than one hundred men are now engaged in putting up the trolley wire between Noblesville and Indianapolis, and the work is being done at the rate of 2 miles a day. With favorable weather connection will be made with Broad Ripple within ten days, and the officials of the company say the entire system will be in operation between Indianapolis and Kokoma before the end of October.

PRINCETON, IND.—The Evansville & Princeton Interurban Company is securing the right of way for an extension of its line northward toward Terre Haute via Vincennes, Bicknell, Freelandsville and Oaktown, paralleling the E., T. & H. Railroad through Sullivan and Vigo Counties.

RUSHVILLE, IND.—The J. A. Schumacher Company, of Indianapolis, has begun work on the excavation for the power plant, car houses and repair shops of the Indianapolis & Cincinnati Traction Company. Work on the grading of the line is progressing rapidly, and will probably be completed by Dec. 1.

SOUTH BEND, IND.—Representatives of the Indiana Union Traction Company are negotiating for the Niles extension of the Indiana Railway Company and the franchises and right of way of the Indiana Western, another branch. It is said that the company also seeks to acquire all the interests of the Indiana Railway Company from South Bend to Goshen, to form an important connecting link for a line from Cleveland to Chicago.

TERRE HAUTE, IND.—The County Commissioners have granted a franchise to the Western Traction Company to build an electric railway from the south line of the county to Terre Haute. Samuel Williams, of Vincennes, is president of the company.

CEDAR RAPIDS, IA.—Col. W. G. Dows and Isaac B. Smith, of Cedar Rapids, who are now engaged in constructing the Cedar Rapids, Iowa City & Southern Interurban Railway, are considering plans for the construction of another interurban line. This new line will be built in a northwesterly direction from Cedar Rapids, through Linn, the objective point being Waterloo, the county seat of Black Hawk County. The line will be constructed about half way between the Decorah and the Minneapolis & St. Paul Divisions of the Chicago, Rock Island & Pacific Railroad, through Linn, Benton, Buchanan and Black Hawk Counties, and will be about 54 miles in length. It is stated that financial arrangements have already been made, and that the work of constructing the line will commence in the spring.

DAVENPORT, IA.—The Tri-City Railway Company has purchased a strip of land 804 ft. by 300 ft. on the south side of East River Street, just east of the White yards. The new car houses are to be constructed on this tract. The work of building them will commence within the next few weeks.

KEOKUK, IA.—The new interurban electric railway from Keokuk to Hamilton and Warsaw, Ill., has been completed by the Keokuk Electric Railway Company, and is now in regular operation. The line is about 7 miles in length. Power is furnished from the power house of the company at Keokuk. Freight, baggage, express and mail will be handled by the company.

LE MARS, IA.—Arrangements have been completed for the construction of the Le Mars-Sioux City Interurban Railway, and the greater part of the necessary capital has been raised. The promoters are considering the plan of using gasolene engines for motive power in place of electricity. Each car will be equipped with a gasolene engine. Franchise elections will be held in Le Mars, Merrill and Sioux City within the next few weeks. The people of all three cities are in favor of the line, and there is no doubt but that the franchises will meet with success at the polls.

SIOUX CITY, IA.—The Sioux City Traction Company has completed its new stone and brick car house at Third Street and Water Street. The new car house extends over the alley which formerly separated the old barn from the power house. Forty-five cars may be housed in the new car house, making the total car house capacity seventy-five. The company is rushing the completion of its special track from the Water Street intersection to the new West Third Street bridge. So soon as the deck of the new steel bridge shall be erected the company will lay its track and run its cars across without waiting for the bridge to be finished. The old Jackson Street cars, which are built upon standard-gage trucks, will be used on the West Third Street line until new cars can be built.

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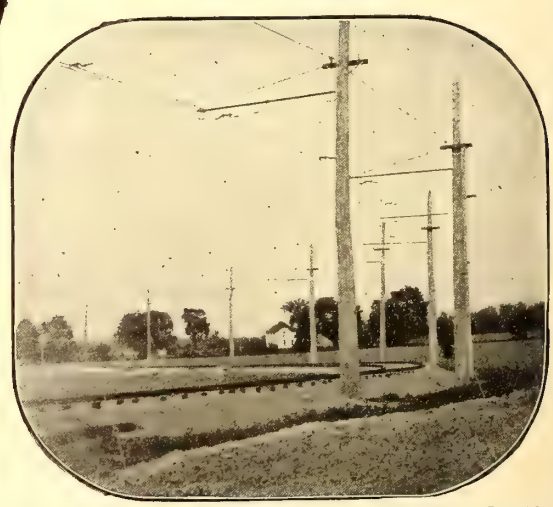
The following are some of our sales this season:

	GUARDS		GUARDS
Aurora, Elgin & Chicago Ry.	120	South Bend and South Mich. Ry.	27
Stark Co. Electric Ry.	100	Cleveland & South-western Traction Co.	50
Long Island R. R.	50	The Falk Co.	25
Rochester & Eastern Rapid Ry.	70	Southwest Missouri Electric Ry.	25
Canton & New Philadelphia Ry.	90	Chicago, Bluffton & Cincinnati R. R.	200
Rock Island System	50	Rockford and Freeport Electric Ry.	50
Vandergrift Construction Co	25	W. R. Grace & Co., FOR LIMA, PERU	56
Oneida Construction Co.	30	C. M. & St. P. R. R.	50

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SIOUX CITY, IA.—Negotiations have been pending for the purchase by the Sioux City, Homer & Southern Railway Company of a right of way across the Winnebago and Omaha Indian reservations. This seems to point to the certainty of the extension of the line from Homer to Omaha. The Omaha Northern Railway Company owns a right of way over these reservations, but has never done anything as yet to construct the line from Omaha to Sioux City. It is stated that Mr. Talbot, president and promoter of the Sioux City, Homer & Southern Railway Company, has offered the officials of the Omaha Northern a good price for the right of way. The work on this electric railway from South Sioux City to Homer is progressing slowly. The company has been handicapped by lack of material. Several car loads of steel rails and ties have been received by the company at Sioux City, and it is hoped that the work of construction can be rushed.

KANSAS CITY, KAN.—There is a project forming of building an electric line from Kansas City to Jefferson City and thence to the lead and zinc fields of Missouri. This information has been given out by P. H. Coney, an attorney, of Topeka, Kan., who has been working on the plan for some time. He says that St. Louis capital is back of the scheme. The road will handle freight and passengers.

LOUISVILLE, KY.—The Louisville & Southern Indiana Traction Company has leased 10 acres of land adjoining Glenwood Park on the north and will make extensive improvements to that popular pleasure resort. A lake will be provided for boating and fishing parties by damming Silver Creek, additional buildings will be erected, and numerous flower beds will be planted.

LOUISVILLE, KY.—It is said that at the next meeting of the Board of County Commissioners, in New Albany, the Louisville & Southern Indiana Traction Company will petition for a right of way through the county for an electric railway from New Albany to Paoli and French Lick and West Baden Springs. The company, it is understood, will take up the franchise that has just been abandoned by the New Albany, Paoli & French Lick Valley Traction Company, and construct the road to Paoli, where it will connect with the proposed line of the Louisville & Southern Indiana Traction Company, from Corydon to the Springs by way of Wyandotte Cave and White Sulphur Wells, in Crawford County. The franchise of the New Albany Street Railway Company, which recently passed into the hands of the Louisville & Southern Indiana Traction Company, gives that company a right of way into the city of New Albany, and all that will be required for the construction of the proposed line will be a right of way through Floyd and Orange Counties.

BALTIMORE, MD.—William P. Lyons, of Baltimore, has been appointed co-receiver of the Washington, Baltimore & Annapolis Railway Company.

BURLINGTON, MASS.—The town of Burlington has instructed the Board of Selectmen to grant a location to the Middlesex Street Railway Company, which proposes to construct a line between Arlington and Lowell, with rails in Arlington, Bedford, Burlington and Billerica. The route, so far as possible, will be over private land and a double track will be laid. The petition, with regard to Burlington, asks for a franchise along the easterly side of the old turnpike, so-called on private land.

NAHANT, MASS.—The voters have decided in favor of an electric railway at a special election held to give them an opportunity to show their preference on the question whether or not the Selectmen should grant a franchise for an electric railway. With this decision of the voters it is now said the Selectmen will meet and consider the propositions of the two rival companies, with the indications that a railway will be built very soon.

PLYMOUTH, MASS.—At a meeting of the directors of the Plymouth, Carver & Wareham Street Railway Company, held in Middleboro, it was voted to call for a 10 per cent assessment of the capital stock, this being the next step toward incorporation of the company, it being necessary under Massachusetts statutes to have 10 per cent of the capital stock paid into the treasury before a charter is granted. The company is moving right along, and construction should be completed in time for the busy season next year.

SPRINGFIELD, MASS.—The Springfield Suburban Street Railway Company has asked the Railroad Commission to approve locations over private way in Springfield, Wilbraham and Ludlow.

WORCESTER, MASS.—The Boston & Worcester Street Railway Company is to build an addition to its car house at Westboro, doubling the capacity. The car house now has a capacity of twenty cars.

BENTON HARBOR, MICH.—Right of way is being secured for an electric railway from Benton Harbor to South Haven via Riverside, Pottawatamie Park and Colma. Mr. Mueller, a Chicago lumberman, owns a large part of the property necessary for the right of way, and it is reported that he offers to donate land for the power house, besides a liberal cash donation when the road is completed. This will make a short line between the points mentioned, and will also tap all of the numerous summer resorts along the lake shore.

LANSING, MICH.—Maps have been submitted to the Commissioner of Railroads showing the route of the proposed line of the Ohio & Michigan Electric Railway, which will be built from Toledo to Ann Arbor.

TRAVERSE CITY, MICH.—The Common Council, of Traverse City, has granted a franchise for an electric railway to L. K. Gibbs and his associates. They will proceed immediately to organize the Traverse City Peninsular Railway Company, and will build a line from Traverse City to Old Mission resort, and it is stated that the road will be completed and ready for operation on or before July 1, 1904.

JEFFERSON CITY, MO.—Articles of incorporation have been issued to the St. Louis & Valley Park Railroad Company, of St. Louis. It is capitalied at $150,000, with W. H. Langsdale, Jr., S. L. Langsdale, H. S. Doyle, John E. Bishop and Thomas H. Cobb, all of St. Louis, as the incorporators. An electric railway is to be built from St. Louis to the Jefferson County line and from Fenton to Valley Park, all in St. Louis County. The length of the proposed line is 15 miles.

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ATLANTIC HIGHLANDS, N. J.—The New Jersey Central Traction Company, which has an application before the Atlantic Highlands Council for a franchise, is rapidly pushing the work of building the line between Keyport and Red Bank.

TRENTON, N. J.—The fight between the Camden & Trenton Railway and the Pennsylvania Railroad Company over the Cass Street crossing is still on. For weeks the railroad company has had one or more locomotives and a gang of men near the spot night and day for the purpose of heading off any attempt upon the part of the trolley company to cross. The Camden & Trenton Company has offered to put in block signals and derailing switches, to be operated from a tower, but the Pennsylvania wants it to put up a $20,000 bond besides.

LOWVILLE, N. Y.—It is expected that the Lowville & Beaver River Railroad Company will organize permanently within a few days. At a recent meeting of the company more than 10 per cent of the capital of $150,000 was subscribed, and it is expected to raise the entire capital stock before construction work is begun. The company has already filed articles of incorporation with the Secretary of State. Ten and one-half miles of line will be constructed. F. S. Easton, who is interested in the company, is of the opinion that construction work will be begun next spring.

MIDDLETOWN, N. Y.—It is understood that negotiations are on for the extension of the power lines of the Honk Falls Power Company from Ellenville to Middletown, a distance of more than 20 miles, so as to supply power to both the Middletown-Goshen Electric Railway Company and the Consumers' Light & Power Company. Honk Falls is situated on the Rondout Creek, about 2 miles from Ellenvile. Nothing is said of any plans to increase the capacity of the plant.

NEW YORK, N. Y.—The Pennsylvania Railroad has called for bids for the work on the construction of tunnels under Manhattan and the North River. The contractor's bond will be 10 per cent of the amount of his bid. The railroad reserves the right to reject any or all bids. Bids are also asked for construction of tunnels under Bergen Hill and North River, and for the construction of tunnels under Manhattan, East River and Long Island City under the same conditions.

SYRACUSE, N. Y.—The Syracuse & Suburban Railroad Company has been placed in operation to Jamesville.

SYRACUSE, N. Y.—General Manager Connett, of the Syracuse Rapid Transit Company, announces that the difficulties between it and the Syracuse & Ontario Railway Company over the franchise for a line to Oswego have been settled, and that the company will soon be ready to take up the work aggressively. The company has recently been granted an extension of time until June 1, 1904, in which to begin the construction of its lines in Oswego.

BELLEFONTAINE, OHIO.—The Columbus, Marysville & Bellefontaine Railway has secured right of way to a point within 6 miles of this place. W. H. Luchtenberg, of Columbus, the chief promotor, states that work on the line will start in the near future.

GREENVILLE, OHIO.—The People's Rapid Transit Company has secured a franchise in this place. The company will build a line from Toledo to Greenville.

CINCINNATI, OHIO.—The Cincinnati, Dayton & Toledo Traction Company will install a new generating unit at its Spring Grove Avenue power house, and it is probable that a new power house will be erected at Hamilton to improve the condition of the city service. The Southern Ohio Express Company, which operates over the Cincinnati, Dayton & Toledo, is negotiating for a store in the downtown section of the city, which will be used for an express terminal. The company made a proposition to utilize the new station of the Interurban Railway & Terminal Company, but the latter company decided its station was too small to do double service.

CLEVELAND, OHIO.—Owing to an error it was reported in the Street Railway Journal of Sept. 26 that sleeping cars had been placed in service Sept. 15 on the interurban line between Indianapolis, Ind., and Columbus, Ohio. Later advices state that the sleepers have not yet been placed in service on account of certain bridges, but probably will be as soon as this difficulty is overcome.

MARTINSBURG, OHIO.—Frank Elliott and Dr. F. Shrontz, of Martinsburg, are securing the right of way for a proposed electric railway from Mount Vernon to Mansfield.

NEWARK, OHIO.—The Newark, Martinsburg & Mount Vernon Traction Company has amended its articles of incorporation to authorize the construction of branch lines through Martinsburg, Gambier and Wooster.

TOLEDO, OHIO.—The franchise ordinance granting a twenty-five-year franchise to the Toledo Railways & Light Company, which has been vetoed by the Mayor, was tabled at the last Council meeting, after the most sensational session in the history of the city. An immense crowd of citizens filled the chamber, the corridors and overflowed into the streets. Red fire was burned freely in the streets and several glass doors in the chamber were broken. The ordinance was finally tabled, as the Council, which is in favor of passing the grant, feared the crowd. The company's solicitor made an address, in which he announced that the company wold not accept the ordinance in its present form, even if the Council succeeded in passing it.

GUTHRIE, OKLA.—Construction work on the Oklahoma City-Guthrie Interurban Railway, being built by the Oklahoma Traction Company, has commenced. The road will be 33 miles in length, and will cost $1,000,000; $12,000 has already been expended for a right of way, and $28,000 in grading terminals. A street railway system 6 miles in length will be built in Guthrie and a connection made with the interurban between Oklahoma City and Guthrie.

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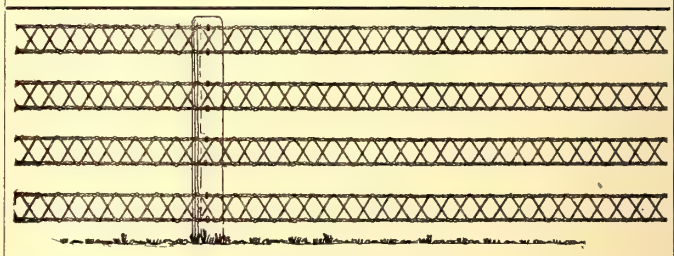
Indianapolis, -	Ind.	Peru, - - -	Ind.
Lafayette, -	"	New Castle, -	"
Elwood, - -	"	Connorsville, -	"

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PORTLAND, ORE.—President Furth, of the Seattle-Tacoma Electric Railway Company, admits that the ultimate purpose of the company is to extend its lines to Portland, but says that the building of the line depends somewhat on the completion of the company's power plant at Electra.

BEAVER, PA.—The Beaver Valley Traction Company will extend the Morado line to Homewood, and may extend the Monaca line to Aliquippa Park. Surveys for both extensions have been made. Work has been started on the Vanport extension. There are some heavy grades along the proposed Aliquippa extension. It is reported that the company will build an extension to Ellwood City.

CHAMBERSBURG, PA.—Residents of Chambersburg, St. Thomas and Fort Loudon have organized the Chambersburg, St. Thomas & Fort Loudon Electric Railway Company, with John R. Eberly, president; Frisby Miller, secretary, and F. G. Strock, treasurer, all of St. Thomas. S. S. Emery, in addition to being a director, will be constructor of the road and sole purchasing agent. An application for a charter has been filed at Harrisburg. The capital stock will be $300,000. The road will run from Chambersburg to St. Thomas and thence to Fort Loudon, with probably a spur to Mount Parnell.

CONNELSVILLE, PA.—A charter has been granted the Monongahela & Clairton Street Railway Company. The incorporators of the new company are: Paul W. McCully, W. P. Whitledge, John G. Parke, Jr., Cullin Armstrong, Wm. H. Lewis, B. W. Castner, John W. Ailes, Wm. H. Binns, J. N. Mullin and Oliver S. Scott. The capital stock of the company is $75,000. The route begins at Black Diamond Hollow, and will run through Monongahela upon some route yet to be agreed upon, and will connect at Clairton with the street railway system in course of construction by Pittsburg capitalists, making a continuous line from Donora to Pittsburg. The headquarters of the new line will be in Monongahela. The directors are as follows: B. W. Castner, John Ailes, Paul McCully, John G. Parke, Jr., and William H. Binns. J. N. Mullin will be president of the new company, Oliver S. Scott is secretary, and Herbert Ailes is treasurer. An ordinance will shortly be presented to the Monongahela Councils asking a right of way through the city.

DOYLESTOWN, PA.—The Doylestown Borough Council has been notified that it violated the law in repealing the franchise granted to the Doylestown & Newhope Street Railway Company last year. For some months the road has been laying quiet, but it seems that the company had complied with the legal terms of the ordinance, and as a consequence it holds good for another year. It is not probable that the line will be built this year, as President Boroughs Michener was one of the directors in the defunct Doylestown National Bank, and this may have disarranged the financial end for the time being.

EASTON, PA.—The Philadelphia & Easton Railway will soon have 3000 tons of coal at the Raubsville power house, 6 miles below this city, and cars will be started to that point. There is a break of 1 mile in the line below Raubsville, but this will soon be closed, so that cars can be run to Durham Furnace, about 12 miles down the Delaware River. The 10-mile break between Durham and Tohickon will be closed before next summer. A force of men will be put to work this month, and if the weather does not become too severe will be kept busy grading and putting down track all winter. There are no great obstacles to overcome between Durham and Tohickon. Between Durham and Easton the road is carried high along the face of the cliffs for miles, and it was necessary to blast out rock for miles to secure a foothold.

GILBERTON, PA.—The Town Council has filed a bill in equity to restrain the Schuylkill Traction Company from laying its tracks above the established grade of the streets, and from constructing any additional turnouts. The rule is made returnable Oct. 4.

HARRISBURG, PA.—Under the ordinance just passed by Council the Central Pennsylvania Traction Company will shortly begin the following new work: Double tracks, Derry Street, from Thirteenth Street to Eighteenth Street; Second Street, from Chestnut Street to Maclay Street; Sixth Street, from Reily Street to the northern limits of the city. Extensions, on Market Street, from Thirteenth Street to the eastern limits of the city; on Camerai Street, from State Street to the northern city limits; on Thirteenth Street, from Derry Street to Berryhill Street; on Eighth Street, from Market Street to Walnut Street; on Reily Street, from Sixth Street to Seventh Street; on Maclay Street, from Second Street to Fourth Street. The company has accepted the provisions of the ordinance providing for the payment to the city by the company annually of 3 per cent of its gross receipts.

KENNETT SQUARE, PA.—According to present plans, and at the rate work is being pushed, the West Chester Street Railway Company will have its cars running to this borough before Christmas. Rails are expected within a few days, 20,000 ties have been purchased, and the grading is completed, the last work having been done near Pocopson.

OXFORD, PA.—The Town Council has granted the right to lay tracks to the West Chester, Kennett & Wilmington Electric Street Railway Company. The projectors promise to have the road in operation by the new year.

PITTSBURG, PA.—Officials of the Pittsburg, McKeesport & Connellsville Street Railway Company and the Pittsburg Railways Company have come to terms whereby the Connellsville Company secures possession of Walnut Street from Fifth Avenue to Sixteenth Avenue in McKeesport. The ordinance granting the Connellsville Company a right of way on Shaw Avenue, between Walnut and Locust Streets, at McKeesport, to complete its lines from the Youghiogheny Valley towns direct into the heart of McKeesport, has been passed by the McKeesport Councils, and Mayor Falkenstein has declared his intention of signing the bill.

POMEROY, PA.—The Brandywine Electric Railway, in which E. A. Tennis, of Philadelphia, is interested, has graded 2 miles of roadbed at this place. President A. H. Swing says that work will be started in Coatesville within another week. The company has filed extensions through Parkesburg and westward to Atglen and the Chester County line. Just what action the

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Philadelphia & Western or the Coatesville & Lancaster Companies, which propose to build lines through this same territory, will do remains to be seen.

SUNBURY, PA.—Officials of the Shamokin Extension Railway Company conferred last week with Irish Valley property owners regarding a trolley line between Shamokin and Sunbury. Many offers of free rights of way through Irish Valley were made. Two other routes are under consideration, via, Trevarton, and via Paxinos and Snydertown. The route will be finally decided upon in the near future.

WEST CHESTER, PA.—The West Chester Street Railway Company, through Thomas E. O'Connell, contractor, has opened a stone quarry near Alton Station, in East Bradford Township, and from this quarry will be taken the stone to ballast the road between Downingtown and Coatesville, 6 miles. The line between West Chester and Downingtown, 8 miles, is well ballasted and in first-class condition.

WILKESBARRE, PA.—It is stated that engineers have been surveying a route for the Wilkesbarre & Hazleton Electric Railway from Ashley to the Market Street terminal of the Lackawanna & Wyoming Valley Electric Railway. This would mean a continuous third-rail electric railway from Hazelton to Scranton and Carbondale. The line surveyed would enable the Hazelton-Wilkesbarre system to enter this city over its own tracks, avoid grade crossings, and to protect its tracks the entire distance. The route has been twice surveyed, and found to be entirely feasible. It is expected to connect the two systems by April 1.

CHATTANOOGA, TENN.—The Chattanooga Electric Railway Company has a large corps of men at work investigating and securing estimates on the amount of improvements to be made on the different lines of the company. It is said that during the next six months the road is to be entirely rebuilt in many places.

MEMPHIS, TENN.—The Memphis Street Railway Company will extend its line from Buntyn, a suburb of Memphis, to Colliersville, Tenn., a distance of 18 miles.

MEMPHIS, TENN.—The Legislative Council has received two reports on the new franchise application, one a majority and one a minority. From the standpoint of the applicants for a franchise, neither report is satisfactory, and the outlook for the new company is gloomy. Neither report was adopted by the Council, but the whole matter was referred to some future session, in order, as was stated, that there might be time for deliberation and that the opinion of the public upon the questions presented by the reports might be learned.

TRENTON, TENN.—The Gibson County Construction Company has been organized for the purpose of constructing an electric railway from Trenton to Eaten, Brazil and Gibson Wells. The projected route is about 17 miles long. A survey is to be made at once.

FORT WORTH, TEX.—The Northern Texas Traction Company has completed its new line to Polytechnic College Heights.

FORT WORTH, TEXAS.—At a special meeting of the Council of North Fort Worth Sam Rosen was granted a franchise for a 2-mile street railway, to commence at the corner of Twenty-Fifth Street and North Main Street, and run up Twenty-Fifth Street in a westerly direction to the city limits of North Fort Worth. It provides that the construction of the line is to be commenced within ninety days, and is to be completed within six months. The territory covered is between Rosen Heights and North Fort Worth. Mr. Rosen announced that work would be commenced as soon as the material could be secured. Gordon & Haperistein, of Beaumont, will be interested with Mr. Rosen in the enterprise.

SALT LAKE CITY, UTAH.—The Consolidated Railway & Power Company has decided to extend its lines south as far as Sandy, a distance of about 12 miles. The work, however, will not be commenced until early next year.

PETERSBURG, VA.—The Virginia Passenger & Power Company will build its dam across Appomattox River at Petersburg, all bids having been rejected. The dam will be 40 ft. high, 43 ft. thick and nearly a mile long. More than 40,000 barrels of cement and 2000 carloads of sand will be necessary in its construction. It is estimated that the building will consume about three years. The power house at the locks near the city will develop about 5000 hp, and a still larger plant at the dam, 7 miles beyond the city, will develop more than 7000 hp, giving in all about 12,000 hp.

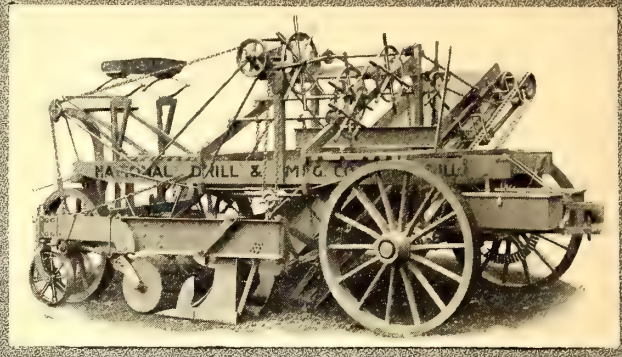
SEATTLE, WASH.—Donald Fletcher, a local real estate dealer, has asked for a franchise to build some elevated and underground roads for furnishing Queen Ann Hill and the interbay district with additional street car facilities.

SPOKANE, WASH.—J. H. Holden, of Chelan, locator of the famous Holden Mines, says that if the Great Northern Railroad does not build a road into the Okanogan Valley, in Washington, an electric line will be built.

SPOKANE, WASH.—Herman J. Rossi, of Wallace, is reported to have interested Eastern capital in a scheme to connect the important points in the Cœur d'Alenes by an electric railway. The proposition is said to have been so well developed that active work may be started early in the spring. The new line as proposed, it is understood, will run from the town of Harrison to Wardner and Wallace and later may be extended farther on up the gulch, taking in several other towns. Connections with Cœur d'Alene City are to be made by the new lake steamer "Idaho," where the boat will meet the lines of the Cœur d'Alene & Spokane Railway Company, which is now constructing an electric railway between Spokane and Cœur d'Alene City.

WHATCOM, WASH.—The Whatcom & Skagit County Interurban Railroad Company, of which E. M. Day, of Whatcom, is promoter, has applied for a franchise in Burlington. The proposed route is over the old line of the Great Northern from Whatcom to Belleville, then over an old abandoned railroad bed to Sedro-Woolley, thence through Burlington, Avon and La Conner, returning via Bay View and connecting again with the main line at Belleville, with a power plant located at Burlington.

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WHEELING, W. VA.—The new power house of the City Railway Company, the construction of which will soon commence on Wood Street, between Twenty-Seventh Street and Twenty-Eighth Street, will be one of the finest plants along the Ohio Valley.

MADISON, WIS.—The Chicago & Northwestern Lakes Electric Railway Company has filed an amendment to its charter, with the Secretary of State, providing for the construction of a branch line from the south State line, in Kenosha County, into the city of Milwaukee, 45 miles.

OSHKOSH, WIS.—The Eastern Wisconsin Railway & Light Company, which has in contemplation the construction of an electric railway between Oshkosh and Fond du Lac and through contiguous territory, has just filed articles of incorporation with the Secretary of State of Wisconsin. The capital of the company is $500,000, and the directors of the company are: Frank B. Hoskins, Benjamin Wild, Sr., and Leander Choate.

CANADIAN NOTES

WINNIPEG, MAN.—The Winnipeg Electric Street Railway Company's system will be extended through St. James, from the city limits, 3½ miles westward to a point near St. Charles postoffice.

GUELPH, ONT.—The by-law for taking over the Guelph Radial Railway Company by the city of Guelph has been voted on and passed. The cost will be $78,000.

NEWS NOTES

CHICAGO, ILL.—Passenger train No. 103 on the Wisconsin Central Railroad, known as the "Cannon-Ball Express," and running at a high rate of speed, crashed into a crowded Fifty-Second Avenue electric car at Hawthorne Sept. 30, killing five persons instantly and resulting in the injury of nearly two score of passengers. The electric car was completely demolished.

ST. LOUIS, MO.—Superintendent John Grant, of the St. Louis Transit Company, has been fined in the police court for failing to run a car through the full length of the line. The Court ruled that all the company's cars must carry passengers the entire distance of the route for one fare.

ST. LOUIS, MO.—It is suggested that a new ordinance be introduced in the Municipal Assembly, compelling cars to stop on the near side of the street, instead of crossing over before allowing passengers to leave and enter the cars. Superintendent John Grant, of the Transit Company, is fighting this, and declares that it will be impracticable, and that the loss of life from accidents would be increased rather than diminished if such an ordinance were passed.

NEW YORK, N. Y.—The statement is made by Thomas F. Ryan, of the Interurban Street Railway Company, that that company is willing to sell to the Interborough Rapid Transit Company the bulk of its surplus power, so that the first section of the subway can be placed in operation as soon as it is completed. The construction of the power house for the subway has been delayed many months through strikes. In making this announcement, Mr. Ryan said: "The Interurban owes a duty to the people to help in every way to add to their comfort and facility while in transit about the city, and last, but not least, the improved facilities of the elevated, by reason of its equipment with electricity and the opening of the subway, which we hope for at the earliest date, will relieve us of many long-haul passengers who are now obliged to use the surface cars, and thereby enable us to carry with more comfort and greater dispatch our natural patrons and the millions of people who during the year are forced to walk because of the overcrowded condition of the surface cars."

NEW YORK, N. Y.—The annual meeting of the Manhattan Railway Company will be held at the company's office here on Wednesday, Nov. 11. A board of directors for the ensuing year is to be elected and three inspectors of election. The transfer books will be closed on Saturday, Oct. 10, at 12 o'clock noon, and will be reopened on Nov. 12, at 10 o'clock a. m.

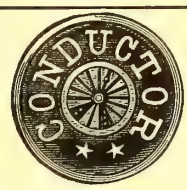
NEW YORK, N. Y.—Five masked men armed with revolvers, knives and clubs made a daring attempt to hold up a car of the Eighth Avenue line of the Metropolitan Street Railway Company at 158th Street, New York, Saturday, Oct. 3, at 2 a. m. The men boarded the car as the motorman was making a switch, two entering by the rear platform and three entering by the front platform. They at once attempted to subdue the motorman and the conductor. Both employees gave fight, and the conductor, after a desperate struggle, succeeded in routing his assailants. The motorman, although set upon, stuck to his post until he ran his car into the glare of an electric light. Then he shouted for help, and the police responded. All three of the men who attacked the motorman were captured, but only after a long chase. The motorman was so severely cut up in his encounter with the would-be highwaymen that he had to be taken to the hospital.

NEW YORK, N. Y.—A letter written by August Belmont to the Rapid Transit Commission has been made public, in which Mr. Belmont begs to be relieved of the construction of the Broadway subway. The reason he assigns for this is the agitation of the Broadway business men and property owners against an open ditch during the process of construction. He says that the subway cannot be built at a reasonable cost unless the streets are torn up. Mr. Belmont says, however, if the business men and property holders in Broadway between Union Square and Forty-Second Street desire to finance the construction of that branch themselves, building it according to the method they desire, and if they can satisfy him that the operation of the line can be made profitable, considering the expense, he will enter into a contract for the operation of that portion of the line.

NEW YORK, N. Y.—The local branch of the Brotherhood of Locomotive Engineers claims that it has a grievance against the Interborough Rapid


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Transit Company, which operates the elevated lines here. The claim, it seems, is made that wholesale discharges of men are being made on unsatisfactory claims of unfitness for service. The connection of the Brotherhood of Locomotive Engineers with the case is accounted for by the fact that when the road was electrified the engineers on the locomotives were given positions as motormen at the scale of wages formerly paid when the men ran the engines.

UTICA, N. Y.—The directors of the Utica & Mohawk Valley Street Railway Company re-elected officers at the annual meeting, held here a few days ago.

EASTON, PA.—The Blue Ridge Traction Company has asked the Attorney-General for a writ of quo warranto on the Bethlehem & Nazareth Street Railway Company, the Bethlehem & Siegfried Street Railway, the Nazareth & Bath Street Railway Company, the Easton & Belvidere Street Railway Company, and the Alliance, Bath & Nazareth Street Railway Company, requiring them to show cause why their charter rights should not be declared forfeited.

PHILADELPHIA, PA.—The stockholders of the Railways Company General, at their annual meeting, elected the following directors: Evans R. Dick, J. Andrew Harris, Jr., David M. Minzesheimer, George S. Graham, J. Ogden Hoffman, F. J. Lisman, Gerald Holsman, D. A. Hagarty, J. Horace Harding, B. M. Ewing and Thomas R. Patton, Jr.

PITTSBURG, PA.—Several arrests have been made here of men who were planning to dispose of stolen transfers of the Pittsburg Railways Company. Of the cases that have already been tried in court one man has been sentenced to nine months' imprisonment, and another has been fined heavily.

SCRANTON, PA.—The Central Labor Union's executive committee has decided to head off all communication with the Lackawanna & Wyoming Valley Electric Railway officials tending toward a withdrawal of the present boycott placed on the new line.

UNIONTOWN, PA.—A fire at the plant of the United Light Company, controlled by the Pittsburg, McKeesport & Connellsville Street Railway Company, early Sept. 27, did considerable damage to the dynamos and machinery.

DALLAS, TEX.—The Rapid Transit Railway Company has refused the request of its employees for new conditions of service. A general reduction of the working day and a substantial increase in wages are said to have been among conditions of the new agreement.

SAN ANTONIO, TEX.—The Southern Light & Traction Company and its employees have not yet been able to reach an agreement on which to base a new contract. The demands made by the men are very exacting. They call for a scale of wages graduated from $1.75 to $2.25 per day, which the company has so far refused to grant. Another feature in the demands is that the company shall discharge any men that the union demands for "non-payment of union dues or for violation of any union rules," such as buying anything from an "unfair dealer." Another demand is that no man shall be discharged by the company until his case has been passed on by a board of arbitration. In short, the union will not consent to the discharge of any men unless it is agreeable to the union.

FOND DU LAC, WIS.—The Eastern Wisconsin Railway & Light Company, which recently filed articles of incorporation at Madison, was organized for the purpose of taking over the Fond du Lac & Oshkosh Electric Railway Company and the Fond du Lac Street Railway & Electric Light Company, combining the lines under one system. No new line between Fond du Lac and Oshkosh will be built by the new corporation. The officers of the new company are as follows: President, F. B. Hoskins; vice-president, F. Grover; treasurer, W. E. Cole; secretary, B. Wild, Jr. Major E. R. Herren, Leander Choate and Elmer Leach, of Oshkosh, with the above-named officers, constitute the board of directors.

FINANCIAL NOTES

CHICAGO, ILL.—The Merchants Loan and Trust Company, receivers for the second-mortgage bonds of the Chicago General Railway Company, has been requested by the Chicago Midland Transit Company to discontinue foreclosure proceedings, on the grounds that the Midland Transit Company now holds a majority of these bonds. The Chicago Midland Transit Company is the name under which a number of bondholders have organized, with the plan of recovering control of the road.

CHICAGO, ILL.—President Knight, of the Lake Street Elevated, says: "I am pleased to state that our conference indicates progress toward a rehabilitation of the Lake Street property. We have discussed many plans, some of which will not work out. As a result of this meeting of the reorganization committee figures, plans and details will be prepared for a special meeting some time this week, at which James B. Dennis will be present. We have discussed the matter exhaustively, but have not agreed on anything definite, so that i is not possible to say that there will or will not be an assessment. It can be said, however, that we have made much progress."

MICHIGAN CITY, IND.—Judge Baker, of the Federal Court, has ordered the Lake Cities Electric Railway property to be sold under a decree of foreclosure in favor of the Metropolitan Trust Company, of New York. The decree directs that the road be sold at public auction at Laporte, and that no bid under $40,000 be accepted. Alexander A. Boyd, of Terre Haute, is receiver.

GREENFIELD, MASS.—The Greenfield & Turner's Falls Street Railway Company has asked the Railroad Commission for authority to issue $130,000 in bonds. The road is appraised at $251,869, but several expenses have not been included in this account. The financial statement filed shows assets of $303,000, capital stock of $130,000, bonded indebtedness of $86,000, and bills payable, $55,000. For the eleven months ending Aug. 31 the net surplus, in addition to a dividend in April, was $13,700.

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WORCESTER, MASS.—The Railroad Commissioners have approved the petition of the Boston & Worcester Street Railway Company for authority to issue registered or coupon bonds amounting to $250,000, payable in twenty years, and to bear interest at the rate of 4½ per cent. The bonds are issued for the purpose of paying certain floating indebtedness incurred in the construction and equipment of the railway.

BOSTON, MASS.—The Marlboro & Framingham Street Railway Company has entered a petition with the Railroad Commissioners, asking permission to issue capital stock to the amount of $105,000, to be used in the payment of floating indebtedness and for the purchase of real and personal property and additional equipment. The Board will give a hearing on the petition very shortly.

BAY CITY, MICH.—The Bay City Consolidated Street Railway Company, which has been in the hands of a receiver for about three years, has been sold to H. D. Walbridge, of Detroit, representing the Bay City United Traction Company, a corporation recently organized to take over the property. There was but one bid, the price offered being $500,000.

BROOKLYN, N. Y.—The Brooklyn Eagle gives the earnings of the Brooklyn Rapid Transit Company for the first twenty-nine days of September as follows: Gross, $1,208,367, against $1,042,944 last year, an average increase of $6,000 a day. From July 1, gross $3,837,074, against $3,003,434 in 1902. On Sunday, Sept. 27, gross were $34,195, against $25,586 in 1902.

CINCINNATI, OHIO.—The Zanesville Railway, Lighting & Power Company has increased its capital stock from $1,000,000 to $1,250,000.

NORFOLK, VA.—The Norfolk Railway & Light Company reports earnings as follows for the eight months ending Aug. 31, 1903: Gross, $411,139; net, $156,570; company's proportion of the earnings of the City Gas Company, $17,230; total net income, $173,809; interest and taxes, $131,888; balance, surplus, $41,912. The company owns 4011 shares out of the 5000 of the capital stock of the City Gas Company, of Norfolk.

OGDENSBURG, N. Y.—The long fight of the creditors of the Brockville, Westport & Sault Ste. Marie Railroad has been ended, and the title of the New York syndicate who purchased the road confirmed by an act incorporating the Brockville, Westport & Northwestern Railway Company to operate a road from the Thousand Islands to the upper lake, with a bridge over the St. Lawrence River at Brockville. Construction and labor creditors of the old company, whose claims amount to about $200,000, will receive 25 per cent of their original claims, when the unearned subsidy is revoted and earned by the new company. All actions to set aside the sale are dismissed.

PHILADELPHIA, PA.—A special to the Wall Street Journal, of New York, says: "It is stated officially that the gross earnings of the Philadelphia Rapid Transit Company for September will show an increase of nearly $140,000 over those of September, 1902, and that the business for the three months ending Sept. 30 show the same proportion of gain over the same period last year as the annual report indicated for the preceding months."

YOUNGSTOWN, OHIO.—The Youngstown & Southern Railway Company and the Youngstown & Salem Railway Company have been consolidated into one corporation to be known as the Youngstown & Southern Railway Company; capital, $1,800,000. A. W. Jones, John Ruhmann, W. H. Ruhmann, J. R. Long, W. S. Andrews and R. L. Andrews are the directors.

CANADIAN NOTE

VANCOUVER, B. C.—The Dominion Securities Corporation, of Toronto and Montreal, owns and offers at par and interest $300,000 of the 4½ per cent joint mortgage gold bonds issued by the British Columbia Electric Railway Company, Ltd., and the Vancouver Power Company for the construction and equipment of a water-power plant. These bonds are dated Jan. 15, 1903, and are due Jan. 15, 1953; denomination, $486.66 currency, or £100 sterling; interest payable Jan. 15 and July 15 at the office of the National Trust Company, of Toronto; the Chartered Commercial Company, of Vancouver, or Sperling & Company, of London.

AMONG THE MANUFACTURERS

JEFFREY POWER AND HAND DRILLS for rock and coal are described and illustrated in the latest catalogue issued by the Jeffrey Manufacturing Company, Columbus, Ohio.

J. G. WHITE & COMPANY have removed to the twenty-second floor of the newly constructed Wall Street Exchange Building, 41 and 43 Wall Street, and 43 to 49 Exchange Place, New York.

THE BROWN CORLISS ENGINE COMPANY, of Corliss, Wis., is in receipt of an order from the Lorain Steel Company, of Lorain, Ohio, for a 30-in. and 60-in. x 60-in. cross-compound Corliss engine.

THE PITTSBURG BRANCH of the H. W. Johns-Manville Company, on account of increased business, has secured larger quarters by taking the adjoining property, and now occupies the entire building at 218-220 First Avenue.

THE MICA INSULATION COMPANY, of New York and Chicago, announces that it will send on application samples of its high-grade insulating compound for armatures, field coils, magnets, etc., together with a descriptive booklet.

INTERESTING FACTS ABOUT TRANSFORMER INSULATION are revealed in a concisely written pamphlet, No. 9121, recently issued by the General Electric Company. This booklet deserves the attention of all who are interested in the safest and most economical use of transformers.

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THE STANLEY ELECTRIC MANUFACTURING COMPANY, of Pittsfield, Mass., announces the opening of two new sales offices, one at Cincinnati, with headquarters in the Perin Building, in charge of O. H. P. Fant, and the other in the Century Building, St. Louis, Mo., in charge of F. Johnson.

THE H. W. JOHNS-MANVILLE COMPANY, of New York, is sending to the trade a handsome folder depicting "Uncle Sam" before and after the recent investigations of roofing for use on the army buildings in the Philippines. As stated in the Street Railway Journal of Oct. 3, this company has closed a contract with the government for an immense quantity of asbestos "Army" brand roofing.

THE MASSACHUSETTS CHEMICAL COMPANY, 170 Summer Street, Boston, Mass., announces that it still has on hand some of the souvenir cuspidor mats for which there was a great demand at the Saratoga Convention. It will be pleased to send these out as long as the supply lasts to any street railway official or electric manufacturing company if such requests are accompanied by name, address and position held.

THE ECLIPSE CAR FENDER COMPANY, of Cleveland, has secured an order from the New York & Long Island Traction Company, of New York, to equip its cars with the new Eclipse fender. Since its remarkable series of demonstrations at the Saratoga Convention the Eclipse Car Fender Company has secured trial orders from a large number of leading railways, not only in this country, but in several foreign countries.

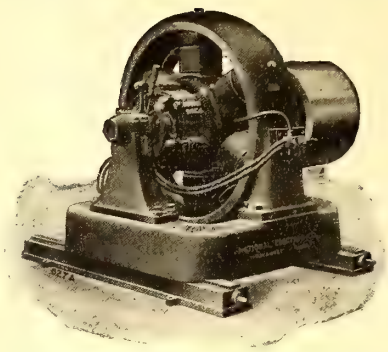
ABOUT THIRTY MEMBERS of the Engineers' Club, of Philadelphia, visited the works of the J. G. Brill Company on Saturday afternoon, Oct. 3. The visitors were received by William H. Heulings, Jr., of the Brill Company, who conducted them through the large establishment and explained to them the methods of construction of the cars and trucks. In the evening of the same day Mr. Heulings read a paper before the club, on "The Development of the Brill System of Trucks for Electric-Motor Cars," which proved of considerable interest to the members of the club, and brought forth some discussion.

THE W. R. GARTON COMPANY, of Chicago, Ill., are not only manufacturers' agents, but are also manufacturers, and are carrying out the policy of "Not how cheap, but how good," the material which they furnish can be made. They say that they are putting the best of material into everything, consistent with the requirements of the article, the place in which it is to be used and the conditions governing its use. Practically does this hold true of a special brand of tinned steel armature banding wire, of which they are selling large quantities, and, as evidence of its high grade, they state they are getting duplicate orders from large customers for large amounts, proving conclusively the satisfaction that this wire is giving to the trade.

THE GENERAL ELECTRIC COMPANY has just issued the following publications of special interest to electric railways: Bulletin No. 4335, "Engine-Driven Revolving Field Alternators;" bulletin No. 4337, "Blower Sets for Air-Blast Transformers;" supply catalogue No. 7583, "Parts of U. S. Trolleys;" flyer No. 2117, "Combined Switch and Enclosed Fuse Cut-out for Car Lighting;" publication No. 9123, "Core-Type Transformers." Other recent publications are: Bulletin No. 4334, "Direct-Driven Continuous-Current Generators for Lighting and Power;" bulletin No. 4336, "Isolated-Plant Switchboards, Continuous-Current Two-Wire Type;" bulletin No. 4338, "Power-Factor Indicator for Balanced Systems;" flyer No. 2114, "Diffusion of Light by Concentric Diffusers;" flyer No. 2116, "Meter Jewels."

THE BUSINESS OF THE STAR BRASS WORKS, of Kalamazoo, Mich., manufacturers of the famous Kalamazoo trolley wheels and harps, has assumed such large proportions, and its trade now covers so large a territory, that the company has found it necessary to place some one in charge of its sales department, and for the position has secured the services of Geo. E. Pratt, who has been personally identified with the interests of the company during the past three years, in connection with his other business interests. Mr. Pratt will give his entire time to the business of the sales department and represent the company among the trade, with headquarters at Kalamazoo. To keep pace with its rapidly increasing trade, the company will continue to carry a large quantity of wheels and harps in stock to insure prompt shipment of orders.

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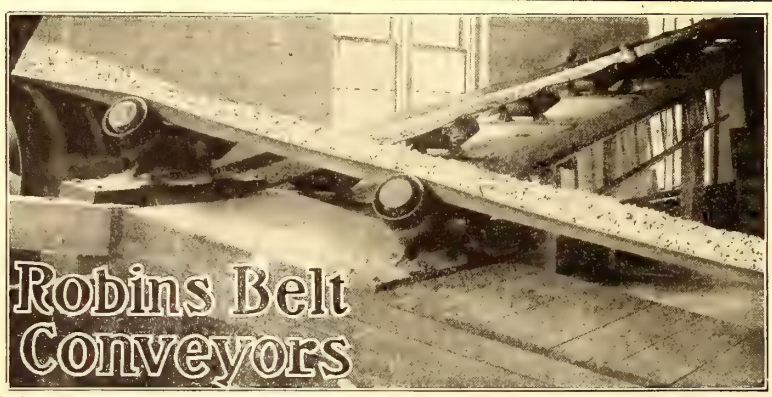
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NEWS OF THE WEEK

CONSTRUCTION NOTES

BIRMINGHAM, ALA.—The new Glen Iris line of the Birmingham Railway, Light & Power Company has been placed in operation. Some 3 miles of new track were required. This reaches one of the newest and most fashionable suburbs in the city.

ENSLEY, ALA.—A franchise has been granted to the Birmingham & Steel Cities Railway Company to operate a street railway practically throughout the city.

MOBILE, ALA.—The Mobile Light & Railway Company has asked franchises over eleven blocks of new streets.

LOS ANGELES, CAL.—The Los Angeles Railway Company is extending its Boyle Heights line to the eastern city limits, a distance of over a mile.

LOS ANGELES, CAL.—The mysterious franchise granted by the Board of Supervisors last spring to the Campbell-Johnston Brothers, has been explained. The Pacific Electric Railway Company has been granted an extension of three months to complete the work. The franchise is through Garoanza.

LOS ANGELES, CAL.—Car No. 110 of the Los Angeles Traction Company has been taken to the shops of the Pacific Electric Railway Company for experimental purposes. The car will be rebuilt and studied as a possible model for the reconstruction of the remaining rolling stock of the entire system. Vestibules will be built at the ends; the body will be reconstructed, and possibly an air-brake equipment added.

OAKLAND, CAL.—Work has been commenced on the electric railway for which J. H. Macdonald recently obtained a franchise. The franchise grants permission to construct a railway from the foot of Broadway to Mountain View Cemetery.

SAN JOSE, CAL.—At a recent meeting of the Council, F. M. Lockwood and John A. Mehling, of Harrisburg, Pa., asked for a franchise for an electric railway over First, Taylor, Second and St. James Streets to Market Street, from the city limits on the north, construction to begin within three months.

SAN JOSE, CAL.—Manager Granger, of the San Jose, Los Gatos & Saratoga Interurban Railway Company, which is busy already with much construction work, says that St. Louis capitalists will expend $2,000,000 in extending interurban lines in this county.

SANTA ANA, CAL.—To protect its franchise rights in this city the Newport Beach Electric Railway Company, which proposes to build an electric railway from Santa Ana to Newport Beach, has laid a few feet of track on East Fifth Street, near the eastern terminus of the line.

SANTA BARBARA, CAL.—The Santa Barbara Consolidated Electric Railway Company has avoided any possible opposition to its application for a franchise along the Ocean Boulevard by securing 6090 ft. of private right of way parallel with and adjoining the boulevard.

SANTA BARBARA, CAL.—The Santa Barbara Consolidated Electric Company has been granted a franchise by the Supervisors for a single-track trolley line from Santa Barbara to Ortega Hill, 6 miles east of the city. The petition was signed by H. H. Sinclair, of the Edison Electric Company, of Los Angeles, which controls the entire local system.

SEBASTOPOL, CAL.—The Board of Trustees has granted a franchise to build and operate an electric railway within the city limits. The railroad is to traverse Green Valley and the famous Gold Ridge fruit country, giving direct communication through Sebastopol, with tide-water at Petaluma, thus insuring a quick delivery of fresh fruits to the San Francisco markets.

TUSCAN, CAL.—Bids are wanted for the construction and equipment of an electric railway from Red Bluff to Tuscan, a distance of about 9 miles. Address, Tuscan Mineral Springs Corps.

VALLEJO, CAL.—The petition of George A. Lamont as an interested taxpayer, to the Board of Supervisors to have declared forfeited the electric railway franchise granted to J. W. and H. F. Hartzell, has been denied. Attorney Lamont appeared for himself and the Vallejo, Benicia & Napa Valley Railroad Company, assigns of Hartzells, was represented by President Cross, Manager J. W. Hartzell and Attorney L. G. Harrier. The company asked the board for extension of one year on the building of the road between Vallejo and Benicia, and the extension was granted.

VENTURA, CAL.—The Town Trustees have granted to John Burson, of the Ventura-Bakersfield Railroad Company, a franchise to build an electric railway through Ventura by way of Clara Street. The first work on the Burson system will be done at Hueneme where 10,000 railroad ties have already been landed. It is believed that the company desires a right of way through Ventura to get to Santa Barbara. It has some very valuable franchises throughout Ventura County, covering over 75 miles and touching every important locality.

ATLANTA, GA.—At a recent meeting of the Board of County Commissioners the Atlanta and Marietta Electric Railway Company was granted a franchise to operate a railway from Atlanta to Marietta. The Atlanta Interurban Railway Company has already been given a franchise for a similar purpose, so it appears that the county seat of Cobb and the city of Atlanta are to be connected by two trolley lines. The Atlanta & Marietta Electric Railway Company agrees to furnish bond in the sum of $15,000 as an evidence of good faith and to liquidate any possible damages that may accrue as a consequence of the erection of the road. The new line will be built along the Howell Mill Road for a distance of 5 miles from the city limits. The company will be allowed to operate a schedule for the hauling of freight during certain hours of the day, and, in addition, a through express service will be maintained.

BOISE, IDAHO.—The Council has granted a new franchise to the Boise Rapid Transit Company. Many new lines are planned by the company.

CHARLESTON, ILL.—The Charleston, Champaign & Northern Interurban Railroad Company, with a capital stock of $10,000, for the purpose of constructing an interurban line from Charleston to Homer, has been incorporated at Springfield. The line which the company proposes to build will run from Charleston to Champaign, through Homer. Organization has been effected by the election of eighteen directors and officers for one year. The officers are: President, Dr. W. R. Patton; vice-president, W. F. Jenkins; secretary, S. S. Anderson; treasurer, George W. Gray. A preliminary survey will be made at once and right of way secured. The stockholders number one hundred of the leading business men of Charleston.

DANVILLE, ILL.—Articles of incorporation of the Hoopeston Street Railway & Light Company have been filed. The directors of the company and sole owners are James H. Dyer, John L. Hamilton, Alfred H. Trego, Charles S. Crary, J. S. McFerren and Charles A. Allen, all well-known residents of Hoopeston. The charter entitles the company to operate an electric street railway system in the city of Hoopeston and to manufacture gas, coke, tar, electricity or steam for the use of fuel, light or motive power. It is stated that work will begin shortly on the construction of a street railway in Hoopeston.

EAST ST. LOUIS, ILL.—Articles of incorporation have been issued in Springfield for the East St. Louis & Columbia Electric Railway Company. The capital stock is $25,000. The incorporators are Thomas N. Chase, P. J. Meyers, John Kickham and others.

JERSEYVILLE, ILL.—The Central Traction Company will petition the Town Board on Nov. 6 for a franchise to operate an electric railway over certain streets. The company proposes to build an electric line from Jerseyville to Hardin, crossing the Illinois River. It is the opinion that the franchise will be granted.

ANGOLA, IND.—T. E. Smith, of Angola, is authority for the statement that he has interested with him a number of capitalists from Pittsburg, Pa., and that they will build an electric railway during the next year from Angola to Battle Creek and Marshall, Mich., via Coldwater, Twin Lakes, Tekonsha and Osborne.

INDIANAPOLIS, IND.—Work has been begun on the Indianapolis & Southwestern Traction Company's line between Indianapolis and Waverley.

INDIANAPOLIS, IND.—The Kokomo, Marion & Western Traction Company's line between Kokomo and Greentown and the Indianapolis & Northwestern Company's line between Indianapolis, Lebanon and Frankfort have been placed in operation.

NEW ALBANY, IND.—The Louisville & Southern Indiana Traction Company has asked the County Commissioners for a right of way through the county for an electric railway from New Albany to Paoli and French Lick and West Baden Springs. The company proposes to take up the franchise that has just been abandoned by the New Albany & Paoli & French Lick Valley Traction Company, and will construct the road to Paoli, where it will connect with the proposed line of the Louisville & Southern Indiana Traction Company, from Corydon to the Springs, by way of Wyandotte Cave and White Sulphur Wells, in Crawford County. The franchise of the New Albany Street Railway Company, which recently passed into the hands of the petitioner, gives that company a right of way into the city of New Albany, and all that is now required is a right of way through Floyd County and Orange County. The Tennis Construction Company has been awarded the contract to construct the company's line from this city to Corydon, work to begin immediately.

RUSHVILLE, IND.—John A. Schumacher & Company, who secured the contract for the building of the grade for the new line of the Indianapolis & Cincinnati Traction Company, have begun construction.

SOUTH BEND, IND.—The Indiana & Southern Michigan Electric Railway secured a franchise for an electric railway some time ago from the Common Council of St. Joseph, and furnished a surety company bond to have the road completed and in operation on or before Sept. 30, 1903. As the time has expired, the bond is declared forfeited by the Council. It is thought that a new franchise will be granted, and that the road will be built from St. Joseph to South Bend within a few months.

TERRE HAUTE, IND.—The Terre Haute Electric Company has leased for thirty years the interurban lines entering Terre Haute owned by the Terre Haute Electric Traction Company. Both companies are controlled by Stone & Webster, of Boston. A mortgage of $600,000 has been filed by the officials of the latter company, which is building new lines to Paris, Ill., and Clinton coal fields. The new lines are included in the lease.

VINCENNES, IND.—The Vincennes-Jasper Traction line is to be built within a year, John A. Davis, treasurer of the First National Bank; Sol Frank, merchant; F. E. Chappell, attorney; E. F. Cox, engineer of the proposed line, all of Petersburg, and Smiley N. Chambers, of Indianapolis, principal promoter of the line, are interested in the project. A. Norvale, first vice-president of the Municipal Bond and Securities Company, of Cincinnati, has agreed to take all the securities of the road. His company will let the contract for the construction of the road to a Cincinnati firm, and agrees to have 500 men at work on the roadbed within sixty or ninety days. The line will be 54 miles long, and the estimated cost of construction is $1,000,000.

BIDDEFORD, MAINE.—Work will be started in the early spring on the construction of the proposed new electric railway from Biddeford to Kennebunk, via York, Wells and Ogunquit, a distance of 29 miles, for the Atlantic Shore Line Railroad. The grading will be done this winter. Power will be taken from the present plant.

BOSTON, MASS.—The Waltham Street Railway Company has opened its new line between Waltham and Belmont. The new line starts from Main Street in Waltham, and passes through Linden Street and over Quince Street extension to Trapelo Road.

BOSTON, MASS.—The three-year limit fixed by the Lynn and Salem City Councils for the Boston & Northern Street Railway to complete its new line from Salem to Lynn over Highland Avenue, Salem, across Floating Bridge in Lynn and along Western Avenue, the links in the Salem-Boston Rapid Transit line, expires in November, but another year will pass before the line is in operation. The Salem Aldermen have extended the time eighteen months on request of the road, and Lynn has granted six months' extension, and is likely to grant additional days of grace if the road asks the favor. Unexpected annoyance has been encountered in acquiring title to the right of way in Salem over private property, where the tracks are to be laid in accordance with the engineers' plans.

MELROSE, MASS.—Upon petition of the Maplewood & Danvers Street Railway Company for locations in Melrose, the Board of Aldermen has voted to give a hearing Monday evening, Oct. 26.

PITTSFIELD, MASS.—The Berkshire Street Railway Company, among recent provisions for the safe operation of cars, has adopted a rule that all orders received over the telephone at turnouts shall be receivd both by the motorman and the conductor, in order to avoid a misunderstanding of the orders.

SPRINGFIELD, MASS.—The Railroad Commission is giving careful consideration to the matter of approving locations granted the Springfield Suburban Street Railway by the Springfield Board of Aldermen. The Springfield Street Railway objects to the locations being granted, and it has considerable local support. The Commission has taken a view of the proposed locations.

WARE, MASS.—The Hampshire & Worcester Street Railway Company is making a survey for an extension of its line from Lakeside Park, in West Brookfield, to Warren.

WOBURN, MASS.—The Woburn City Council has received a petition from the Lowell & Boston Street Railway Company for a location on Arlington Road and Lake Avenue to the Winchester line, and on Bedford and Willow Streets. A hearing was ordered for Oct. 21.

WORCESTER, MASS.—To incorporate and construct an electric railway to be known as the Worcester & Providence Street Railway Company, the president, vice-president and treasurer of the Worcester & Hartford Street Railway Company, with fifteen other men living in Sutton, West Sutton, Douglas, East Douglas and Millbury, have formed a company to be capitalized at $200,000. The plan is a revival of the old scheme to build a road from Providence to Worcester. The proposed road will come into Worcester through Greenwood Street, over the tracks of the Worcester Consolidated Street Railway Company, and will run through Uxbridge, Millbury, Sutton and Douglas to the Massachusetts State line. The men who are interested in the scheme are: Fred C. Hinds, of Newton, president; Thomas C. Perkins, of Hartford, Conn., vice-president, and Charles H. Wilson, of Brookline, treasurer of the Hartford & Worcester Road, together with Henry Rice, James W. Stockwell, Henry S. Stockwell, John E. Gifford, Hollis A. Richardson and T. Burt Stevenson, of Sutton; Henry B. Bullard, of West Sutton; William E. Horne and Warner A. Harris, of Millbury; Silas P. Holbrook, E. N. Jenckes, George Abbott, C. J. Batchellor, J. B. Sweet and A. F. Jones, of Douglas.

WORCESTER, MASS.—The Railroad Commission has issued a certificate approving the construction of an addition of 6830 ft. to the line of the Worcester Consolidated Street Railway in Leominster.

BATTLE CREEK, MICH.—From the present outlook it seems almost certain that Battle Creek will, before a year elapses, have another interurban line. This line has not been named, but it is proposed to start from Angola, Ind., and come to this city via Marshall, or vice versa. T. E. Smith, of Angola, is one of the prime movers of the road, and he has expressed himself as confident that the new line will be in operation by next summer. Mr. Smith stated that the company would purchase a private right of way the entire distance. The interurban will start from the center of Angola and run to Twin Lakes, a few miles north, where it will go over a channel that connects the two bodies of water, and continue its way to Coldwater, covering all intermediate points; then to Tekonsha, Osborne, Marshall and Battle Creek. The capitalization of the new company is said to be $2,000,000.

FLUSHING, MICH.—Steps are being taken to secure franchises for a street railway between Flushing and Fenton. The franchises are in the name of C. Tinker, of Fenton; E. O. Wood and F. P. Sayre, of Flushing. When the entire right of way has been secured the company will be organized. It is proposed to build the line with capital from Flint and the two villages named.

MONROE, MICH.—The Circuit Court in Monroe County has decided against the Toledo & Monroe Railway Company in the long-contested case regarding the right of that company to occupy Elm Avenue, Monroe, with its line. The company claims that this small portion of right of way is all that has not been secured for its continuous line from Port Huron to Toledo, and it will now probably proceed to secure private right of way, although the city of Monroe expresses itself as willing to give the company its choice of two other streets to make a connection of its line in the city.

MONROE, MICH.—Peter N. Jacobsen, who promoted the Toledo & Monroe Electric Railway, now known as the Toledo, Monroe & Detroit Short Line, has been in Monroe to obtain the right of way for an electric railway to

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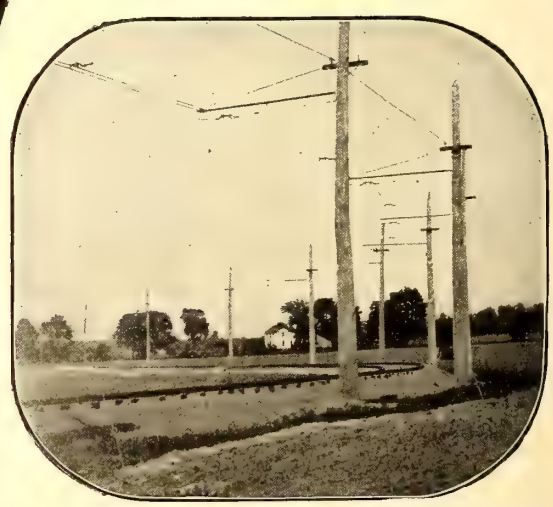
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be constructed from Monroe to Adrian via Dundee and Tecumseh. Mr. Jacobson states that Detroit capital is back of the scheme, and that it will undoubtedly go through. It is the intention to run the line on the north side of the Raisin, with a tunnel under the Pere Marquette and one under the Toledo & Ann Arbor, at Dundee.

SAULT STE. MARIE, MICH.—John Seymour, of Hudson, has started work on an electric railway to connect Adrian and Portland by way of Coldwater, Marshall and Olivet. The contractor announces that there will be a branch line to Lansing.

MINNEAPOLIS, MINN.—The impression here is that Dr. Straub and his associates, who recently secured a franchise for the construction of an electric railway to Anoka, will soon apply to the Council for a franchise to operate within the city limits.

LA GRANGE, MO.—The survey for the proposed electric railway from La Grange to Williamstown by way of Monticello has been completed by Z. T. Daniels, who was employed by the citizens along the proposed line and in three towns. Three different routes to enter Monticello were laid out, and after leaving Monticello a few miles the old railroad grade was followed up to Williamstown. Mr. Daniels states that there is a splendid location for a road. It can be built with but little grading, and the country traversed by it is rich and well populated.

OMAHA, NEB.—The survey for the Omaha, Lincoln & Beatrice Electric Railway has been completed, and it is thought that much of the grading, bridging and track laying will be done this fall, enabling electrical construction work to proceed without delay next spring. Plans and specifications for buildings, machinery and rolling stock are being prepared as rapidly as possible. It is rumored that a passenger rate of 55 cents will be established between Omaha and Lincoln. The present rate on the steam roads is $1.65.

RENO, NEVADA.—An application has been received from the Reno Suburban Street Railway Company for a franchise over the following streets: Plaza, Lake, Fourth and Alameda.

TRENTON, N. J.—The New Jersey & Pennsylvania Traction Company has placed a crossing over a side track of the Pennsylvania Railroad on North Willow Street. The New Jersey & Pennsylvania Traction Company's line competes with the railroad to Princeton

TRENTON, N. J.—The Camden & Trenton Railway Company is now operating a car on its Liberty Street line, running about 1½ miles across the lower part of the city. Trenton & New Brunswick Railroad cars will be run over it as soon as the connection is completed in Hamilton Township, just east of this city.

TRENTON, N. J.—The Camden & Trenton Railway Company has won its fight for a crossing at Cass Street, where the Pennsylvania Railroad Company sought to hold it up. The railroad company asked the electric company for a $20,000 bond before the crossing was placed over the railroad tracks and canal (which belongs to the Pennsylvania Company) bridge, but this the electric railway company refused to accede to. The city had granted the Camden & Trenton Company the franchise, and the company held that it had the right to go across, despite the railroad's opposition. A few days ago the Camden & Trenton Company served notice upon the Pennsylvania Railroad Company that it would cross the tracks and the bridge by the use of force, and at once. Then the Pennsylvania came to terms, and the crossing was placed. It contains the regular frogs for the Camden Company's 5-ft. gage and special frogs for the Trenton & New Brunswick Railroad's 4-ft.. 8½-in. gage. The Pennsylvania Railroad Company kept a locomotive on a nearby siding under steam for weeks to prevent the Camden & Trenton from placing the crossing, and at times three locomotives were located there, so that they could be run upon the crossing at a moment's notice.

BROOKLYN, N. Y.—The new extension of the Court Street line of the Brooklyn Rapid Transit Company from Kensington Junction to Fifty-Eighth Street through Sixteenth Avenue has been placed in operation. The line was constructed during the summer months. It is especially designed to give better service to the Borough Park section during the winter.

BROOKLYN, N. Y.—The Brooklyn Rapid Transit Company has made application to Public Works Commissioner Redfield for permission to lay tracks through Saratoga Avenue, between Broadway and Sutter Avenue, a distance of nearly 2 miles, to form a direct line of rapid transit to the Williamsburgh Bridge. The application has been referred to Corporation Counsel Rives by Commissioner Redfield for an investigation of the franchise of the company.

BUFFALO, N. Y.—After months of negotiation the Hamburg Railway Company has obtained the necessary consents for the construction of its proposed line from Bay View on the lake shore along the Hamburg Turnpike to Buffalo and the work of construction will be proceeded with at once. The proposed line of the Hamburg Railway Company will be about 6 miles long, and will run by the Lackawanna plant, the Rogers-Goodyear plant and other industrial concerns in the locality, and will also afford transportation to the people of the industrial village which is growing up in that region. It will also run by Woodlawn Beach. The northern terminus of the road will be at the city line, south of Tifft Street. The right to lay tracks in the Hamburg Turnpike within the city line is in litigation and will soon be tried out. Both the Hamburg Railway Company and the International Railway Company have applied for franchises in this street. The former claims to own the fee of the road. Contracts for the line have been let and it will be completed before snow flies.

NEW YORK, N. Y.—The application of the New York City Interborough Railway Company for permission to construct tracks and operate a railroad in the Bronx was again before the State Railroad Commission on Tuesday, Oct. 13. The Union Railway Company opposed the application, and at its request an adjournment was taken until Nov. 10.

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NEW YORK, N. Y.—A hearing was held by the Board of Aldermen, on Monday, Oct. 12, on the application of the New York & Port Chester Railway Company, to cross over and under certain streets in the Borough of the Bronx. Decision was reserved. The New York & Port Chester Railway, it will be remembered, planned to build a four-track third-rail electric railway from a connection with the subway in New York to Port Chester, a distance of about 25 miles.

CLEVELAND, OHIO.—The People's Street Railway Company, better known as the "3-cent fare company," has applied for a franchise on Rhodes Avenue. This is the street on which the company attempted to build last year when it was stopped by the change in the city government.

CLEVELAND, OHIO.—The Wooster branch of the Cleveland & Southwestern Traction Company has been completed and cars are now operating under regular headway between Cleveland and Wooster. There is no direct steam route to Cleveland, and the business of the district has heretofore been diverted to Pittsburg over the Pennsylvania main line. The completion of this branch gives a total of 135 miles to the Cleveland & Southwestern system.

CLEVELAND, OHIO.—An electric railway expert is engaged in inspecting the properties of the Eastern Ohio Traction Company, with a view to ascertaining just what is needed to place the property in first-class condition, and it is understood that the largest stockholders have agreed to furnish the money necessary to carry out the work. Owing to the poor physical condition of one branch of the system, the earnings of the road are not on a satisfactory basis at the present time.

CINCINNATI, OHIO.—The Interurban Railway & Terminal Company has completed its Rapid Transit Railway to Lebanon, and within a few days cars will be placed in regular service. This completes this system as originally projected, but it is understood that the syndicate has plans for other extensions.

CINCINNATI, OHIO.—The Cincinnati, Dayton & Toledo Traction Company has opened an executive office in the new Traction Building. Auditor Boyer will make his headquarters there, and F. J. J. Sloat, general manager of the company, will in the future spend Monday, Wednesday and Friday of each week in Cincinnati, spending the remainder of his time in Hamilton, where the operating offices will be maintained.

CINCINNATI, OHIO.—The Cincinnati, Hamilton & Dayton Railway has started to convert its branch between Findlay and Delphos into an electric line. Since the acquisition of the Findlay, Fort Wayne & Western the branch has become practically useless for service out of Findlay, as the latter line connects that city with the main north and south system at Ottawa. The officials decided to experiment and make the Deshler branch an electric system. If the plan is a success it is understood the conversion of other lines subordinate to this system will be made. This will be the first steam road in Northern Ohio to resort to the trolley.

COLUMBUS, OHIO.—The directors of the Scioto Valley Traction Company have decided not to place the stocks and bonds of the company on the market at the present time, but will supply the money necessary to complete the road among themselves. Plans have been approved for the erection of a car house and three sub-stations, and work on these will start at once.

COLUMBUS, OHIO.—The Union Savings Bank & Trust Company has filed a mortgage for $1,000,000 given by the Ohio River & Columbus Railway Company. Headquarters of the company are at Ripley, and S. Bambach is president, and D. Campbell, secretary. The company is building a line from Ripley to Hillsboro, and about 10 miles of grading have already been completed. At present it is being built for handling freight by steam locomotives, but later it will be equipped with electricity for passenger traffic.

DAYTON, OHIO.—The City Railway Company is preparing to extend its West Dayton car houses. The foundations of one of the proposed new buildings are already constructed and plans are being made for another structure to be located on the east side of Western Avenue next to the brick car house.

FREMONT, OHIO.—W. J. Pero, J. W. Thomson and others have been inspecting old Kerlin Road from Fremont to Port Clinton with a view to completing it to form a connection with the Toledo, Lakeside & Port Clinton Railway, which is now well under way. The Kerlin roadbed has been graded and poles and ties are scattered along the line, but work has been suspended for about a year.

GENEVA, OHIO.—C. W. Goodrich has filed a petition with the County Commissioners for a franchise for an electric railway through Ashtabula County, from Geneva to Jefferson, and thence through to Meadville. The right of way for this line has all been secured and engineers have made a survey of the same.

LISBON, OHIO.—Max P. Goodwin, T. W. Hill, Ernst Mueller and other promoters of the Youngstown & Ohio River Railway recently made an inspection trip over the route of the proposed road. It is announced that work will start between Salem and Lisbon in the near future. The road will be built by the Cleveland Construction Company, of Akron.

NEWARK, OHIO.—The Newark, Martinsburg & Mount Vernon Traction Company intends to build an extension to Wooster, which, according to the survey, will come from Mount Vernon through Jelloway to Loudonville, and thence east through Lakeville, Big Prairie and Shreve to Wooster.

TOLEDO, OHIO.—Riggs & Sherman, contractors for the Ohio & Michigan Traction Company, will commence work at once on the line which will extend from Toledo to Ann Arbor. Large forces of men and teams are being collected near Petersburg, where the work will start.

TOLEDO, OHIO.—The Toledo Urban & Interurban Railway Company has secured a franchise in Perrysburg, and will complete its line through that town. The new line will form an independent entrance to Toledo for the Toledo, Bowling Green & Southern Traction Company's road, which now enters over the tracks of the Toledo Railways & Light Company.

TOLEDO, OHIO.—The Toledo & Indiana Railway will not extend its line to Bryan this year. The company has failed to dispose of its bonds on a satisfactory basis, and the matter will be held up until financial conditions are better. The road is in operation between Toledo and Wauseon.

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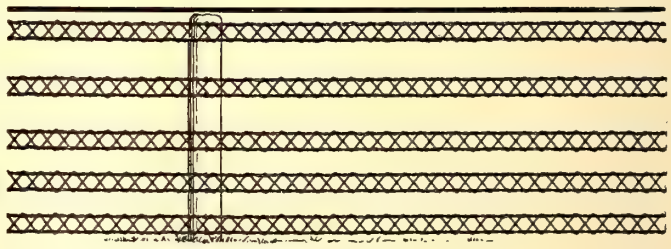
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YOUNGSTOWN, OHIO.—The Salem & East Railway Company has been incorporated, with a capital of $5,000. The incorporators are: E. S. Cook, F. S. McGowan, A. S. Banner, J. W. Tyler and M. L. Fowler. The company proposes to build an electric line from Sebring to Salem and East Palentine, with a branch to Salem. The capital stock will be increased as soon as the preliminary survey has been made

PORTLAND, ORE.—The last rail of the Springwater branch of the Oregon Water-Power & Railway Company's new electric railway to the Clackamas River has been laid. The major portion of the line is now operated by steam, but will be electrified as fast as the equipment arrives. The new road is 38 miles long.

PORTLAND, ORE.—It is said that the University Land Company has offered to build a portion of the track between North Albina and St. Johns if the Portland Railway Company will put on cars and operate them. During the past few months the Portland Railway Company has graded and laid one track to Maryland Avenue and Shaver Street. The grading for the second track is almost completed. This line is to be extended to North Albina, and may be pushed on to St. Johns. The City & Suburban Company is said to be planning to connect its Mississippi Avenue branch with the St. Johns line. The West Avenue branch of the Hawthorne Avenue line of the Oregon Water-Power & Railway Company is almost completed. The Broadway Street branch of the Portland Railway Company is completed to the end of East Twenty-Fifth Street.

BANGOR, PA.—The Bangor, East Bangor & Portland Street Railway Company has purchased the large plant of the Bangor Electric Light, Heat & Power Company. The trolley company intends making some alterations, after which it will extend the line from the present terminus at Portland to the Delaware Water Gap and Stroudsburg.

BELLEFONTE, PA.—E. C. Poorman, of Tyrone, and F. W. Bedford, of Wilmington, Del., drove over the proposed route of the projected electric railway from this town to Axe Mann, Pleasant Gap, Tyrone an dMill Hull, via Bellefonte. The company will ask the Town Council for a franchise at an early date. Work on the new line is to begin next March, provided a franchise is secured.

BIRDSBORO, PA.—The Reading Traction Company has presented an ordinance to the Council of Birdsboro for permission to use First Street. The trolley company has settled with all the property owners from Reading to Birdsboro, a distance of 9 miles, and will run over private property. At Seyfert it will build a bridge across the Schuylkill River.

CHAMBERSBURG, PA.—The Chambersburg, St. Thomas & Fort Loudon Electric Railway Company has been organized to build an electric railway from Chambersburg to St. Thomas and Fort Loudon. The officers of the company are: John R. Eberly, president; Frisby Miller, secretary; Dr. F. G. Strock, treasurer.

LANCASTER, PA.—The charter of the Lancaster & Eastern Street Railway Company has been filed. The proposed road will run from Witmer's Bridge to Christiana, over the Philadelphia Pike, and will pass through Soudersburg, Paradise, Leaman Place, Williamstown, Kinzer's Gap and Christiana. The capital stock is $48,000, and this will be increased as soon as the right of way is secured. The directors of the company are: Samuel R. Slaymaker, J. D. Ranck, Joseph E. Esbenshade, Warren E. Broome and Milo B. Herr. The officers are: President, Samuel R. Slaymaker; secretary, Milo B. Herr; treasurer, Joseph H. Esbenshade. It is expected that the rights of way will soon be secured, after which, the incorporators say, work will be begun before winter.

OXFORD, PA.—The West Chester, Kennett & Wilmington Electric Railway Company has an ordinance before the Common Council of this borough, and it is believed that it will be passed at an early date.

YARDLEY, PA.—The New Jersey & Pennsylvania Traction Company has opened a stone quarry just above this borough, reaching it by a half-mile switch. The line between Trenton and Newton is now being ballasted, and when the job is completed 22,000 tons of crushed stone will have been used.

YORK, PA.—Negotiations have been concluded between the York County Traction Company, and the Wrightsville Turnpike Company, by which the former will build its line between this place and Wrightsville on the turnpike. At Stony Brook the line will diverge from the pike, in order to cross the Pennsylvania Railroad tracks above grade. Work on this line will be rushed. The East Market Street extension is about ready for operation. The grading on the new trolley line between Millersville and York Furnace is about completed, and at least two-thirds of the track laid. Cars will be running in about a month.

PROVIDENCE, R. I.—The Providence & Burrillville Street Railway Company, which is planning to build a double-track electric railway for passenger and freight service between Woonsocket and Providence, connecting with the Rhode Island Company's system to the south and the Woonsocket Street Railway Company to the north, has organized and elected as directors: Edgar K. Ray, of Franklin, Mass.; Edward H. Rathbun and Frank E. Holden, of Woonsocket; F. E. Bartlett and Francis Fagan, of Burrillville; E. B. A. Thayer, of Franklin, and Thomas Martin, of Chelsea. The following-named officers have been elected: President, E. H. Rathbun; general manager and treasurer, E. K. Ray; secretary, Frank E. Holden. The company has an authorized capital of $200,000, will apply for franchises in Lincoln and North Smithfield, and proposes to commence construction in the spring. Surveys and estimates of cost, construction and equipment have already been made.

DYERSBURG, TENN.—The Tennessee Western Railroad Company, which proposes to build and operate an electric railway from Dyersburg to Humboldt, has organized by the election of W. H. Skivington, president; James S. Brown, vice-president; H. E. Nichols, secretary. The company was formed in July and authorized to issue $10,000 capital stock. It has been agreed to make application for an amendment to the charter so as to authorize an increase of capital stock of $2,000,000. The routes have been surveyed, and it is estimated that it will cost $1,500,000 to construct and equip the road.

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TRENTON, TENN.—The Gibson County Construction Company has been organized to construct an electric railway from Trenton to Eaton, Brazil and Gibson Wells. The projected route is about 17 miles long. In the next few days parties will survey the route.

FORT WORTH, TEX.—The Northern Texas Traction Company has completed its new line to Polytechnic College Heights.

MORGANTOWN, W. VA.—A trolley line between Morgantown and Fairmont had its beginning recently in the purchase of the West Side line of the Union Utility Company by the Fairmont, Morgantown & Cheat River Company. The line is now 2 miles long, and Senator Elkins says it will be extended at once.

NEWS NOTES

CHICAGO, ILL.—Corporation Counsel Tolman has rendered an opinion that the city should receive compensation for the advertising which is done on elevated railroad platforms located over city streets; but he did not recommend a suit to recover such compensation for advertising done in the past, because the city has no recognized legal right to allow the elevated roads to advertise on platforms over streets and alleys. Several ordinances are now before the City Council to give the various elevated roads this privilege.

ANDERSON, IND.—The Indiana Union Traction Company will establish at its stations in Indianapolis, Anderson, Muncie, Marion, Alexandria, Elwood and Tipton package and parcel departments, in which articles can be checked by passengers. The plan will be similar to that in effect at the Union Station of the steam roads at Indianapolis.

KOKOMO, IND.—The first car over the Kokomo, Marion & Western Interurban Railway was run on Oct. 2 from Kokomo to Greentown. It was occupied by President O. V. Darby, General Manager T. C. McReynolds and other officials of the company. The line will be in operation between Kokomo and Greentown in ten days.

KEOKUK, IA.—The new electric railway between Keokuk and Hamilton and Warsaw, Ill., has been completed. The line is 7 miles long, and is owned by the Keokuk Electric Railway Company.

LOWELL, MASS.—Four persons were killed practically outright and one is dying, while from fifteen to twenty are more or less injured, as the result of a head-on collision of cars on the Lowell & Pelham Electric Railway about a quarter of a mile north of Pelham Centre, on Sunday morning, Sept. 6.

MARLBORO, MASS.—Permission has been asked of the Railroad Commission to issue articles of association for the Marlboro & Framingham Street Railway Company. It is proposed to form a new corporation to take over the property of the Marlboro Street Railway Company and the Framingham, Southboro & Marlboro Street Railway Company, both of which are controlled by the Boston & Worceser Street Railway interests.

WORCESTER, MASS.—The receivers of the Worcester & Southbridge and the Worcester, Rockdale & Charlton Depot Street Railways are continuing their investigation into the condition of the two properties, upon which they have made a preliminary report. The operation of the roads since they took hold of them have shown a profit. No definite plan of reorganization has been announced.

NASHUA, N. H.—The inquiry by the New Hampshire Railroad Commissioners into the disaster on the Hudson, Pelham & Salem Electric Railway, Sept. 6, as a result of which six people lost their lives and more than a score were seriously injured, has been concluded. The testimony of the employees was contradictory in the extreme. The Commissioners reserved their decision.

ST. LOUIS, MO.—The directors of the United Railways Company have declared the usual quarterly $1.25 on the preferred stock, payable Oct. 10, to the shareholders of record Sept. 25. Stock transfer books close Oct. 11.

CINCINNATI, OHIO.—The Cincinnati, Milford & Loveland Traction Company has elected officers as follows: B. H. Kroger, C. W. Baker, H. L. Gordon, J. M. Wilson, J. N. Roberts, L. J. Van Lahr and Thorne Baker, directors; B. H. Kroger, president; Thorne Baker, vice-president; J. N. Roberts, secretary; L. J. Van Lahr, treasurer. The company has about completed the construction of the first 8 miles of its road from Hyde Park to Milford, and it is expected that cars will be placed in operation in the near future. Power will be furnished temporarily by the Cincinnati, Georgetown & Portsmouth Railway from its station at Olive Branch.

MIDDLEFIELD, OHIO.—Joyce, Heasley & Fawcet, of Youngstown, who have the contract for grading and track laying for the Cleveland & Sharon Traction Company's line, have a large force at work near Middlefield. The work will be pushed until the weather prevents.

FINANCIAL NOTES

CHICAGO, ILL.—It is understood that the plan of the Lake Street Elevated reorganization committee thus far formulated for rehabilitation of the property, and that which will very likely be ultimately agreed upon, calls for an assessment of $2 per share on the stock. This would realize $200,000 on the 100,000 shares of stock outstanding. The sum is seemingly small, but by other plans of refunding the bonds and taking up the income issues it is said the committee sees a way to pull the road out of its present straits.

CHICAGO, ILL.—The statement of the Chicago Electric Traction Company for April shows a deficit of $274; for May a gain of $4,525, and for June a gain of $3,252, or a net gain of $7,503 for the quarter.

INDIANAPOLIS, IND.—Suit has been filed in the Federal Court by Dewitt Delworth, of Pittsburg, Pa., asking for a restraining order and injunction against the officers and stockholders of the Indiana Electric Rail-

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way Company to enjoin them from making a lease of the defendant company's property, franchises and assets to the Indiana Western Railway Company, or to any other corporation, for the benefit of the Indiana Western Railway Company, and from holding a stockholders' meeting on Oct. 30 for the making of the lease. The proposed lease is for a term of ninety-nine years. Mr. Delworth holds 1833 shares of the capital stock. Judge Anderson issued a temporary restraining order, and cited all parties to appear before him on Oct. 12 to show cause why the injunction should not be made permanent.

LAPORTE, IND.—Judge Baker, of the Federal Court, has set Nov. 5 as the date at which the master in chancery will sell at auction the plant and franchises of the Lake Cities Electric Company to satisfy foreclosure proceedings brought by the Metropolitan Trust Company of New York, which holds bonds against the company to the value of $75,000. The bidding for the property promises to be lively. Russell B. Harrison was one of the principal stockholders in the Lake Cities Company, and organized another company for the purpose of again securing control of the plant.

NEW ALBANY, IND.—The Louisville & Southern Indiana Traction Company has filed with the County Recorder a deed of trust to the American Trust & Savings Bank and Frank H. Jones, of Chicago, and the United States Trust Company, of Louisville, trustees, to secure the payment of $1,000,000 5 per cent twenty-year bonds, issued Sept. 15, 1903.

VINCENNES, IND.—The Vincennes Street Railway has been sold to the E. M. Dean syndicate, of Grand Rapids, Mich., for $100,000.

WABASH, IND.—The consolidation of the Fort Wayne & Southwestern Railway, operating between this city and Fort Wayne, and the Logansport & Wabash Valley Company, operating between this city and Logansport, has been consummated by the organization of a new company to take over the two properties, and stock and securities of the consolidated company will be issued for the stock of the old corporation. Six large new vestibule cars have been ordered. The roster of the officials of the consolidated company has not been made public, but it is understood that the McCulloch interests will name the new officers.

BALTIMORE, MD.—A proposition will be presented to the Cleveland owners of the Washington, Baltimore & Annapolis Railway Company whereby the affairs of the company will be straightened out. Under the original syndicate agreement there were subscribed $1,500,000 bonds at par. Of this amount $690,000 has been called for, and $500,000 of this amount has been paid, leaving $190,000 still due. About $200,000 is required to pay the debts of the company, including material bills, receivership expenses, etc. It is proposed to ask the underwriters to pay this amount at once. The unpaid assessments will then be collected and a call for the additional 40 per cent on the original underwriting will be made. It is figured it will take about $800,000 to complete the road and place it in operation. It will be remembered that this is the road which will use Westinghouse single-phase motors.

MARLBORO, MASS.—The Marlboro & Framingham Street Railway Company has asked the Railroad Commission for authority to issue original capital stock of $105,000. William M. Butler, James F. Shaw and George R. Butman, of the Boston & Worcester Street Railway, are interested in the Marlboro & Framingham road.

PITTSFIELD, MASS.—The Pittsfield Electric Company has been authorized to issue $50,000 new capital to repay promissory notes and for the cost of plant construction. The new stock will be issued at $135 per share.

WORCESTER, MASS.—The Railroad Commission has approved an issue of $250,000 in 4½ per cent twenty-year bonds by the Boston & Worcester Street Railway Company, to be used for the payment of floating indebtedness and for the purchase of real estate and personal property.

WORCESTER, MASS.—The receivers of the Worcester & Southbridge and the Worcester, Rochdale & Charlton Depot Street Railway Companies have been granted authority by the Superior Court to issue receivers' certificates on the latter company, not to exceed $10,000, to pay for the completion of improvements on Stafford Street, Worcester.

DETROIT, MICH.—J. D. Hawks, one of the owners of the Detroit, Ypsilanti, Ann Arbor & Jackson Electric Railway, is quoted as authority for the statement that a consolidation of all the electric railways between Detroit and Kalamazoo, a total of about 270 miles, has been practically effected. S. F. Angus, Mr. Hawks' partner, has just returned from New York, where he went on business connected with the merger.

ST. LOUIS, MO.—The report of the St. Louis Transit Company shows that the gross earnings for September were $635,110, as against $561,921 for September, 1902, a gain of $73,189.

ALBANY, N. Y.—The net earnings of the United Traction Company of Albany and Troy for the quarter ended Sept. 30, after deducting for bond interest and other fixed charges, amount to $93,431. The quarterly dividend of the stock of 1¼ per cent, which is payable out of these earnings, call for $62,500, and after the dividend payment there is left a surplus of $30,931. The directors have voted to pay the regular dividend on Nov. 2. Books will be closed on Oct. 21 and reopen Nov. 3.

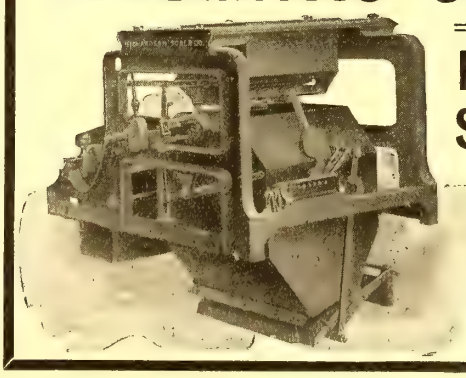
BUFFALO, N. Y.—The International Traction Company reports earnings as follows:

Quarter ending June 30	1903	1902
Gross receipts	$929,749	$772,384
Operating expenses	519,062	436,915
Net earnings	$410,687	$335.469
Other income	15,807	13,896
Total income	$426,494	$349,365
Fixed charges	236,116	289,062
Surplus	$190,378	$60,303

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SYRACUSE, N. Y.—The Syracuse Rapid Transit Company reports earnings as follows:

August	1903	1902
Total gross earnings	$68,568	$60,579
Operating expenses	38,002	33,314
Net earnings	$30,566	$27,265
Deductions from income	20,286	19,024
Net income	$10,280	$8,241
For three months ending Aug. 31		
Total gross earnings	$140,514	$123,150
Operating expenses	77,493	67,679
Net earnings	$63,021	$55,471
Deductions from income	40,553	38,050
Net income	$22,467	$17,421

CINCINNATI, OHIO.—It is announced that the controlling interests of the Cincinnati, Dayton & Toledo Traction Company have practically agreed upon a plan whereby the property is to be leased to the Widener-Elkins syndicate on a graduated scale of dividends, and it is stated that the plan will probably be carried into effect before the first of the year. Since the recent change in the control of the property the road management has been under the supervision of Mr. Schoepf, president of the Cincinnati Traction Company.

CINCINNATI, OHIO.—The Cincinnati, Dayton & Toledo Traction Company reports earnings as follows:

August—	1903	1902
Gross receipts	$56,544	$49,301
Operating expenses	26,277	24,482
Net earnings	$30,267	$24,819
Interest and taxes	16,137	16,280
Surplus for stock	$14,130	$8,538

CLEVELAND, OHIO.—President Charles Wason, of the Cleveland, Painesville & Eastern Railway Company, states that there is no truth in the report that a consolidation of that company with the Cleveland, Painesville & Ashtabula Railway is contemplated for the immediate future. He says it is quite logical that some day there will be a consolidation of all the electric lines paralleling the Lake Shore (steam), but there will be no consolidation between the two roads mentioned until the new Cleveland, Painesville & Ashtabula has demonstrated its earnings powers.

SPRINGFIELD, OHIO.—The report of the Springfield & Xenia Traction Company for the first nine months of the year has been made. This indicates that the gross receipts have been very satisfactory, but just what they have done in operating does not appear. The earnings by months follow: January, $2,591; February, $2,650; March, $3,781; April, $3,569; May, $5,799; June, $5,321; July, $6,416; August, $6,824; September, $5,216; total, $42,167.

TOLEDO, OHIO.—The gross earnings of the Toledo & Western Railway from Jan. 1 to Sept. 1, are: January, $11,095; February, $9,286; March, $12,930; April, $12,315; May, $13,975; June, $13,986; July, $17,153; August, $18,501. The company is now operating for about 53 per cent, on which basis they should earn about 1¾ per cent on its stock.

YOUNGSTOWN, OHIO.—A certificate of consolidation has been filed for the Youngstown & Southern Railway Company and the Youngstown & Salem Railway under the name of the first-mentioned company. The Youngstown & Southern had a capital stock of $1,500,000, while the Youngstown & Salem had $300,000 capital stock. The new company has $1,800,000. The line is now under construction from Youngstown to East Liverpool, and there will be a branch from Leetonia to Salem.

ZANESVILLE, OHIO.—The earnings of the Zanesville Railway, Light & Power Company, which is owned by Cincinnati capitalists, for the six months ending Aug. 31, were: Gross, $74,706; operating expenses, $36,733; net earnings, $37,973; bond interest for six months, $19,625; leaving a surplus of $18,348.

BEAVER, PA.—The Beaver Valley Traction Company reports earnings as follows:

Year ending Sept. 30—	1903	1902
Gross earnings	$227,409	$177,213
Operating expenses	126,206	96,399
Net earnings	$101,202	$80,815
Taxes, interest on bonds	70,414	62,573
Net income	$30,788	$18,241
Surplus account	$46,090	$15,240

COATESVILLE, PA.—The personal property of the Brandywine Traction Company, which has 2 miles of its line to Coatesville graded, has been levied upon at the instance of a New York firm. The West Chester Street Railway Company and the Coatesville Traction Company have also brought suit against the company to restrain it from building the Coatesville line, claiming that the Coatesville Traction Company has a prior right. The Brandywine Company had listed $8,000 with the town authorities, $3,000 for the franchise and $5,000 as a forfeit, and this money was seized by the sheriff. The ordinance granting the Brandywine Company a franchise had been vetoed by the Burgess, but was subsequently passed over his head.

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FORT WORTH, TEX.—The Northern Texas Traction Company reports earnings as follows:

September—	1903
Gross receipts	$41,949
Operating expenses	22,033
Net earnings	$91,916
Fixed charges	9,673
Surplus	$10,243
For the nine months ending Sept. 2—	1903
Gross earnings	$335,296
Operating expenses	178,167
Net earnings	$157,129
Fixed charges	82,490
Surplus	$74,639

RICHMOND, VA.—The Virginia Passenger & Power Company makes the following report to the State Railroad Commissioner of the result of the operations for the year ending June 30, 1903:

Amount received from sale of tickets		$576,981
Amount received from cash fares		311,166
Amount received from freight transported		4,368
Amount received from chartered cars, etc.		2,115
Total gross transportation receipts		$894,630
Amount received from other sources		473,780
Total gross receipts		$1,368,410
Cost of operation and repairs	$825,672	
Amount of interest on indebtedness, and all other fixed charges	770,294	
Total expenses		$1,595,967
Leaving net deficit for the year of		$227,556

SEATTLE, WASH.—The Seattle Electric Company reports earnings as follows:

August	1903	1902
Gross earnings	$188,541	$179,116
Operating expenses	123,829	112,450
Net earnings	$64,712	$66,666
Fixed charges	22,257	21,158
Net profit	$42,455	$45,508
For year ending August		
Gross earnings	$2,055,425	$1,736,070
Operating expenses	1,456,652	1,191,657
Net earnings	$598,773	$544,413
Fixed charges	286,936	252,209
Net profit	$311,836	$292,203

CLARKSBURG, W. VA.—The Clarksburg & Fairmont Traction Company, operating in Clarksburg and Fairmont has given a deed of trust to the Guarantee Trust Company, of New York, for $2,500,000, and will issue 5 per cent first mortgage bonds. The money is to be used for improvements, extentions and additions.

AMONG THE MANUFACTURERS

THE WALTER A. ZELNICKER SUPPLY COMPANY, of St. Louis, Mo., is making a specialty of galvanized strand for electric street railways.

TWO 90-HP DIESEL ENGINES have been ordered for installation in the new power house of the Roslyn Tram Company, Dunedin, New Zealand.

THE AULTMAN COMPANY, of Canton, Ohio, has recently equipped the power station of the Camden Interborough Railway at Kenoba, W. Va., with a complete installation of coal and ash-handling machinery.

THE MOTOR DEPARTMENT of the Stanley Electric Manufacturing Company, of Pittsfield, Mass., will henceforth be in charge of A. W. Henshaw, formerly of the General Electric Company, Schenectady, N. Y.

EVERY ISSUE OF RIDLON'S REPRESENTATIVE contains something of value to street railway men. The October number is devoted to describing some railway specialties sold by the Frank Ridlon Company, of Boston, Mass., which company will be pleased to send this publication regularly to those interested.

A TIMELY PUBLICATION is the pamphlet "About Track-Cleaning Devices," distributed by the Ohio Brass Company, of Mansfield, Ohio. It refers mainly to the well-known Monarch track cleaner for heavy snow, ice, sleet, mud or gravel. Adjustable track brush holders, track brooms and hand brooms are also given attention.

THE ECLIPSE CAR FENDER COMPANY, of Cleveland, Ohio, has recently installed its life guards on the following roads: New York & Long Island Traction Company, 28; Springfield, Troy & Piqua Railway Company, 10; Morgan Electric Traction Company, Morgantown, W. Va., 10. In addition to these, some fifty or more trial orders have been filled. In order to accommodate its growing business, the company has found it necessary to increase the size of its quarters.

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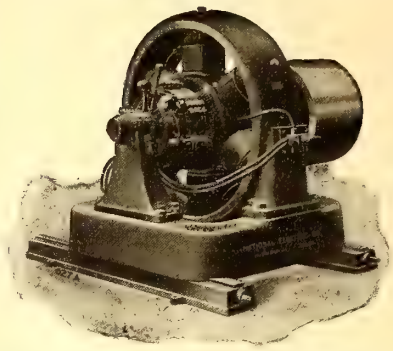
Newark, N. J., U. S. A.

THE AMERICAN BUREAU OF INSPECTION AND TESTS, 930 Monadnock Block, Chicago, Ill., has been established for the purpose of conducting a bureau of inspection and tests of everything entering into the construction of a railroad, including rails and angle-bars, cars and locomotives, bridge material, plates and cast-iron pipes, etc., and is prepared to guarantee that nothing but first-class work will be submitted. The corps of inspectors is stated to be composed of most efficient and experienced men. The bureau will furnish full reports of all its work, giving chemical analyses and physical tests whenever required. It will be pleased to correspond regarding terms for different classes of inspection.

THE STANDARD UNDERGROUND CABLE COMPANY, of New York, has secured the contract for trolley wire—heavy 0000—to be used in the construction of the Wellington, New Zealand Municipal Electric Traction system. The contract for the construction of the road, which will be 30 miles long, was recently awarded to the British electrical engineering and contracting firm of Macartney, McElroy & Company, Ltd., with offices in New York. The Standard Company, the J. G. Brill Company (trucks), and the General Electric Company (motors), are the only American concerns that have been awarded contracts, the major portion of the material having been purchased in England. The value of Macartney, McElroy & Company's contract is about $570,000. The power-house equipment will be entirely of British manufacture.

THE CANADIAN WESTINGHOUSE COMPANY, LTD., has been organzed with a capital of $2,500,000. The new company is a consolidation of all the Westinghouse interests in Canada, which heretofore have been conducted individually. It will take over all the property patents and other interests of the succeeded companies, including the sales organization and business of Ahearn & Soper, of Ottawa. The organization committee elected the following board of directors: George Westinghouse, of Pittsburg; C. F. Size, of Montreal; H. H. Westinghouse, George C. Smith, Frank H. Taylor, L. A. Osborne, all of Pittsburg; Thomas Ahearn, of Ottawa; J. M. Gibson, of Hamilton; W. Y. Soper, of Ottawa, and Paul J. Myler, of Hamilton. The executive, as formed, will consist of the following gentlemen: H. H. Westinghouse, F. H. Taylor, L. A. Osborne, George C. Smith and W. Y. Soper. The officers, as elected, are: President, George Westinghouse; vice-presidents, H. H. Westinghouse and F. H. Taylor; general manager and treasurer, Paul J. Myler; secretary, John H. Kerr. While only the ten directors named were elected, the board, when complete, will consist of fifteen members, the remaining five to be named from the Canadian gentlemen interested. Ground is to be broken for the new works in Hamilton within the next two months, and erection will follow as fast as possible. It is expected that at least 1000 employees will be serving the company within a year, as soon as the plant is completed.

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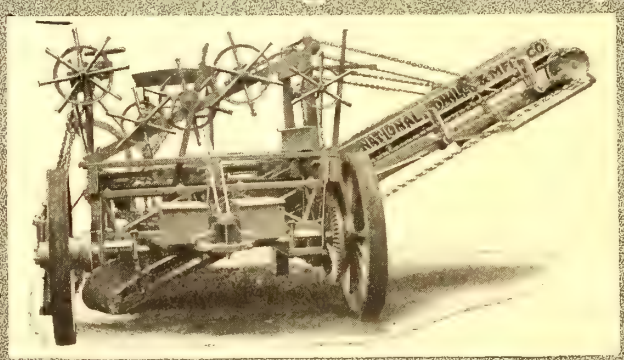
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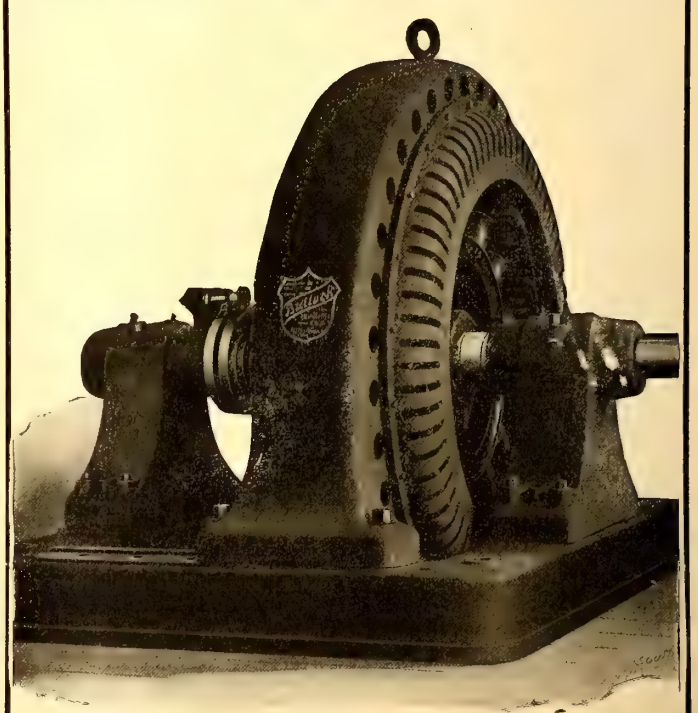
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A WEEKLY RECORD OF THE WORLD'S PROGRESS IN CITY AND INTERURBAN RAILROADING

TWENTY-SECOND ANNUAL CONVENTION
AMERICAN STREET RAILWAY ASSOCIATION

SEVENTH ANNUAL CONVENTION STREET RAILWAY ACCOUNTANTS ASSN OF AMERICA

FIRST ANNUAL CONVENTION AMERICAN RAILWAY MECHANICAL & ELECTRICAL ASS'N

SARATOGA SPRINGS N.Y.
SEPTEMBER 2-3-4 1903.



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AUGUST 29 1903

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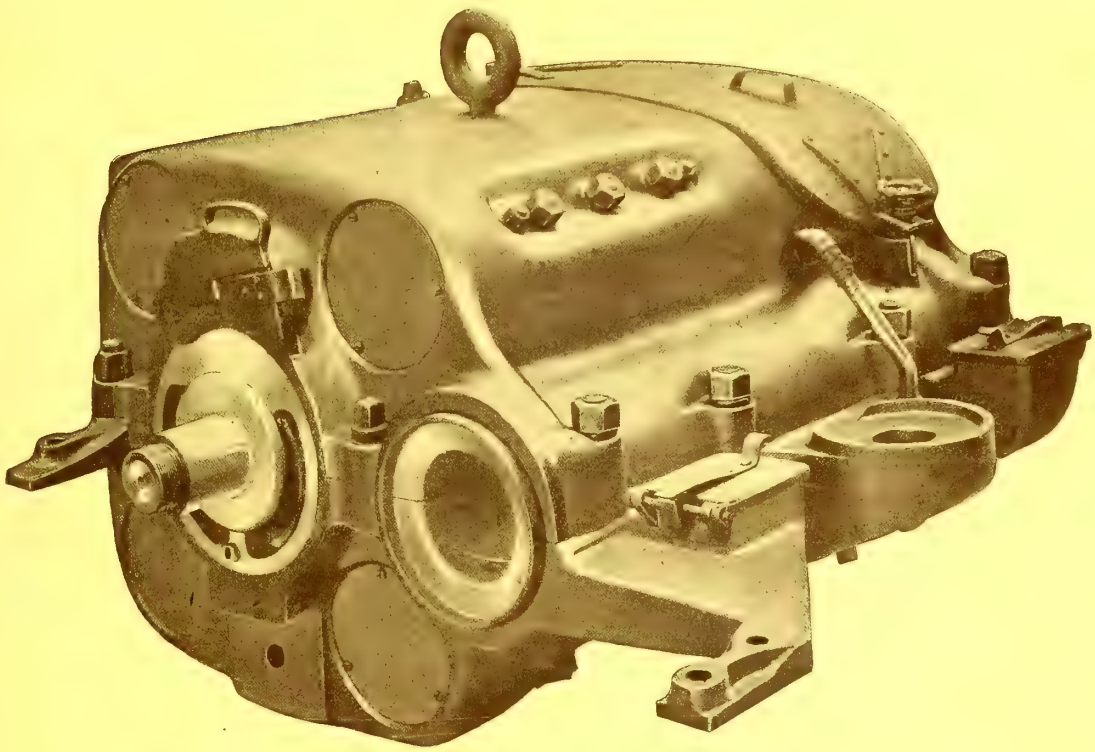
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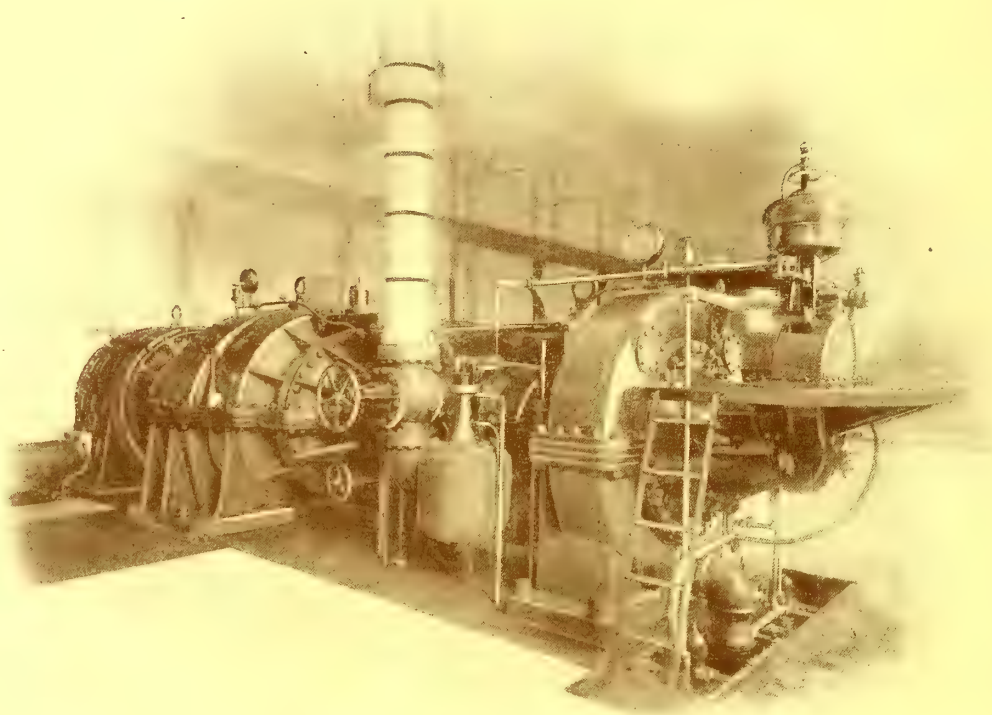
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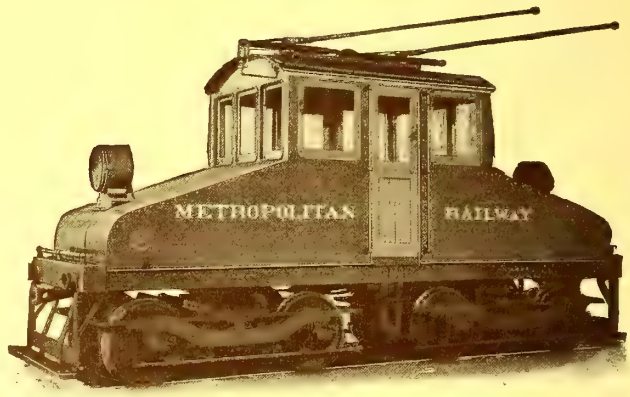
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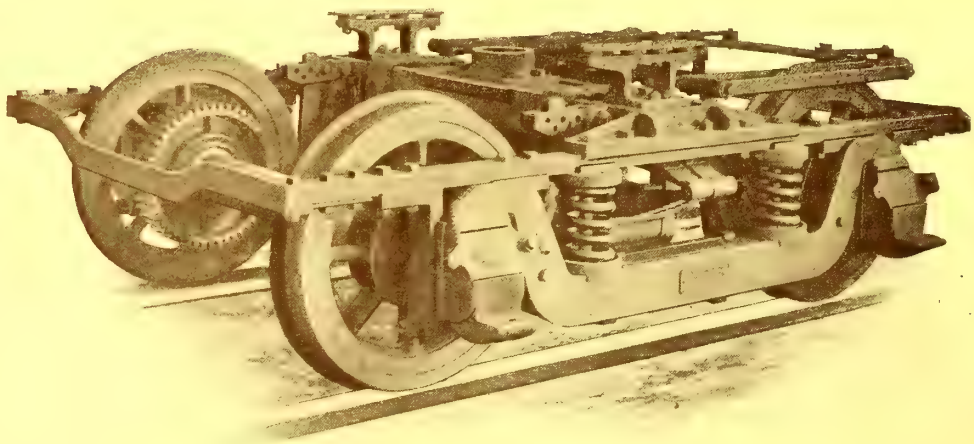
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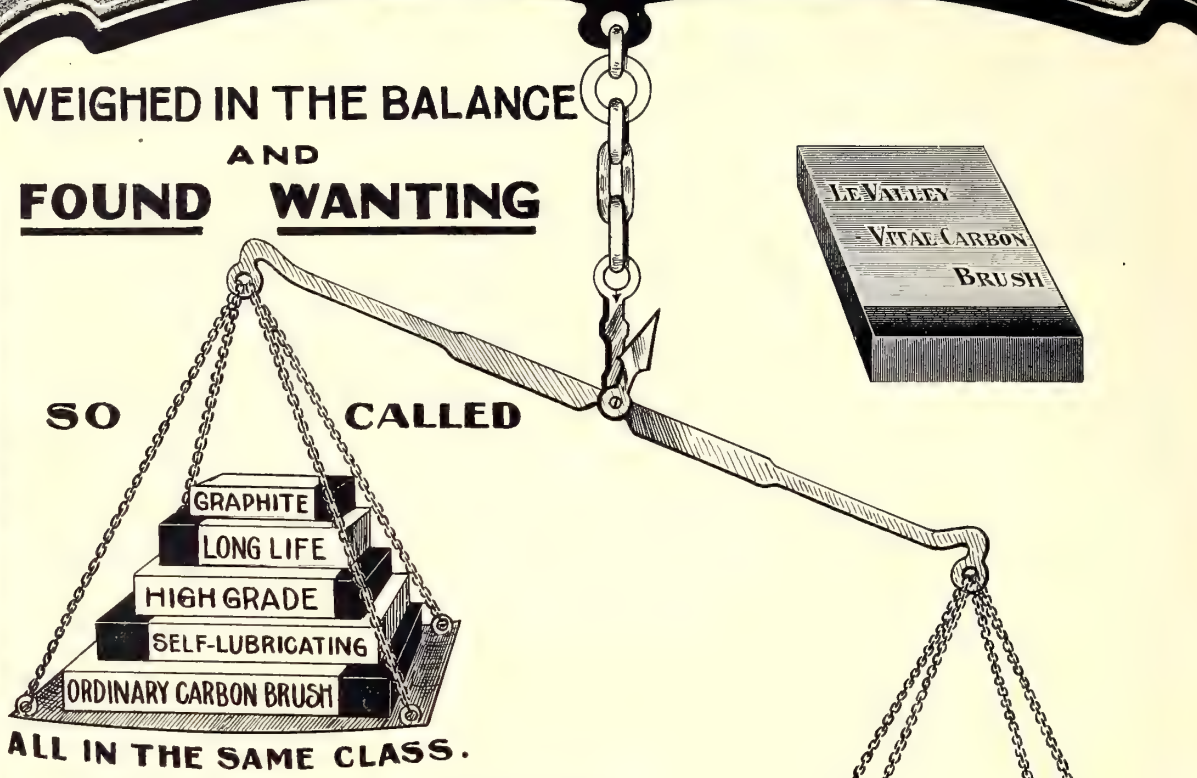
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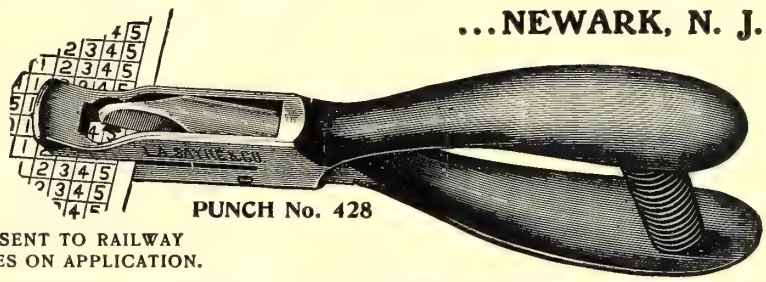
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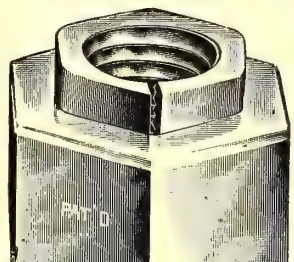


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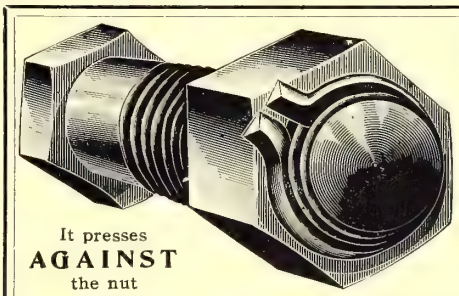


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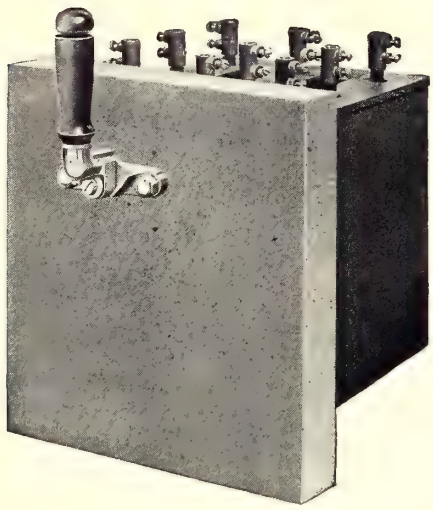


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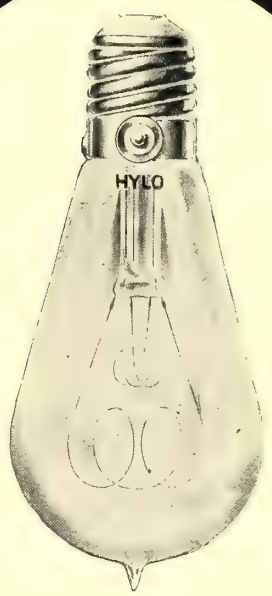
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What? They intend selling them?

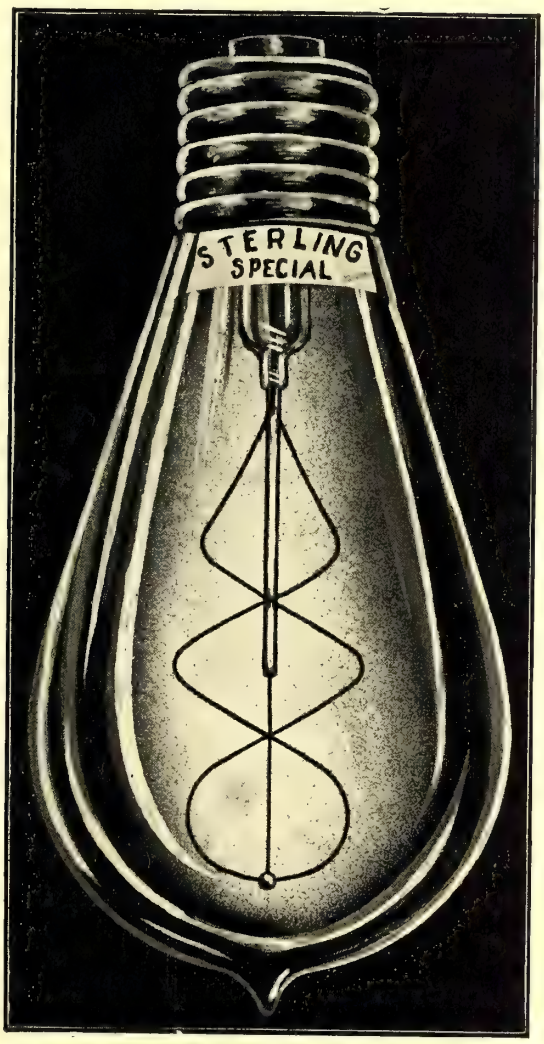


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That is a good joke



INCREDULITY.
That's just talk!

I CANNOT TELL A LIE



I did it with my Filament

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They can't get that!



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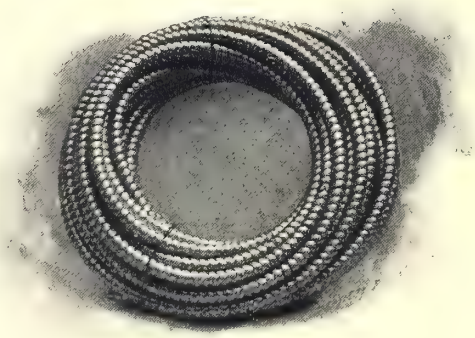
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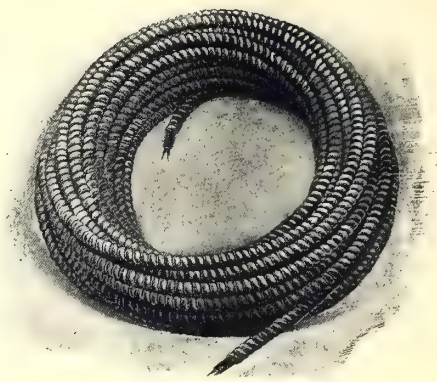
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American Street Railway Association

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RIDING GALLERIES

Our Galleries and Miniature Railways attract the crowds, and pay for themselves in one season.

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NORTH TONAWANDA NEW YORK, U. S. A.

IMPROVED MERRY-GO-ROUNDS



AND EVERYTHING IN UP-TO-DATE ATTRACTIONS FOR RAILWAY PARKS

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Can be operated by Steam or Electricity.

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A Business Proposition

A Street Railway System without a Park is a tame proposition.
A Park without a Roller Coaster is a dead proposition; but
A Street Railway with a Park for a feeder, in which is one of our

FIGURE 8 ROLLER COASTERS



is a **BUSINESS PROPOSITION** that no wide-awake Street Railway Manager can afford to overlook.
Do you question the truth of this? If so, what shall we do with the following?

PITTSBURG, PA.,
July 11, 1903.

GENTLEMEN:—Our experience with your Figure 8 Toboggan slide at Kennywood Park was extremely satisfactory. It was one of the best drawing cards we had on the grounds.

Yours truly,
MONONGAHELA STREET RAILWAY CO.,
Geo. S. Davison, *Secretary.*

READING, PA.,
July 1, 1903.

GENTLEMEN:—Your Figure 8 Toboggan and "Laughing Gallery" at Carsonia Park have not only done a large business in themselves, but have attracted thousands to the Park, increasing largely the trolley traffic.

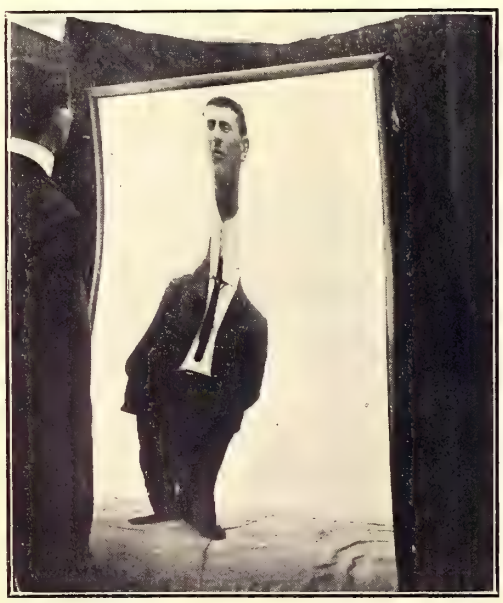
Yours truly,
P. D. LAUMAN, *President,*
Interstate Amusement Co.

SANDUSKY, OHIO,
July 8, 1903.

DEAR SIRS:—The Figure 8 Roller Coaster your company built at Cedar Point last season was undoubtedly the best attraction and biggest money maker on our resort grounds. The phenomenal business the coaster is again doing this season is certainly very gratifying to us.

Yours truly,
G. A. BOECKLING, *President,*
Cedar Point Pleasure Resort Co.





"Laughing Gallery" to complete your Park. Here's what the people say, and they know:

And then there's the Ingersoll **"LAUGHING GALLERY"**—The only one in the world. Funiest Attraction and greatest money maker ever known. Does your Park need a "booster?" We have it—not in the "fake" class—clean, amusing, and a great drawing card. Advertises itself. Two persons can operate it. You need a

SANS SOUCI PARK, CHICAGO, ILL., July 10, 1903.

GENTLEMEN:—We are doing a very satisfactory business at the Park. Everybody very much pleased with our "Gallery."

Yours truly,
FRANK R. GREENE.

READING, PA., July 1, 1903.

GENTLEMEN:—The "Laughing Gallery" we bought from you for Dorney Park, Allentown, Pa., is a winner. We will be pleased to hear from you any time you have new attractions to offer.

Yours truly,
P. D. LAUMAN, *President,*
Interstate Park Amusement Co.

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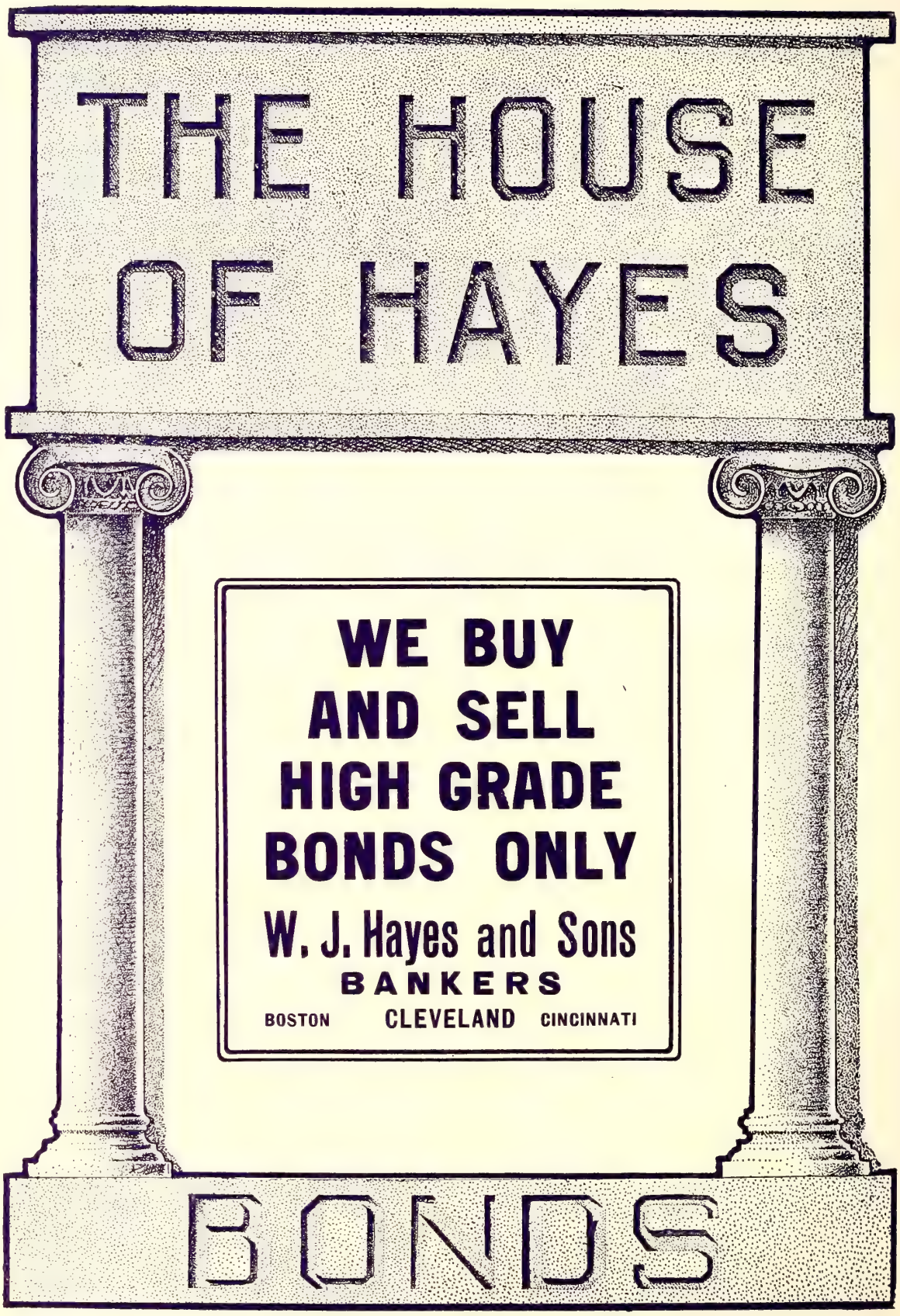
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Cars, Trucks, Snow Plows, Sweepers and Sprinklers

SECTION II.

EUROPEAN MANUFACTURERS, DEALERS, CONTRACTORS AND ENGINEERS

FOR ALPHABETICAL INDEX TO ADVERTISERS SEE PAGES 5-8

ROBERT W. BLACKWELL & CO., Ltd.

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LAYING TRACK AT CHESTER.

CONTRACTORS FOR COMPLETE TRAMWAY EQUIPMENT, STEAM AND TRANSMISSION PLANT

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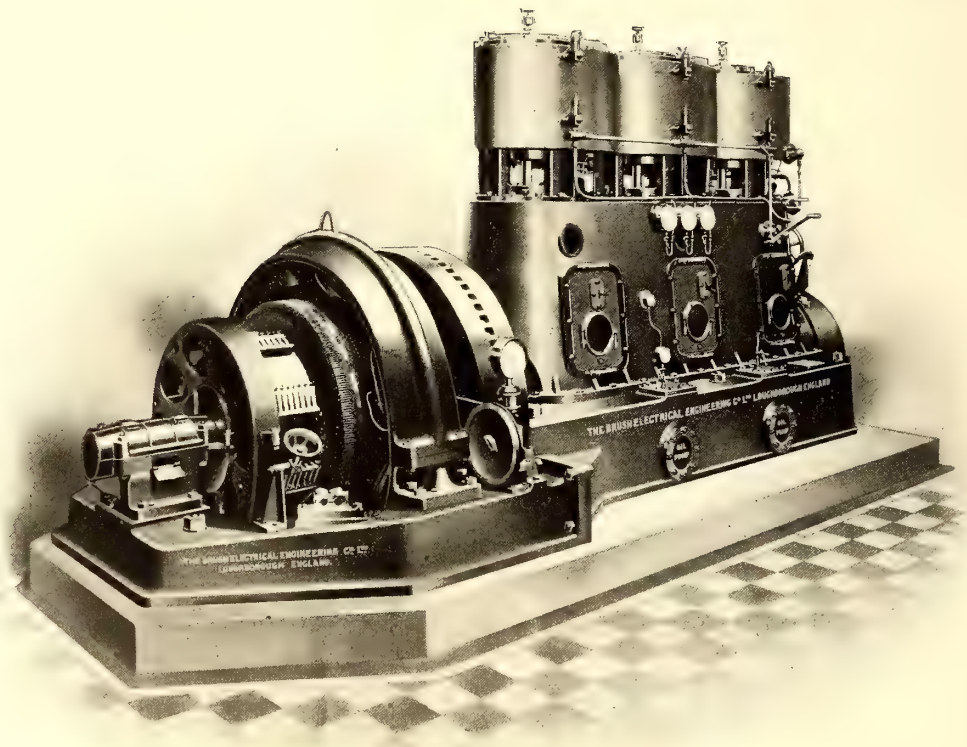


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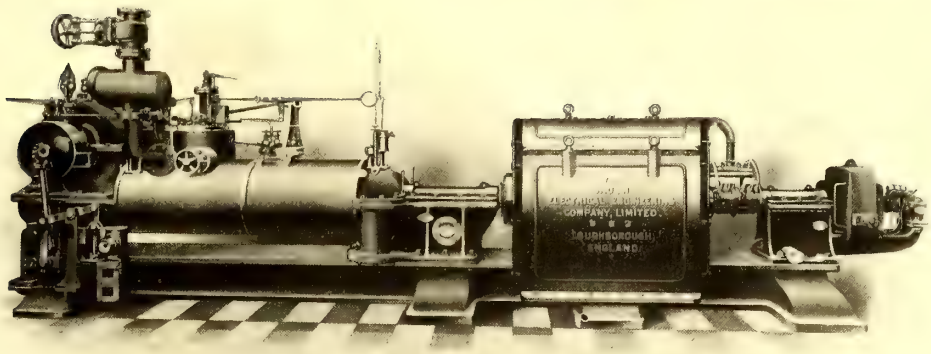
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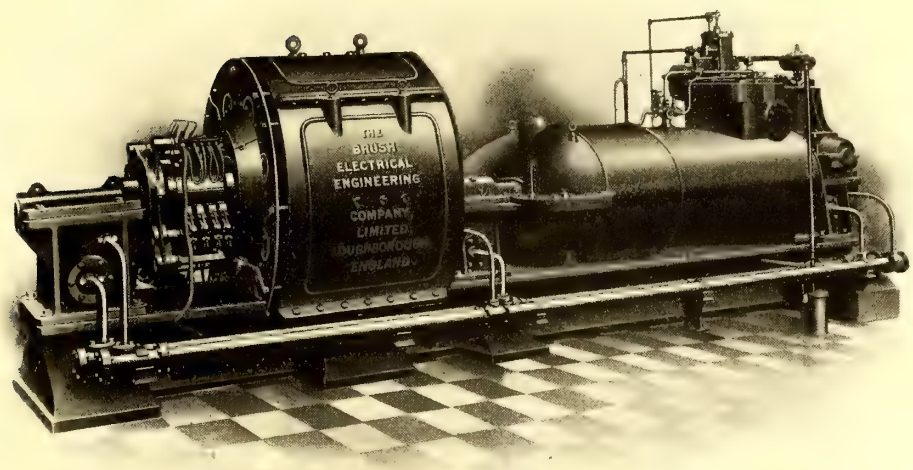
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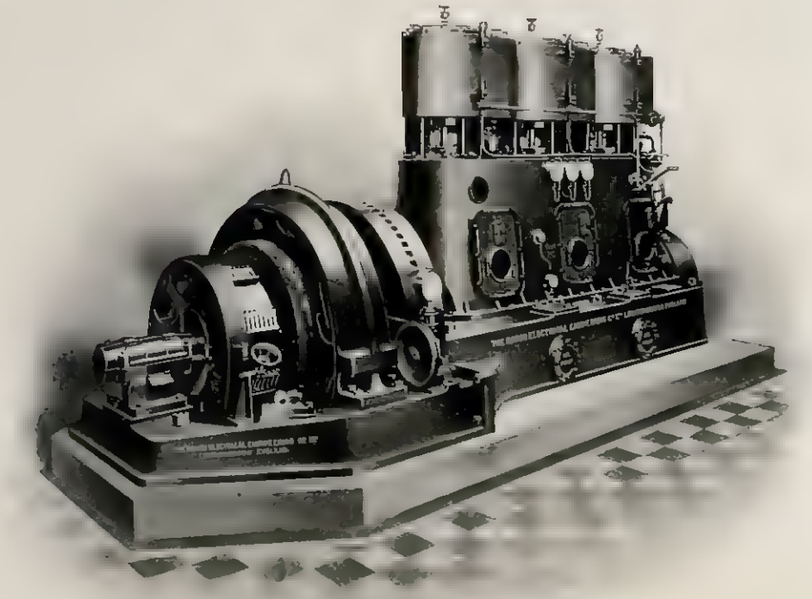
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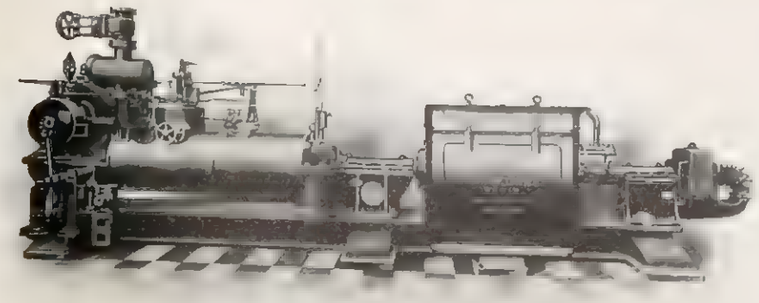
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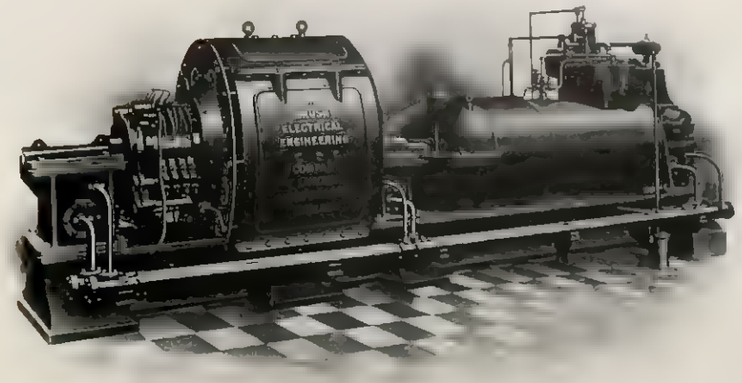
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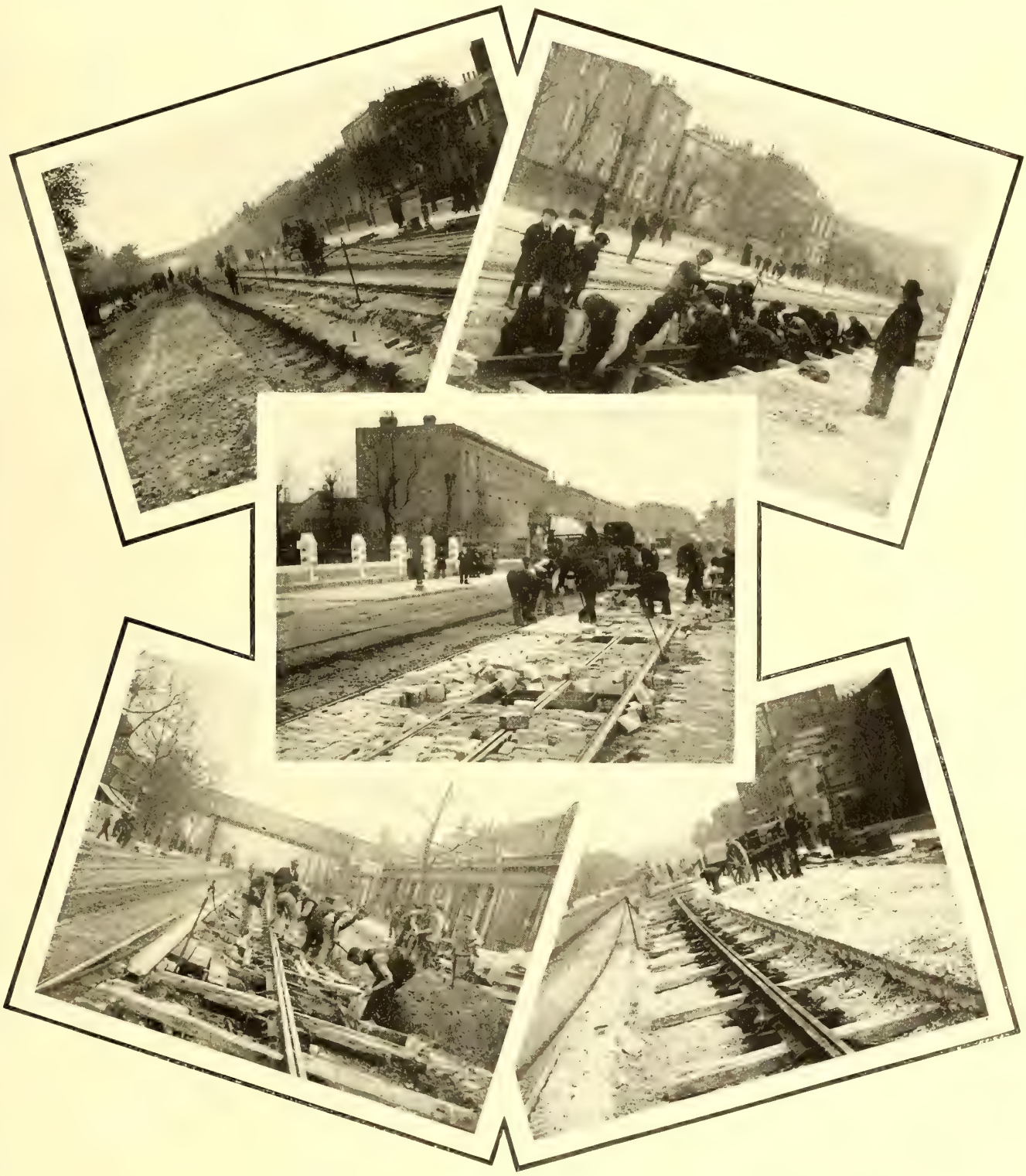
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(TWO 1500 K. W. (D. C.) GENERATORS)

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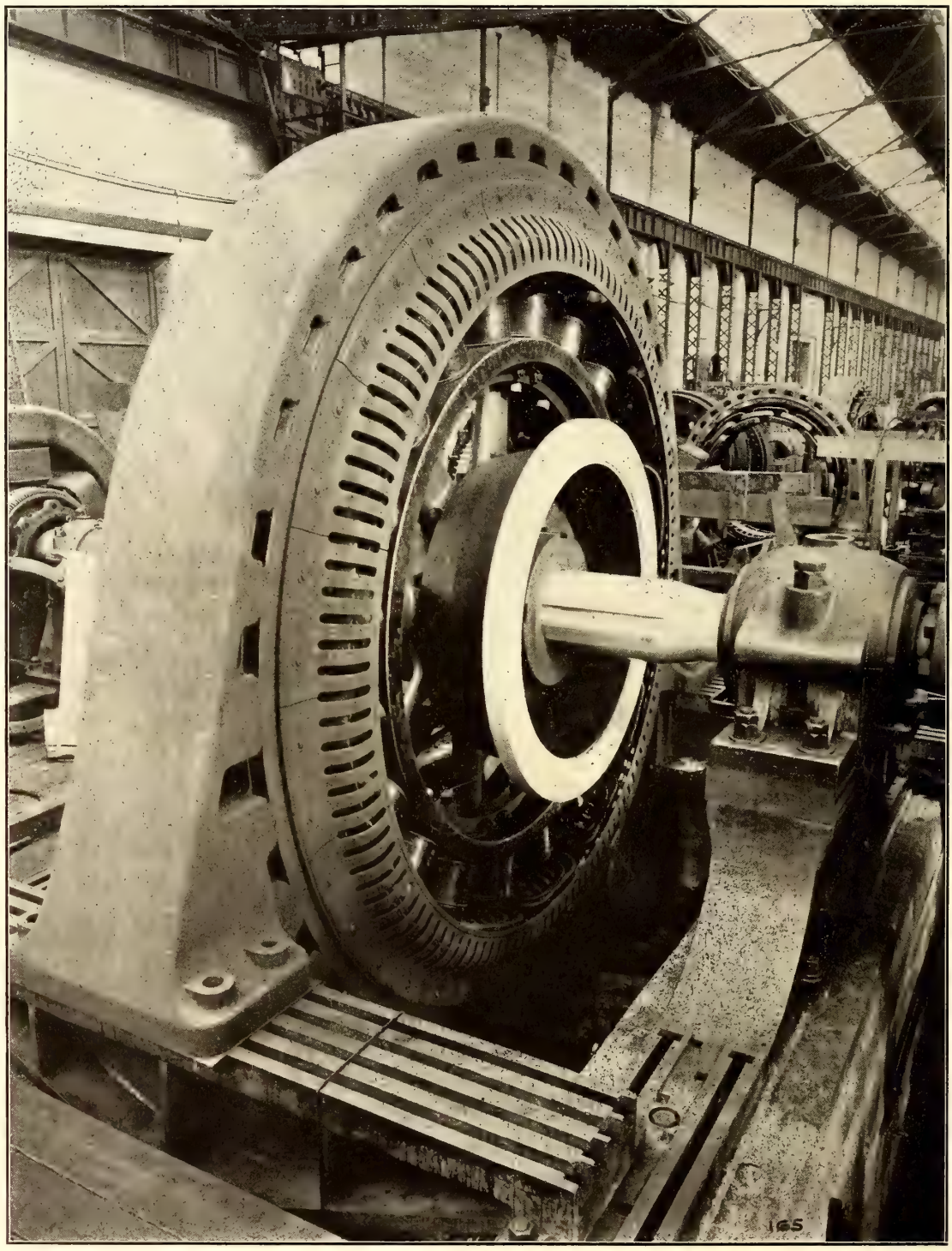
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1500 K. W. THREE-PHASE ALTERNATOR FOR THE

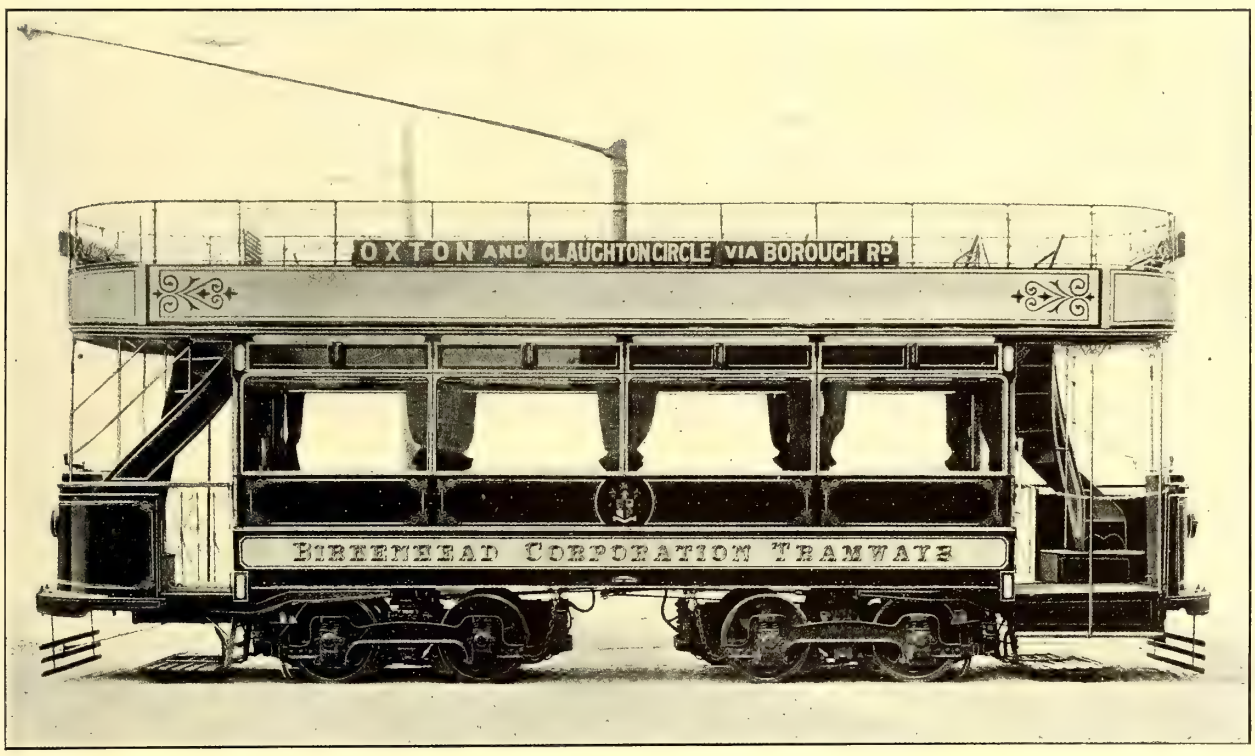
LONDON COUNTY COUNCIL TRAMWAYS.

Witting, Eborall & Company, Ltd.

ELECTRICAL ENGINEERS AND CONTRACTORS

LONDON, E. C.

Every Requisite for Electric Power and Traction



BIRKENHEAD CAR EQUIPPED WITH FOUR 20 B H. P. MOTORS AND RHEOSTATIC BRAKE CONTROLLERS.

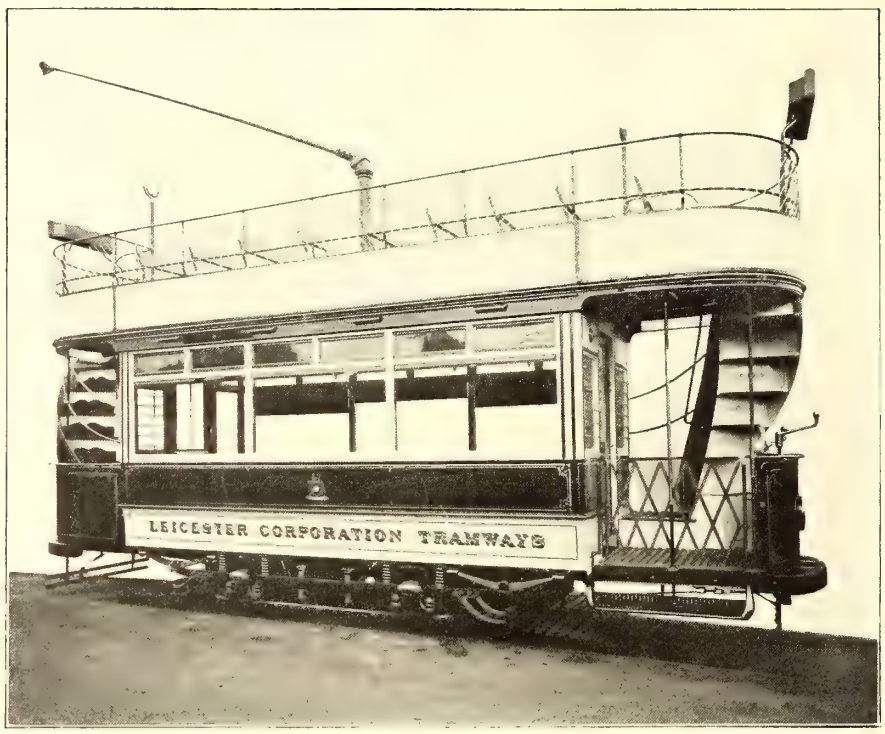
Electrical equipments or complete cars have been or are being supplied by us *to over 20 towns* including Bradford (200 cars), West Ham Tramways (50 cars), Glasgow (100 cars), South Lancashire Tramways (50 cars), Brighton Tramways (10 cars), Birkenhead Tramways (15 four-motor cars), Madras (6 cars), Manx Electric Railway (13 four-motor cars), etc., etc.

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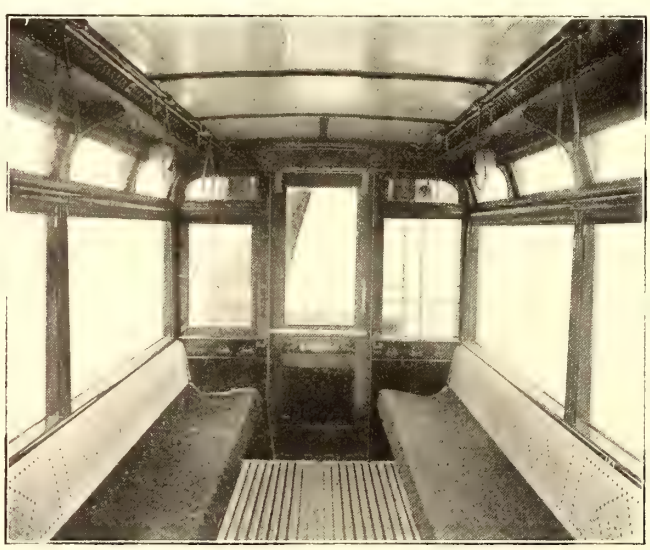
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THE ELECTRIC RAILWAY AND TRAMWAY CARRIAGE WORKS Limited

Manufacturers of RAILWAY CARRIAGES, TRAMCARS for ELECTRIC TRACTION, and all kinds of rolling stock for light railways



Outside View of Leicester Car



Inside View of Leicester Car

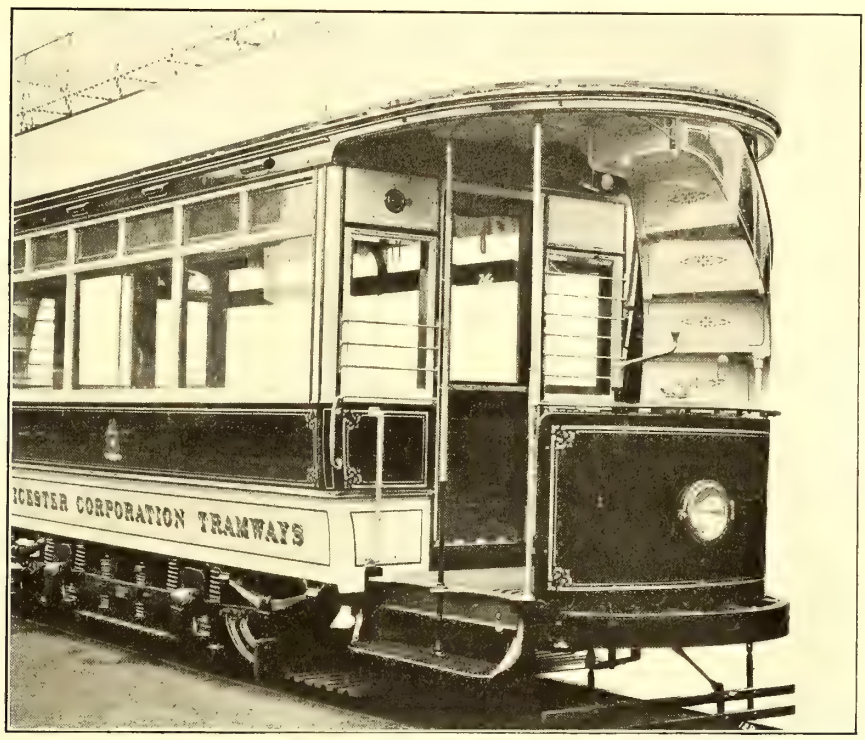
The standard designs at Preston include types of cars for all climates

Registered Office and Works: Strand Road, Preston, Lancashire

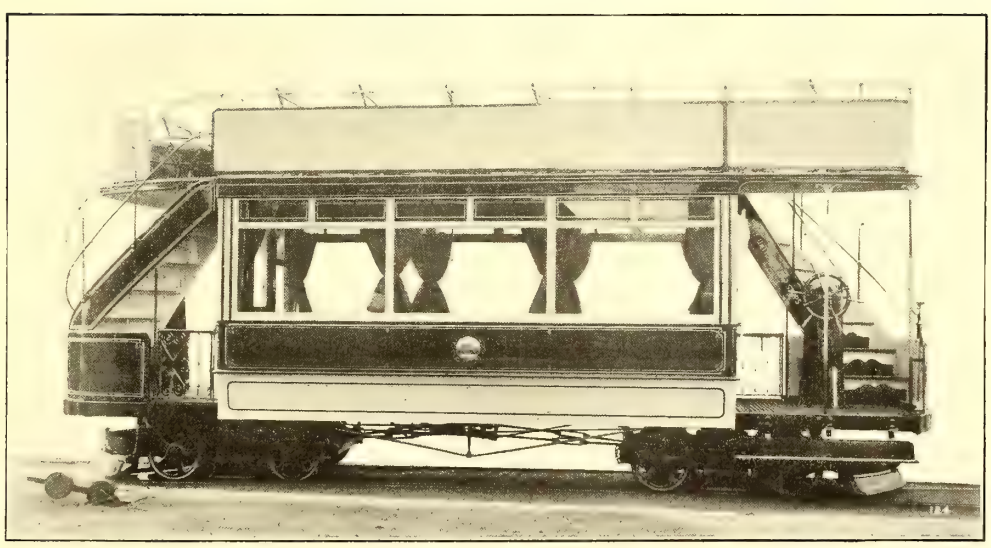
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End View of Leicester Car



Cable Car built for the Edinburgh & District Tramways Co., Ltd.

The standard designs at Preston include types of cars for all climates

Registered Office and Works: Strand Road, Preston, Lancashire

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THE BRITISH ELECTRIC

Manufacturers of TRAMWAY and LIGHT RAILWAY CAR BODIES, TRUCKS and all Accessory Supplies



"B. E. C." Standard Car and Truck (Type "S. C.")

CONTRACTS FOR CAR BODIES, TRUCKS, ETC., completed or in process of execution:

HUDDERSFIELD CORPORATION TRAMWAYS (4 Contracts)
LONDON UNITED TRAMWAYS (4 Contracts)
CITY & SOUTH LONDON (TUBE) RAILWAY
PORTSDOWN & HORNDEAN LIGHT RAILWAY (3 Contracts)
ABERDEEN CORPORATION TRAMWAYS (3 Contracts)
NEWCASTLE CORPORATION TRAMWAYS
HAMILTON, MOTHERWELL & WISHAW TRAMWAYS
BLACKPOOL, ST. ANNES & LYTHAM TRAMWAYS
DUBLIN UNITED TRAMWAYS
SOUTH LANCASHIRE TRAMWAYS
TRAFFORD PARK TRAMWAYS
SALFORD CORPORATION TRAMWAYS
BATLEY CORPORATION TRAMWAYS
LONDON COUNTY COUNCIL
ILFORD URBAN COUNCIL
STALYBRIDGE, HYDE, MOSSLEY & DUKINFIELD TRAMWAYS
WELLINGTON (NEW ZEALAND) TRAMWAYS
ALEXANDRIA & RAMLEH TRAMWAYS (EGYPT), ETC., ETC.

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Trafford Park
MANCHESTER

Head Office:
Oxford Court, Cannon Street
LONDON, E. C.

CAR COMPANY, Limited

Patent Illuminated Destination Indicators

For ELECTRIC TRAM-CARS, RAILWAY CARRIAGES and STATION PLATFORMS

Type D. O.
Standard type for double-deck cars, with detachable handle at right end of frame.

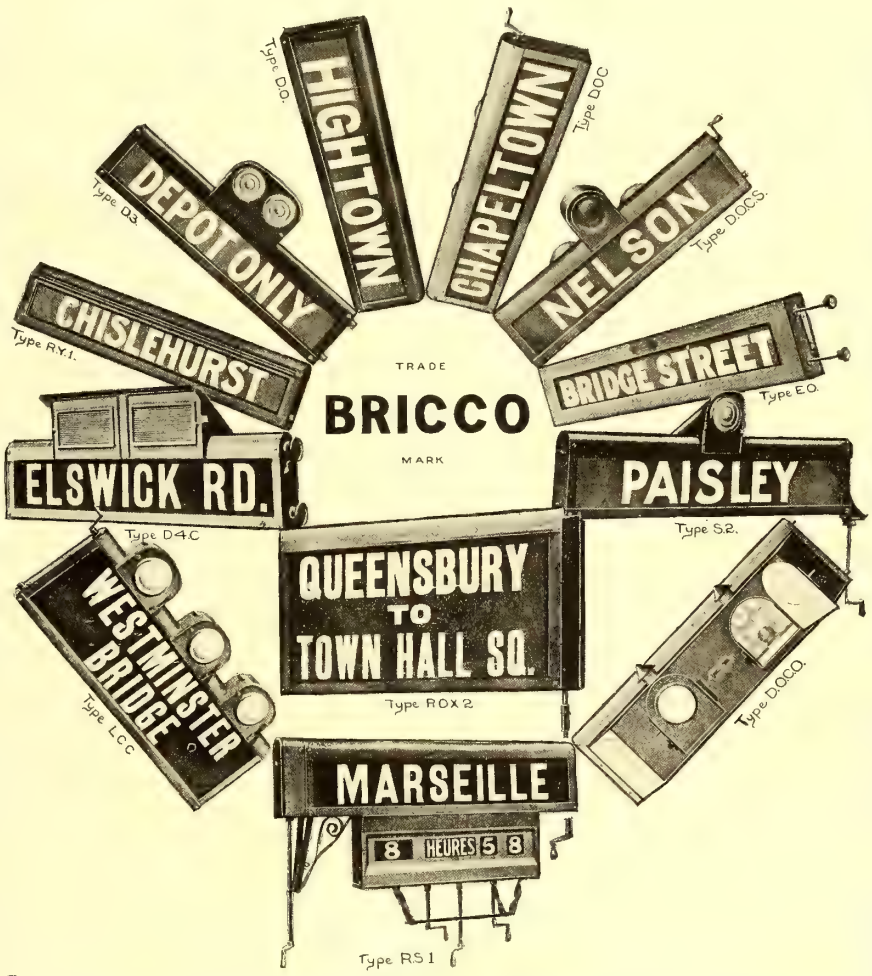
Type D. O. C. S.
Has bull's eyes in rear for illuminating upper deck, with further red bull's eye fixed in hood, designed to meet the Board of Trade requirements for showing red light in rear of car.

Type D. 4 C.
Hood fitted with prism glass doors, supplementing regular signal lights. Also has corrugated glass doors in the rear for illuminating upper deck.

Type D. 3
For double-deck cars, fitted with bull's eye signal lights in hood.

Type R. O. X. 2
By one turn of the handle the departure points, as well as the destinations, can be shown on the screen.

Type D. O. C.
Operated by one handle—fixed or detachable—as desired. Has bull's eyes in rear for illuminating upper deck.



Type S. 2
For single-deck cars. Contains signal light in hood. Operated from platform by means of hand rod.

Type D. O. C. O.
Specially designed for use with oil lamps. Cut shows rear view of indicator.

Type E. O.
These indicators are fitted inside the car, the destinations being visible through the side windows. Having clear glass backs, the lights in the car illuminate the names at night.

Type R. Y. I.
Specially designed for railway carriages, to take the place of the usual painted destination boards.

Type R. S. I.
For use on railway station platforms. Gives destination and time of departure. Can be illuminated for night use.

Type L. C. C.
Displays route and destination at same time. Contains three bull's eyes in front, fitted with colored slides.

For particulars of other types manufactured by the Company write for illustrated Catalogue

THE B. E. C. CO.'S INDICATORS ARE IN USE ON THE FOLLOWING SYSTEMS:

CROYDON TRAMWAYS
EAST HAM
SALFORD
ROTHESAY
CHATHAM
AYR
BOURNEMOUTH
TYNESIDE TRAMWAYS
MANCHESTER
COVENTRY
ABERDEEN
FARNWORTH
DARLINGTON
DONCASTER
ROCHDALE
WALSALL
STOCKPORT
BRIGHTON
WALLASEY
BIRKENHEAD
GATESHEAD
BUENOS AYRES
SOUTHPORT
NEWPORT
BURNLEY
CARDIFF
BRADFORD
BATLEY
CORK TRAMWAYS
ROTHERHAM
NEWCASTLE
DUNDEE
SHEFFIELD
READING
GRAVESEND
DEVONPORT
CARLISLE
GLASGOW
DUBLIN
HUDDERSFIELD
SUNDERLAND
BLACKPOOL
HAMILTON, MOTHERWELL & WISHAW
POTTERIES ELECTRIC TRACTION CO.
LONDON COUNTY COUNCIL TRAMW'S
GREENOCK & PORT GLASGOW
WELLINGTON, NEW ZEALAND
WESTON-SUPER-MARE
SOUTH LANCASHIRE TRAMWAYS
BLACKPOOL, ST. ANNES & LYTHAM
ALEXANDRIA & RAMLEH RY. CO.
YORKSHIRE WOOLEN DISTRICT
WREXHAM & DISTRICT
CALEDONIAN RAILWAY
PORTSDOWN & HORNDEAN
LONDON UNITED TRAMWAYS

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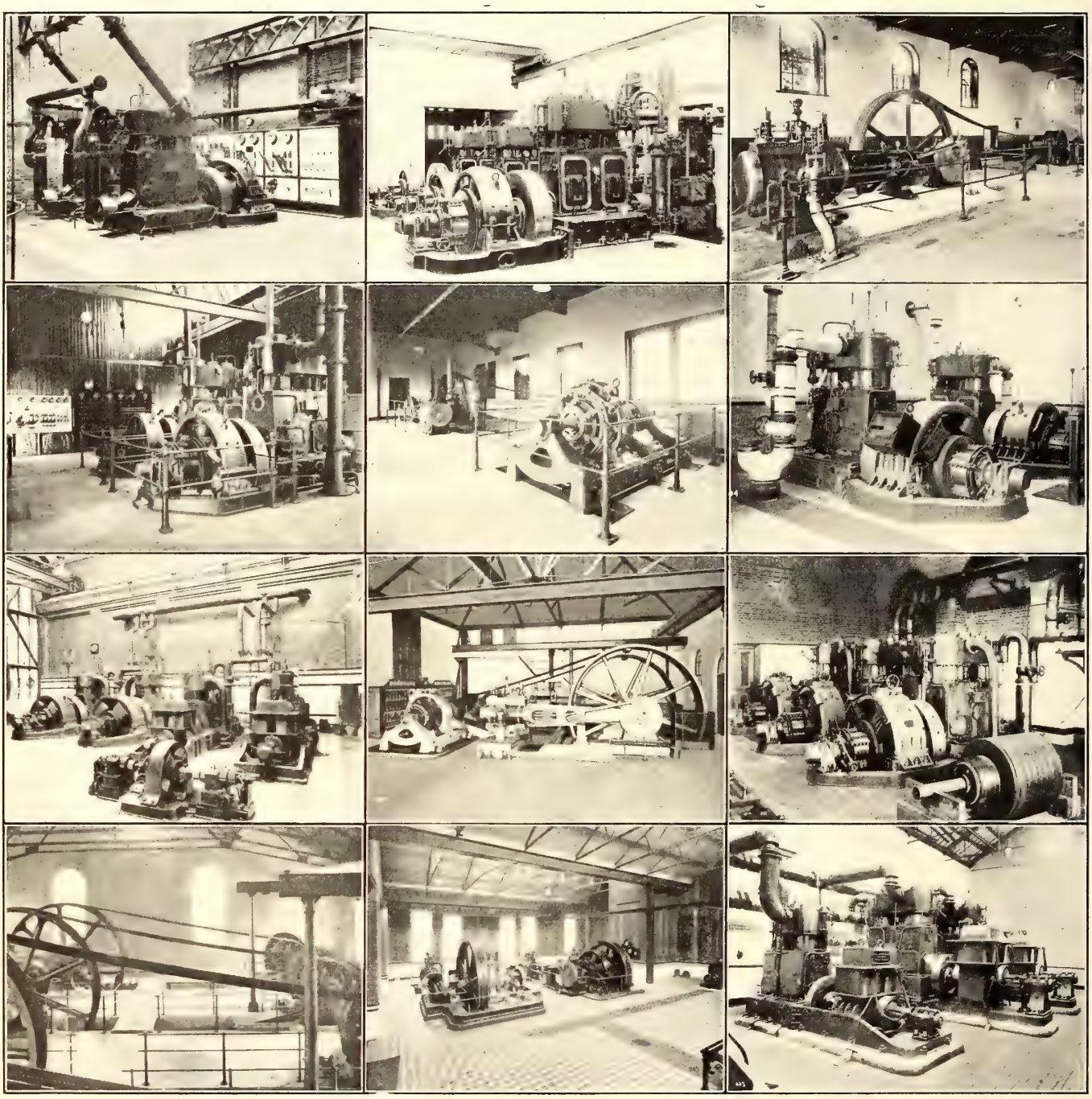
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Steel Works Power Station	Colliery Power Station	Birkenhead Corporation Power Station
Darlington Corporation Power Station	Shipyard Power Station	Tramway Power Station
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Power Stations

Complete Equipments for Tramways

Suburban, Elevated and Tunnel Railroads

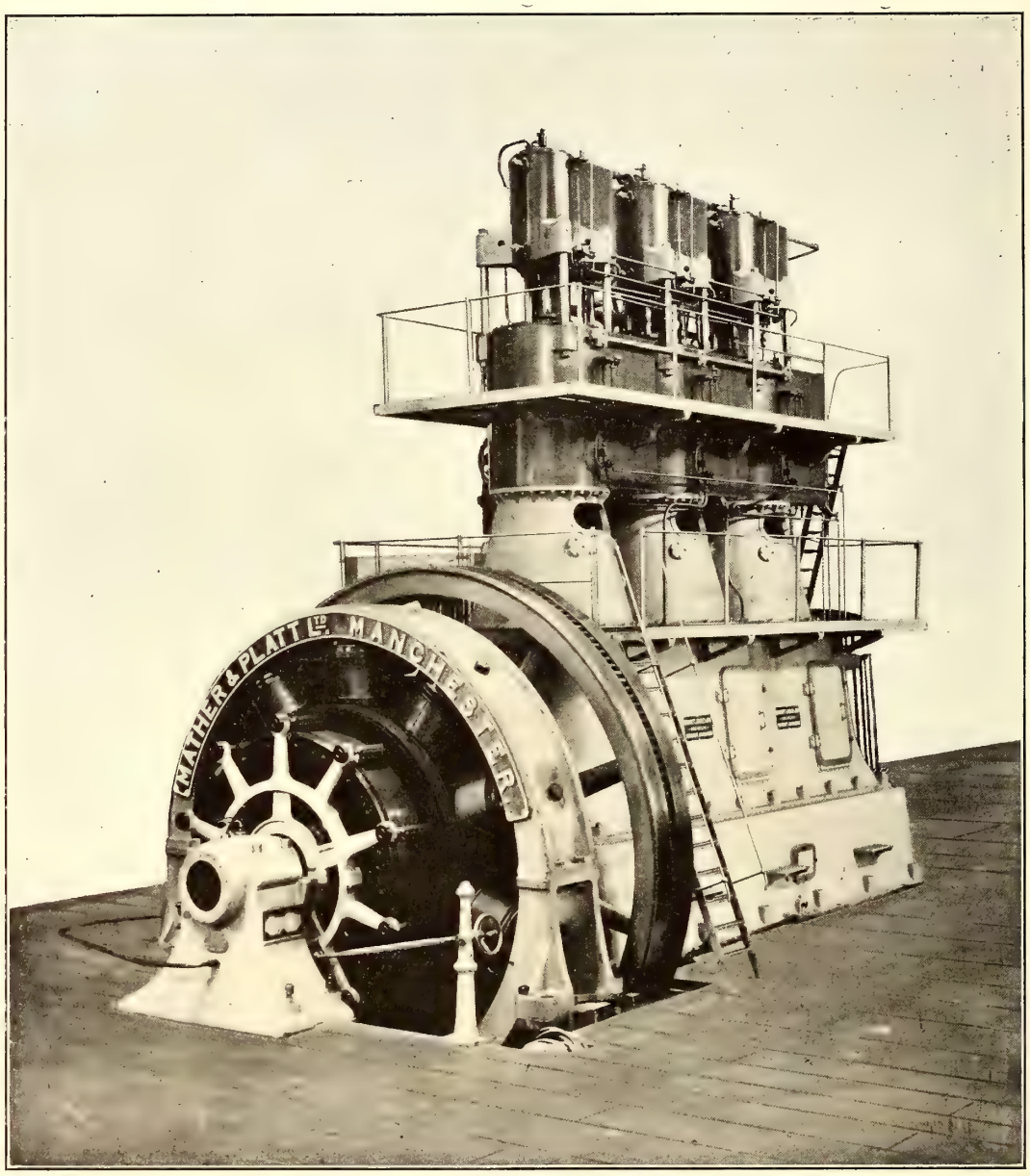
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Head Office BERLIN, GERMANY

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STEEL CLAD MOTORS



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MATHER & PLATT, Limited

SALFORD IRON WORKS MANCHESTER

DIRECT CURRENT DYNAMOS

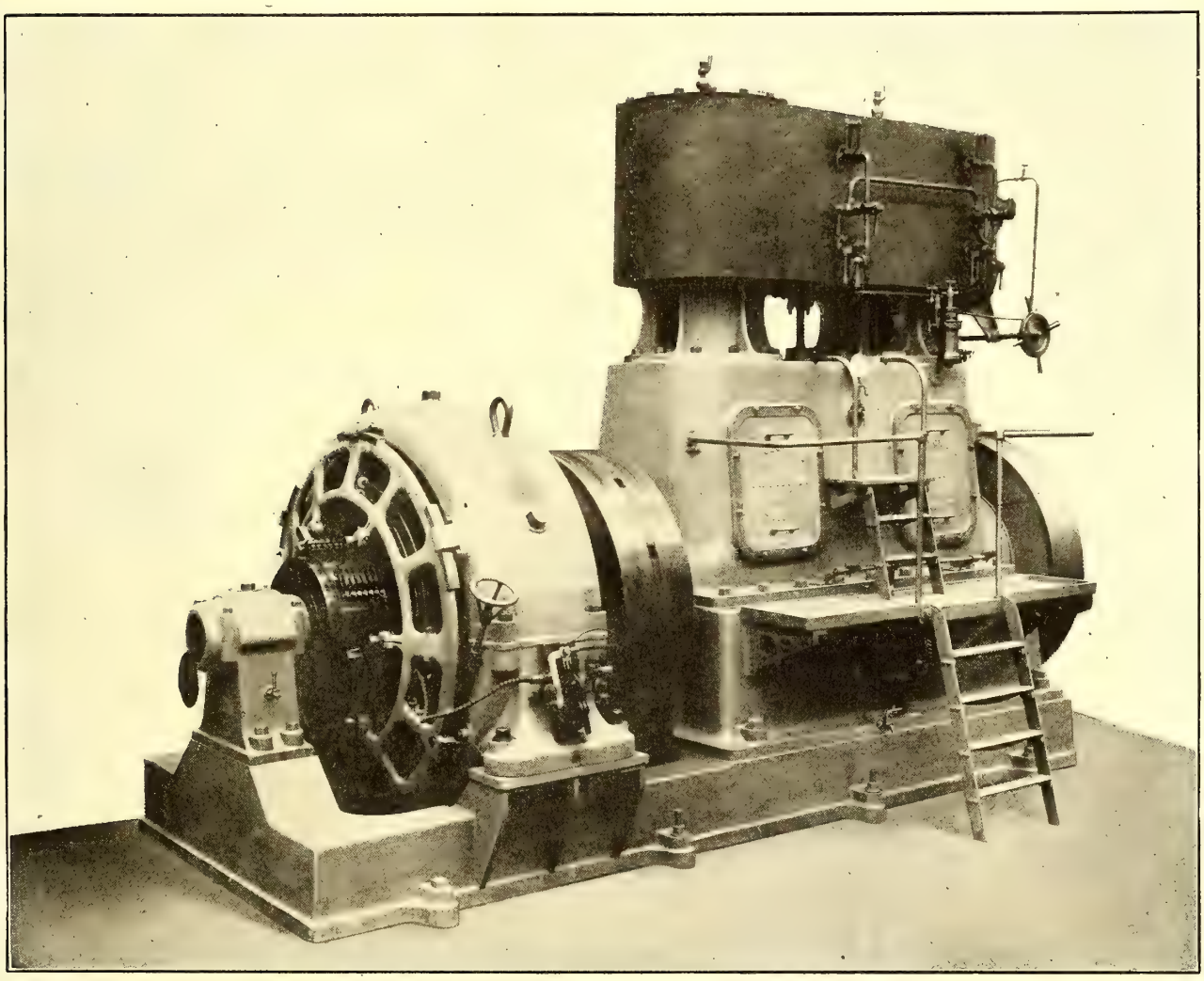
FOR BELT DRIVING OR DIRECT COUPLING

ALTERNATORS

SINGLE-PHASE OR POLYPHASE

IRON-CLAD MOTORS

DUST-PROOF OR VENTILATED, CONTINUOUS OR POLYPHASE



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ALL SIZES TO 100 H. P. IN STOCK. QUICK DELIVERY OF LARGER SIZES
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Telegrams: IRONCLAD, Manchester

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Maschinenfabrik Oerlikon

Oerlikon, near Zurich, Switzerland

Builders of all kinds of electrical machinery, contractors of complete central power stations and distribution and transmission plants for light, power and railways.

GRANDS PRIX: Paris, 1900; Paris, 1889; Antwerp, 1894



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DEPARTMENT FOR ELECTRIC TRACTION

Complete Power Stations with boiler, engines, turbines, **dynamos** and **switchboards.**

High-Class Switchboards for low and high tension current.

Converting Plants for the transformation of **high tension alternate** and **threephase** current into **continuous** current.

Street Railway Cars and equipments, **motors, controllers,** manufactured to standard designs and templates.

Overhead Contact Lines of most modern design and highest safety.

Mountain Railways, adhesion and rack, operated by continuous or threephase current, **locomotives,** cars, **line equipment, motors, controllers,** current collectors.

Same for **standard gauge railways, main** and **suburban.**

SIEMENS-SCHUCKERTWERKE G.m.b.H.

BERLIN

Strassen-bahnen, Gruben-, Material, Klein-, An-schluss-und Rangier-bahnen Elektrische Lokomotiven



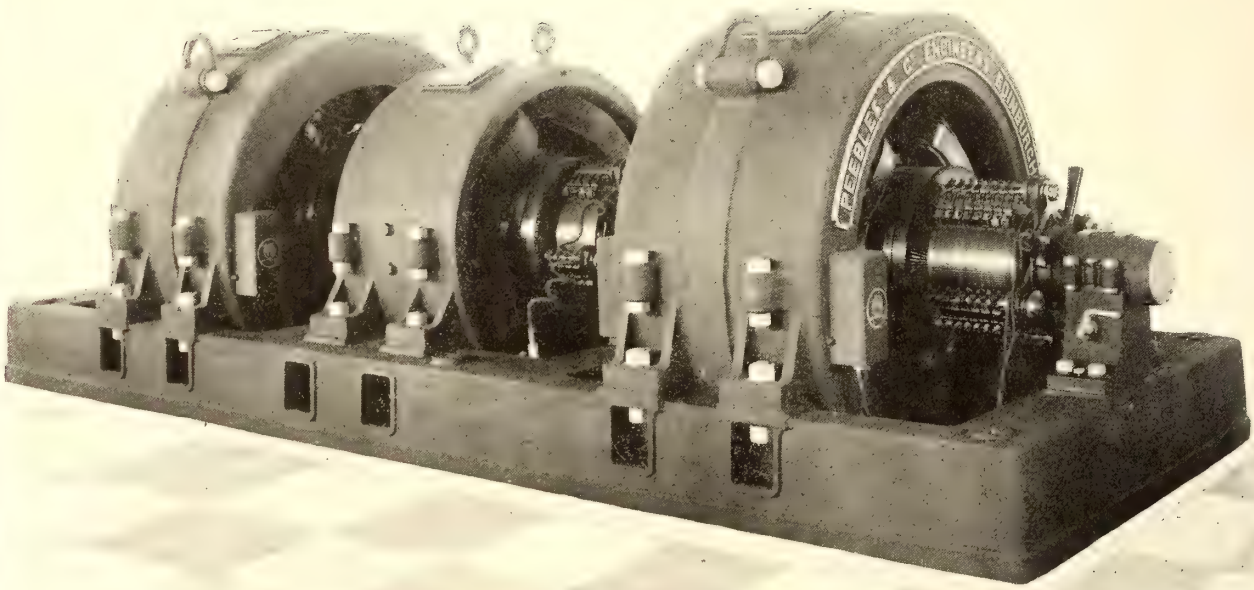
Erste mit Hochspannungs motoren (10,000 volt) ausgeruestete Schnellbahn-Lokomotive



Vier-Wagenzug, ausgeruestet mit dem Siemens-Schuckert Multiple-Unit-System

Bruce Peebles & Co., Ltd.

EDINBURGH



P. P. P. PATENT AUTOMATIC REVERSIBLE TRAMWAY BOOSTER

Continuous and Alternating

CURRENT PLANT

FOR ELECTRIC LIGHT & POWER INSTALLATIONS

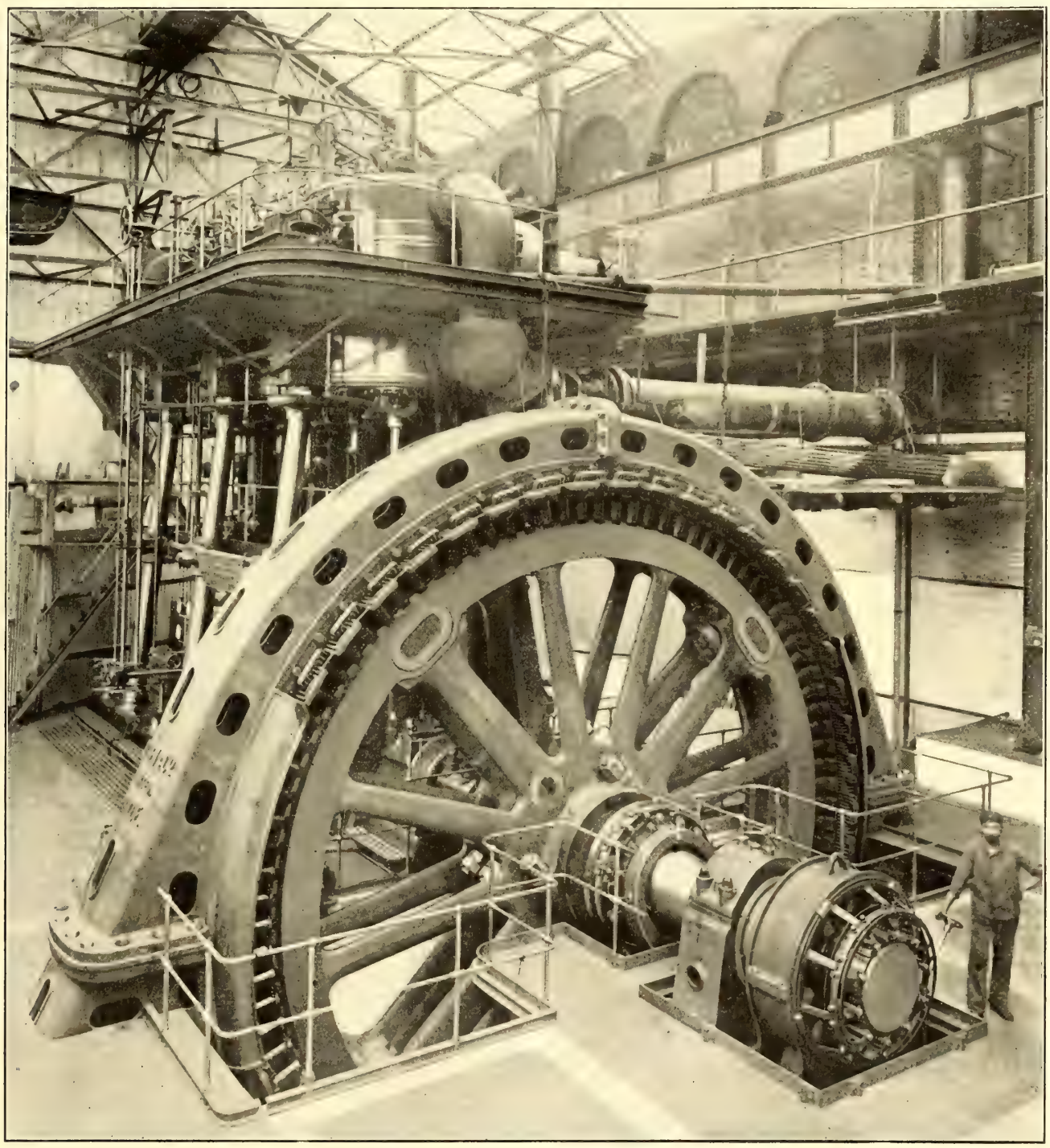
P. P. P. PATENTS

Telegraphic Address, "REACTANCE" Codes: A B C, A I. Telephones { 582 / 5096 } HOLBORN.

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Two-phase Steam Generator, 5000 B. H.P., 75 Revolutions, 60 cycles, 10,500 Volts. One of two sets delivered by us to the Metropolitan Electric Supply Co, Ltd., Willesden, London.



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Built by
SULZER BROS., WINTERTHUR,
SWITZERLAND.

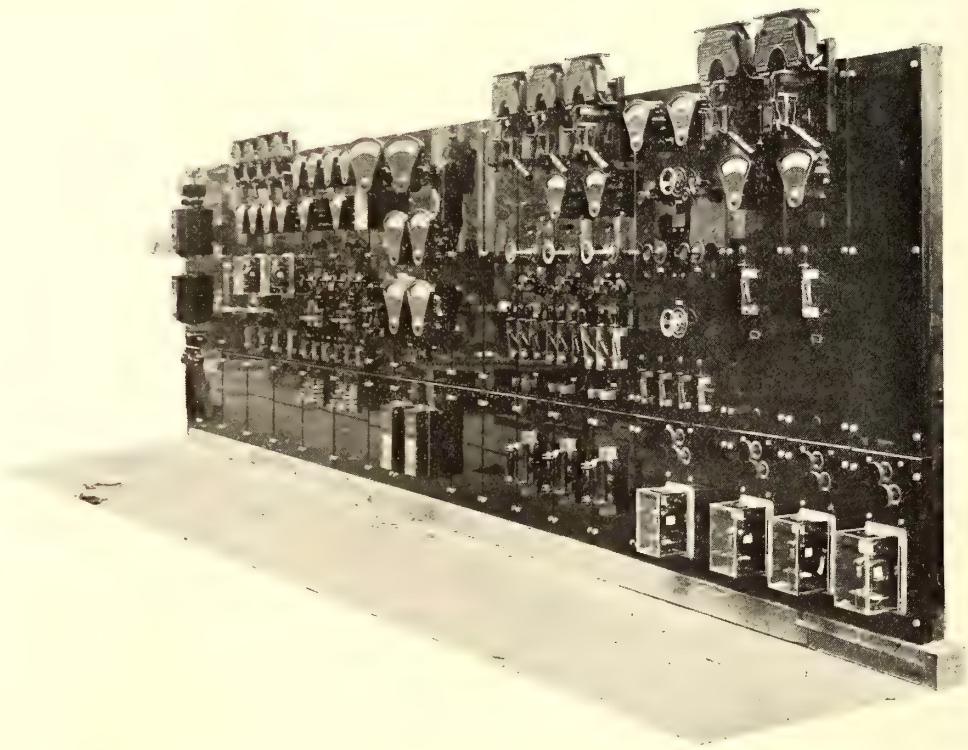
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Built by
KOLBEN & CO., Ltd., PRAGUE,
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The above Steam Generator is the Largest now Running in Europe.

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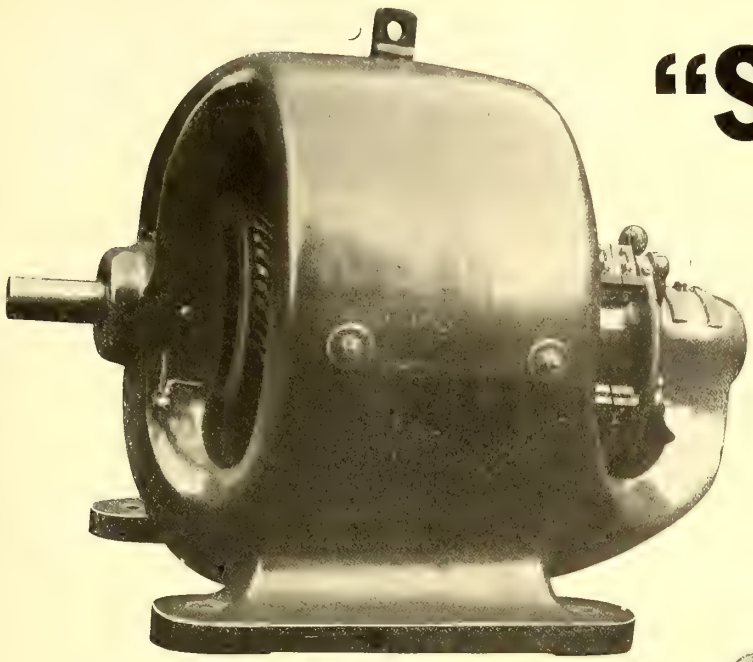
Traction, Lighting and Power



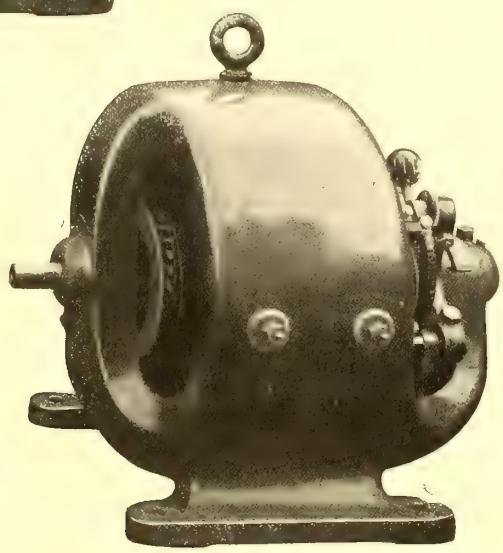
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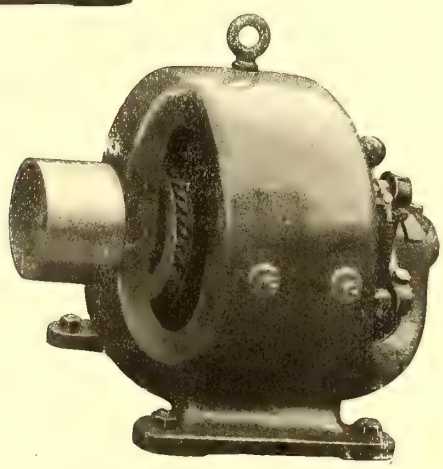
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PATENT THERMIT RAILWELDING PROCESS

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Only Appliances Necessary: CRUCIBLE, MOULD, RAILCLAMP



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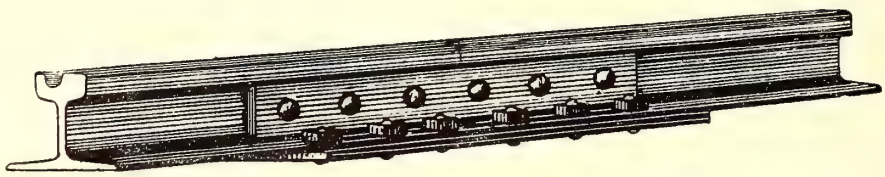
MANUFACTURERS OF

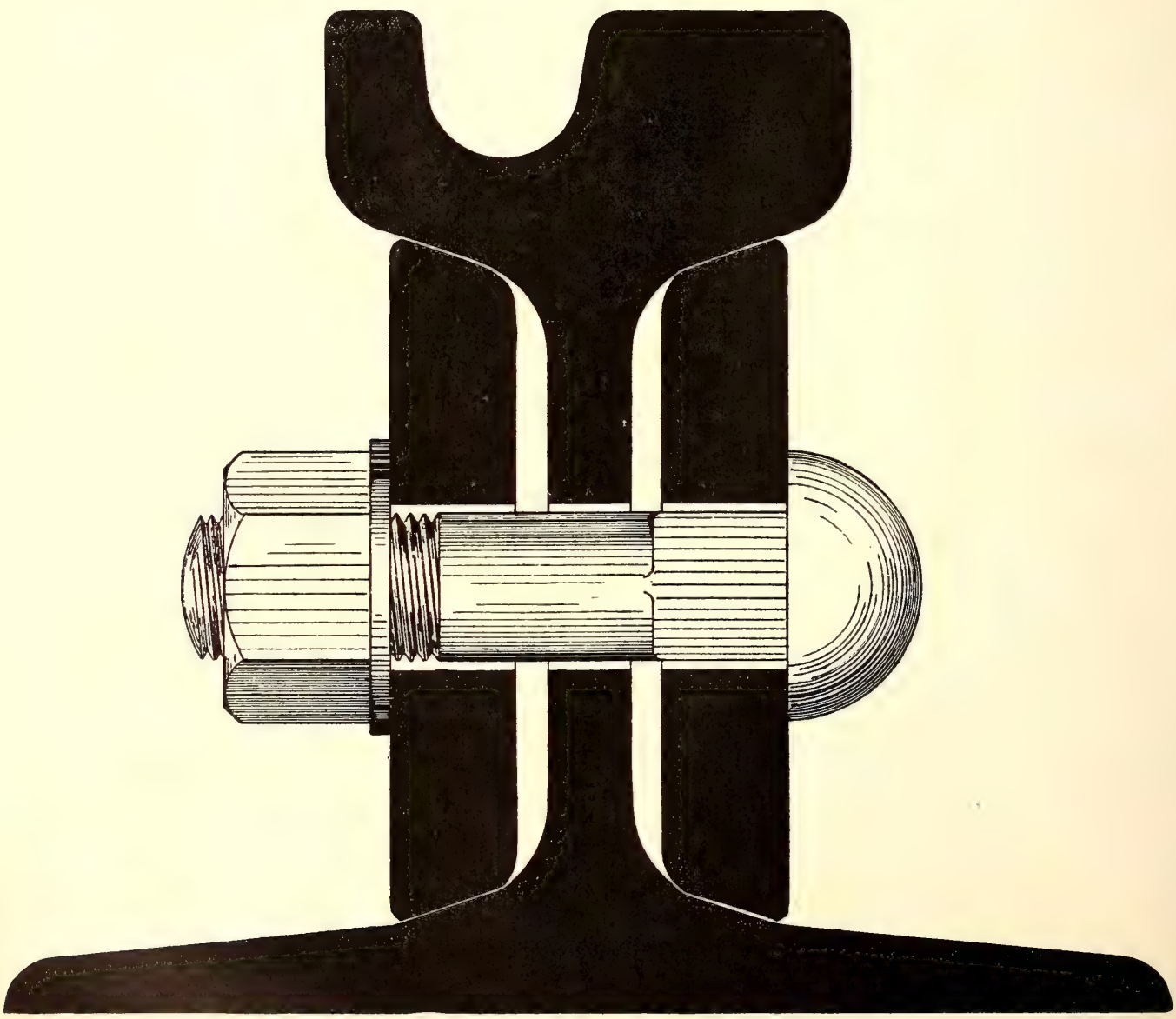
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One of the most important junctions in Great Britain



THE

Points and Crossings

are of Special Cast Steel fitted with

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For Lathe, Planing and Slotting Tools

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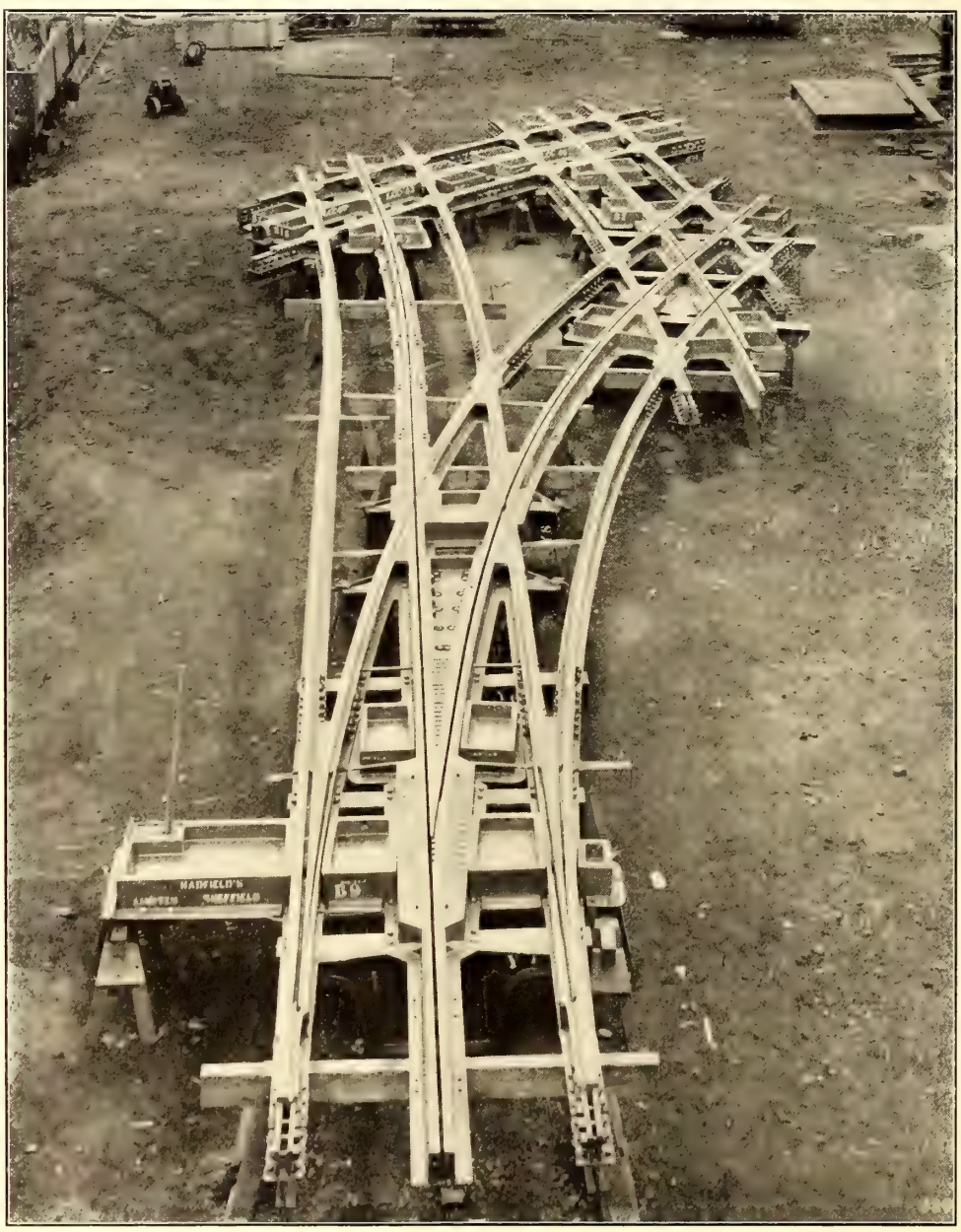
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LAY-OUTS CONSTRUCTED OF EVERY SIZE AND DESCRIPTION

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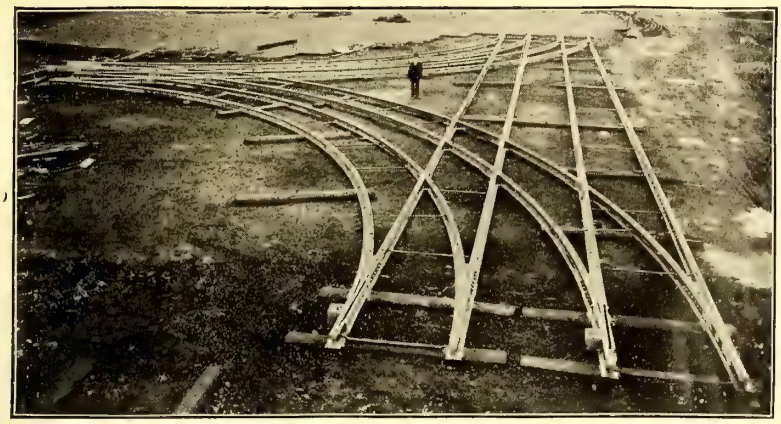
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IS THE SUPREME MATERIAL FOR

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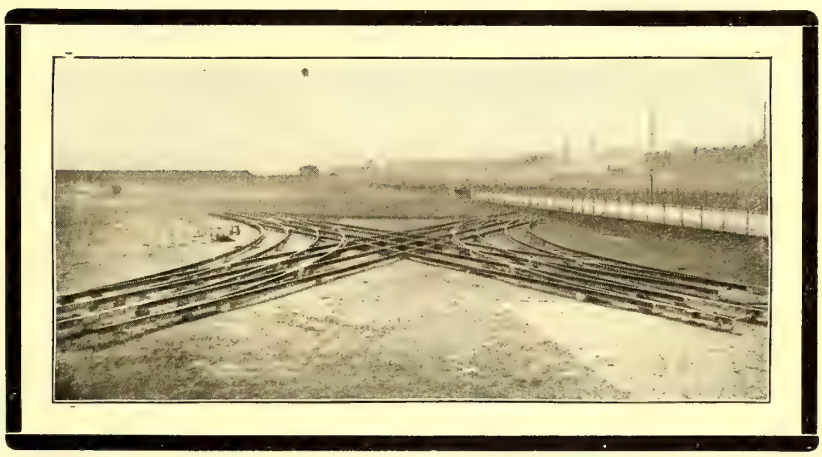
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ETC., ETC.

TRAMWAY POINTS AND CROSSINGS

TRAMWAY DRAIN RAILS TIE BARS, ETC.

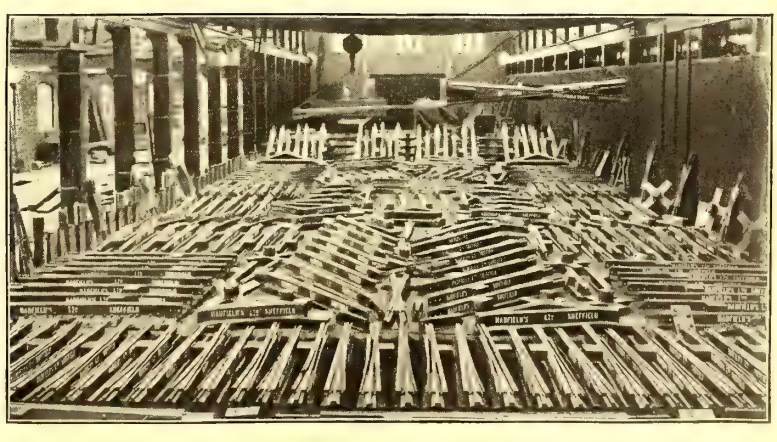
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NO RAIL BONDS REQUIRED

Because this joint gives more perfect conductivity than any bond

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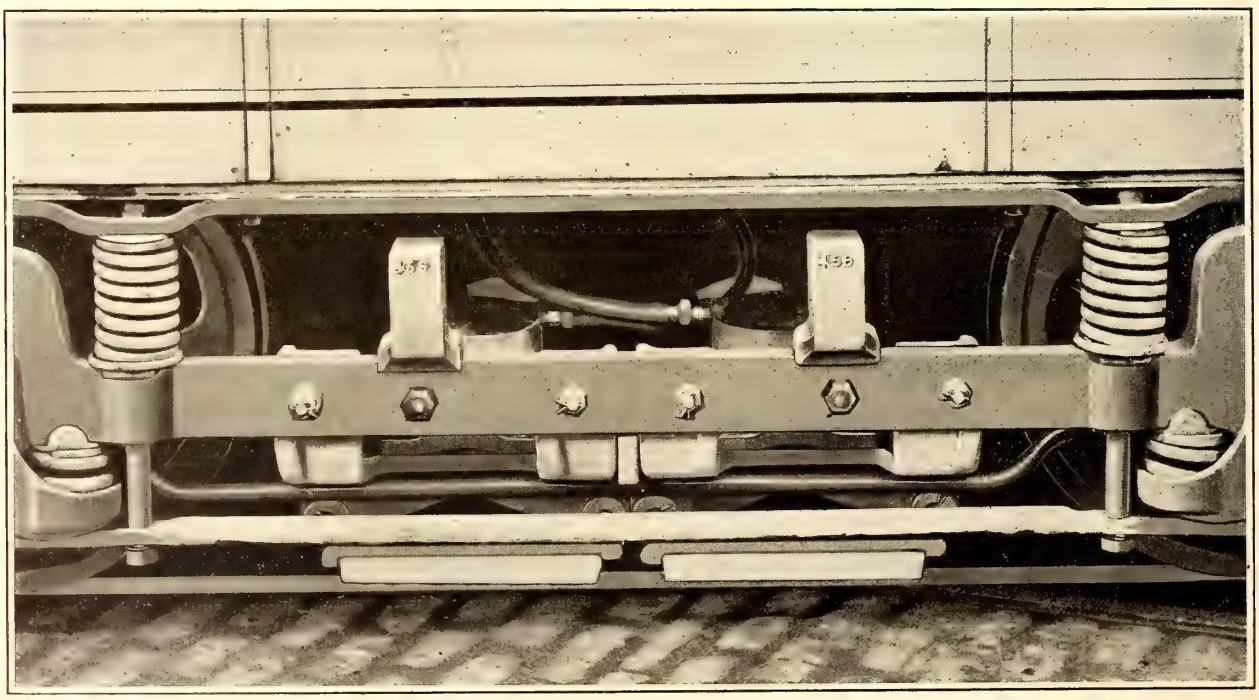
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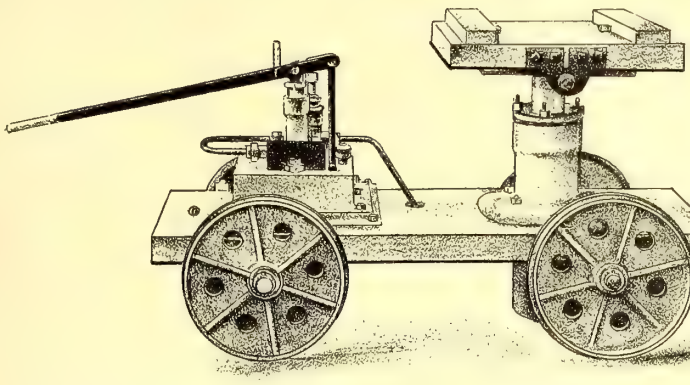
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Is the Most Powerful Emergency Brake. **Equipments for 150 Cars Complete or on Order.**



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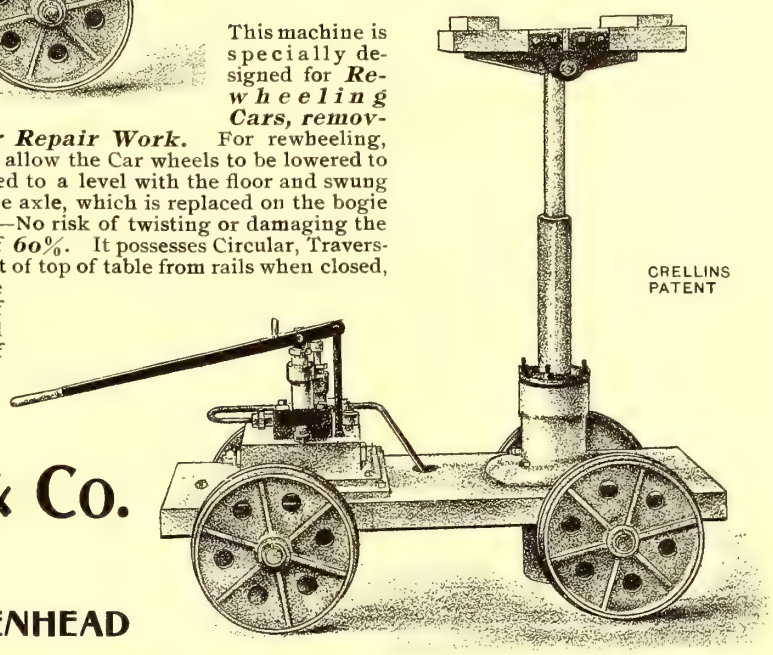


Portable Pit Bogie

With Telescopic Ram

TO LIFT 5 TONS

This machine is specially designed for ***Rewheeling Cars, removing Armatures*** and ***General Car*** and ***Motor Repair Work.*** For rewheeling, provision is made for sliding a portion of the Rail to allow the Car wheels to be lowered to clear the truck. The wheels and axle are then raised to a level with the floor and swung round, the wheels removed, the new ones put on the axle, which is replaced on the bogie and placed in position again. ***ADVANTAGES.***—No risk of twisting or damaging the car body as in the ordinary way. A saving in time of ***60%***. It possesses Circular, Traversing, Vertical, and Longitudinal adjustments. Height of top of table from rails when closed, **2** ft **7½** in., when ram is full out, **5** ft. **2** in. in the one shown, but it can be made to give any height of lift required. The Tool is substantially made, all materials being of the first quality, workmanship of the best, and parts interchangeable.



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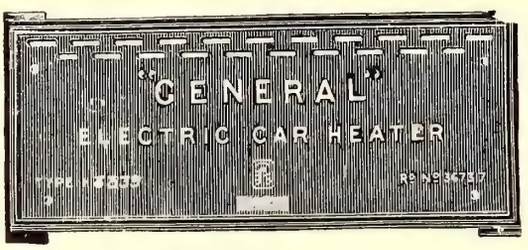
ELECTRIC LIGHT WIRES AND CABLES

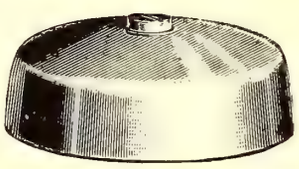
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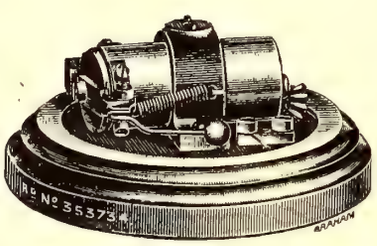


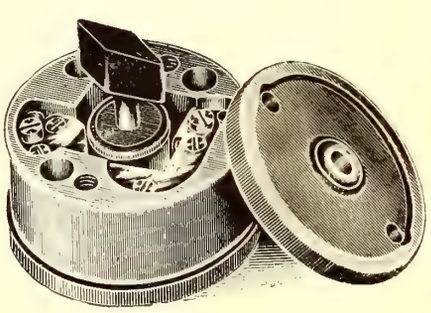


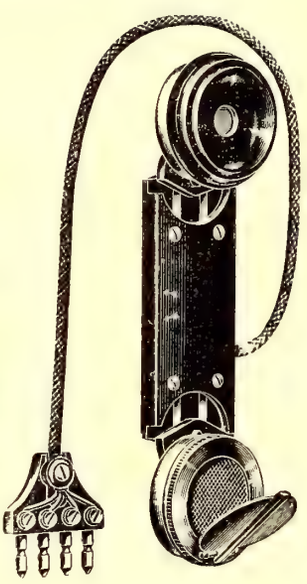
The General Electric

WORKS

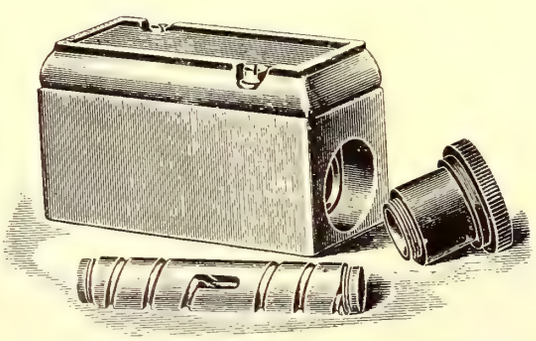
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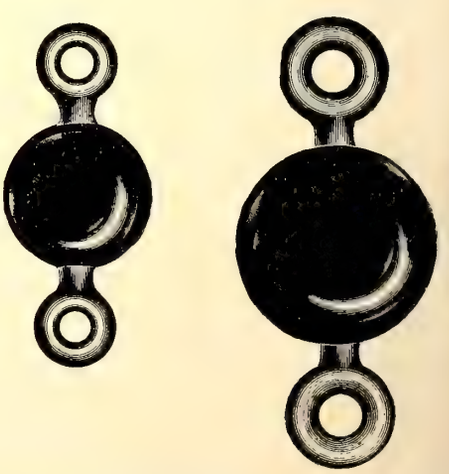




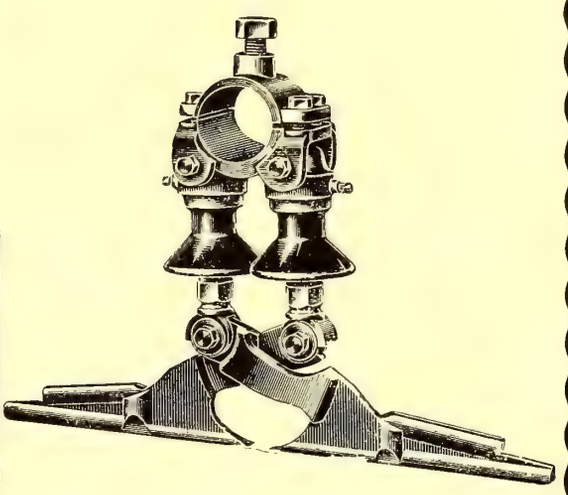
"Samsohm" Insu
Standard Gears
Waterproof
Hangers, Ears and Strains,
The "Acme"
Carbon Brushes, Switches,
Electric Light Fittings,
Etc.,







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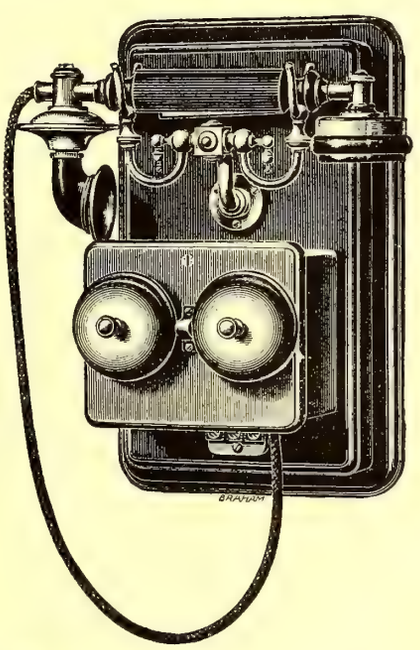


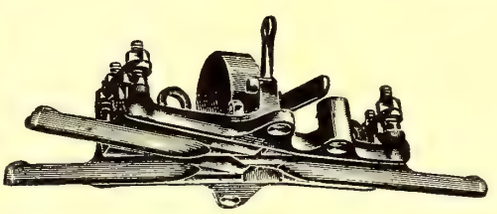
Company, Limited

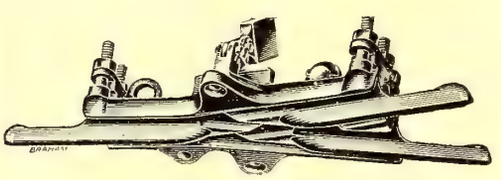
HEAD OFFICE

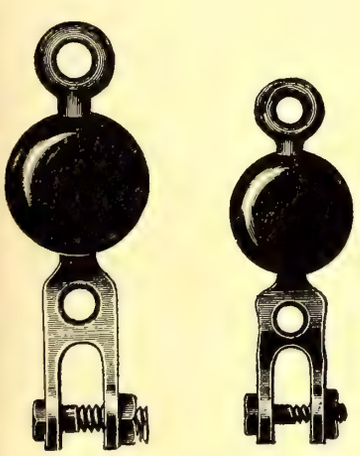
71 Queen Victoria Street, London

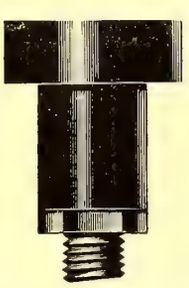
lating Material
and Pinions
Trolley Cord
Wood's Fittings
Splicing Sleeve
Gongs, Heaters,
The G. E. C. System of Traction
Etc. Telephones

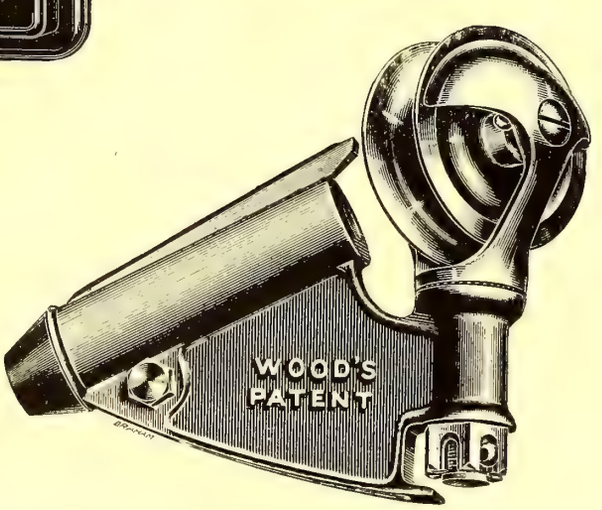






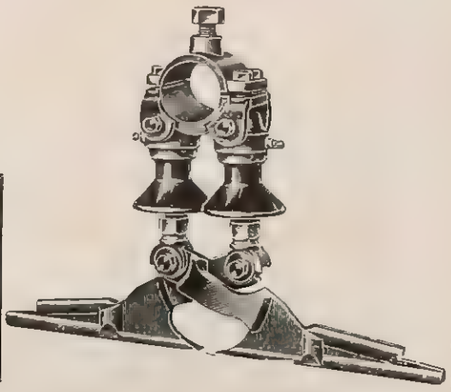






G. E. C. TRACTION SUPPLIES



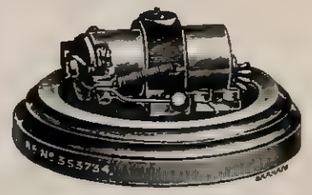


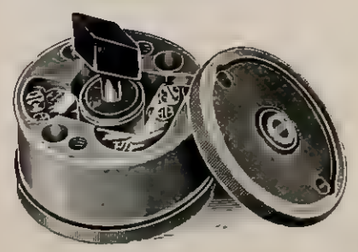
The General Electric Company, Limited

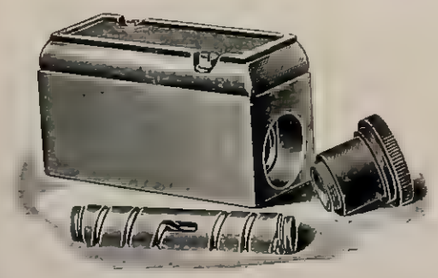
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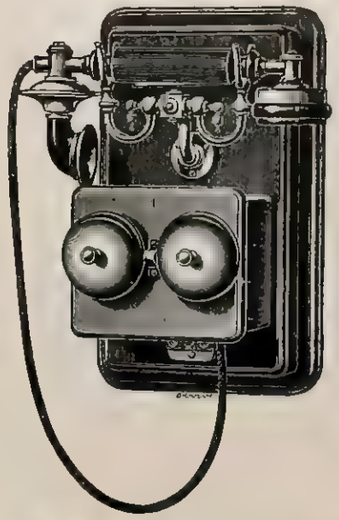


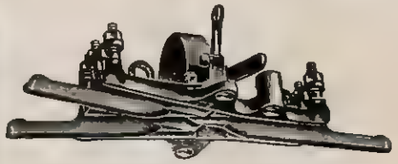




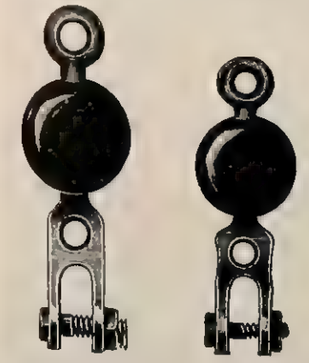
"Samsohm" Insulating Material
Standard Gears and Pinions
Waterproof Trolley Cord
Hangers, Ears and Strains, Wood's Fittings
The "Acme" Splicing Sleeve
Carbon Brushes, Switches, Gongs, Heaters,
Electric Light Fittings, The G. E. C. System of Traction
Etc., Etc.



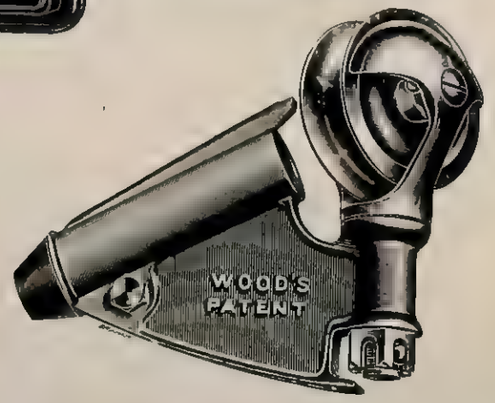












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Insulated Wire and Cable Manufacturers

SOLE MANUFACTURERS OF

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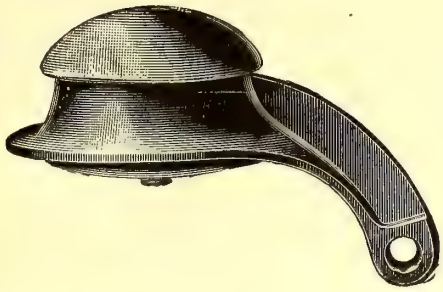


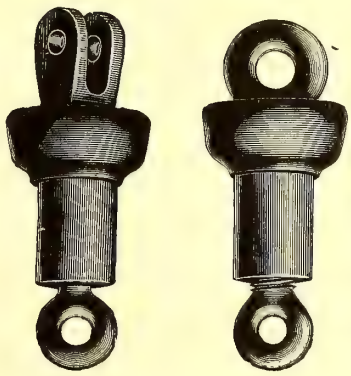
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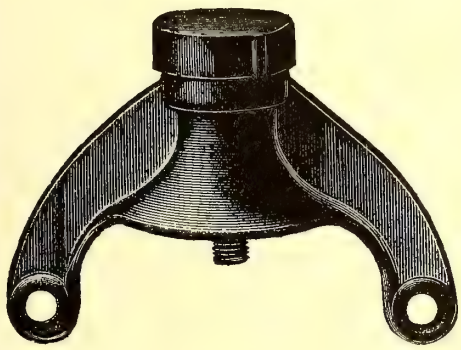
Bias Cut Tape

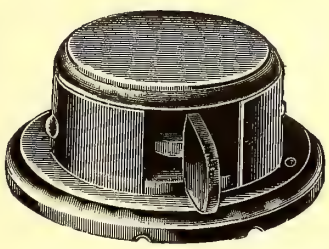
Special

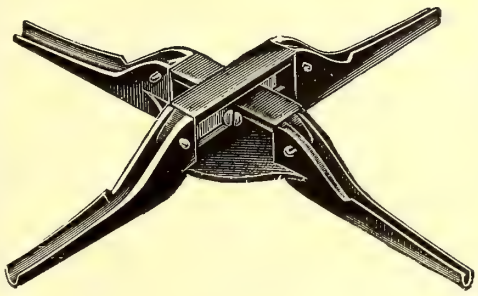
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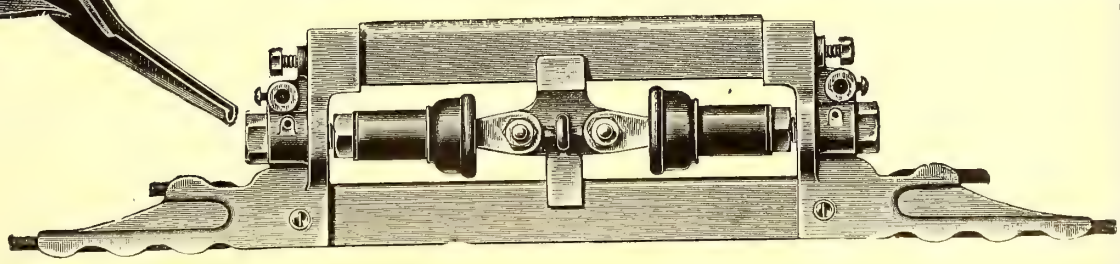
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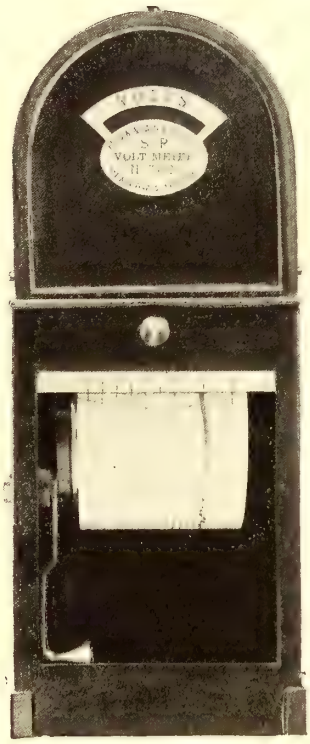
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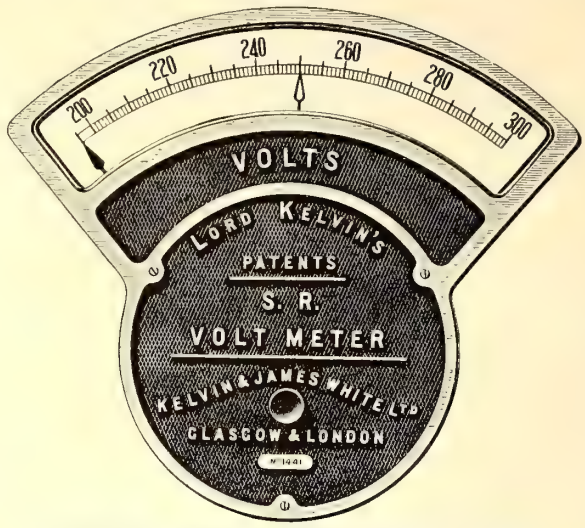
INSTRUMENTS

FOR . . .

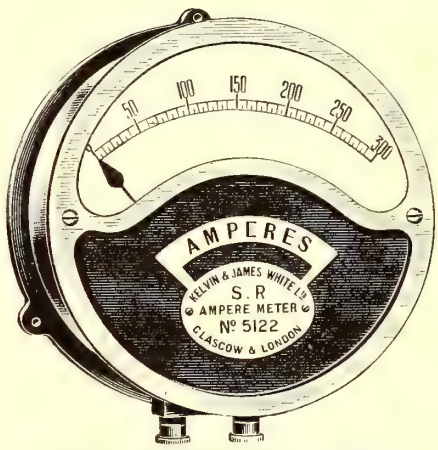
TRACTION WORK



Recording { Ammeters / Voltmeters / Wattmeters



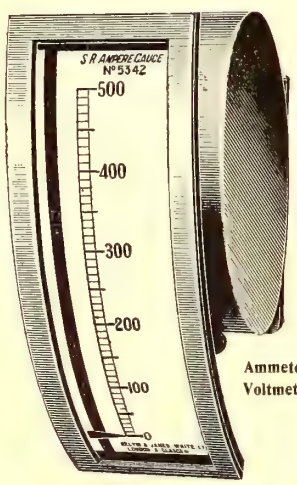
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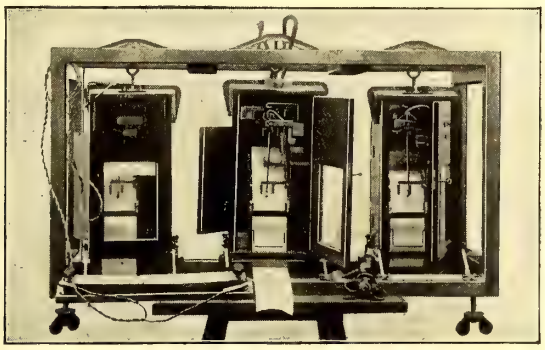
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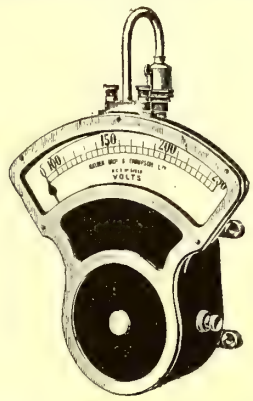
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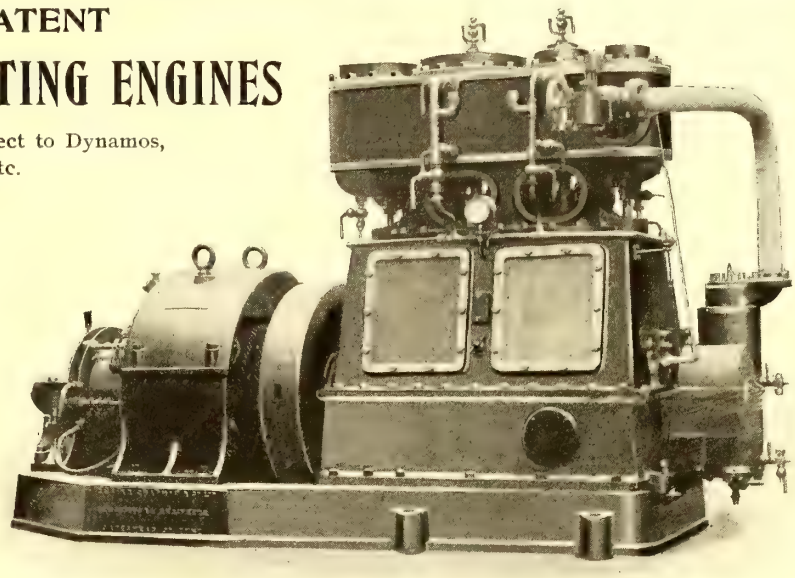
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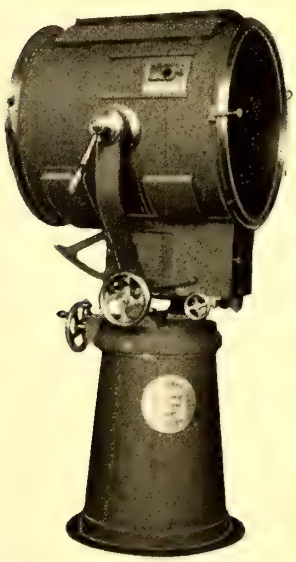
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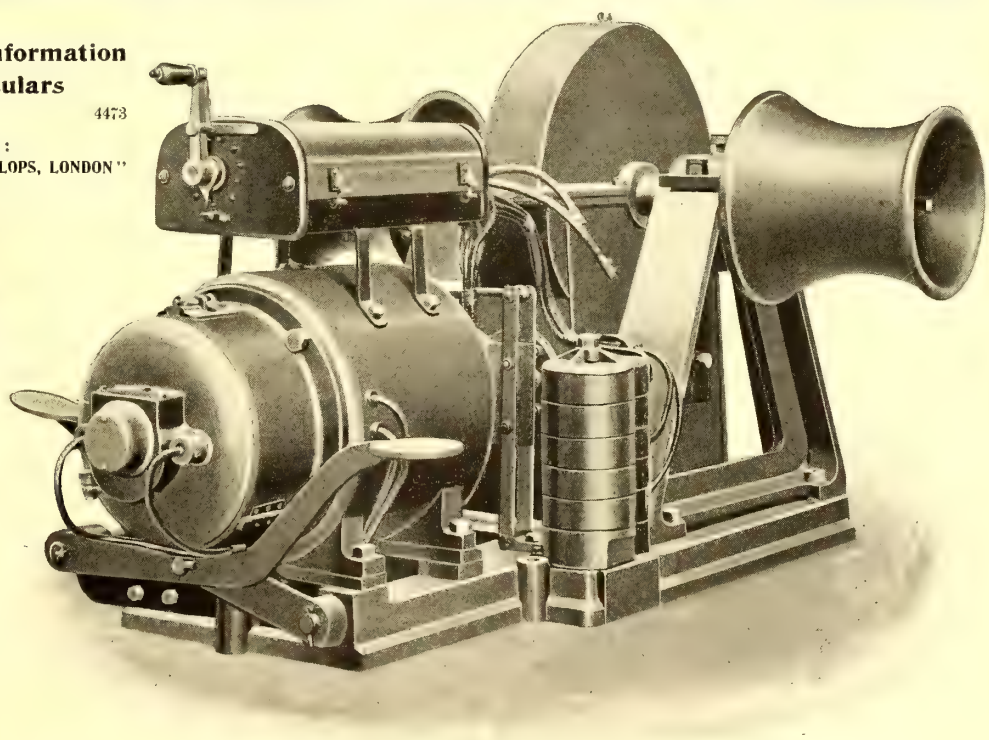
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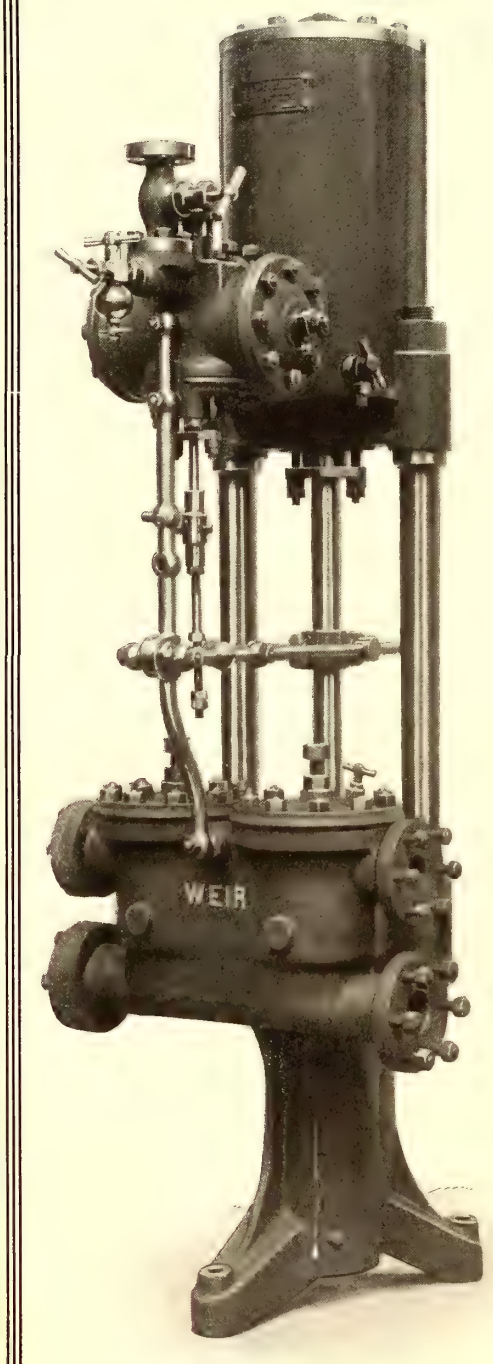


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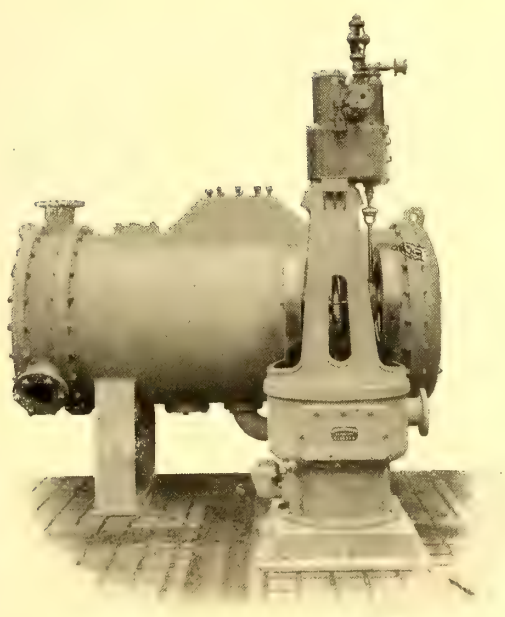
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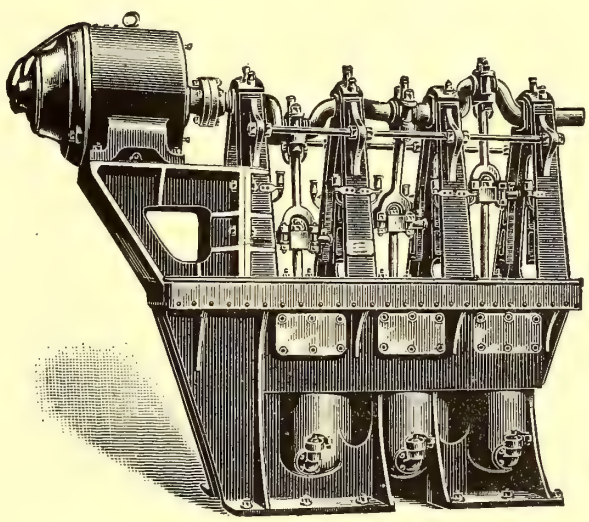
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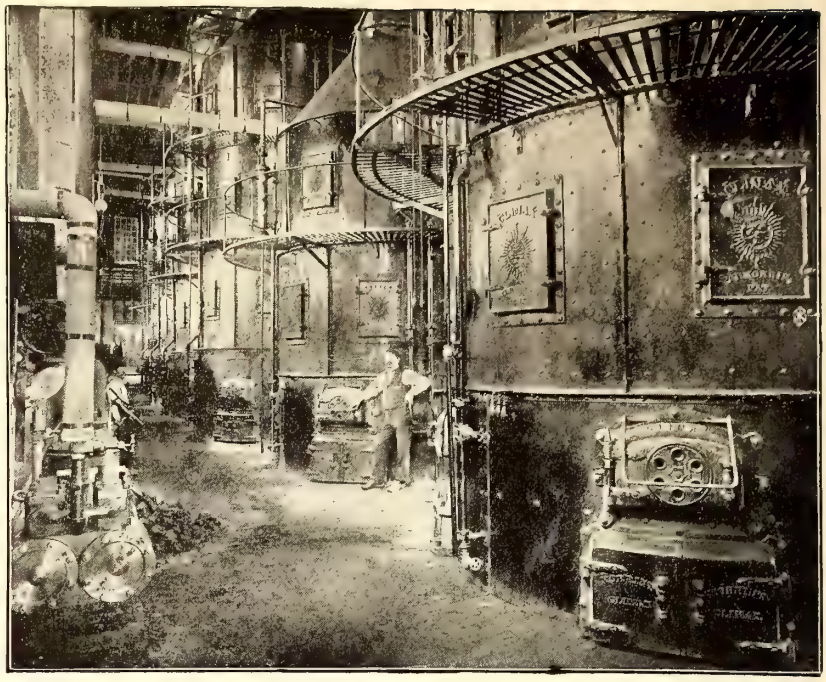
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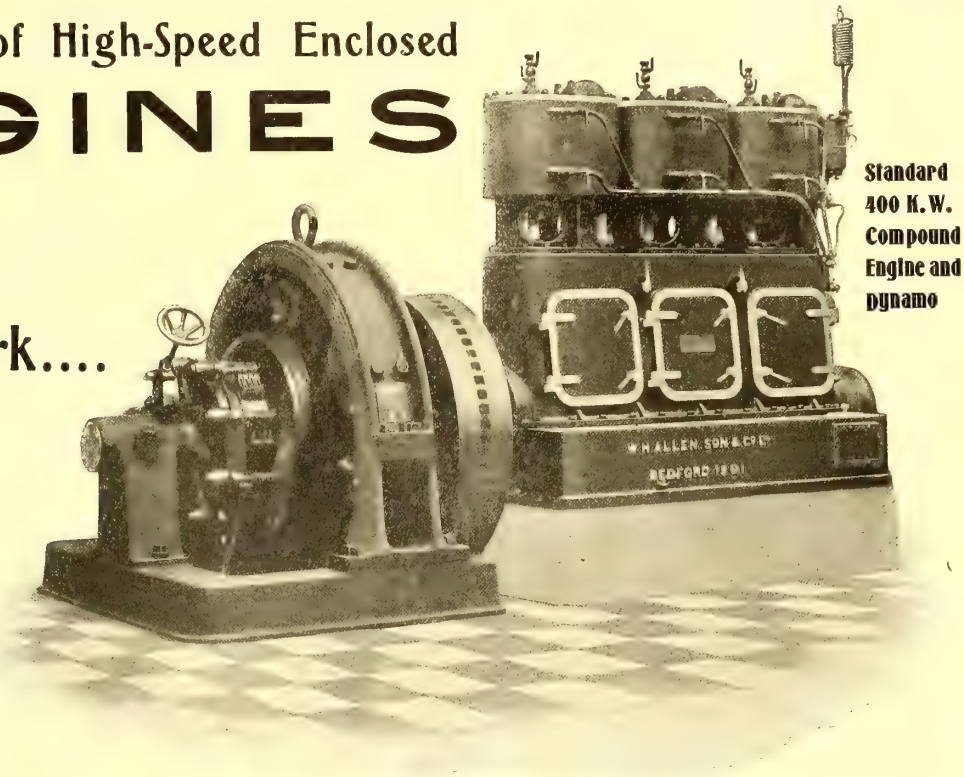
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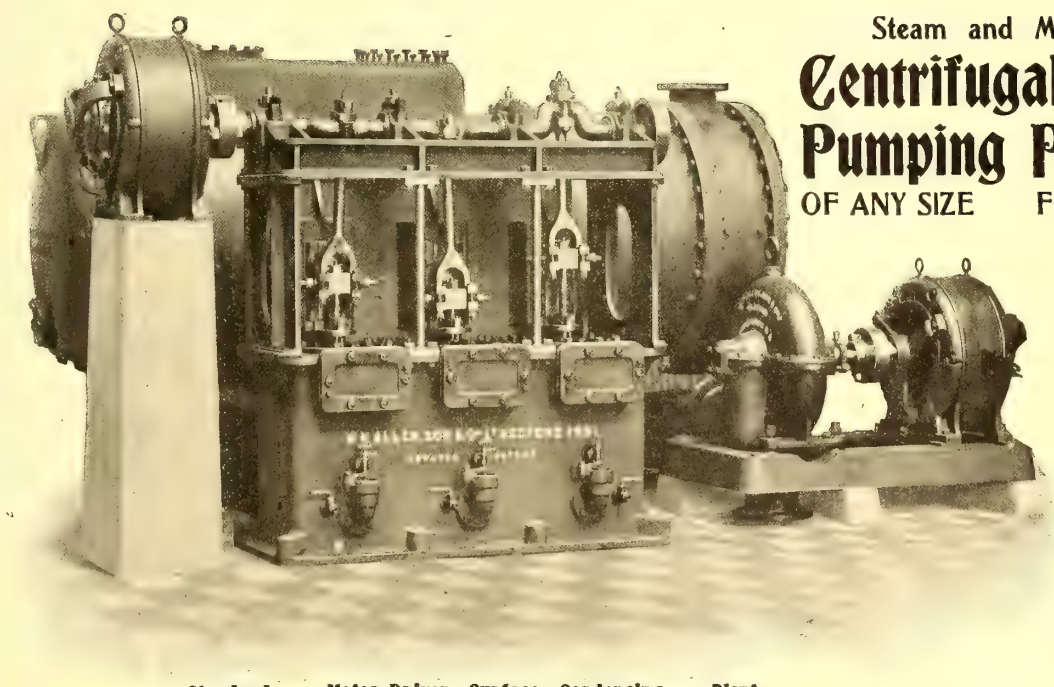
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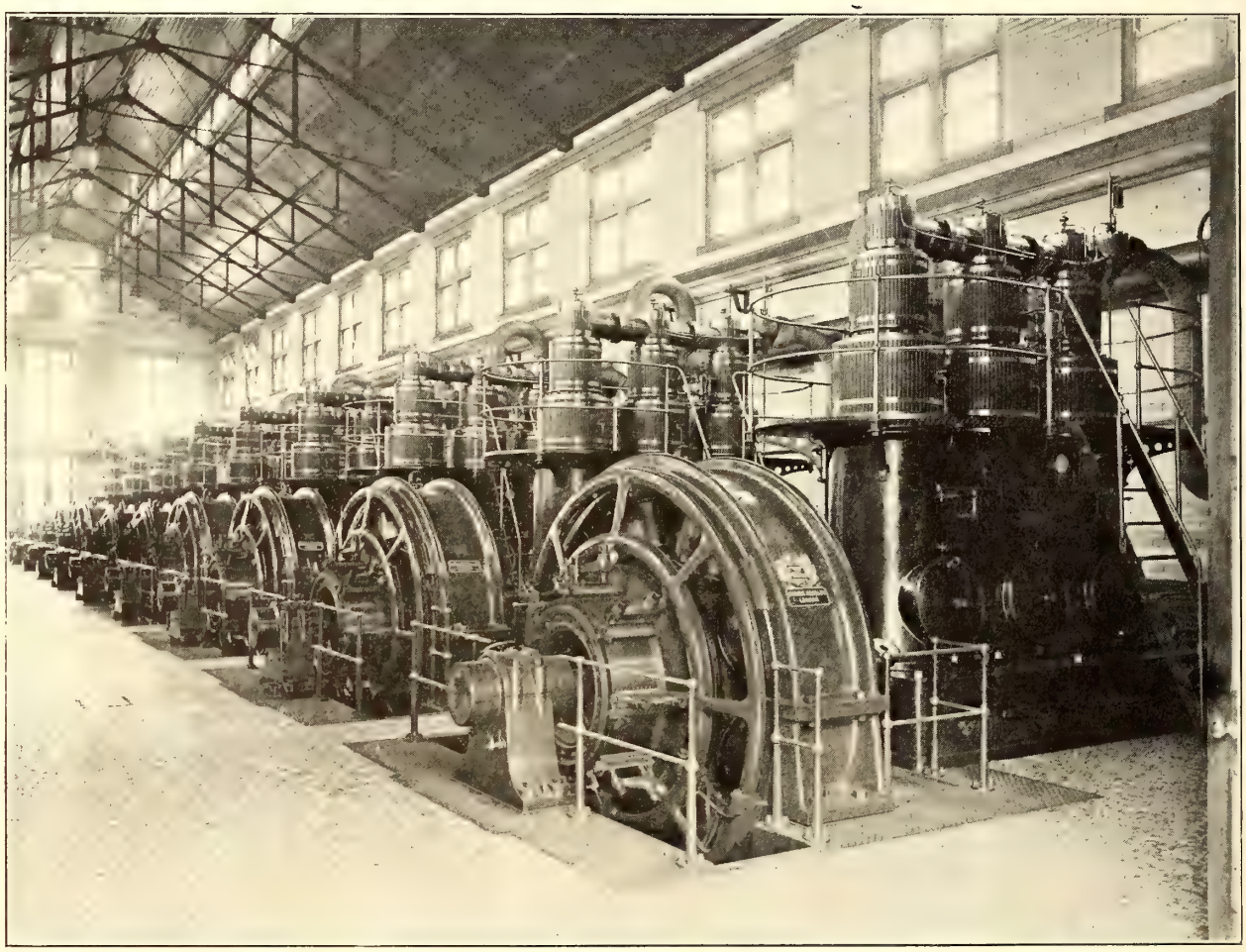
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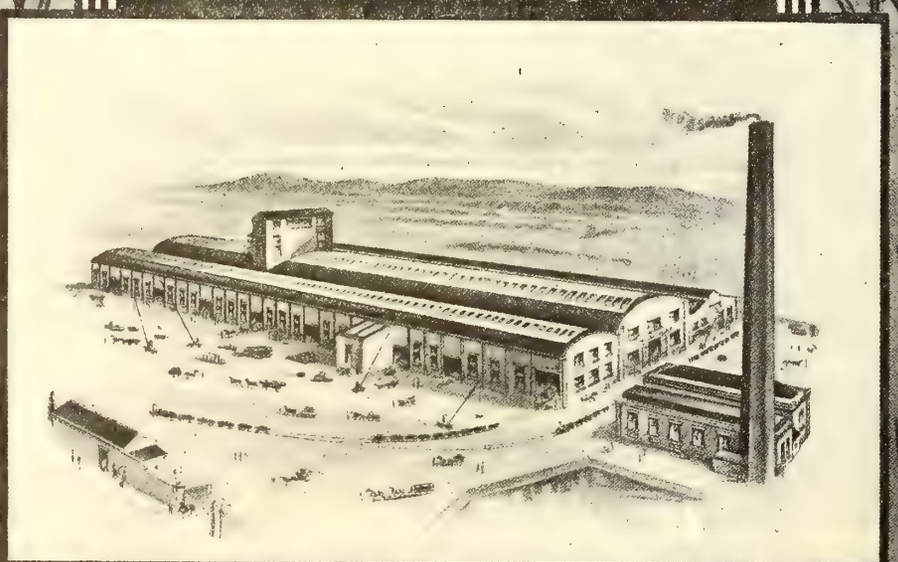
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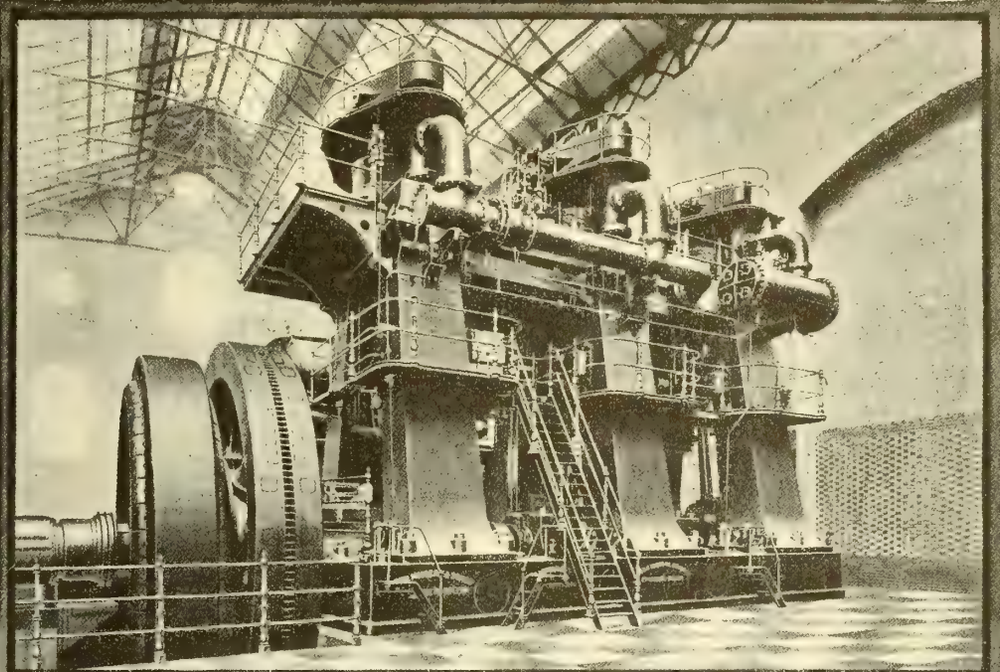
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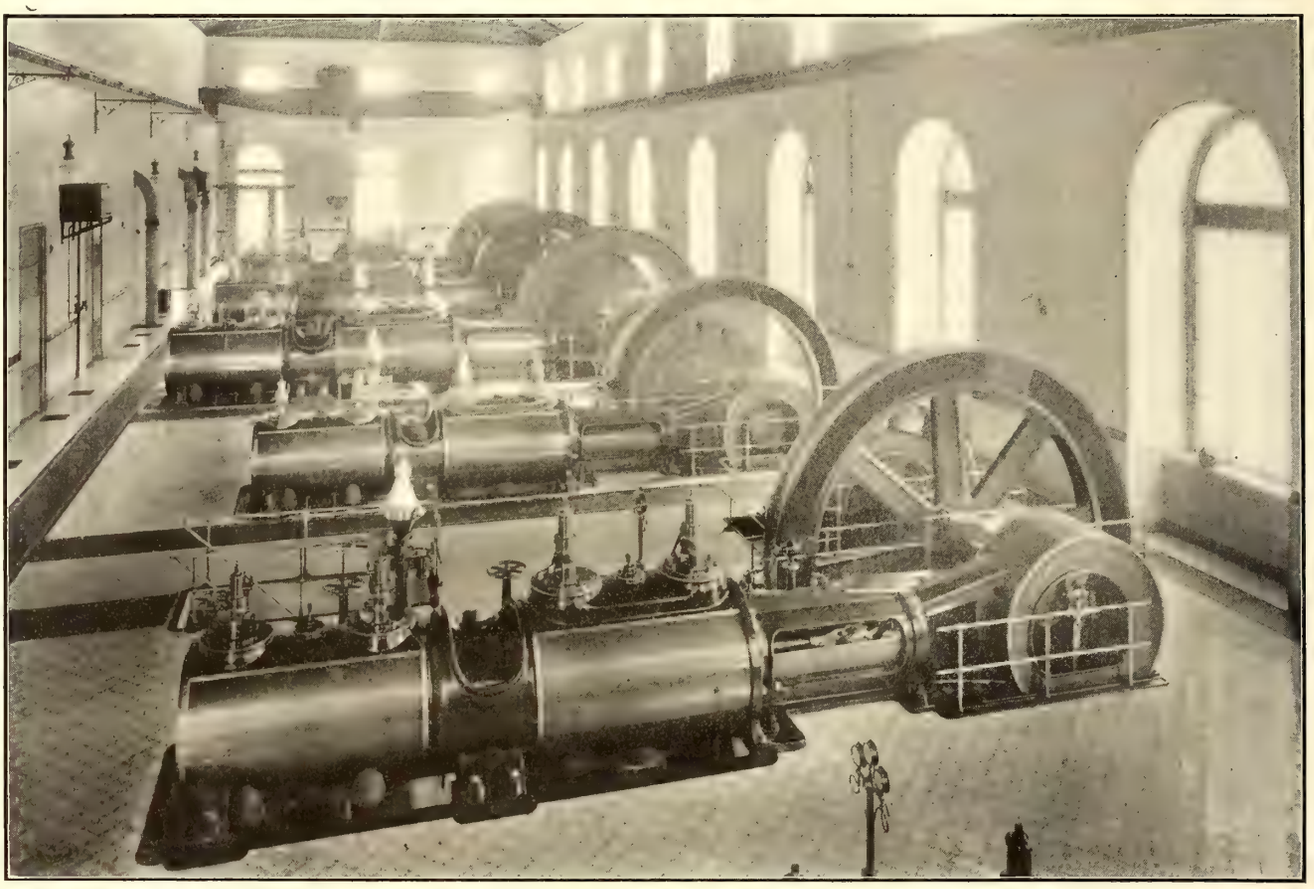
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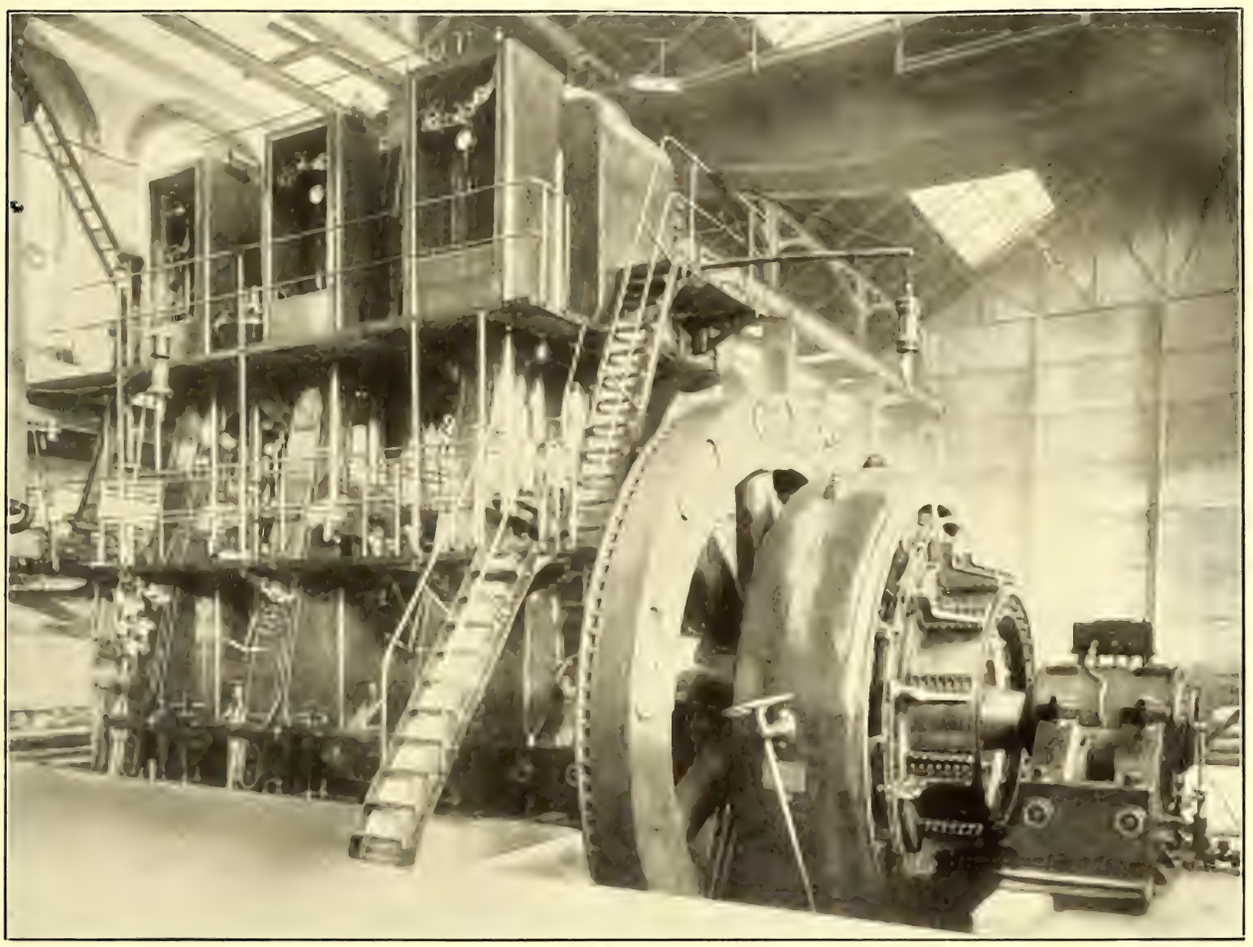
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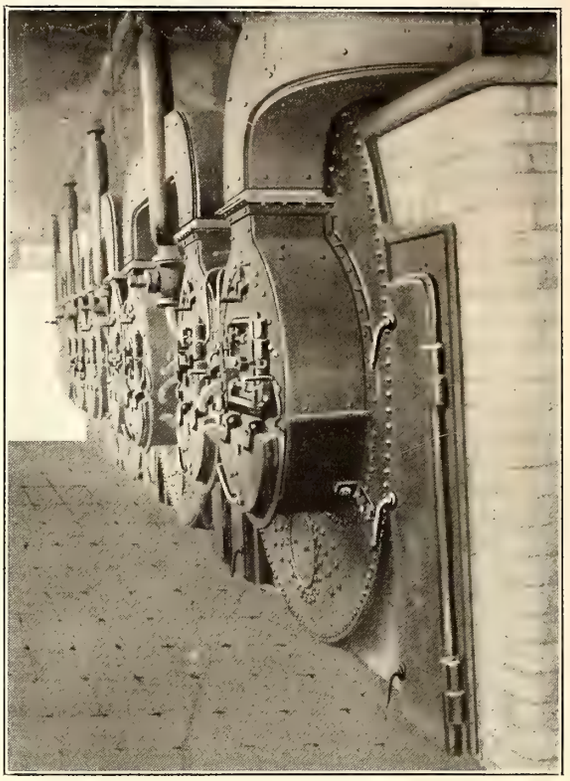
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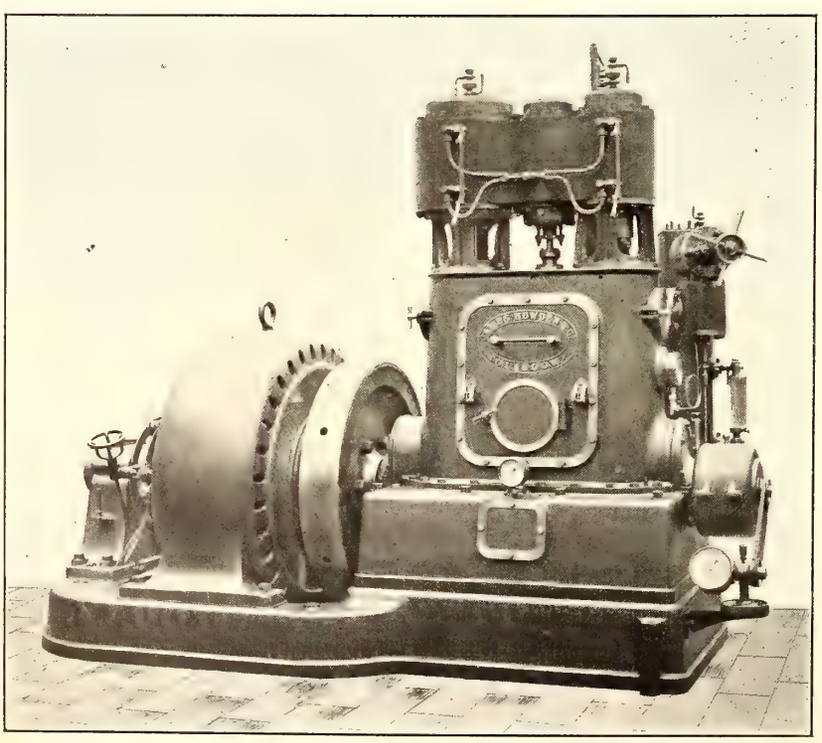
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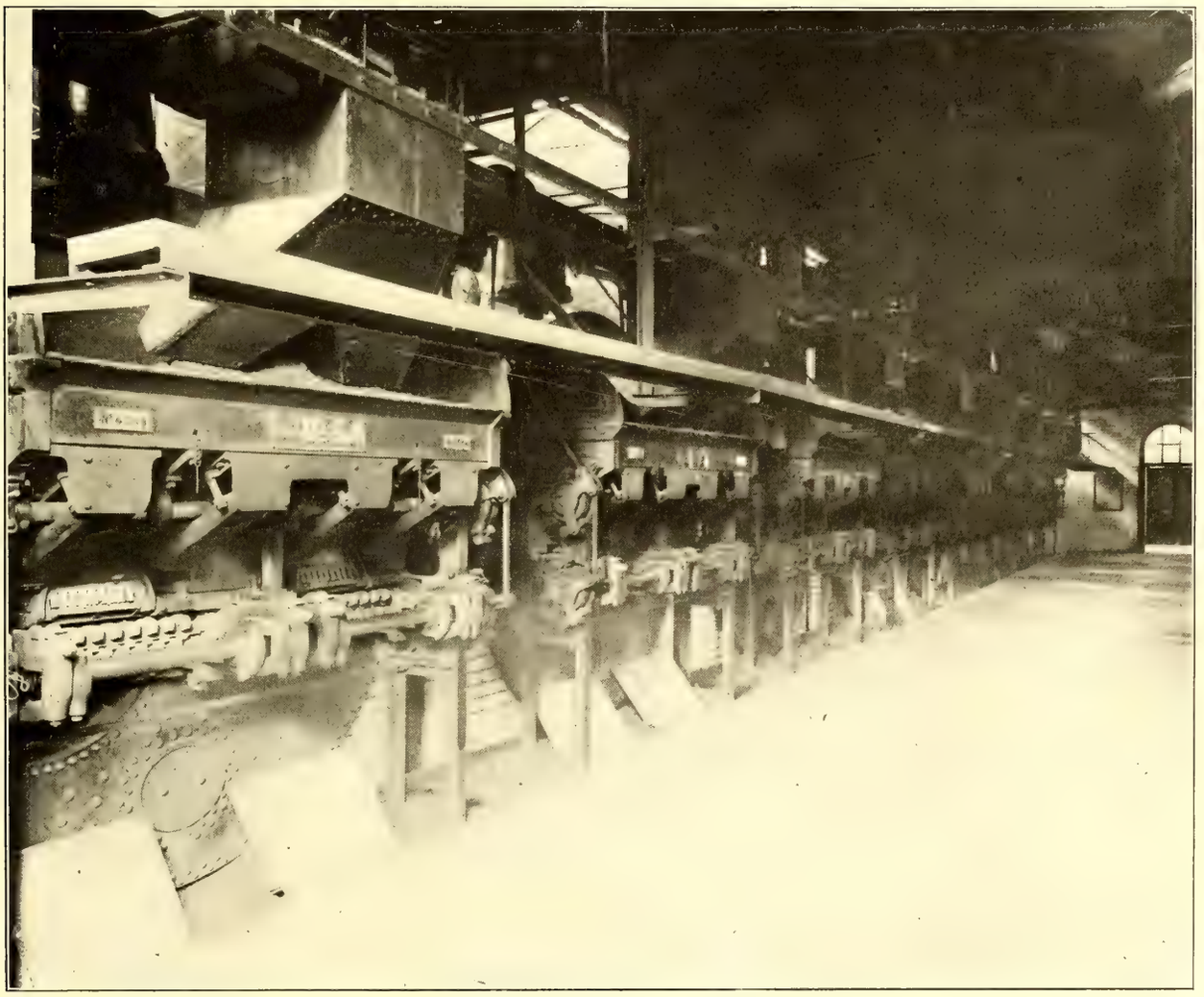
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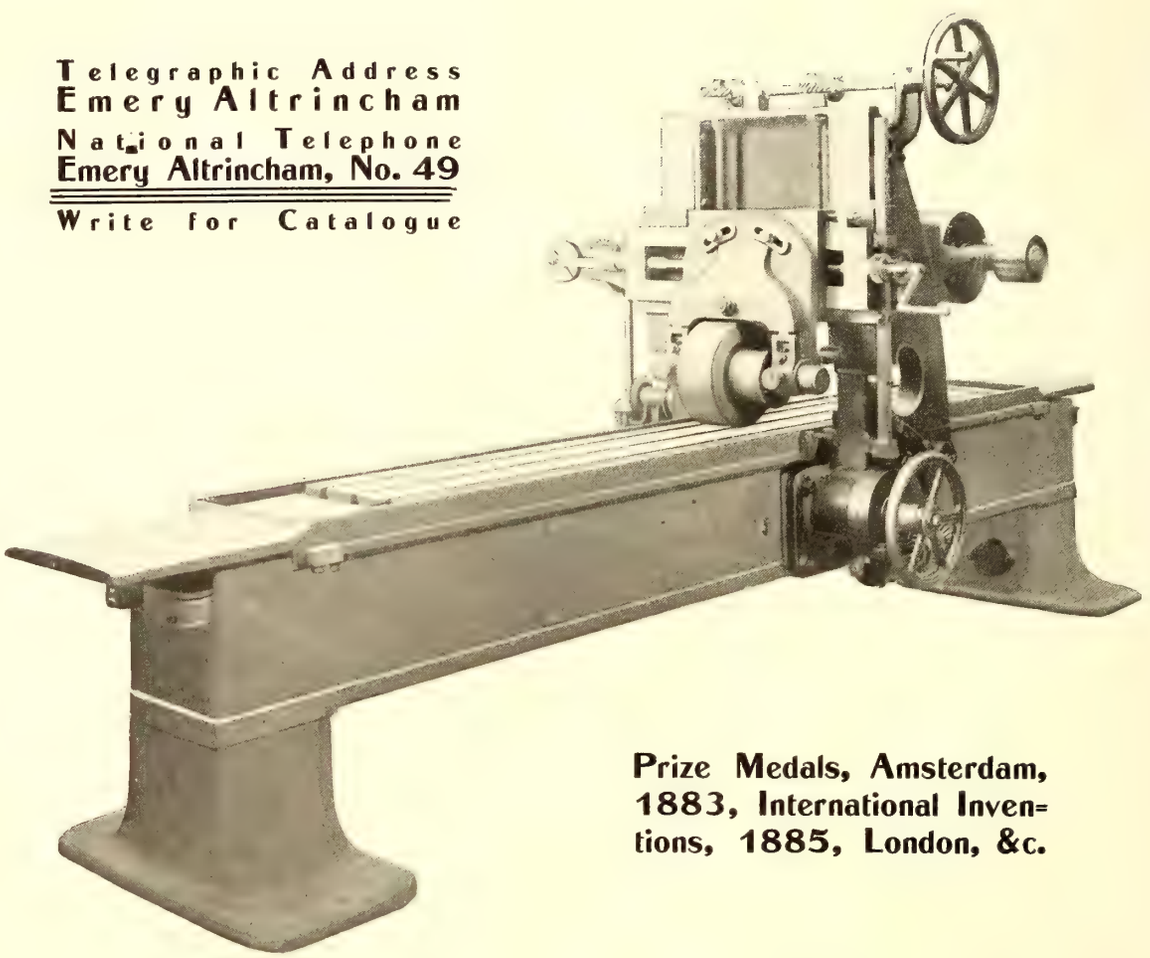
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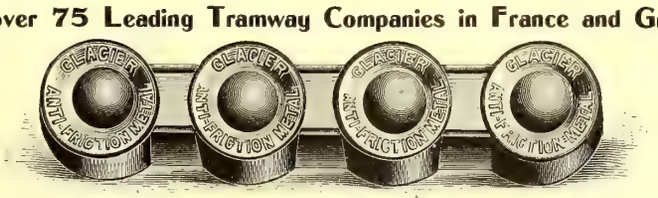
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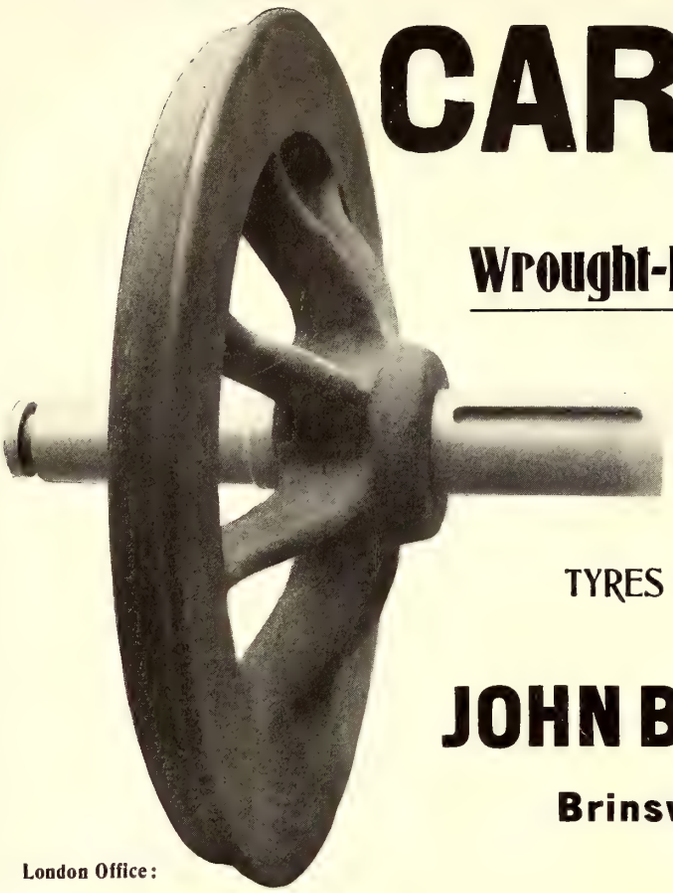
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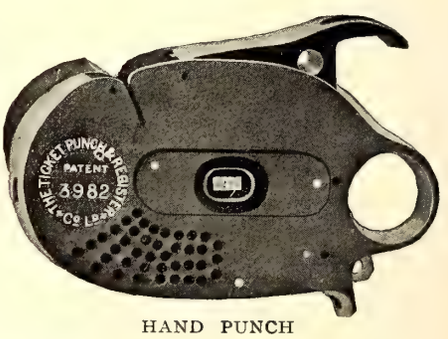
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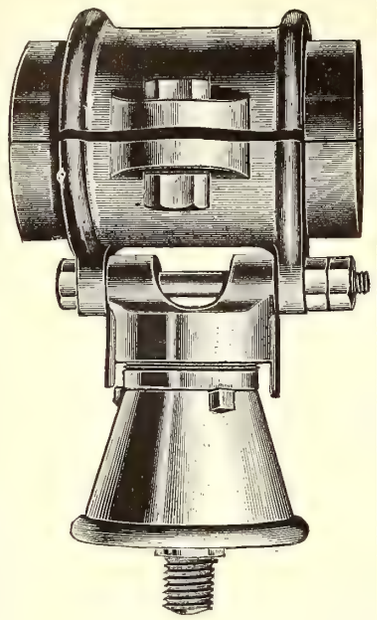


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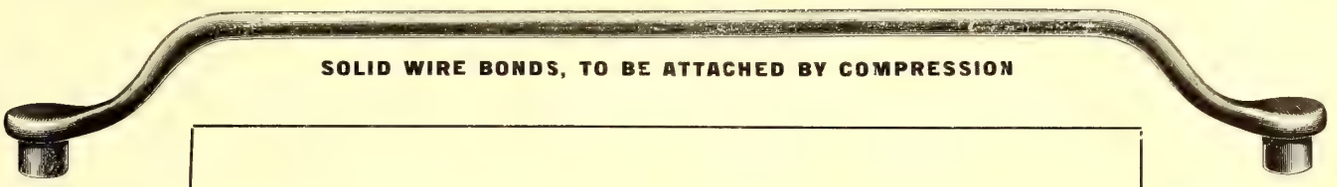
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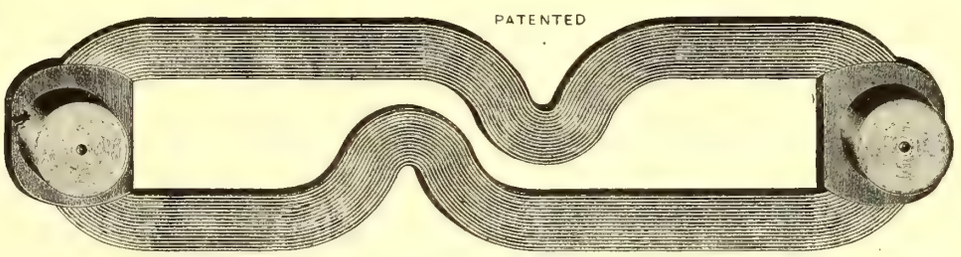
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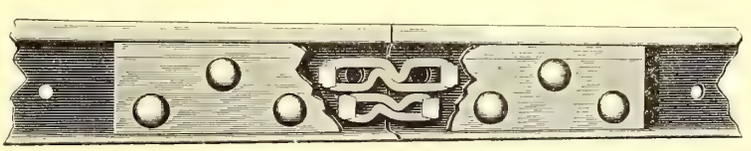
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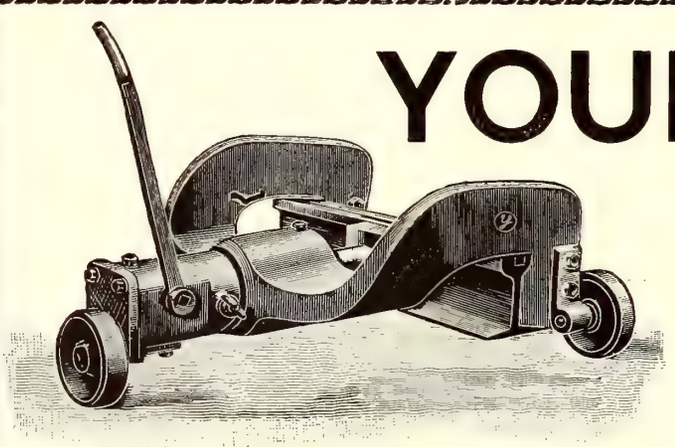
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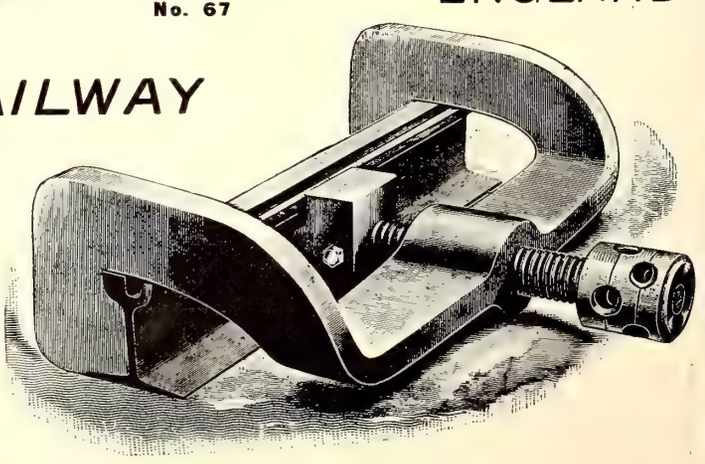
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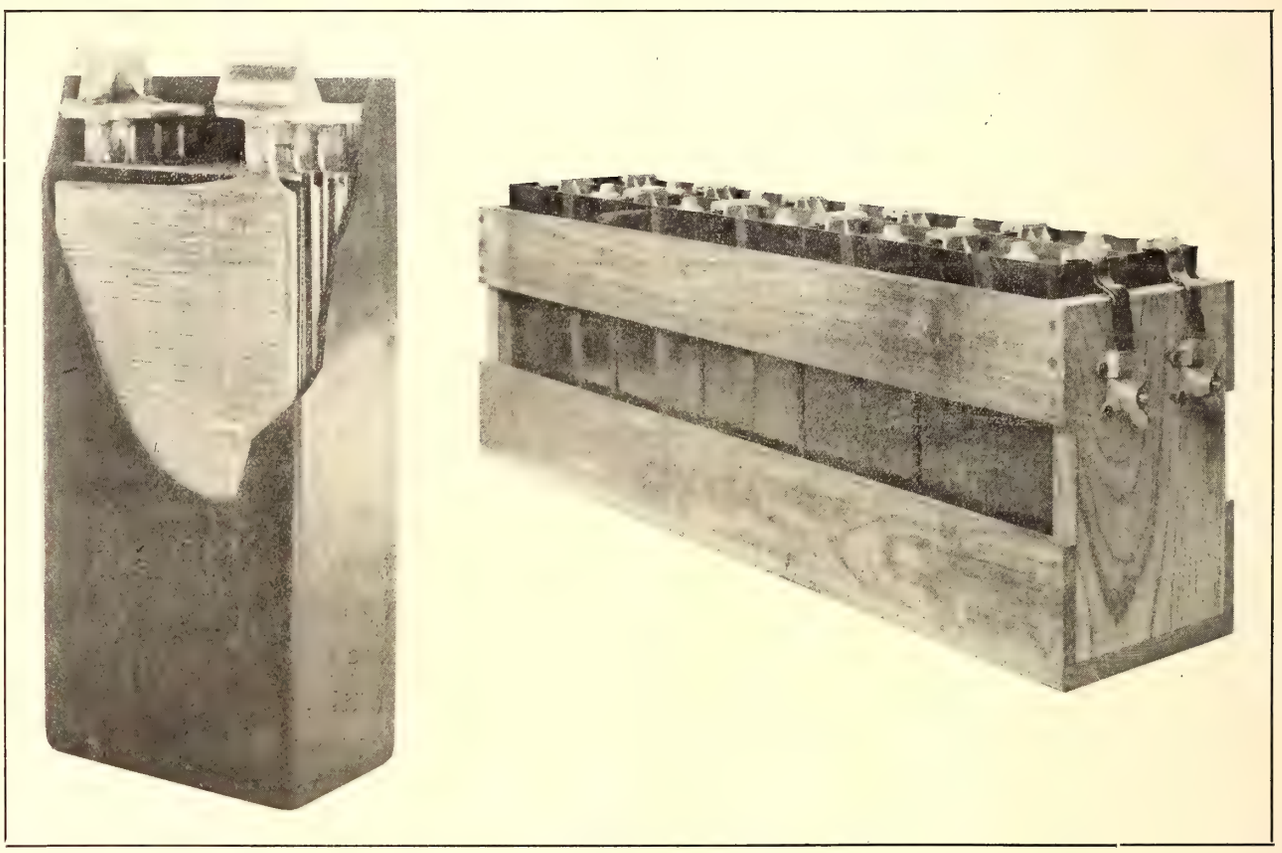
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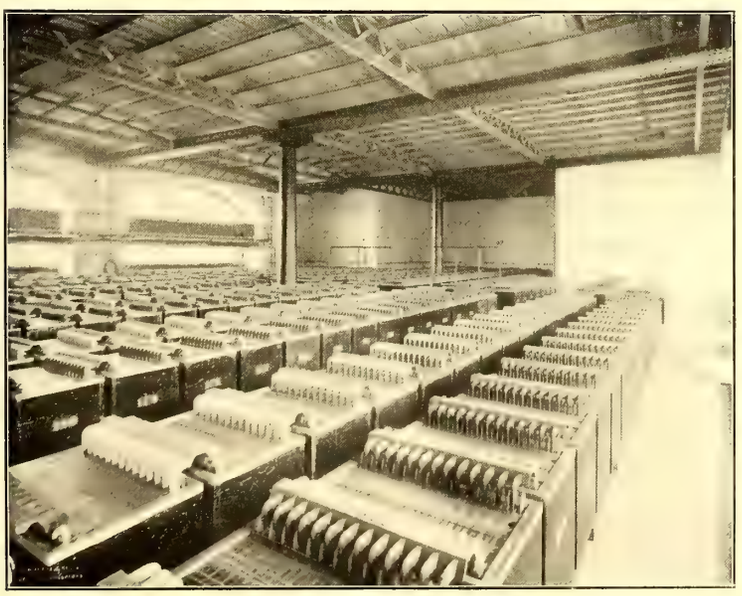
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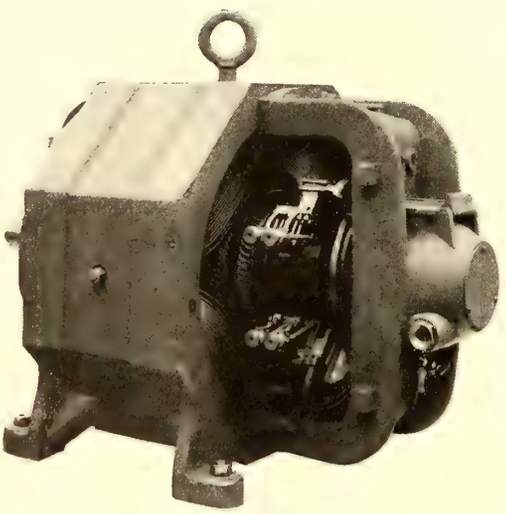
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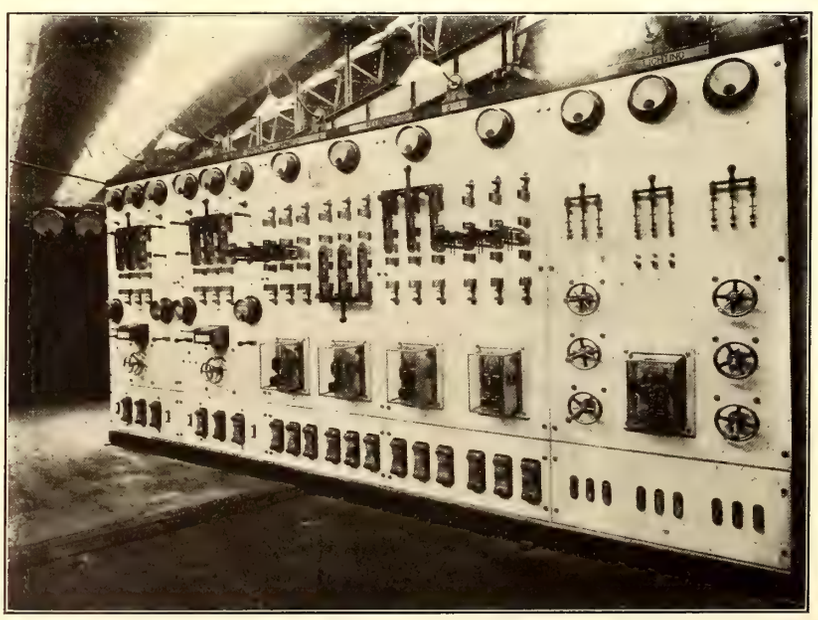
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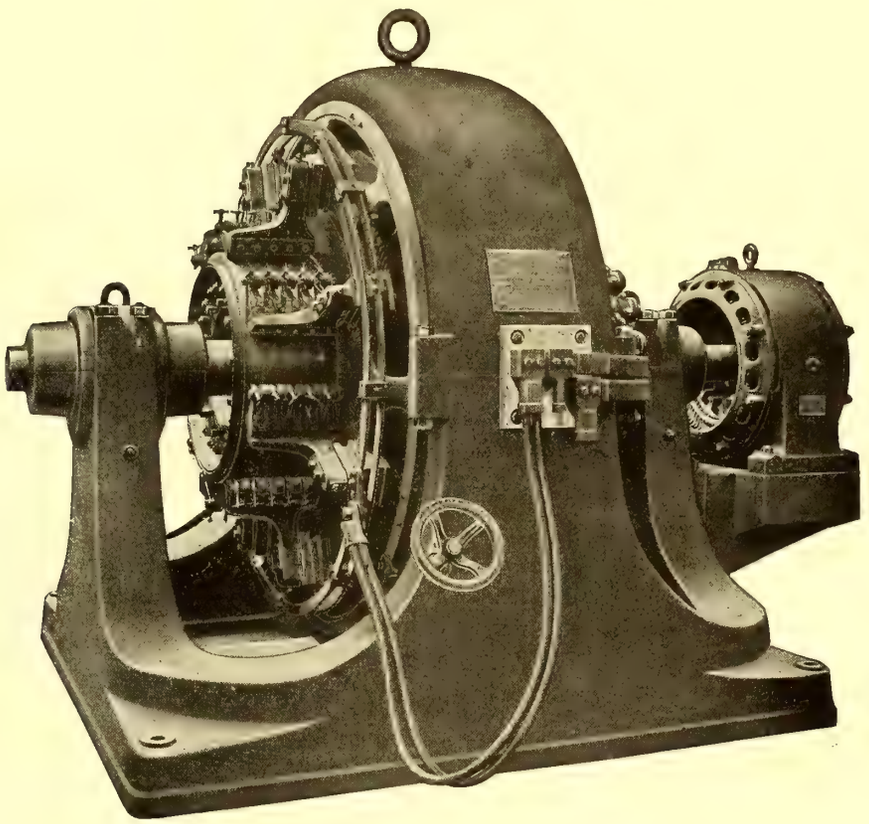
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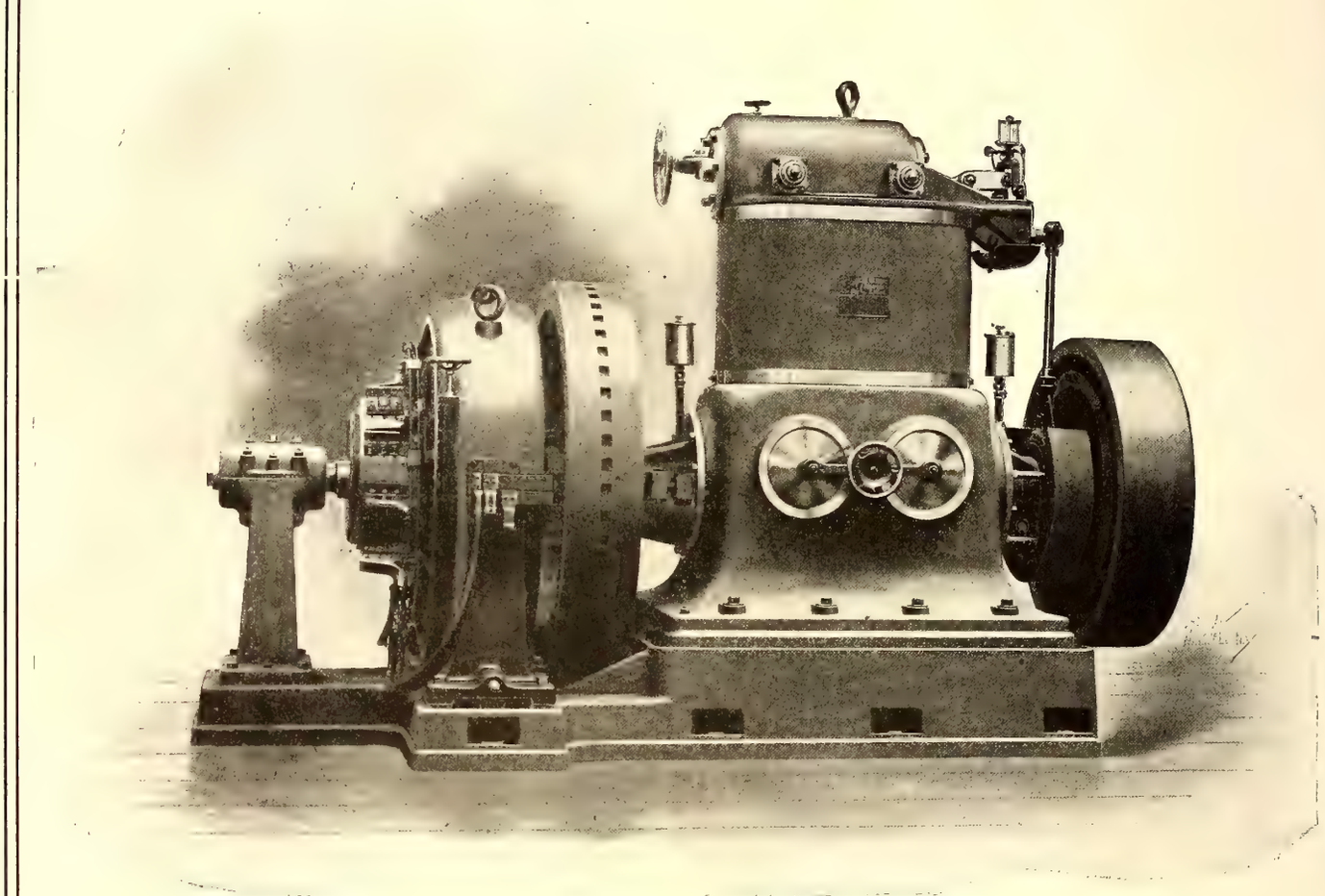
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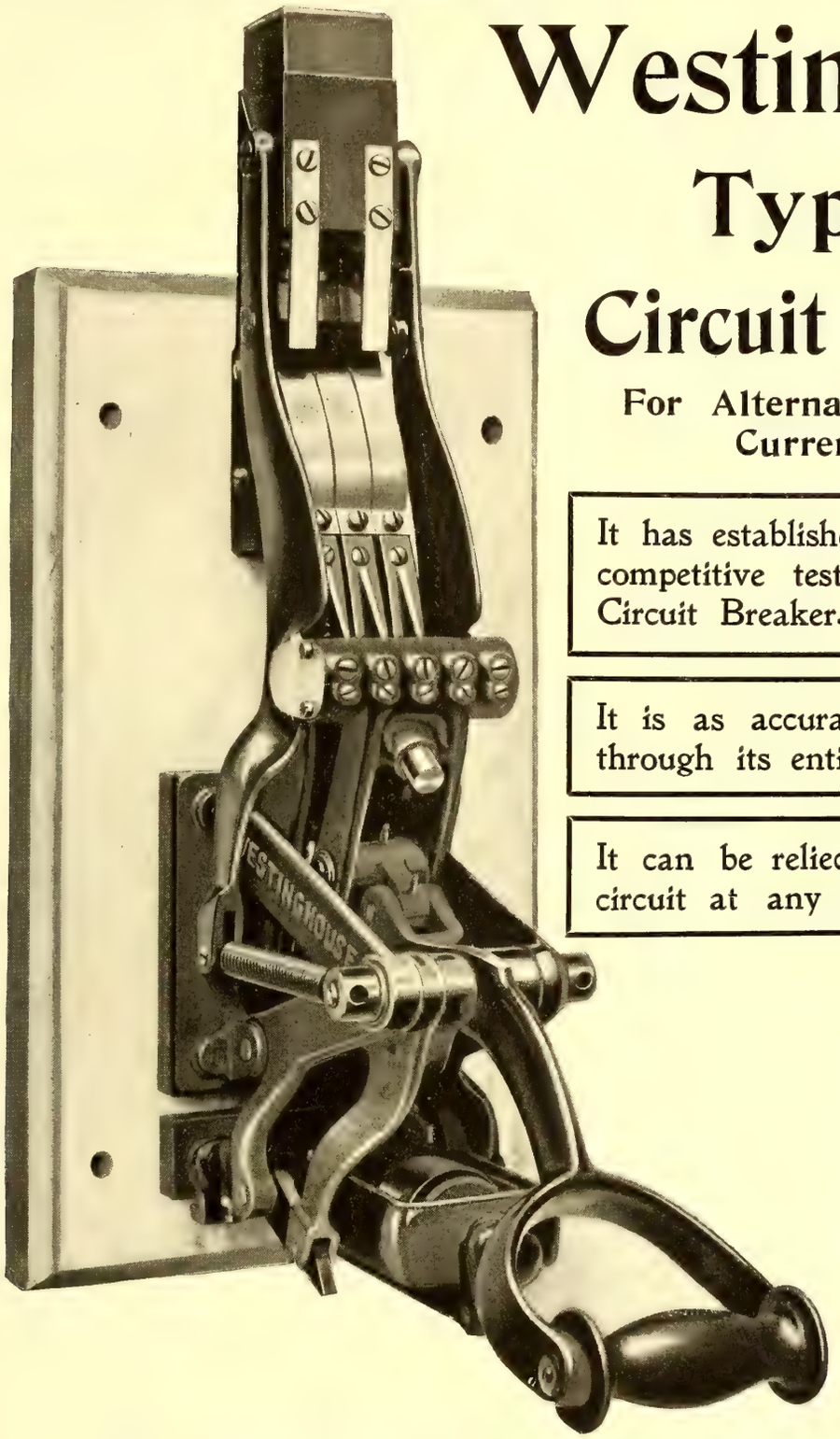
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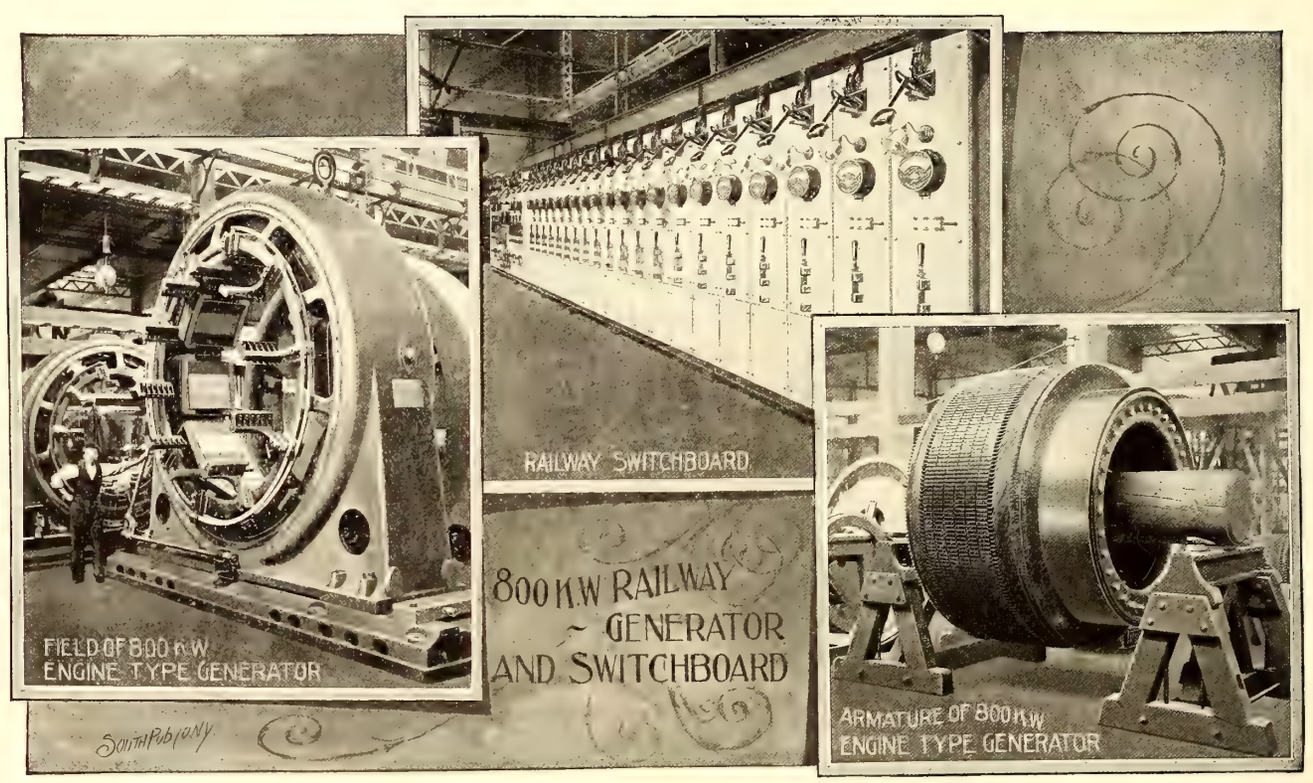
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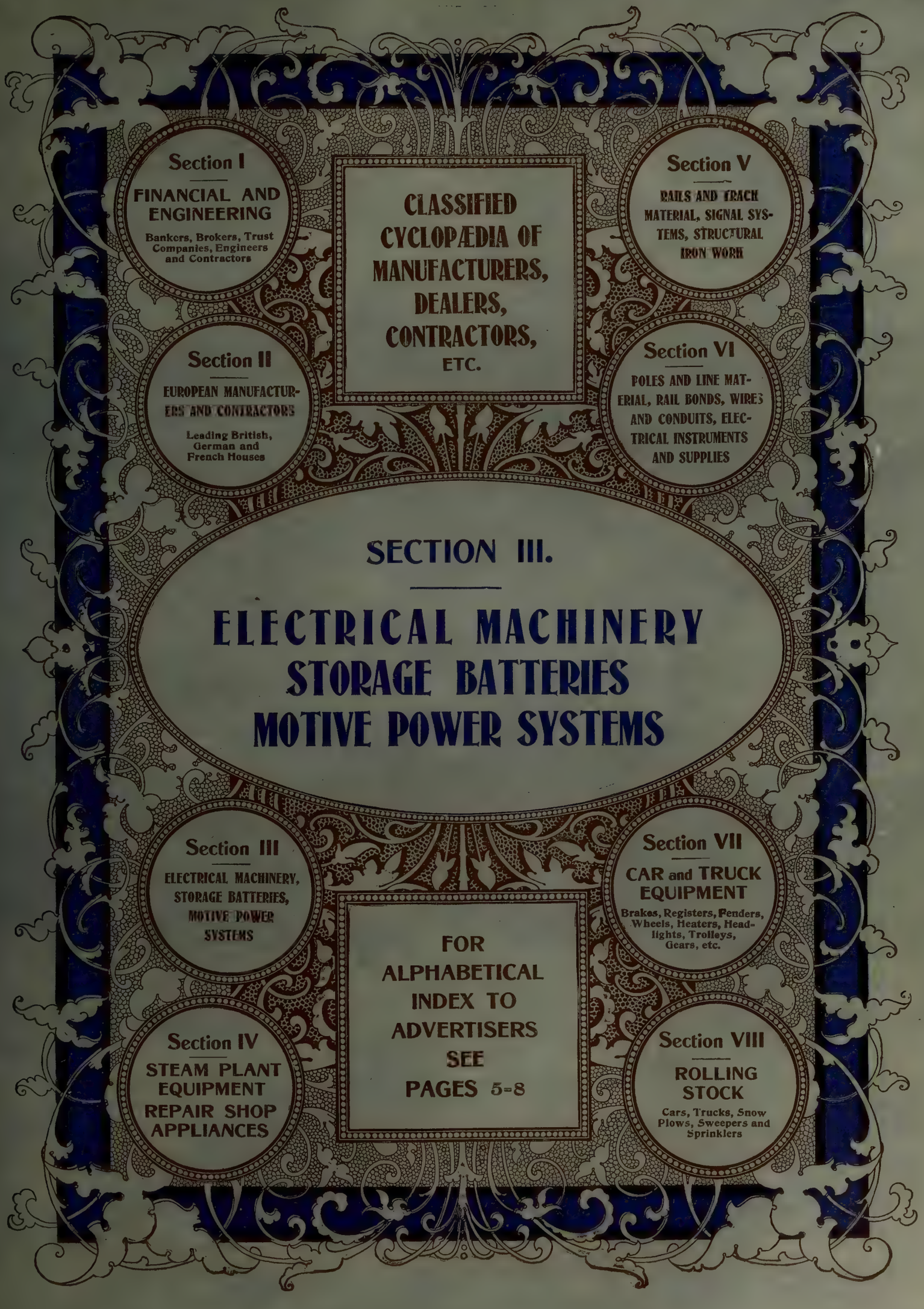
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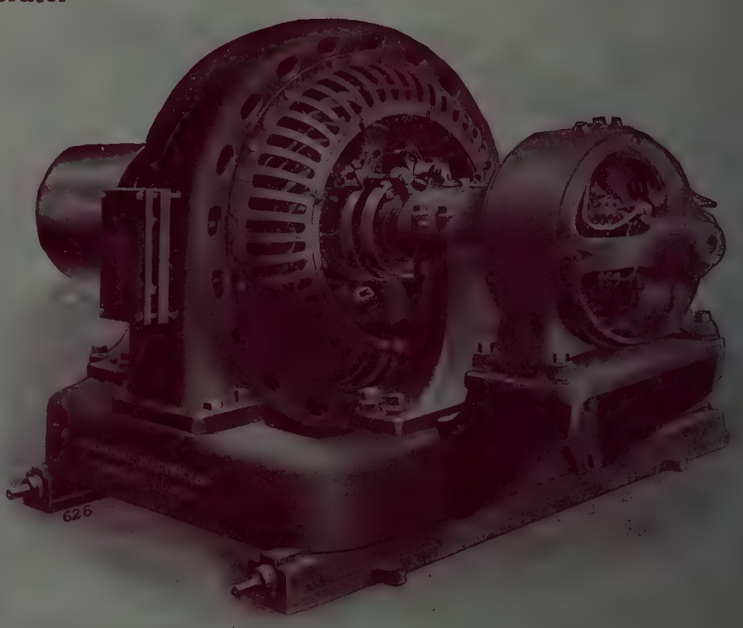
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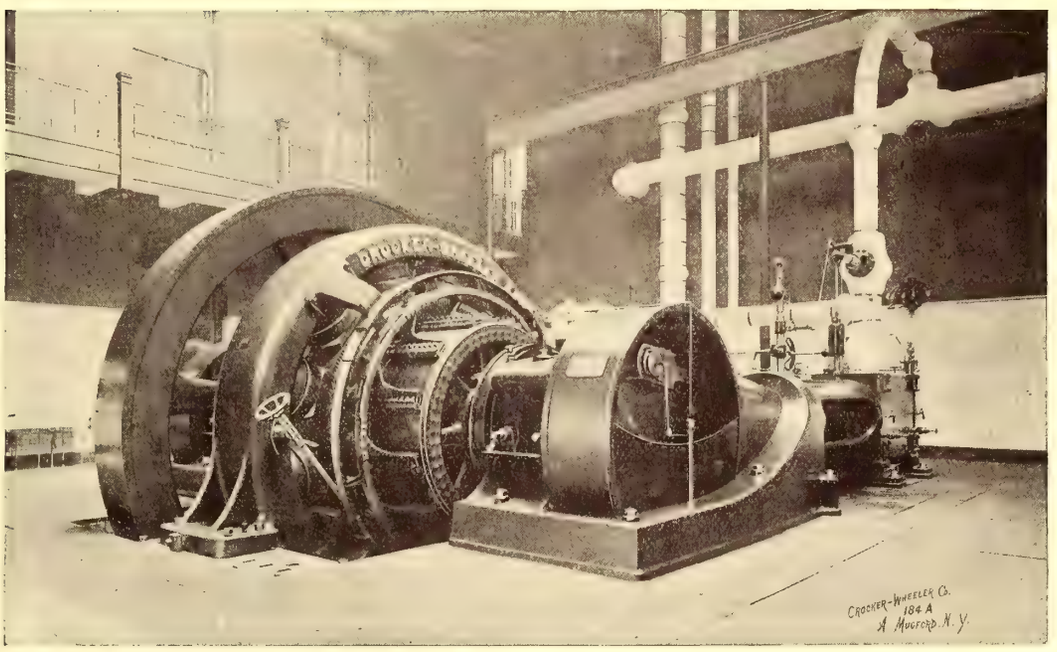
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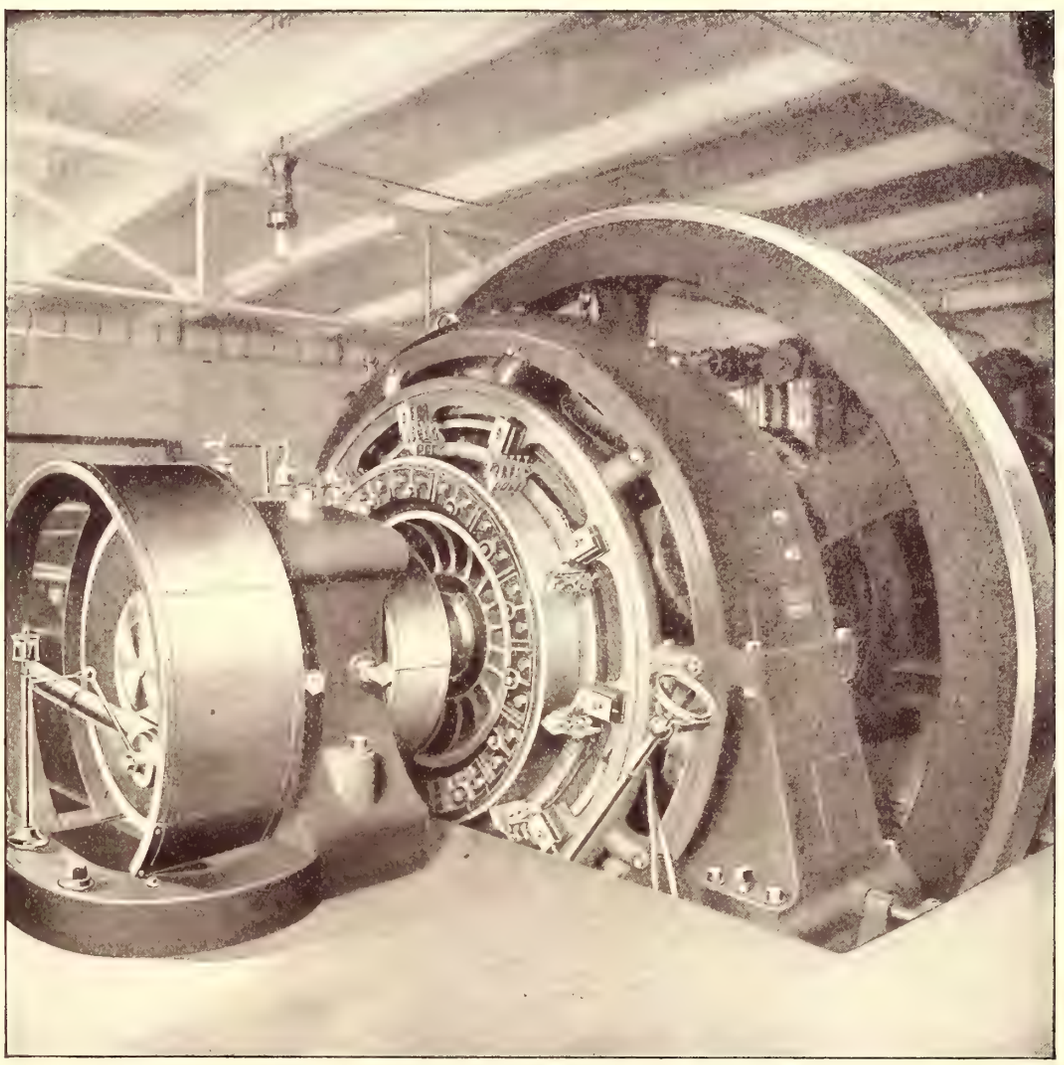
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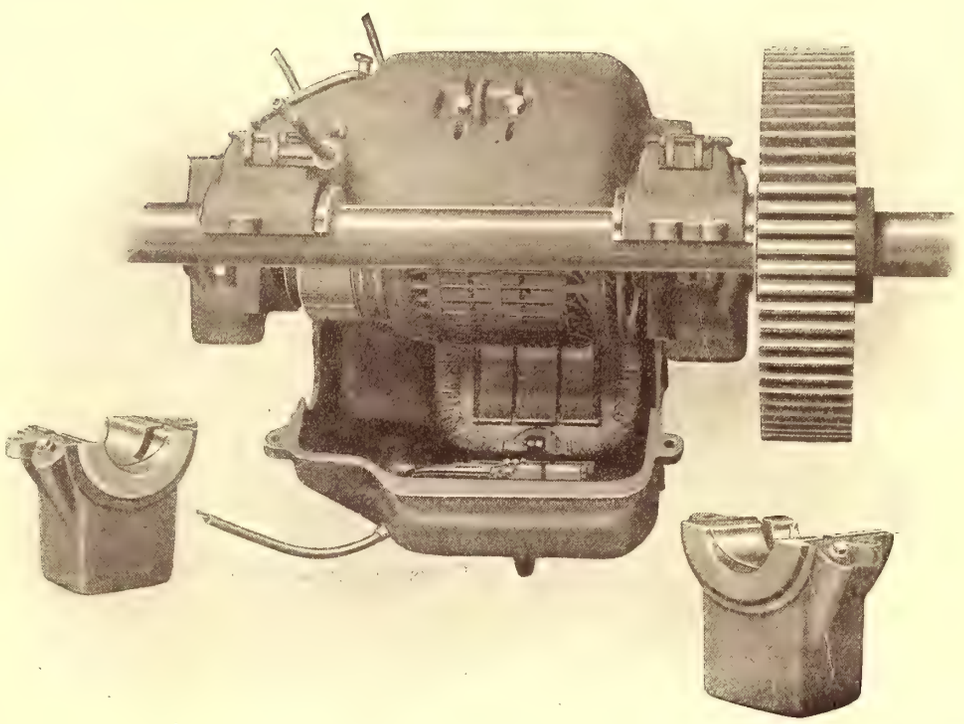
Are distinguished by unusually liberal ventilation and low temperature in operation

FRAME

THE frame is divided horizontally into halves. The lower half can readily be swung down to the position shown in the illustration, or, if desired, it may be entirely removed.

POLE PIECES

The pole pieces are made up of soft laminated steel punchings riveted together. Each pole piece has a flare at the armature end, which, besides holding the field coil in place, effects the best distribution of the lines of magnetic flux. Ventilating ducts through the body of the pole piece permit air circulation and insure a low temperature of the field coil.



BEARINGS

The bearings are Babbitt lined castiron shells of ample dimensions, with means for abundant and constant lubrication. Both armature and axle bearing caps are bolted to the top half of the motor frame.

FIELD COILS

The field coils are wound of square wire, eliminating the air spaces which occur when round wire is used, and thus securing a rapid transfer of heat from the interior to the surface of the coil. The coils are insulated with successive layers of insulating material with an insulating compound, the layers being thoroughly cemented together into a solid mass. This insulation is water proof and elastic, strong both electrically and mechanically, and because of its solidity, permits of the rapid transfer of heat from the coil.

ARMATURE

The armature is unusually well ventilated. Large ducts parallel to the shaft allow the air to enter the body of the armature and ventilating ducts, perpendicular to the shaft, allow the heat to escape. The end castings project above the level of the coils, so as to protect the end winding from injury. The armature coils are form-wound, dipped and thoroughly insulated with oiled linen and tape. The band wires holding the coils in place lie in grooves below the general surface of the armature, thereby protecting them from injury.

COVER OVER THE COMMUTATOR

A neat cover over the commutator permits inspection of same and replacing of brushes. Another hand-hole allows inspection from below.

Bulletin 130 gives further details of S. K. C. Railway Motors.

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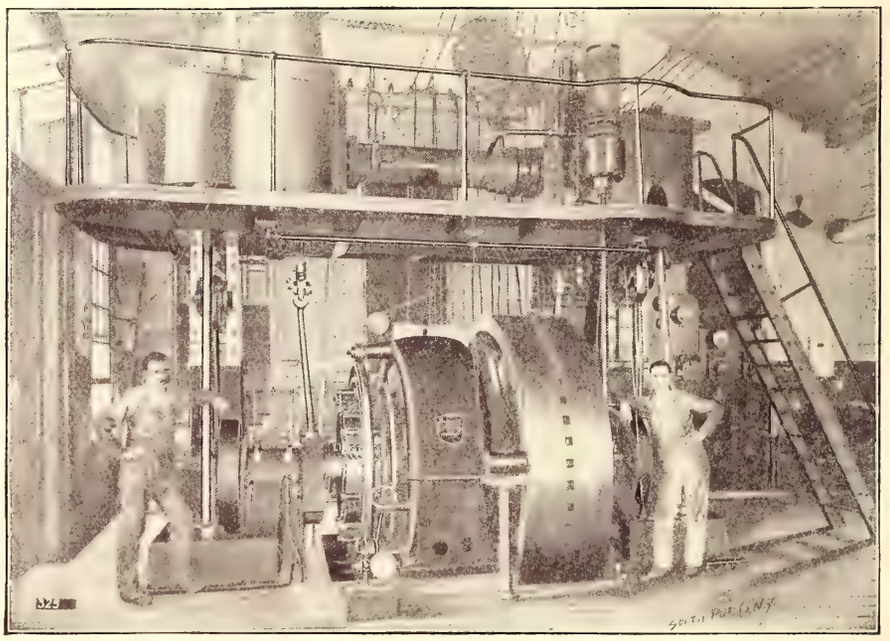
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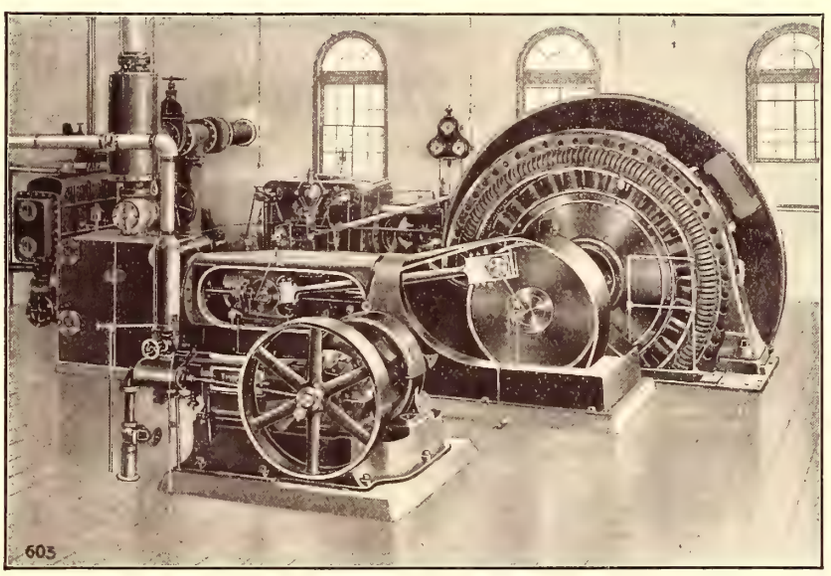
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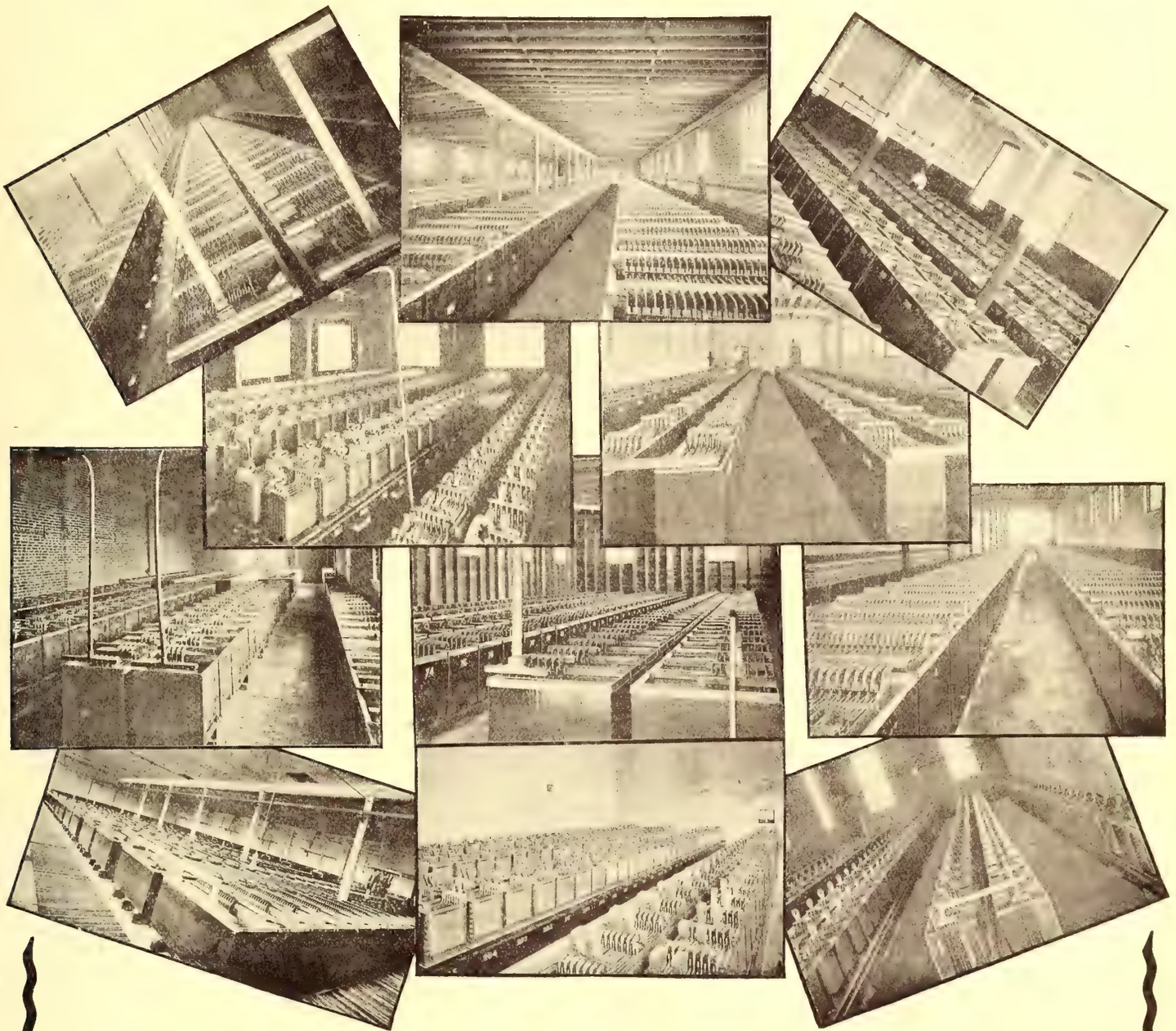
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Accessories	Estimate
Operation	General Conclusions

Extract from Introduction

IN view of the present interest in interurban railway development and engineering the writer submits, as a result of an invitation from the STREET RAILWAY JOURNAL, the plans and recommendations embodied in a report on a proposed railway in the Middle West, which serves as a good example of many roads now on paper, and which may soon assume tangible form. This article is in no way to be construed as an attempt to generalize and instruct others in the art of railway construction, but it is intended to show the way in which certain conditions were to be met in a certain case, together with the reasons which lead up to the recommendations and plans therein submitted.

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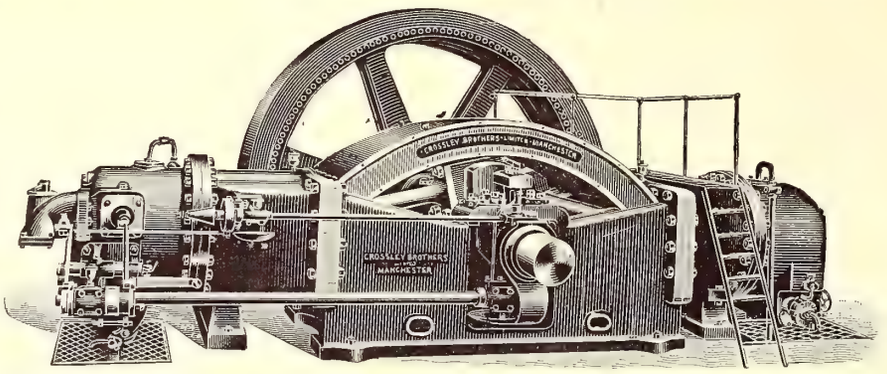


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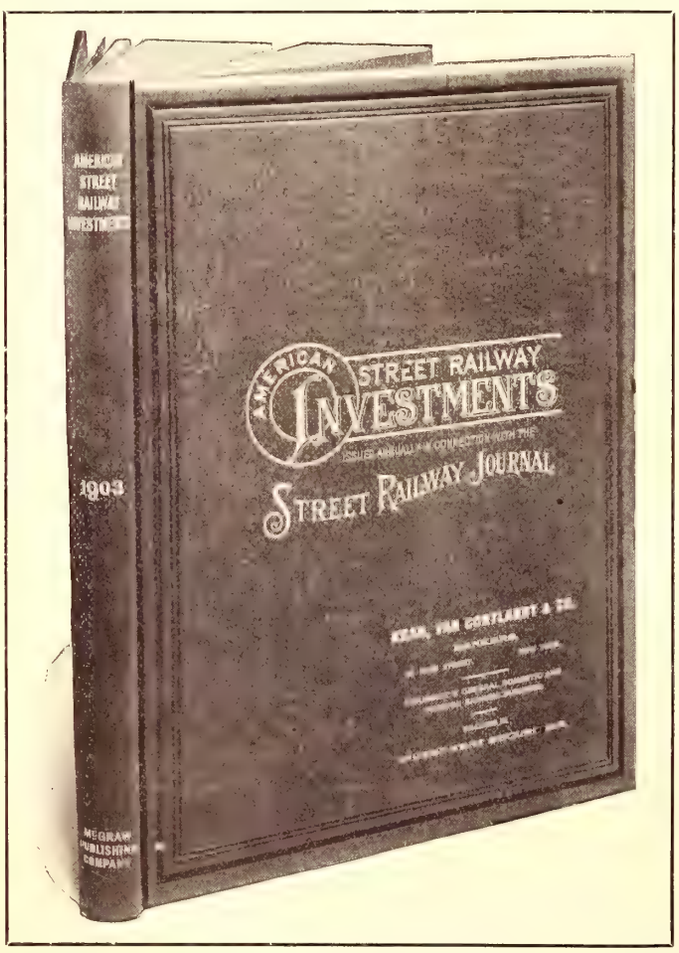
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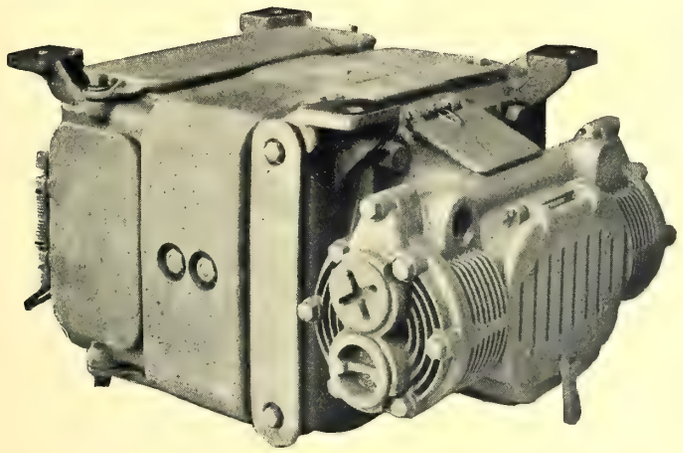
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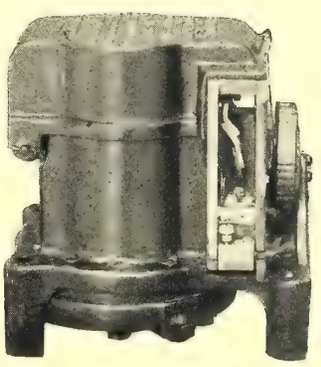
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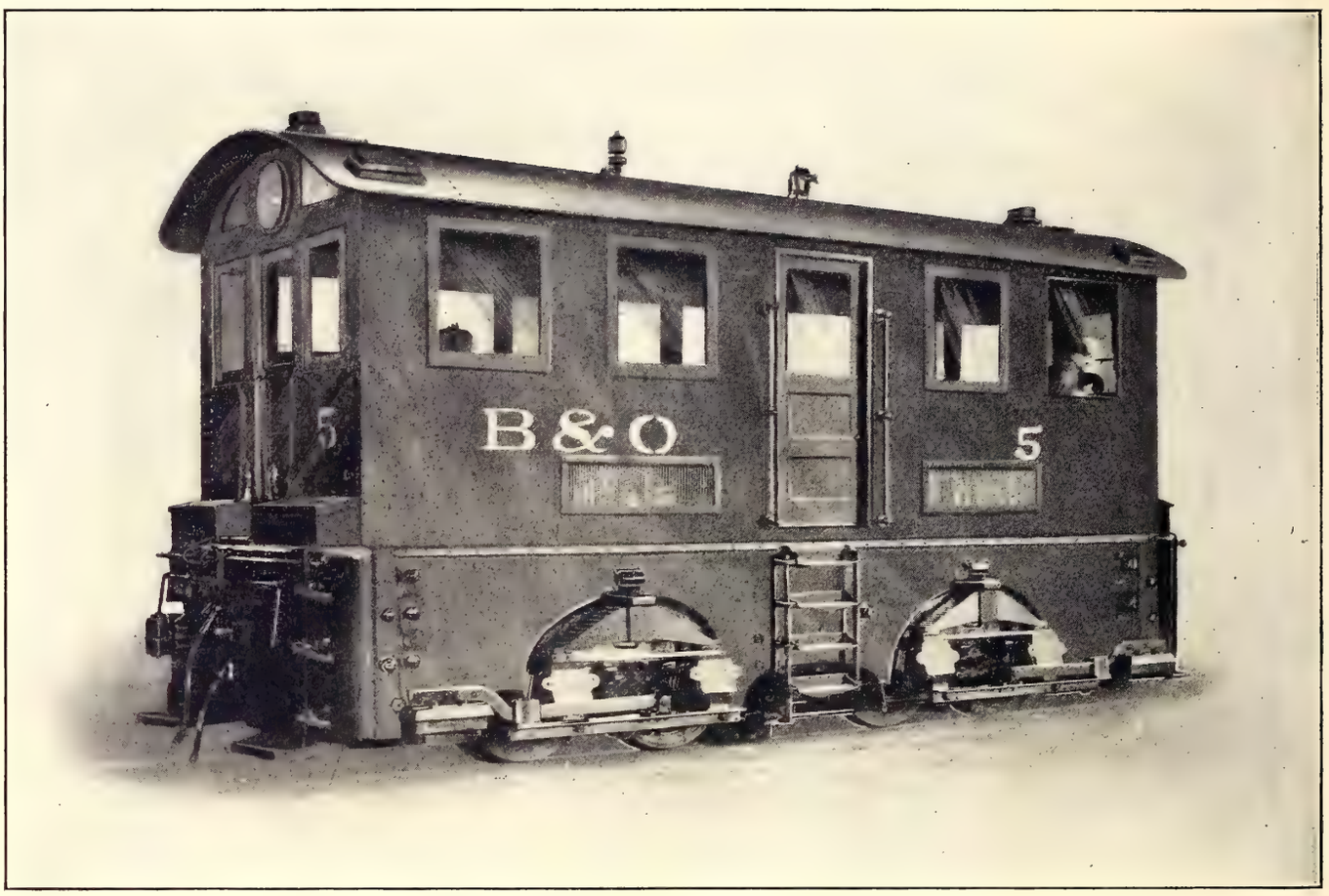
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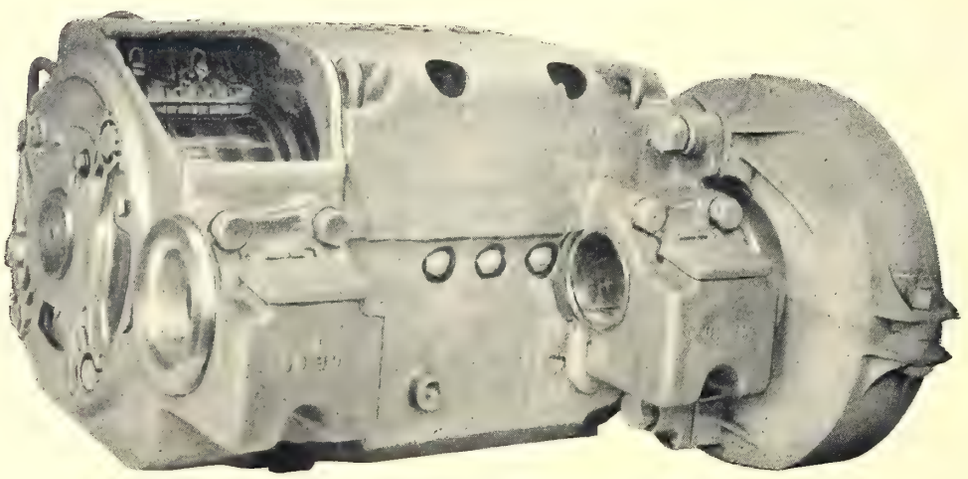
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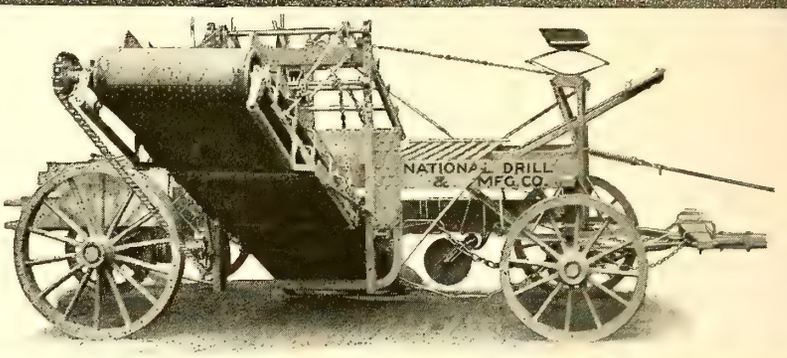
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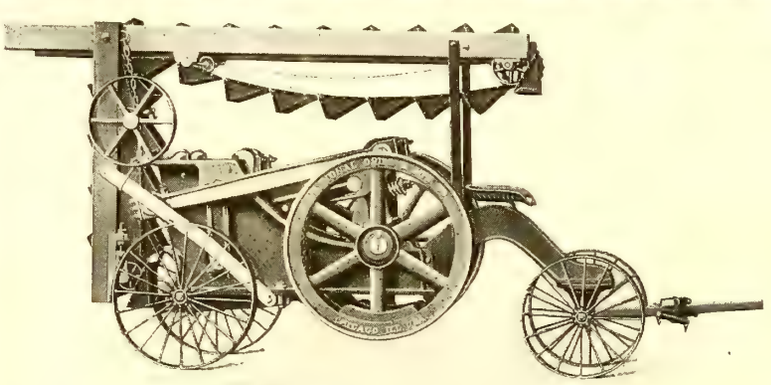
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500 tons of 80-lb. Relaying Steel Rails, with angle splices. Pennsylvania delivery.
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We BUY Relaying Rails for cash; write us if you have any to offer.

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200 two way Dump Cars.

3½ yards capacity, 36-inch Gauge

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FOUR CARS for dummy line or trailer service, Brill and St. Louis Car Co. make Length over all 34 feet, seating capacity 50 people. Inside finish ash and cherry in three and mahogany in one. Wrought iron draw bars, Eames vacuum brakes. Good order. Will sell cheap for cash.

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For Contractors and Railroad Workmen.

We can furnish immediate shipment of 36-inch Gauge Box Cars, in elegant condition, at prices competitive to building huts for workmen. Sanitary advantages innumerable. Such houses could be moved at completion of each contract to new field of operation. Free transportation furnished interested parties for inspection of these cars from Chicago. Have also Cabooses, Refrigerator, Stock and Flat Cars.

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CONSTRUCTION SUPERINTENDENT, making a specialty of electric railway building, desires to communicate with builders of electric railways; 13 years' experience, almost entirely in the actual supervision of electric railway construction. Engineer's degree. Age 33. Liberty after August 15th. Address "Contractor," care STREET RAILWAY JOURNAL.

WANTED—A position as superintendent or manager of electric road. Have had eighteen years' experience on steam and electric railroads. Understand track and overhead construction and all kinds of repairs, having served two years in repair shop; also familiar with power-house and railway generators. Am now superintendent of a road but desire a change. Would be pleased to take a road now not paying properly and endeavor to place it on a paying basis. Address "EXPERIENCE," care STREET RAILWAY JOURNAL.

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WANTED—Master mechanic to take charge of power house and equipment for 90 miles of high-speed interurban electric line. Must be thoroughly familiar with multiple unit control. Good references. Salary $125 per month. Address all communications "Traction Co.," care STREET RAILWAY JOURNAL, 114 Liberty St., New York.

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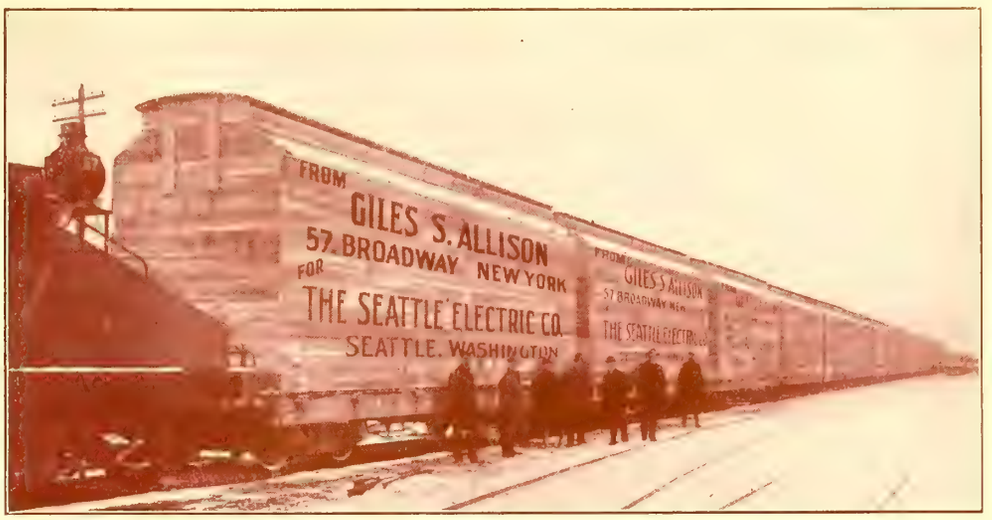
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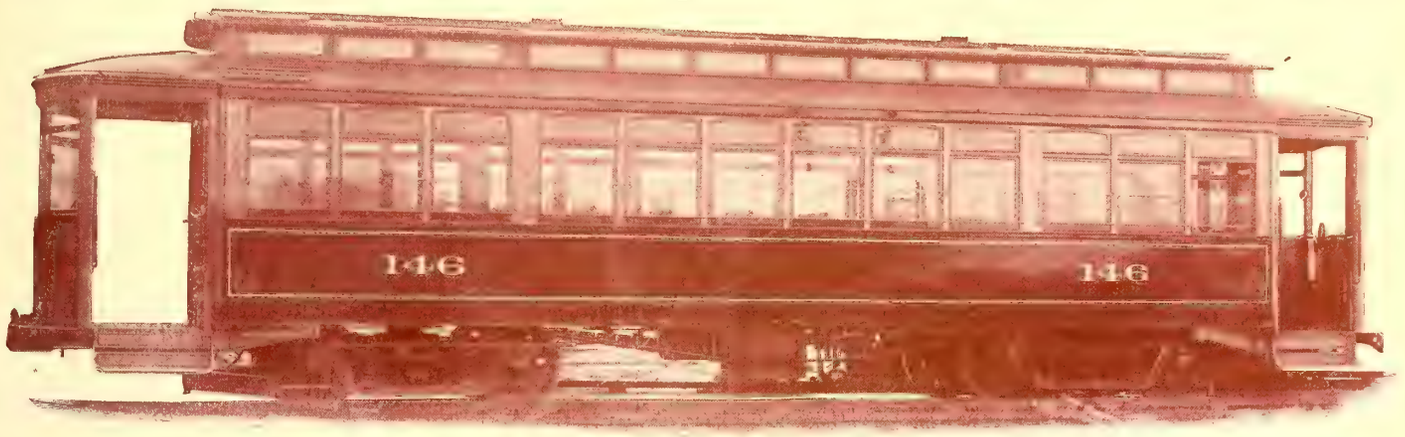
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Sixty fully equipped Cars, like cut, equipped with two Westinghouse 38 Motors and Diverters, K-8 Controllers, Peckham Trucks, Sterling Brakes, Smith Headlights, etc. Length over all 41 feet; closed body 16 feet, with longitudinal seats inside. All in good condition and can arrange to have painted to suit purchaser. Offered very cheap.



Twenty-five cars like cut, fully equipped, in good operating condition, with G. E. 800 Motors and K Controllers, Heaters, Headlights, Register and all complete, mounted on Peckham Truck and painted to suit purchaser; 20' bodies, 4' 5" platforms. If you need any such equipment, would advise quick action, as they will go fast, being the best offer of this kind ever made. Only reason for selling is the substitution of standard double-truck Cars for them.

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Railway Motors of every description
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3,000 8-inch and over top white Chestnut Poles for immediate shipment from Mt. Arlington, N. J., also
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One Goubert horizontal, closed, 800 H.P. heater, flanged for 14-inch pipe connections, newly received from factory, never used. A great bargain at special price offered Address MICHIGAN ELECTRIC COMP'Y, Detroit, Michigan.

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100 K. W. West. 500 volt R'y Generator
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80 Light Brush Arc Machine.
First-class Condition. Exceptional Bargains
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1 ENGINE, McIntosh & Seymour 13 x 23 x 17 (250 h. p.) tandem compound.
2 BOILERS, Abendroth & Root, 127 horse power each.
PUMP, HEATER and CONDENSER.
2 STACKS, 66 feet long, 42 inch diameter.

Railway Generators

1 General Electric, 100 K. W., M. P. 4 General Electric, 75 K.W., M. P.

Also

1 BOOSTER, D-62, series wound, boost ½ volt per amp.; total capacity 350 amp. at 175 volts.
1 INDUCTION MOTOR, Westinghouse "Type C," 200 horse power, 2-phase, 400 volts.

All of the above apparatus is in first-class operative condition, and ready for immediate shipment. Prices on application.

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Sound, carefully measured and cut to exact dimension, and either 7 or 8 ft. in length, all ready to ship, and the lowest market prices consistent with first-class ties.

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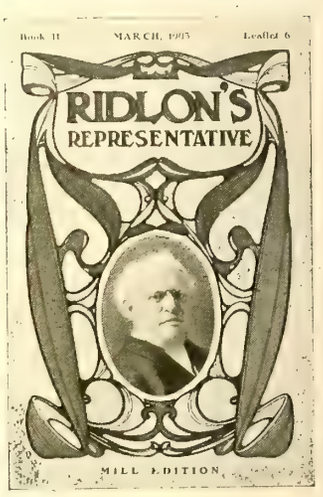
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A DIRECT CONNECTED RAILWAY UNIT, consisting of 225 kw. General Electric 550 Volt Generator Type M. P., Class 6-225-120, Form E, directly connected to Buckeye 16½-30½ x 30 Horizontal Cross Compound Engine. This Unit is in excellent condition and ready for immediate delivery.

Belted Railway Generators, 500-550 Volts

Two 500 K. W. General Electric, 6-pole, speed 300 R. P. M.
Two 300 K. W. General Electric, 4-pole, speed 400 R. P. M.
One 200 K. W. Westinghouse, 6-pole, speed 465 R. P. M.
Two 200 K. W. General Electric, 4-pole, speed 425 R. P. M.
Two 180 K. W. Westinghouse, 4-pole, speed 535 R. P. M.
One 150 K. W. Fort Wayne, 6-pole, speed 550 R. P. M.
One 110 K. W. Eddy, 4-pole, speed 600 R. P. M.
Two 100 K. W. General Electric, 4-pole, speed 650 R. P. M.
Two 100 K. W. Edison, bi-polar, speed 620 R. P. M.
One 100 K. W. Walker, 4-pole, speed 750 R. P. M.
One 90 K. W. Thomson-Houston, 4-pole, speed 700 R. P. M.
Four 62 K. W. Thomson-Houston, bi-polar, speed 900 R. P. M.

Corliss and High Speed Automatic Engines

One 22 and 40 x 60 Watts Campbell Corliss Cross-Compound.
One 20-36 x 48 Wheelock Cross-Compound.
One 24 x 48 Hamilton Corliss.
One 23 x 48 Harris Corliss.
One 18 x 48 Geo. H. Corliss.
One 16 x 42 Providence Greene.
Two 18-30 x 16 Westinghouse compound.
Three 18½ x 18 Armington & Sims.
Two 14 x 13 Armington & Sims.
One 10-18 x 20 Payne tandem compound.
One 13 x 12 Armington & Sims.
One 12 x 34 Brown.
One 11 x 12 New York Safety.
One 10½-16½ x 12 Armington & Sims cross compound.
One 10 x 14 Straight Line.
One 12 x 12 Watertown.
One 8 x 10 B. F. Sturtevant.

Six G. E.-58, two-motor equipments, with K-10 Controllers, Gears, Pinions, Gear Cases, Resistances, Main Motor Switches, Magnetic Cut-outs, Lightning Arresters, Car-Wiring Cables, Material for Power Wiring and Car Lighting materials. Motors and Controllers in excellent second-hand condition. All other apparatus new, direct from the factory.

Also G. E.-52, G. E.-800, G. E.-1000, Westinghouse 38-B and Westinghouse 12-A Equipments, with K-2 and K-10 Controllers.

A large number of Alternators, single, two and three-phase, 60 and 125 cycles, as well as all kinds of direct-current Motors and Generators.

Small direct-connected units, from 25 to 130 K. W., for lighting and power.

Open and closed cars, with or without trucks and equipments

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1—20-36x36 Buckeye Tandem compound 700-H.P. at 130 lbs.
1—23x48 Corliss, 80 R.P.M. 250-H.P.
1—18x18 G. H. Corliss 200-300-H.P.
1—16x42 Improved Greene, 250-H.P.
1—16x36 Friek Corliss, wheel 12x20.
1 pair Putnam, 300-H.P. at 80 lbs., 500-H.P. at 165 lbs., condensing.
1 pair Fitchburg engines, 150-H.P.
1—14x42 Hamilton Corliss, 80 R. P. M.
1—11x14 Aut. Buckeye, type C.
1—13x12 Harrisburg Ideal, self-oiling, center crank.
1—50-H.P. Westinghouse Jr.
1—10-18x20 Payne Tandem Comp., with Knowles condenser.
1—12-20x12 Westinghouse Comp., 100-125-H.P., 300 R.P.M.
1—12x12 Watertown, center crank.
1—10½-16½x12 Armington & Sims cross comp., 100-H.P.
1—13x12 Armington & Sims.
1—13¼x12 New York Safety, 100-H.P.
1—13"x12" Erie Ball.
1—15x20 Russell, 180 R. P. M.
2—14x14 Taylor Beck automatic.

Factory: 455-463 Greenwich St.

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60-K.W. G. E., 125 cycles.
70-K.W. National, 125 cycles.
1 West. A-120, 2000-Lt., 1000 or 2000 v., 125 cycles.
2 G. E., A-70, 1300-Lt., 1000 or 2000 v., 125 cycles.
1 G. E., A-120, 2000 v., 60 cycles, practically new.
2—180-K.W. G. E., 60 cycles, 1100 or 2300 v., 12-180-160, single phase, exciters and instruments almost new.
2—120-K.W. G. E., 1000 v., 125 cycles, single phase, 14-120-1070.
1—120-K.W. G. E., 2000 v., 125 cy., single phase, 14-120-1070.
2—180-K.W. Stanley, 60 cycles, 2200 v., 2 phase.
1—A 35 T.-H. 1000 v.

ARC DYNAMOS

A number of Ball, T. & H. Brush, etc.

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3—220-H.P. Babcock & Wilcox.
2—100-H.P. Conklin.
1—150-H.P. Babcock & Wilcox.
1—66x16 Thompson tubular.
1—150-H.P. Dillon tubular.
4—100-H.P. tubular, 66". 100 3" tubes
1 upright boiler, 26" diam., 80" high.
1 Armstrong tubular, 66 4" tubes, 18' long, 66" diam.
1 Taylor Mfg. Co., 121 3" flues, 18" long, 66" diam.
1—Russell Bros. Boiler, 51 4" flues 18' long, 66" diameter.

500 V GENERATORS

1—110 K.W. G. E. 6-100-600, practically new.
2—80 K.W. T.-H. 4-pole 700 rev.
2—500 K.W. G. E. 6-pole, 300 rev., almost new.
2—200 K.W. West. 6-pole, with switchboard apparatus.
1—100 K.W. Walker 4-p. 750 rev.
1—200 K.W. G. E. 4-p. 4-200-425 G. E. Railway Panel.
1—100 K.W. West. M. P. 650 rev., with marble switchboard, instruments, etc.
1—75 K.W. Walker, good as new.

CARS

18' 6" Vestibuled Cars, 3 with G. E. 800 motors; 2 with G. E. 1000 motors. In splendid condition throughout.
12—12-Bench, 9 9-Bench Wason Mfg. Co. Cars, with G. E. 67 motors, K-10 controllers, air brakes, fenders, registers, etc. Newly painted. Splendid condition throughout.
16—18' closed cars, Brill & American Car Co., K-2 or 10 controllers with Westinghouse 3 or G. E. 800 motors on Brill 21-A and Peckham No. 7 trucks. Bodies Stevenson and Brill. Fine condition.

RAILWAY ARMATURES

West. 3 Armature at $75.
West 38B Armature at $140.
West 12A Armature at $125.
West. 12 Armature at $115.
West 49 Armature at $125.
G. E. 52 Armature at $130.
G. E. 67 Armature at $140.
G. E. 57 Armature at $175.
G. E. 800 Armature at $100.
G. E. 1000 Armature at $130.
G. E. 1200 Armature at $160.

These armatures are newly wound with standard coils, have new commutators and standard shafts. Equal in every way to new armatures.

RAILWAY MOTORS

10—38 B. Motors, new throughout, except shells.
20—G. E. 800 Railway Motors.
10—G. E. 1000 Railway Motors.
20—M. P. 50 Railway Motors.
10—Steel, No. 22 Railway Motors.
20—Westinghouse, No. 3 Railway Motors.

We can furnish controllers, resistance, etc., for any of above motors, making complete equipments.

Office: 465 Greenwich St.

We have on hand, ready for immediate delivery, a large number of all sizes and kinds of Railway Motors and Armatures

I. S. VAN LOAN COMPANY

Railway and Power Equipment

COMPLETE RAILWAY POWER PLANT

ENGINE ROOM

2 300 Kw. Type M. P. 6-300-100 R. P. M., 550 volt Westinghouse Generators, each direct connected to a tandem compound heavy duty tangye frame Corliss Engine, 16" and 30" x 42".

2 Jet Condensers and Pumps.
2 Standard Generator Panels.
2 Standard Feeder Panels.
1 Wattmeter Panel.

BOILER ROOM

2 375 H. P. Water Tube Boilers, arranged with independent settings.
1 Self-Supporting Steel Stack.

2 Worthington Feed Water Pumps.
2 Hartford Heaters.

The above Plant in operation but one year, now ready for immediate delivery

ALTERNATING CURRENT POWER PLANT

1 600 Kw. Type A. T. B., 80-600-90 R. P. M., 600 volt General Electric Generator, direct connected to a 32 x 48 E. P. Allis heavy duty Corliss Engine.
1 10 Kw. 125 volt General Electric M. P. Exciter, direct connected to a 9 x 7 vertical marine type General Electric Engine.

3 200 Kw. Type A. B. Step Up Transformers, interchangeable secondary 600 to 20,000 volts.
3 180 Kw. Type A. B. Step Down Transformers, interchangeable primaries, 20,000 to 600 volts.
Also 300 Kw. in Motors, 550 volts for above plant.

DIRECT CONNECTED UNITS

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1 800 Kw. General Electric Type A. T. B. 72 Pole, 60 Cycle, 3 Phase Revolving Field Alternator; direct connected to a 27-in. and 54-in. x 42-in. Vertical Cross Compound McIntosh & Seymour Engine. ALL BRAND NEW.

DIRECT CURRENT, 550-600 VOLT.

1 1,650 Kw. direct connected to Allis Cross Compound Engine, ready for immediate delivery.

2 300 Kw. Type M. P. 6-300-100 R. P. M., General Electric Railway Generators, direct connected to Tandem Compound Corliss Condensing Engines.
1 375 Kw. 6-pole Westinghouse Railway Generator. Direct connected to a 17 and 34 x 42 Allis Cross Compound Engine.
1 425 Kw. General Electric, Type M. P. 10-425-120. Direct connected to a Cross Compound Heavy Duty Engine. Unit being complete with Independent Jet Condenser and connections thereto, also Machine Panelboard with instruments.

ROTARY CONVERTERS

1 300 Kw., 2 phase, 565 volts, direct current, 60 cycle, 12 pole, 600 R. P. M.

1 250 Kw., 2 phase, 535 volts, direct current, 60 cycles, 12 poles, 600 R. P. M.

The above Rotaries complete with Standard Switchboard Panels.

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Street Cars and Railway Machinery

OPEN CARS

3 12-bench Newburyport Cars. Length, 35 ft. 5 in.; width, 7 ft. 7 in.; height, from bottom of sill to top of trolley plank, 9 ft. 3 in. Condition as good as new. Specifications on application.

CLOSED CARS

5 Jackson and Sharpe Cars, 18-ft. body, longitudinal seats, Taylor trucks with 33-in. wheel, 7-ft. wheel base.

1 Brill Car, 18-ft. body, longitudinal seats, Brill truck with 33-in. wheels, 6-ft. 6 in. wheel base.

Street car bulletin sent on application.

BELTED GENERATORS

DIRECT CURRENT, 500-550 VOLT.

2 500 Kw. Gen. Electric, type M. P. 4 500-350 R. P. M.
2 300 Kw. Gen. Electric, type M. P. 4-300-400 R. P. M.
1 300 Kw. Westinghouse, 6 pole type.
1 200 Kw. General Electric, 6-pole type.
3 200 Kw. G. E., type M. P. 4-200-425 R. P. M.
1 200 Kw. B. P. Edison, with new armature.
1 150 Kw. Fort Wayne, 6-pole. Speed 550 R. P. M.
1 100 Kw. Westinghouse, 6-pole type.
1 75 Kw. Westinghouse, 6-pole type.
4 100 Kw. G. E., type M. P. 4-100 650 R. P. M.
2 90 Kw. Thomson-Houston, 4 pole.
2 75 Kw. Thomson-Houston, 4 pole.
4 D 62 Thomson-Houston, B. P.
4 60 Kw. Edison, B. P.

ALTERNATING CURRENT

1 700 Kw. Bullock Generator, 3 phase, 25 cycle, 13,200 volt, 275 R. P. M.

2 375 Kw. General Electric Generators, 3 phase, 25 cycle, 2,400 volt, 300 R. P. M.

TRANSFORMERS

14 175 Kw. Stanley Oil Insulated, self-cooling Transformers, 66 cycle, 2,400-20,000 volts.
10 200 Kw. Stanley Water-cooled Transformers, 66 cycle, 2,400-22,500 volts.
10 400 Kw. Stanley Water-cooled Transformers, 66 cycle, 2,400-22,500 volts.

ENGINES

2 24 and 44 x 48 Cooper tandem compound Corliss.
1 20 and 36 x 48 tandem compound Hamilton Corliss.
1 20 and 36 x 42 tandem compound Fitchburg.
1 18 and 34 x 48 Cross compound Cooper Corliss.
1 16 and 26 x 36 " " Murray Iron Works Corliss.
1 36 x 72 Corliss.
1 30 x 72 Hamilton Corliss.
1 24 x 48 Twin Hamilton Corliss.
1 28 x 60 E. P. Allis, heavy duty.
1 18 x 48 E. P. Allis.
1 22 x 42 Harris Corliss.
1 20 x 48 Geo. Corliss.
1 14 x 30 Cummer.
1 13 and 19 x 15 tandem McIntosh & Seymour.
1 16 and 28 x 18 tandem compound Erie Ball.
1 18½ x 18 McIntosh & Seymour.
2 18½ x 18 Armington & Sims.

BOILERS

2 375 H. P. Campbell & Zell Water Tube, 140 lbs. pressure.
2 130 H. P. Heine Water Tube, 130 lbs. pressure.
3 72 in. x 18 ft. Erie City Tubular, 120 lbs. pressure.

Special Offer of G. E. 1200 Motors

We are offering a large lot of Motors of the above type that have gone through the factory and put in excellent condition at an extremely low price. Send for full particulars, either to our main office or St. Louis office. These can also be inspected at our St. Louis factory.

WE HAVE IN OUR FACTORY IN JERSEY CITY, WHERE THEY CAN BE INSPECTED, READY FOR IMMEDIATE SHIPMENT

5 Westinghouse No. 68 Equipments.
12 Westinghouse No. 49 Equipments.
10 Westinghouse No. 12 A Equipments.
40 Westinghouse No. 3 Equipments.
5 Westinghouse No. 69 Equipments
10 Westinghouse No. 38 B Equipments.
10 General Electric No. 52 Equipments.
10 General Electric No. 62 Equipments.
50 General Electric 800 Equipments.

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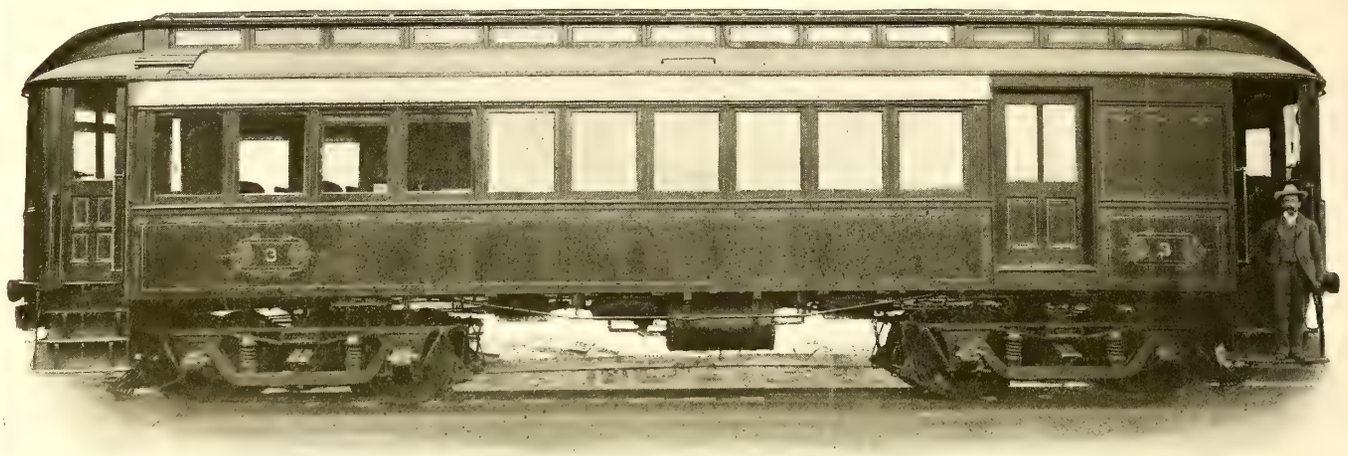
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FOUR NEW BEAUTIES

Ready to Ship. Who gets 'em?

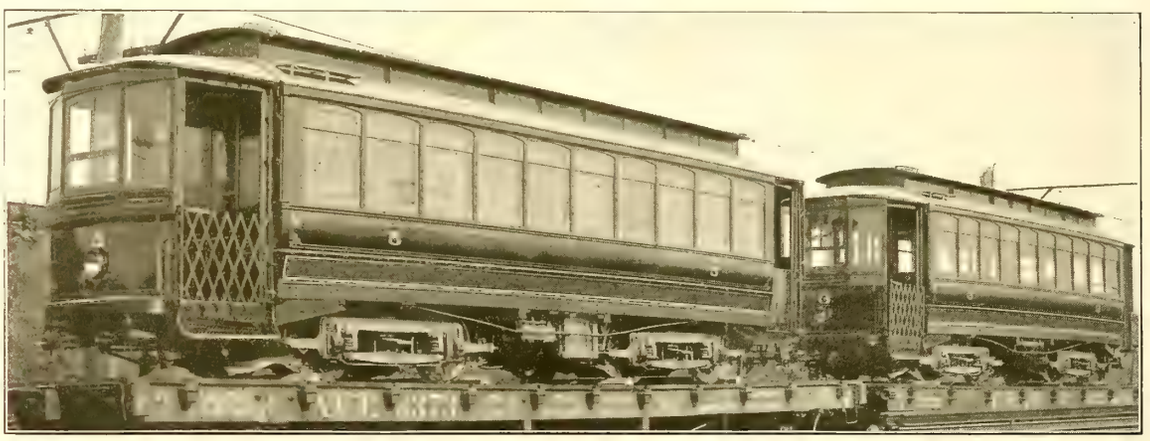


Pennsylvania R. R. specifications throughout; P. R. R. color, tuscan red; 45 feet long; width, 9 feet 4½ inches over all; 8 feet 8 inches inside; baggage or smoking compartment; seats 40 in main compartment, 20 Walkover seats; M. C. B. trucks, steel tired wheels; P. R. R. standard automatic couplers. Inside finish, mahogany; electric heaters and lights, gongs, curtains and all fixtures complete. Christensen air brakes and whistles. Electrical equipment: four No. 56 Westinghouse motors with K 14 controllers, all complete and new, never had the juice on. Everything direct from factory. Only sold because of change of plans in the road ordering. **Ready to ship and operate upon receipt of order.**

Two cars same as above, excepting 8 feet wide, 12 feet high; Peckham 14 B trucks and two motors instead of four. Also two combination cars 56 feet over all, new.

Away they go. A few left. Come quick!

JUST SHIPPED EIGHT OF THESE FINE SUBURBANS.



38 feet over all; width, 8 feet; cross seats, seat 40. Equipped with four 35 H. P. motors, K 12 controllers, Christensen air brakes. Ready to ship. Perfect running order.

Generators, Engines, Rails, Boilers, Motors; open and closed cars, all sizes.

OFFER ME ANYTHING YOU HAVE FOR SALE.

CHARLES F. JOHNSON, 935-937 Ellicott Sq. BUFFALO, N. Y.

Railway Generators

1-500 K. W. General Electric, M. P.
1-500 K. W. Westinghouse, M. P.
4-300 K. W. General Electric, M. P.
1-150 K. W. Westinghouse, 4 pole.
2-125 K. W. Westinghouse, 4 pole.
1-120 K. W. C. & C., 6 pole.
1-100 K. W. C. & C., 6 pole.
4-100 K. W. General Electric, 4 pole.
3-90 K. W. Thomson-Houston, M. P.
1-75 K. W. General Electric, 4 pole.
3-60 K. W. Edison, bi-polar.
4-D-62 K. W. Thomson-Houston, B. P.

Engines

2-24 x 44 x 48 Cooper Corliss.
4-16 x 30 x 48 Cooper Corliss.
4-22 x 42 x 48 Hamilton Corliss.
1-22 x 32 x 48 Reynolds Corliss.
1-20 x 40 x 60 Watts-Campbell Corliss.
1-13 x 19 x 15 McIntosh & Seymour.
1-13 x 20½ x 15 Armington & Sims.
1-28 x 48 Wetherill Corliss.
1-20 x 40 Hamilton Corliss.
1-18 x 36 Cummer, 4 valve.
1-18 x 18 Ridgeway-McEwen.
1-16 x 16 Ball & Wood.
1-13 x 21 Buckeye automatic.
1-13 x 14 Ideal automatic.
1-13 x 12 Armington & Sims.
1-12 x 12 Armington & Sims.

Watertube Boilers

3 Batteries, Sterling Boilers (2-250 H. P. to the battery), insured for 125 lb. pressure.
3 Batteries of B. & W. Boilers (2-300 H. P. to the battery) insured for 125 lb. pressure.

Return Tubulars

14-72″ x 17′ return tubular boilers, insured by Hartford for 110 lb. pressure.

Railway Motors

100 G. E.-800, form B, with K-2 or K-10 controllers complete.

SEND FOR
COMPLETE STOCK LIST
NOW READY

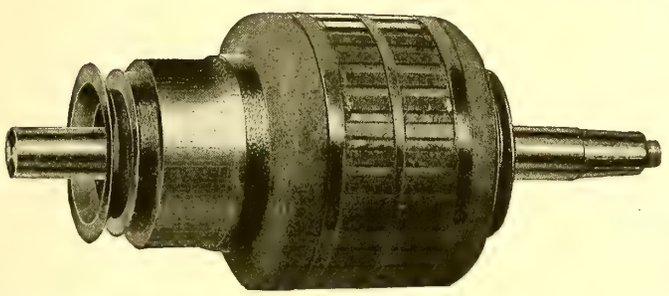
THOMPSON, SON & CO. 114, 116, 118 LIBERTY ST., NEW YORK
Works, 90 Verona St., Brooklyn, N. Y.

ALL KINDS OF ELECTRICAL REPAIR WORK

THE QUICKEST WORK CONSISTENT WITH THOROUGH WORK—WORK THAT WILL LAST. OUR CHARGES ARE NOT HIGH. GOOD WORK IS NEVER CHEAP WORK, BUT THE VERY BEST WORK IS CHEAPEST IN THE END. OUR PRICES ARE AS LOW AS IS CONSISTENT WITH HIGH CLASS WORK—NO MORE IN REALITY THAN YOU PAY FOR INFERIOR SERVICE. BY DOING YOUR WORK PROMPTLY WE CAN—AND DO—SAVE YOU MONEY. IN MAKING REPAIRS TO DYNAMOS AND MOTORS, WE ALWAYS DO IT ON THE SPOT WHEN IT IS POSSIBLE TO DO SO. IF, HOWEVER, IT IS NECESSARY TO DO THE WORK IN OUR OWN SHOP, NOT A MOMENT IS LOST IN REMOVING THE PART TO BE REPAIRED AND RETURNING IT TO YOU.

DOUBLEDAY-HILL ELECTRIC CO., Pittsburgh, Pa.

The Elliott Bros. Electric Co.

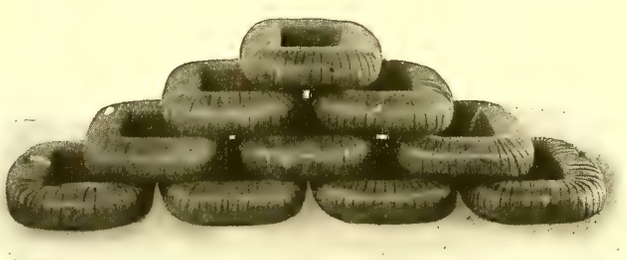


Armature Winding
Field Winding
Armature Coils
Field Coils
Commutators

The Best Equipped
Electric Repair and
Supply Factory
In the Country

TWENTY YEARS'

PRACTICAL EXPERIENCE in the construction and repairing of Electrical Machinery should be sufficient guarantee of quality being High Grade



GET OUR NEW FOR OLD
FIELD PRICE

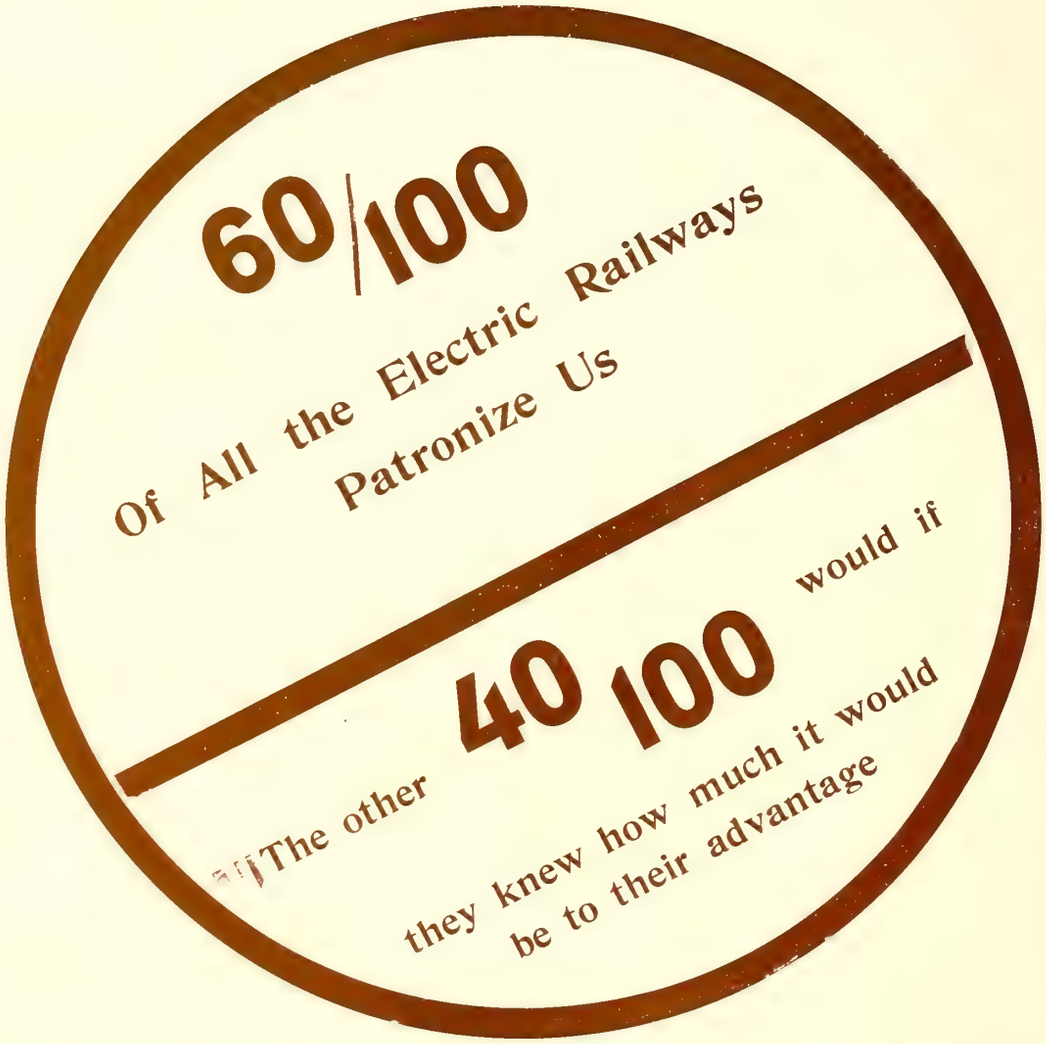
WESTERN UNION CODE
Long Distance Telephones
Bell, North 89 Cuyahoga, A 1520

CLEVELAND, OHIO

970-972 HAMILTON
STREET

AMERICA'S

Don't be without a copy of our book PRACTICAL ELECTRICITY, Price $2.00 delivered



REPAIR

CLEVELAND ARMATURE WORKS

CLEVELAND, OHIO

GREATEST

Our Lines

Armatures Wound

Armatures Complete Armatures Reshafted

Street Railroad Motor or Generator

Commutators Complete Commutators Refilled

Commutators Assembled

Street Railroad Motor or Generator

Fields Made for All Types of Railway Motors and Generators

Write for our Bulletin of Prices

If book is not satisfactory upon examination, will refund money cheerfully

WORKS

CLEVELAND ARMATURE WORKS

CLEVELAND, OHIO

AMERICA'S

Don't be without a copy of our book PRACTICAL ELECTRICITY, Price $2.00 delivered

60/100
Of All the Electric Railways
Patronize Us

40/100
The other would if they knew how much it would be to their advantage

REPAIR

CLEVELAND ARMATURE WORKS

CLEVELAND, OHIO

GREATEST

Our Lines

Armatures Wound
Armatures Complete Armatures Reshafted
Street Railroad Motor or Generator

Commutators Complete Commutators Refilled
Commutators Assembled
Street Railroad Motor or Generator

Fields Made for All Types of Railway
Motors and Generators

Write for our Bulletin of Prices

If book is not satisfactory upon examination, will refund money cheerfully

WORKS

CLEVELAND ARMATURE WORKS

CLEVELAND, OHIO

A Set of Bound Volumes of the Street Railway Journal

Forms a complete and comprehensive history of the development of the Electric Railway Industry—an encyclopedia of valuable information concerning

Electric Railway

Engineering
Machinery
Management
Finance
Apparatus
Law
Accounting
Supplies
News
Associations
Men

It is a weekly record constantly kept up-to-date. Such a set of books never loses value.

Complete Set for Sale

We have on hand one complete set of the STREET RAILWAY JOURNAL (November, 1884, to June, 1903), 21 volumes, bound in half morocco, for sale at - - - - - - - **$148.75**

Volumes for 15 Years

Complete volumes are offered for all years from 1889 to date. Prices for these volumes (unbound) is as follows:

1889 to 1891 - - -	$7.00	per year
1892 to 1896 - - -	6.00	"
1897 to 1901 - - -	5.00	"
1902 and 1903 - -	4.00	"

These volumes may be had bound in half morocco at $1.75 per volume additional. Beginning with 1901 the STREET RAILWAY JOURNAL is published at two volumes to the year.

International Edition

Bound or unbound volumes of the INTERNATIONAL EDITION (1898 to 1902, monthly, complete, with Digest of Contents printed in French and German) may be had at same rates as above.

Binding of Current Volumes

Complete unbound volumes delivered to us, postage or express prepaid, and in good condition, with covers on, will be exchanged for the corresponding bound volumes and returned, charges prepaid by us, for $1.75 a volume—bound in half morocco. The volume contains twenty-six numbers. Back numbers such as we have in stock for filling out current volumes will be supplied at regular rates.

BOUND VOLUME XXI NOW READY

STREET RAILWAY JOURNAL

114 LIBERTY STREET NEW YORK



Nineteen Through Trains

In daily service over the Lake Shore & Michigan Southern Railway, between the cities of Chicago and Toledo, Cleveland, Buffalo, St. Louis, Indianapolis, Cincinnati, Pittsburg, New York and Boston, in connection with the New York Central, Boston & Albany, Pittsburg & Lake Erie and Cleveland, Cincinnati, Chicago & St. Louis Railroads.

Don't Forget when you buy a through ticket to tell the ticket agent plainly that you wish it over the Lake Shore & Michigan Southern Railway. You will secure the best in travel that money can buy.

Send for booklet "Privileges for Lake Shore Patrons," contains useful information; also, "Book of Trains."

Address A. J. SMITH,
G. P. & T. A., CLEVELAND, OHIO.

THE ADIRONDACK MOUNTAINS

The lakes and streams in the Adirondack Mountains are full of fish; the woods are inviting, the air is filled with health, and the nights are cool and restful. If you visit this region once, you will go there again. An answer to almost any question in regard to the Adirondacks will be found in No. 20 of the "Four-Track Series," "The Adirondacks and How to Reach Them"; issued by the

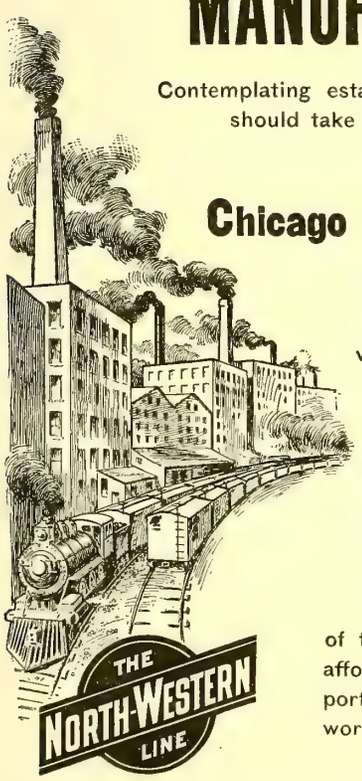
NEW YORK CENTRAL

A copy will be mailed free on receipt of a two-cent stamp, by GEO. H. DANIELS, General Passenger Agent, Grand Central Station, New York.

MANUFACTURERS

Contemplating establishing plants in the West, should take advantage of a location on the

Chicago & North-Western Railway



which reaches the famous

Water Powers,
Coal Fields,
Iron Ore Ranges,
Hard and Soft Lumber Districts

of the West and Northwest, and affords the best means of transportation to the markets of the world.

THE PIONEER LINE
WEST AND NORTHWEST OF CHICAGO.

MARVIN HUGHITT, JR., Freight Traffic Manager, E. D. BRIGHAM, General Freight Agent
CHICAGO.

EXPOSITION FLYER

VIA

"BIG FOUR"

FROM

CINCINNATI

TO

ST. LOUIS

WRITE FOR RATES AND FOLDERS.

WARREN J. LYNCH, Gen'l Pass. & Ticket Agt.
W. P. DEPPE, Ass't Gen'l P. & T. A.
CINCINNATI, OHIO.

"The Picturesque Trunk Line of America"

ERIE

Solid Vestibuled Trains
Unsurpassed Dining-Car Service

Stop-over at Cambridge Springs allowed on all through tickets

Illustrated Booklet of Cambridge Springs may be obtained from any Erie Ticket Agent, or by addressing

D. W. COOKE
Gen'l Pass'g'r Agt., NEW YORK

Cambridge Springs, Pa.

Midway Between
New York & Chicago

Reached only by the
ERIE RAILROAD

A Favorite Resort for Health, Rest and Recreation

AT ALL SEASONS

All Trains Protected by Block Safety Signals

The Erie Dining Car Service is Unsurpassed

Erie Railroad

"The Picturesque Trunk Line of America"

LUXURIOUS VESTIBULED TRAINS

consisting of Sleeping Cars, Dining and Cafe Cars and Day Coaches are run daily between

New York and Buffalo, Niagara Falls, Cleveland, Cincinnati Chicago

Making direct connection with all lines to points WEST, NORTHWEST AND SOUTHWEST

D. W. COOKE, General Passenger Agent, New York



The accompanying illustration represents the

National Penny Sales Machine

which this Company is now prepared to install, and which is especially designed for operation in *Railway Cars*, it being the **only machine** suitable for that purpose, its size, 2¾ x 2¾ inches, 30 inches high, allows it to be placed in the ends of cars, where it takes but little room, sometimes none at all, and **in no way interferes with passengers.** *Constructed* entirely of steel, finished in bronze, enamel, etc., with a secure lock. As a mechanical invention it is really wonderful, as **nothing but a penny will operate it and deliver the goods.** All fraudulent and imitation coins pass through without results. It is designed to sell **Chewing Gum, Chocolate, Confections, Matches,** and other articles. *Officers of Railway Companies* are solicited to investigate this business, as the earning power of these machines is very great, and **a source of large revenue** to all who install them.

Contracts will be made, based upon rental of space or division of gross receipts. Correspondence is invited and personal interviews desired. Please address all communications to New York office.

See our Exhibit at Annual Convention American Street Railway Association, Saratoga Springs, Sept. 2, 3 & 4, 1903

New York Penny Sales Co.

34 PINE STREET

W. C. BRYAN, President
H. B. RIGGS, Treasurer

NEW YORK

Ticket Systems

Advise us of your wants in the ticket line and let us give you the benefit of our experience.

We will submit a complete system covering your particular needs together with all necessary books and records.

Ask for our illustrated catalog.

THE FARR & FOSTER CO. Chicago, Ill.

POOLE BROS. CHICAGO. TICKETS TICKET CASES DATING STAMPS AND PUNCHES CORRESPONDENCE SOLICITED

THE NATIONAL TICKET COMPANY CLEVELAND, O.

PUNCHERS - DATERS
TICKETS
TICKET CASES
1899

The Duplicate Transfer & Rebate Company

P. O. BOX 562 Norfolk, Va.

OUR LINE OF BUSINESS CONSISTS OF

Secret Service Work on Street Railways.
Advertising on Transfers of Street Railways.

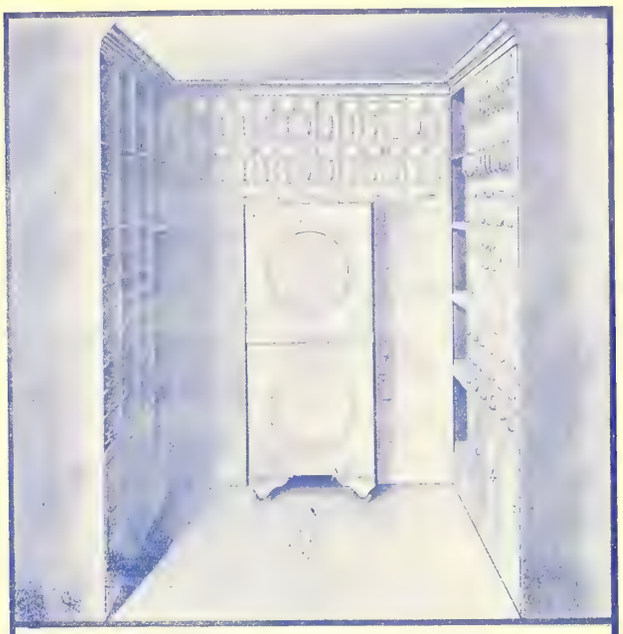
Also represent one of the largest Printing Companies in the U. S., handling all kind of Books used by Purchasing Agents and Store Keepers of Street Railway Companies. Address all communications to H. N. BROWN, Gen'l Mgr.

ON advertising pages 28 and 106 of this issue will be found announcements of two new books, now in press, of great interest and value to electric railway managers and engineers

THE
BELLAMY VESTLETTE
For Street Railway Conductors
ABSOLUTELY SAFE
Patented April 27, 1897


A SNAP CAUGHT

Manufactured from
CORDUROY and SERG-E-NETTE
Saves the price of a coat yearly.
Conductor's Uniform always presentable. Made of Special Material
Manufactured Expressly for this purpose
Adopted as a part of the Uniform by many Street Railway Companies
——CORRESPONDENCE SOLICITED——
Manufactured Exclusively by
The Bellamy Vestlette Mfg. Company
74 FRANKFORT ST., CLEVELAND, OHIO


METALLIC VAULT FIXTURES
ensure systematic filing, afford security and economize space.
Send floor plan for submission sketches and estimates.
BOOKLET 502
ART METAL CONSTRUCTION CO.,
519 Gifford Avenue, Jamestown, New York.

USED BY EIGHTY PER CENT. OF STREET RAILWAY COMPANIES
Watchman's Improved Time Detectors
E. IMHAUSER & CO.
206 Broadway New York



Special
Conductors' Safes....
FOR
STREET RAILWAYS
Conductors can deposit their returns without access to Safe
Made in Several Sizes.
In use on over 100 roads.
Send for prices and Catalogue.
MORRIS-IRELAND SAFE COMPANY
64 Sudbury Street
BOSTON, - - MASS.

American Street Railway Investments
The "RED BOOK" is the most complete and valuable manual of street railway statistics published. Shall we send you the 1902 edition? **$5.00** per copy.
McGRAW PUBLISHING CO., 114 LIBERTY ST., NEW YORK.

Drummond's Detective Agency
RAILWAY WORK A SPECIALTY
A. L. DRUMMOND, General Manager, Ex-Chief U. S. Secret Service
Park Row and Ann St., New York

NEW YORK

"As purchasing agent for various foreign tramways it is necessary for me to consult the advertising columns of the Journal, as many of the requisitions received contain references to description of the material as being published in the STREET RAILWAY JOURNAL."
W. P. Plummer, Purchasing and Forwarding Agent.

SYRACUSE, N. Y,

"The advertising pages are especially valuable to our purchasing department, and are used as a reference in soliciting bids for material."
Syracuse Rapid Transit Ry. Co.,
E. G. Connette, Vice-Pres. and General Manager.

DETROIT, MICH.

"The information which the STREET RAILWAY JOURNAL contains from week to week, technical and otherwise, is of the greatest value to the officers of all of our departments, and its advertising pages are constantly referred to by our purchasing department for reliable information."
Detroit United Railway,
J. C. Hutchins, President.

NEW HAVEN, CONN.

"We consider your advertising department a very valuable feature of the Journal, as we very often have to refer to it."
Fair Haven & Westville R. R. Co.,
L. Candee, Secretary.

JACKSONVILLE, FLA.

"It is a great assistance to us in locating firms, and points clearly through its advertising space to many valuable new inventions, as well as to the regular lines of supplies which we are daily in search of."
Jacksonville Electric Co.,
W. H. Tucker, Manager.

HAMILTON, OHIO

"Hardly a day passes but what I refer to the Journal for advertisements or for general information, and through its columns it is the medium for informing us how and what the other fellow is doing."
The Cincinnati, Dayton & Toledo Traction Co.,
F. J. J. Sloat, Gen. Mgr.

HAMILTON, CANADA

"I have found it very useful to me in the purchasing department."
The Hamilton Electric Light & Cataract Power Co.,
J. Griffith, Pur. Agt.

NORFOLK, VA.

"In looking up advertisements your publication always receives first consideration."
The Norfolk Ry. & Light Co.,
R. T. Gunn, General Supt.

DURBAN, SO. AFRICA

"I consider the STREET RAILWAY JOURNAL to be of the greatest possible value both from a technical and practical standpoint to myself and staff.
"Some of the advertisers have reason to thank your advertising pages for orders placed by this department."
Durban Municipal Tramways,
Wm. D. Jeffs, Manager.

BIRMINGHAM, ALA.

"When anything is needed by the purchasing agent he finds it to his advantage to look over your advertising columns."
Birmingham Railway, Light & Power Co.,
J. B. McClary, Mgr. Ry. Dept.

CHICAGO, ILL.

I have always subscribed for a number of copies of the STREET RAILWAY JOURNAL. I know it is generally read by the officers and heads of departments of our companies, and my attention is drawn by them to the advertisements.
Chicago City Railway Co.,
D. G. Hamilton, President.

PROVIDENCE. R. I.

"There is not a day passes but what some one in our office consults the advertising pages of the Journal. We have it sent to all of our car houses, power stations, and to the heads of our different departments."
The Rhode Island Co.,
A. T. Potter, General Manager.

PHILADELPHIA, PA.

"The advertisements are scanned very closely by the Purchasing Department, as is also the reading matter by the heads of the various departments."
Philadelphia Rapid Transit Co.,
Chas. O. Kruger, 2d Vice-President and Gen Mgr.

PARKERSBURG, W .V A

"When we want an article, and don't know who makes or sells it, we invariably consult the STREET RAILWAY JOURNAL, and are seldom disappointed in finding what we want advertised there."
Parkersburg, Marietta & Interurban Railway Co.
G. H. Shattuck, President.

A QUESTION *of* PRIME IMPORTANCE TO MANUFACTURERS, DEALERS AND CONTRACTORS

How Frequently do *the* Purchasers *of* Electric Railway Equipment *and* Supplies Consult the Advertising Pages *of the* STREET RAILWAY JOURNAL ?

HERE ARE ANSWERS FROM TWENTY-EIGHT CITIES

PARIS, FRANCE

"Managers, engineers and even the employees of European roads study with the greatest benefit the articles published in your paper, as well as the advertisements which are so numerous and so complete, and which show them the latest apparatus with which to equip the installations in their charge."
Campagnie Generale des Omnibus,
Lavalard.

CITY OF MEXICO

"We always consult the advertising pages, and through them have made some very satisfactory business conections."
Mexico Elec. Tramways, Ltd.,
A. E. Worswick Resident Engr.

GENEVA, SWITZ.

"I think that most railway managers read your advertisements as "industriously" as they do the excellent articles which you, with so much good judgment, bring to their notice."
Compagnie Genevoise des Tramways Electriques,
H. P. Bradford, L'Administrateur Délégue.

TRINIDAD, B. W. I.

"The advertising pages are constantly consulted by me, and the various advertisers written to when I see anything which they are exploiting that may be of value to me in any of these various departments."
The Trinidad Electric Co.,
Fred W. Teele, Gen. Mgr.

BOSTON, MASS.

"As a book of reference it is found very useful when occasion arises, by reason not only of the printed matter, but the excellent cuts with which various devices are set forth in the advertising columns."
Boston Elevated Railway Co.,
C. S. Sergeant, Vice-President.

TAMPA, FLA.

"We find the Journal of great value in making purchases, and consider it a most reliable source of information in regard to many supplies which we find it necessary to purchase in connection with our business."
Tampa Electric Co.,
H. H. Hunt, Manager.

PITTSBURGH, PA.

"It is a journal of frequent reference by the officers and division superintendents of this company, on subjects of both a technical and practical character, as well as by our purchasing agent on maters touched upon in your advertising columns."
Pittsburgh Railways Company,
James D. Calery, President.

SAULT STE. MARIE, MICH.

"We frequently consult your advertising pages for information, and use them very largely as a buyer's directory."
Trans-St. Marys Traction Co.,
G. W. Chance, Manager and Chief Engineer.

LYONS, FRANCE

"The officers of my company and myself read with care and interest the STREET RAILWAY JOURNAL, which is of great value to us, both as regards its technical and practical articles and its interesting advertisements."
Compagnie des Omnibus & Tramways de Lyon,

CLEVELAND, O.

"In patronizing your advertisers we have always secured the most satisfactory results, and I am pleased to take this oportunity to express my appreciation of your paper."
Henry A. Everett.

BINGHAMTON, N. Y.

"The publication is thoroughly read by the officers and employees of this company, and its pages, both advertising and editorial, are referred to frequently by us.'
Binghamton Railway Co.,
G. T. Rogers, President.

QUINCY, ILL.

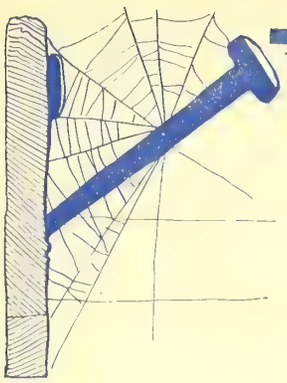
"We recognize it as up to date on street railway subjects, and refer to the advertisements not only when in the market for supplies, but at other times."
Quincy Horse Railway & Carrying Co.,
W. A. Martin, Supt.

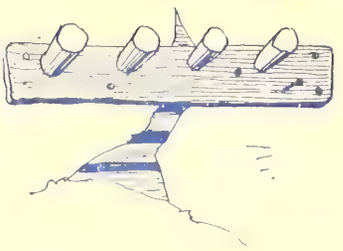
MOBILE, ALA.

"I look over the advertisements as carefully as I do the reading matter. I find that we often save several times the subscription price by adopting some suggestion that we find in your description of different systems."
Mobile & Light Railroad Co.,
J. H. Wilson, Pres. and Mgr.

BUFFALO, N. Y.

"I consider the STREET RAILWAY JOURNAL almost a necessity to the officers and employees of a corporation of the size of ours. We are taking fifteen copies. The advertising pages are considered very valuable."
International Railway Co.,
W. Caryl Ely, President.





A rusty nail or a row of pegs in some cobwebby corner, to hang employees' belongings, not only litters the place, but affords no protection.

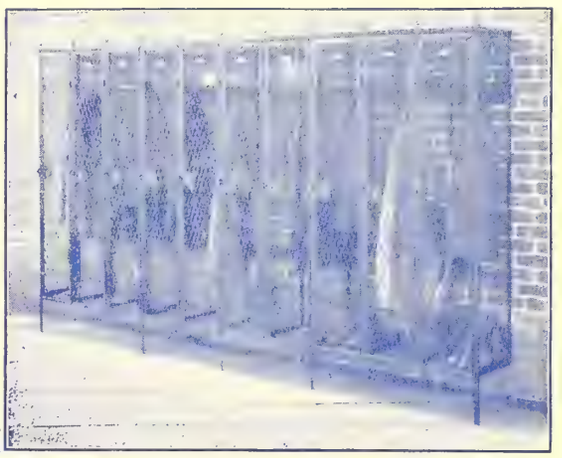
MANY LARGE STREET RAILWAYS HAVE ADOPTED

Expanded Metal Lockers

IN THE CAR HOUSES AS WELL AS GENERAL OFFICES

Only open meshed lockers built of material that is neither jointed or interwoven.
Expanded metal is sheet steel cut and opened into diamond shaped meshes; this forms a network that is without joints or welds and so strong that no human pressure can force the meshes apart.
No better material can be found for window guards or tool-room enclosures.

If you will send size of space to be used, we will give you an idea of the style of locker best adapted and send you an estimate.



MERRITT & CO., 1124 RIDGE AVE., PHILADELPHIA

Good Cuts Save Money

COMMERCIAL ENGRAVING CO. INC.

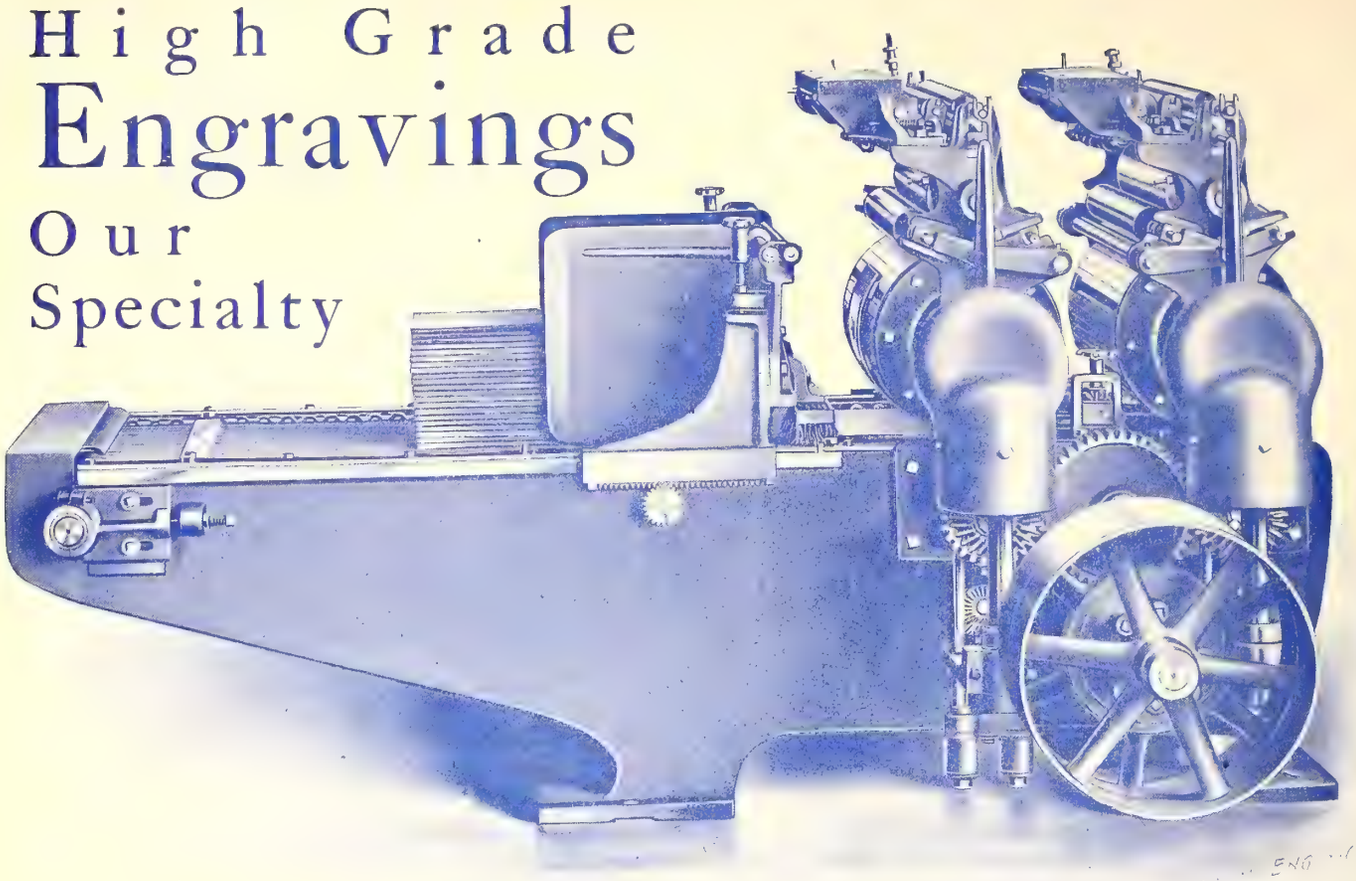


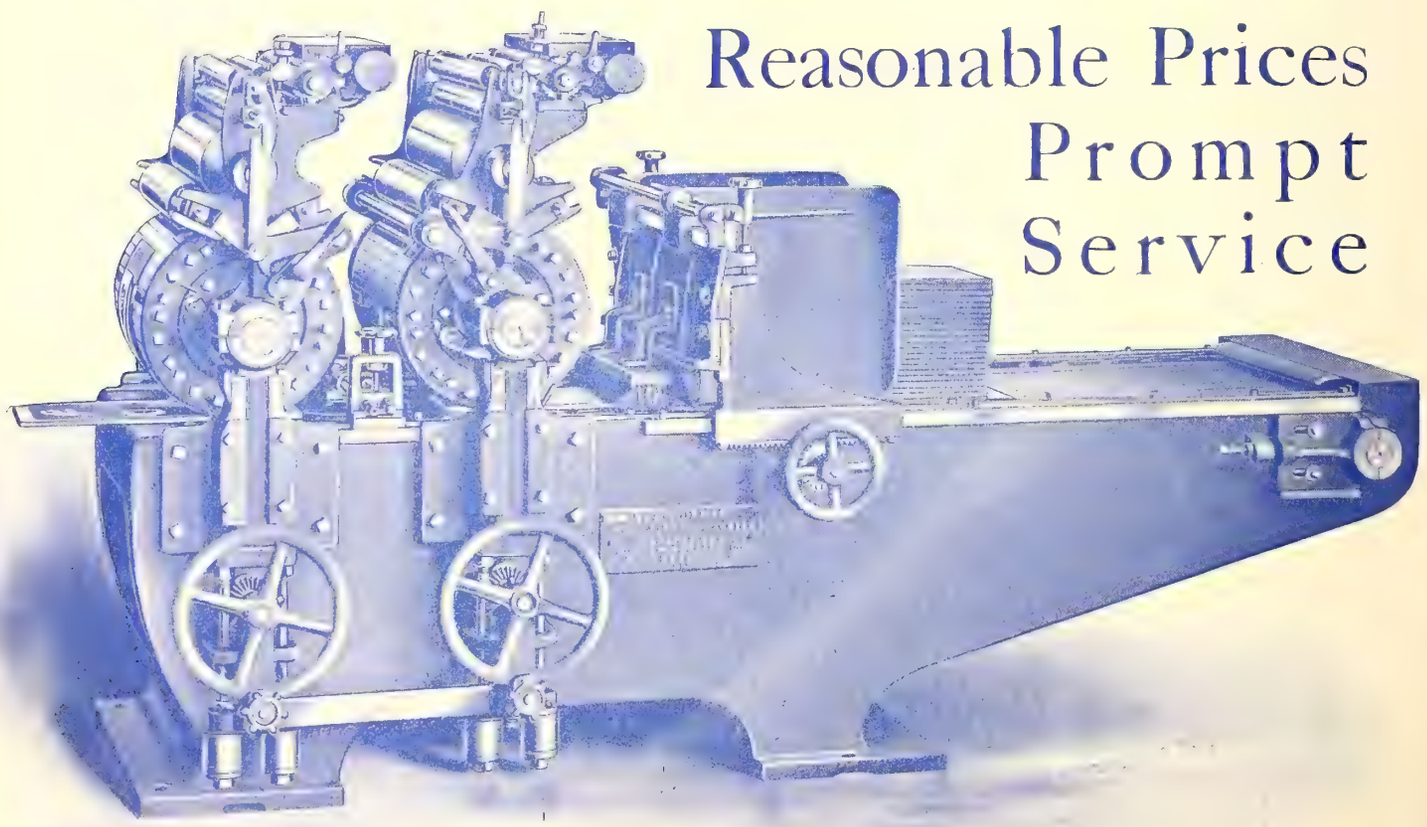
We make good cuts for catalogue, circular, magazine or any printing purpose. Trade paper advertising designs a specialty. Superior facilities for their preparation.

Our process reproduction of photos, tracings and drawings of any description, please publisher and advertiser. Prices well within the reasonable limit. Write for estimates.

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Section IV

STEAM PLANT EQUIPMENT REPAIR SHOP APPLIANCES

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FOR ALPHABETICAL INDEX TO ADVERTISERS SEE PAGES 5-8

Section V

RAILS AND TRACK MATERIAL, SIGNAL SYSTEMS, STRUCTURAL IRON WORK

Section VI

POLES AND LINE MATERIAL, RAIL BONDS, WIRES AND CONDUITS, ELECTRICAL INSTRUMENTS AND SUPPLIES

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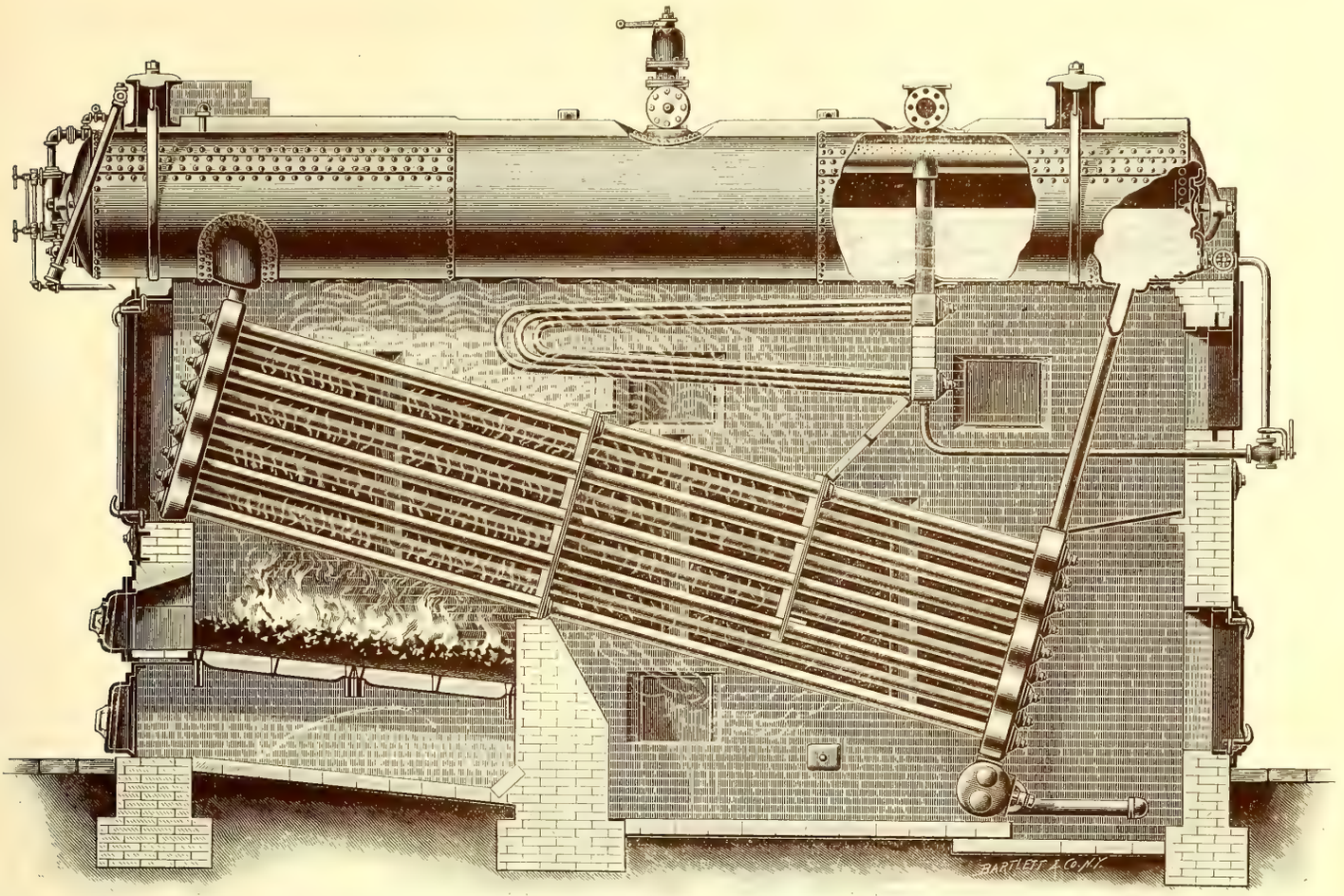
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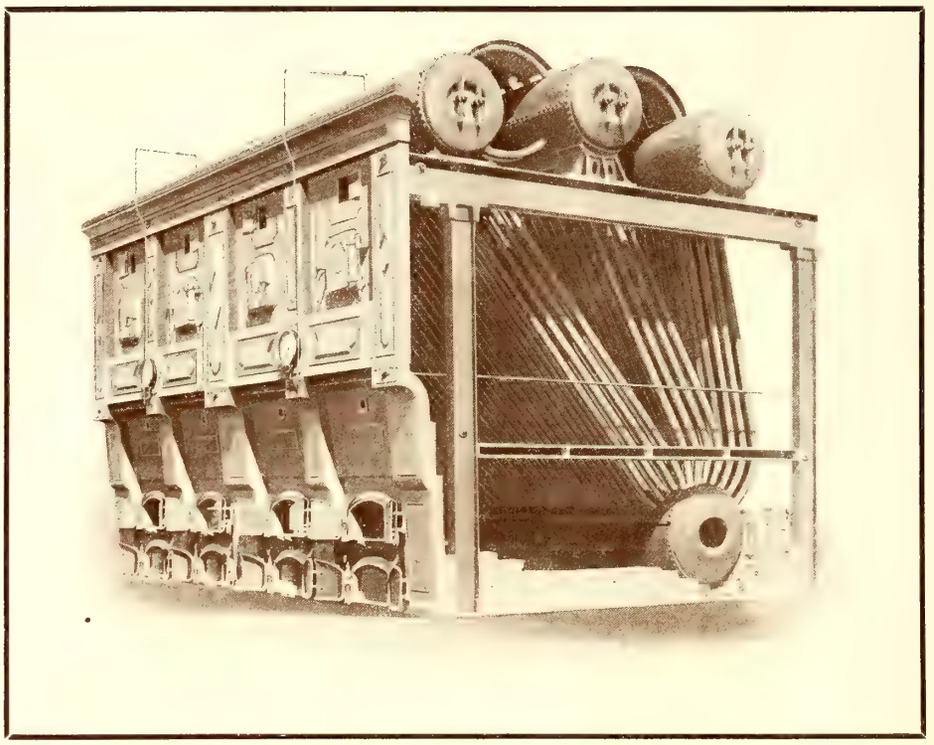
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1,500,000 HORSE POWER IN USE

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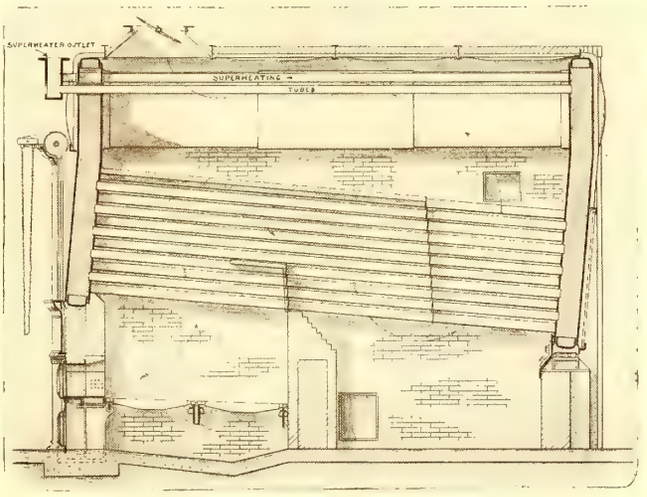
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WATER-TUBE
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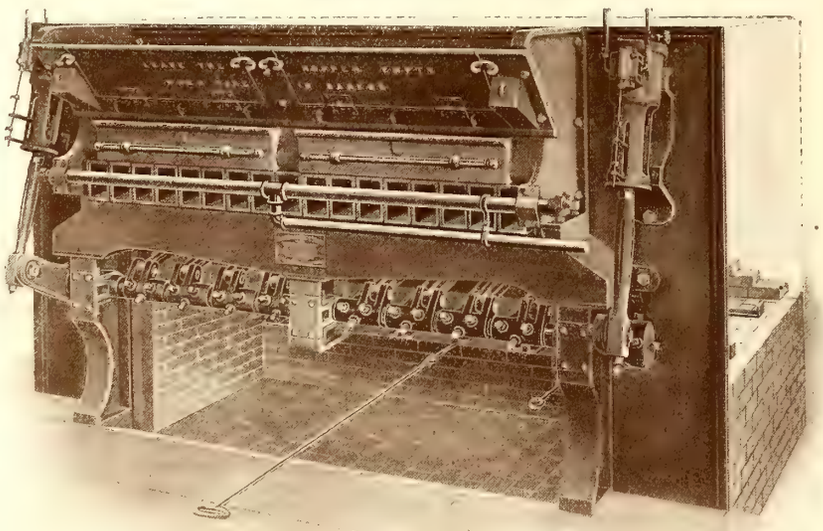
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MECHANICAL STOKER

wherever installed has

eliminated the use of the **Slice Bar, Poker, Fire Door,** the three most objectionable features of hand firing



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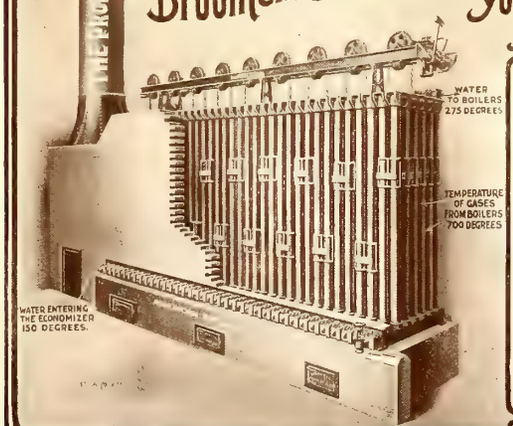
TEMPERATURE AFTER LEAVING ECONOMIZER 300 DEGREES

THE PRODUCTS ARE NOT ALL GOING OUT OF THIS STACK

"AMERICAN" FUEL ECONOMIZER

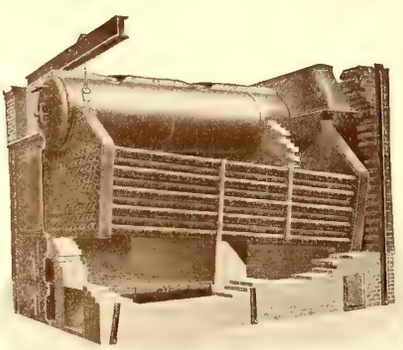
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A large body of very hot water always ready for use is of great advantage in keeping regular steam pressure. Boilers are supplied with purified water, fewer boilers are required and much less repairs—all from waste heat.

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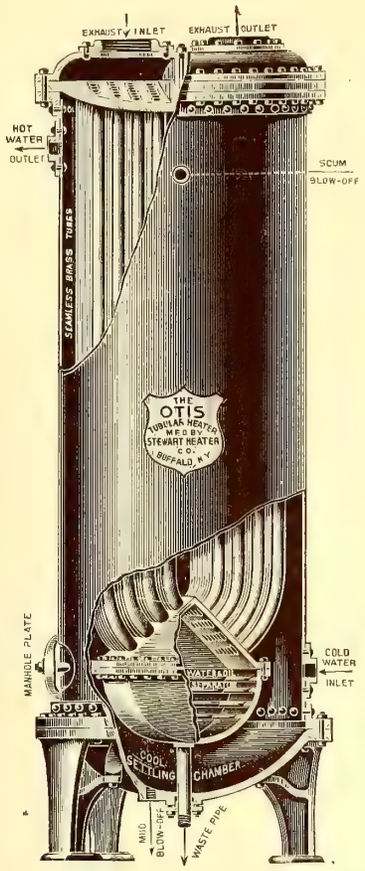
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GUARANTEED TO EXTRACT MORE OIL FROM EXHAUST STEAM

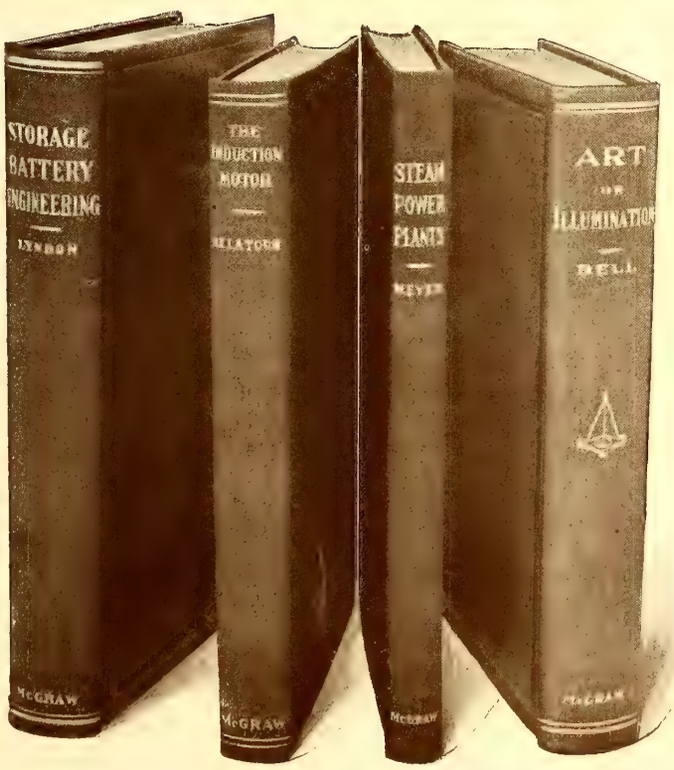
Than can be extracted by any other device on the market. This is one of the many reasons why it would pay you to install in your power station the

OTIS TUBULAR FEEDWATER HEATER AND PURIFIER

It is the only Feedwater Heater having an oil separator at all times surrounded by the cool feedwater when it first enters the boiler. If it doesn't give you entire satisfaction, we will pay cartage and freight both ways, and all cost of installation. Doesn't our confidence merit yours?

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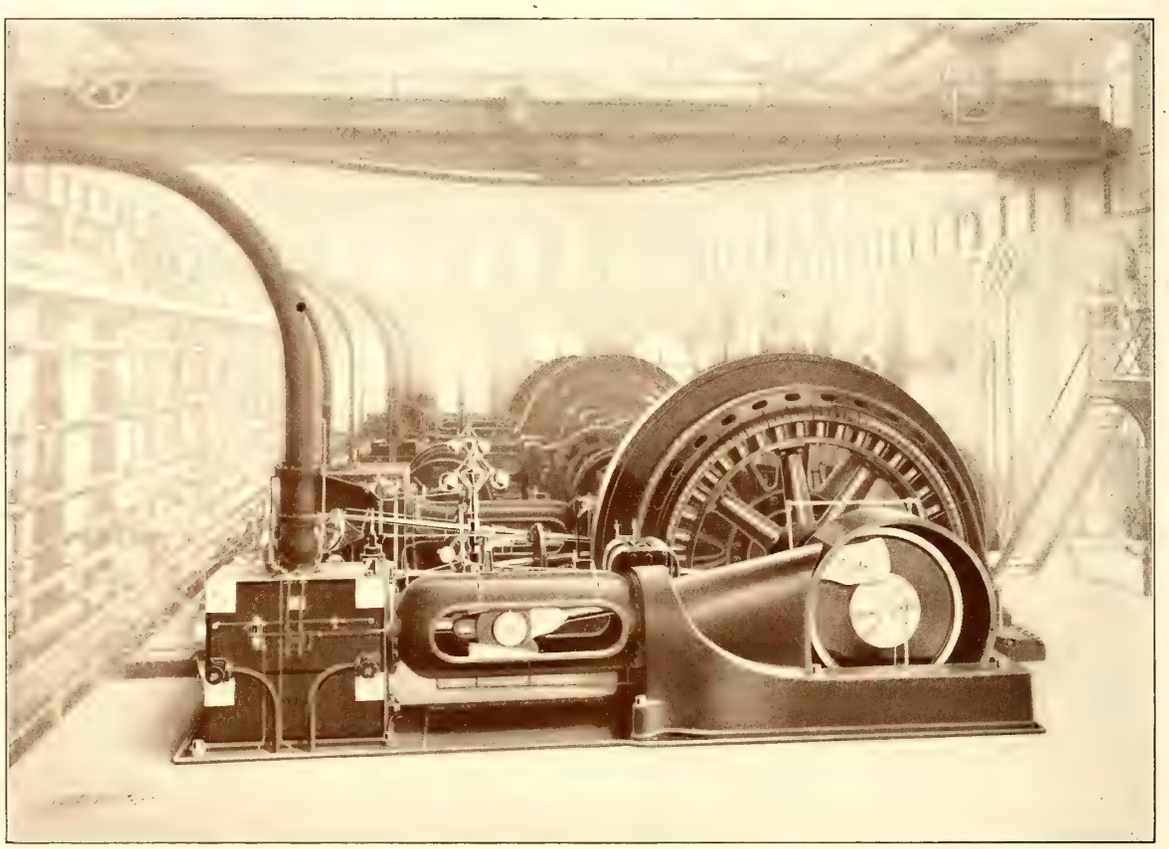
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OPERATING 3-PHASE ALTERNATING CURRENT RAILWAY GENERATORS IN PARALLEL

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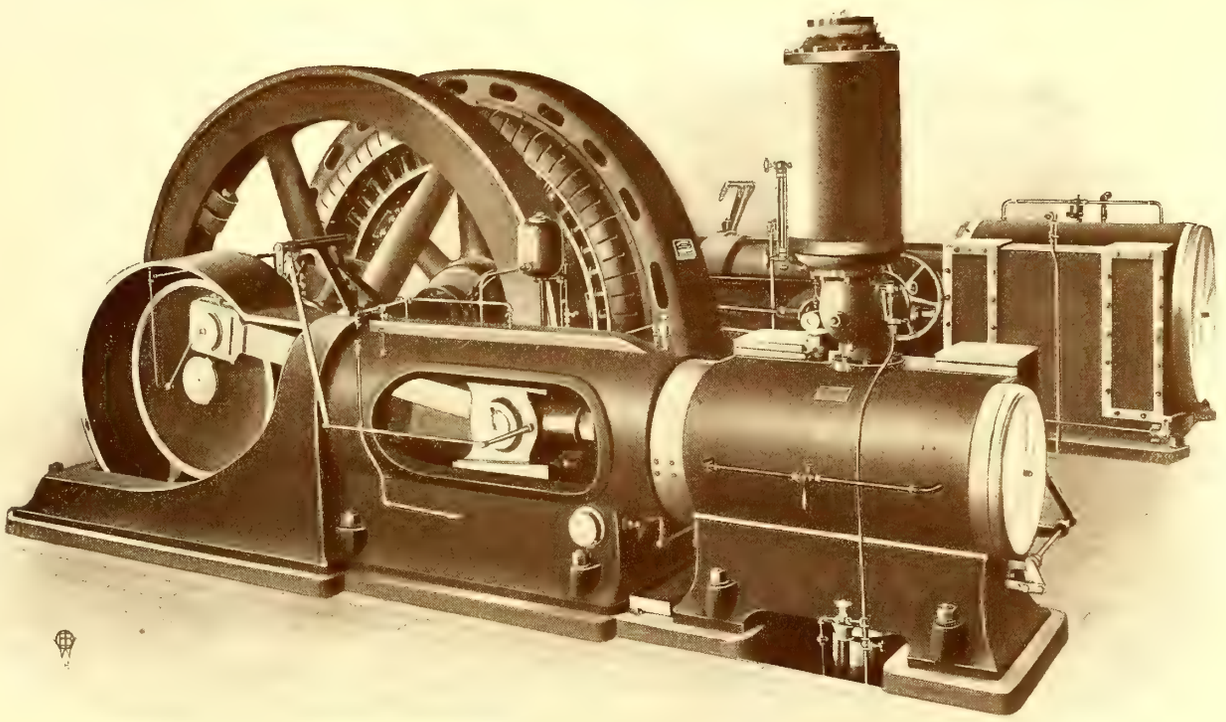
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DEPENDABLE SERVICE

DESIRABLE ROTATIVE SPEEDS
MINIMUM FLOOR SPACE
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HIGHEST STANDARD OF EXCELLENCE THROUGHOUT



Built in all sizes to 1500 H. P., Simple, Tandem Compound or Cross Compound

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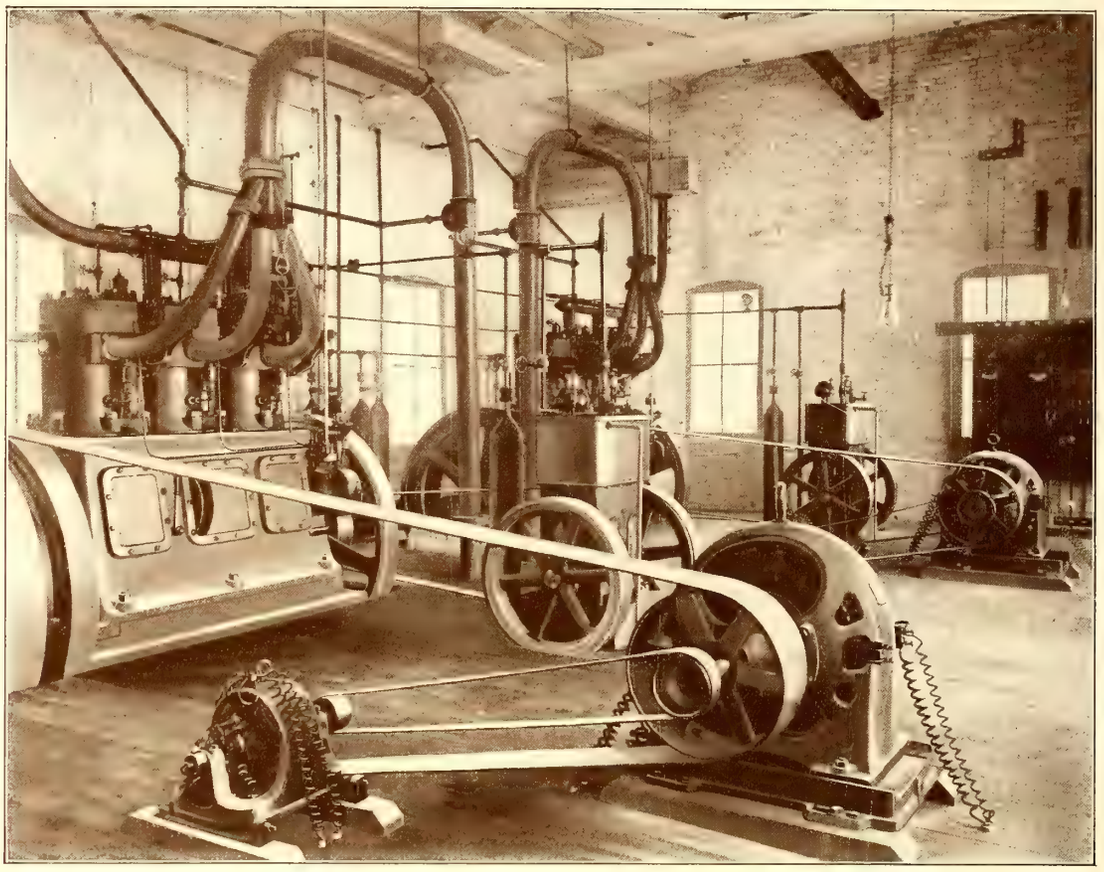
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Cost of operation July 15 to Aug. 15, 1903 (with plant running at less than one-third load):

Total number K. W. hours, 9,300 (one-third load)

Fuel oil consumed, 992 gals. at 4 cents	$39.68
Oil, waste and supplies	31.62
Labor	77.50
Total cost generating power	$148.80

Cost per K. W. hour, at one-third load, 1.6c.—AT FULL LOAD, 7.5 MILLS

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American & British Mfg. Co.	Providence, R. I.	American Ordnance Works	Bridgeport, Conn.
Wm. Cramp & Sons' Shipbuilding Co.	Philadelphia, Pa.	A. J. Ellis Co.	West New York, N. J.
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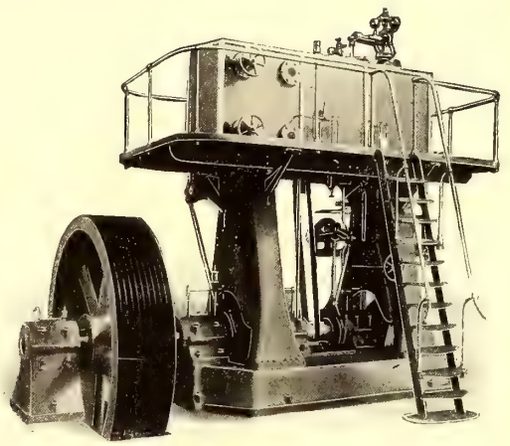
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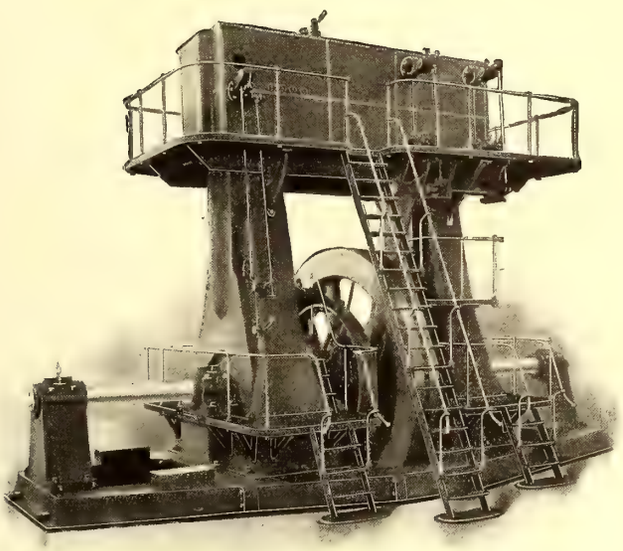
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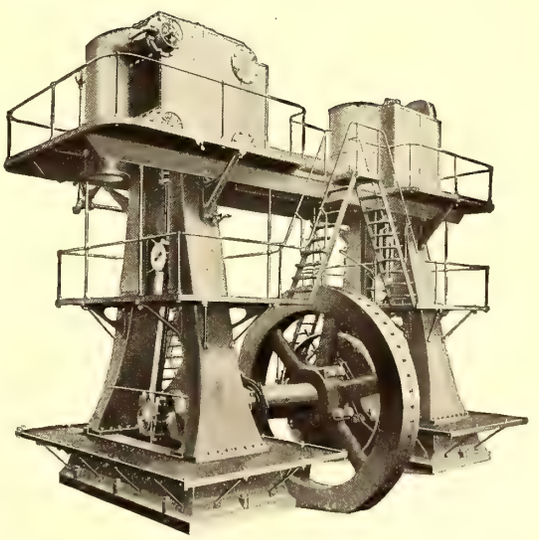


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Moderate Speeds
High Efficiency

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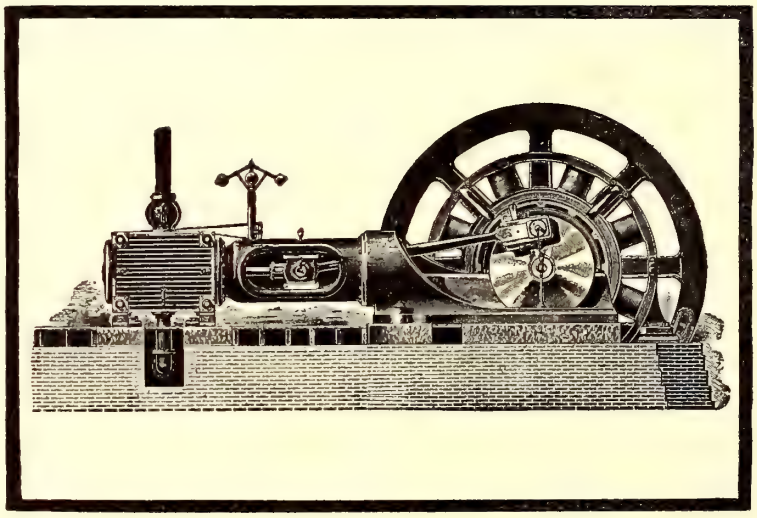
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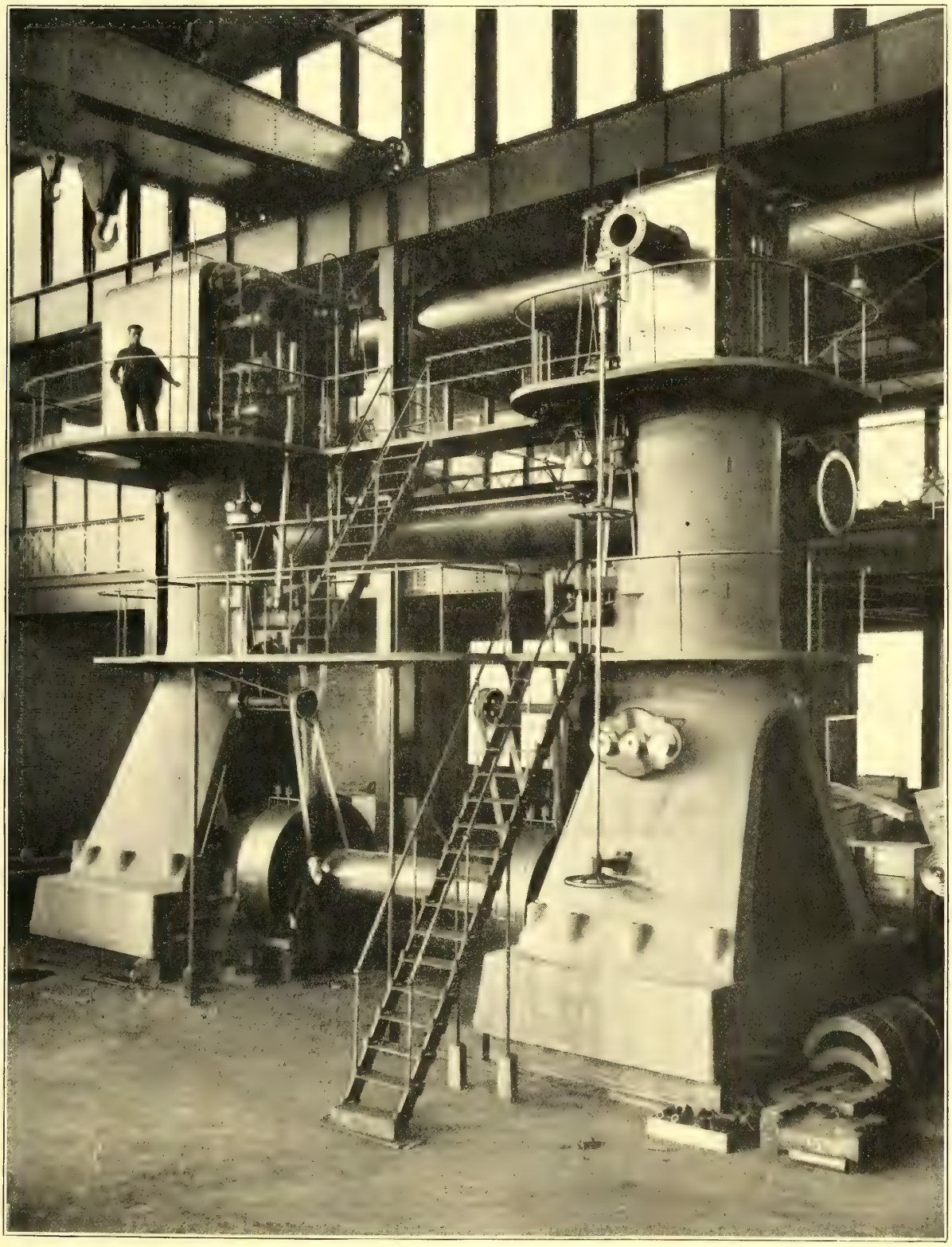
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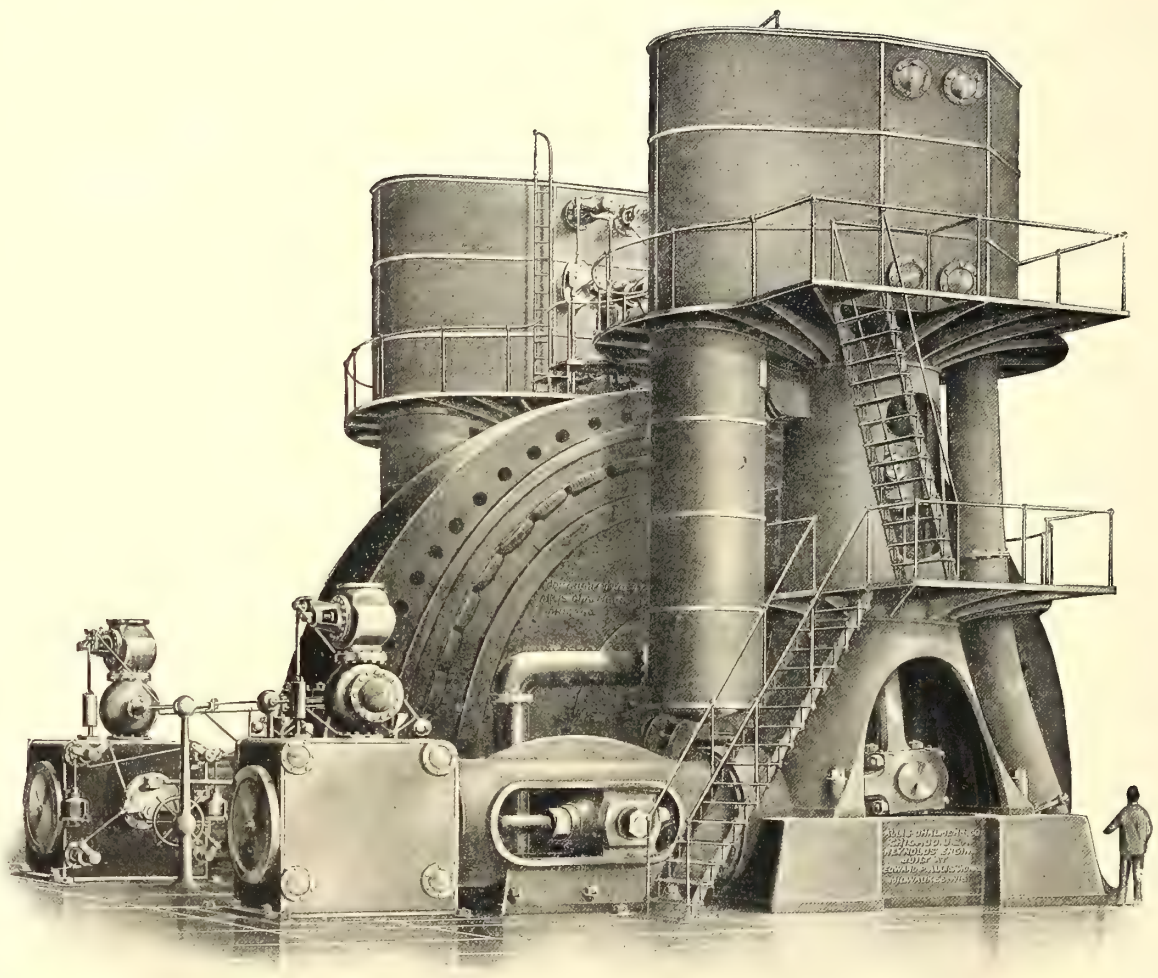
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WE ILLUSTRATE HEREWITH A

Reynolds Twin Combined Vertical and Horizontal Electric Light and Street Railway Engine



We have furnished eight of the above engines for the Manhattan Railway Co., New York (The Elevated) Power Station, also eight engines of the same design for the New York Rapid Transit Railway (The Subway) Power Station. Each engine is rated at 8,000 H. P. for its most efficient load, and is capable of operating continuously under a load of 12,000 H. P. We also furnished one engine of the above design to the Southern Electric Co., Philadelphia, Pa.

This design permits the installation of large units keeping the fly-wheel weight within reasonable limits by the use of four cranks, but not having the usual objection of numerous journals and pins, necessary with the ordinary three or four cylinder engine. It is particularly desirable for a high frequency generator.

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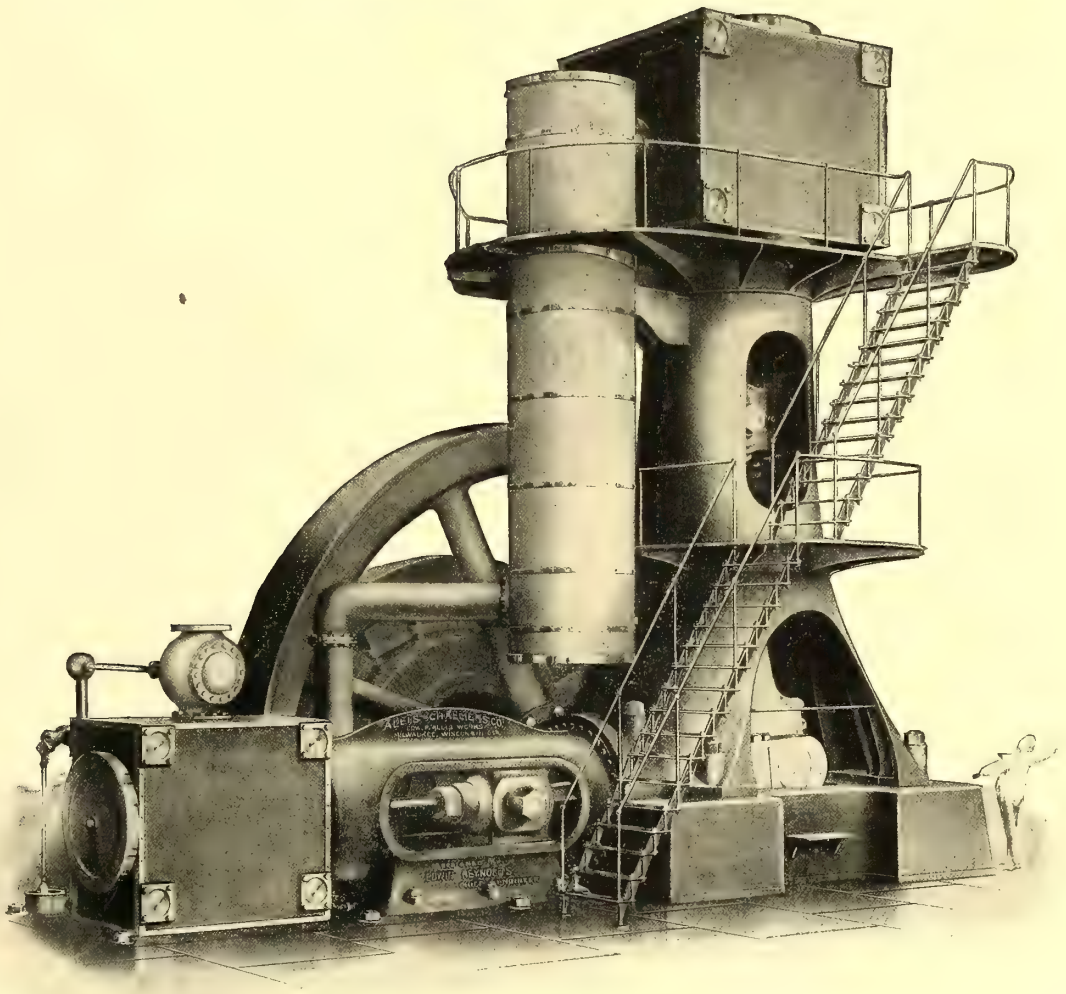
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WE ILLUSTRATE HEREWITH A

Reynolds Single Combined Vertical and Horizontal Electric Light and Street Railway Engine



This type of engine has the same crank effect as the vertical or horizontal cross compound. The smaller cylinder being of moderate size can be placed horizontally, while the larger cylinder which would not be so desirably placed horizontally, can be placed vertically. Its principal advantage being the feasibility of placing the generator in an exposed position making it accessible.

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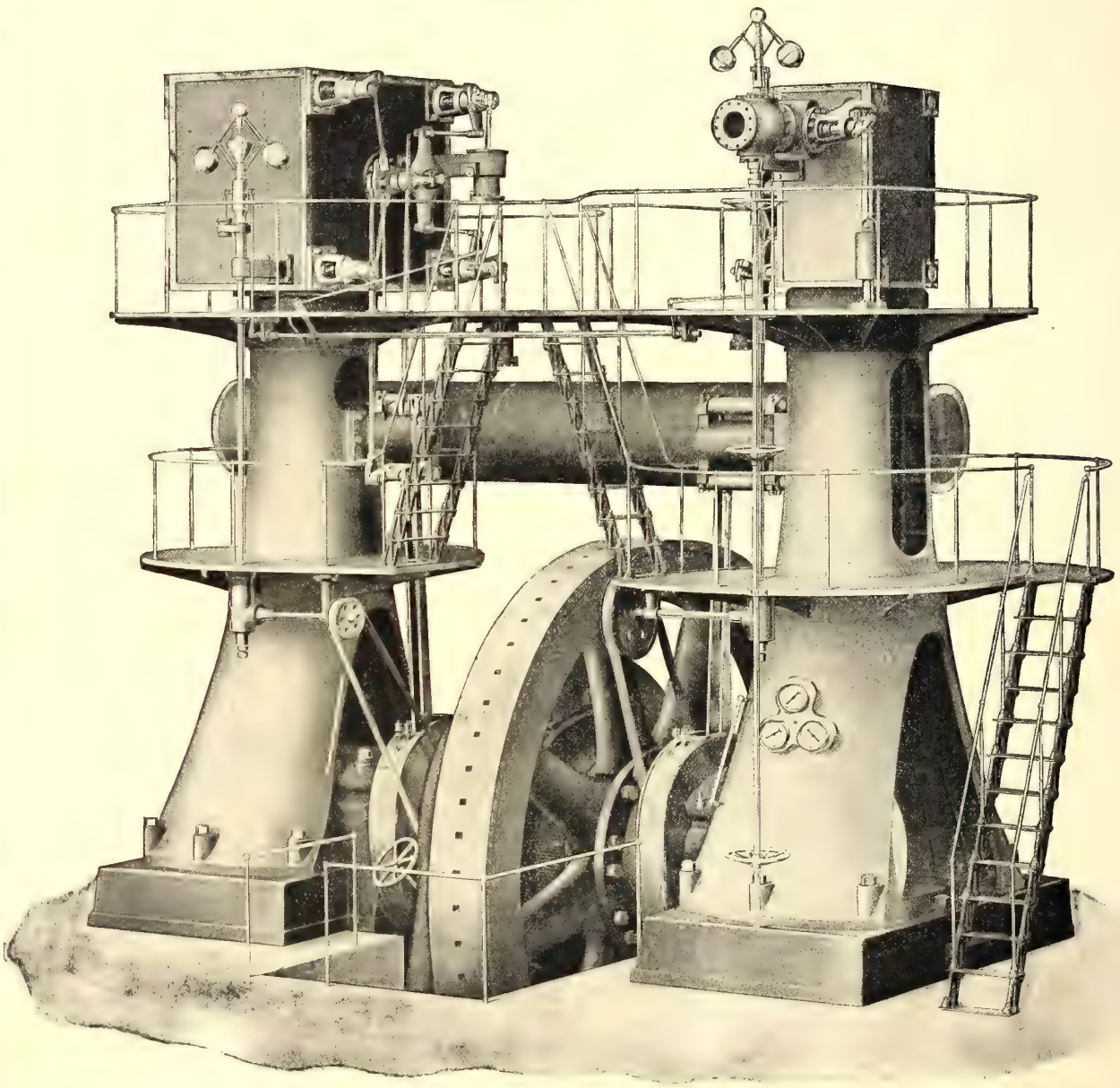
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WE ILLUSTRATE HEREWITH A

Reynolds Vertical Cross-Compound Engine

(DIRECT COUPLED)



Having built several hundred of all sizes of the above engine, we are prepared to offer an engine of any capacity with an absolute assurance of its giving very satisfactory results.

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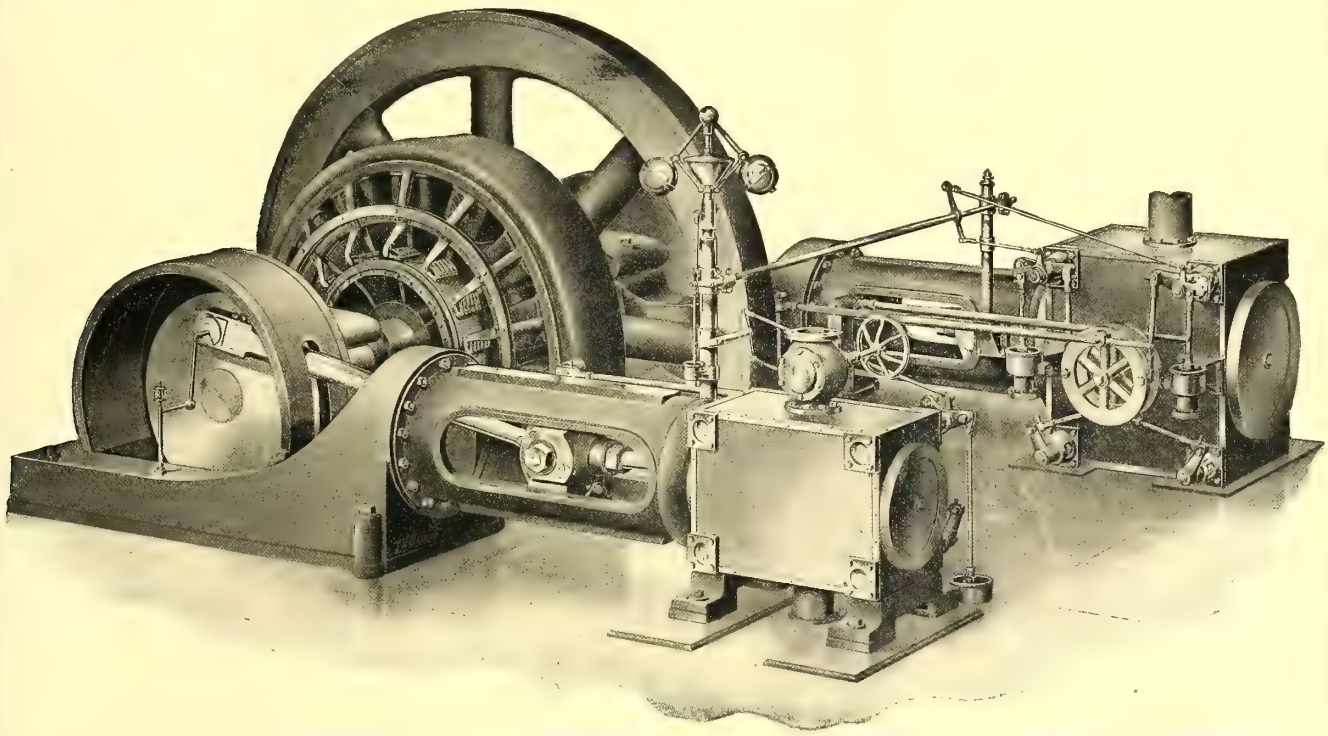
WE ILLUSTRATE HEREWITH A

Reynolds Horizontal Cross-Compound Engine

(DIRECT COUPLED)

This type of engine as made by us has been installed in a greater number of central power stations than any other engine on the market. We build them in all sizes up to as large as is advisable to construct a horizontal engine.

Perfection of workmanship is illustrated by successful operation at speeds as high as 150 R. P. M.



REYNOLDS HORIZONTAL CROSS-COMPOUND DIRECT COUPLED ENGINE

SOLE BUILDERS OF

NURNBERG GAS ENGINES

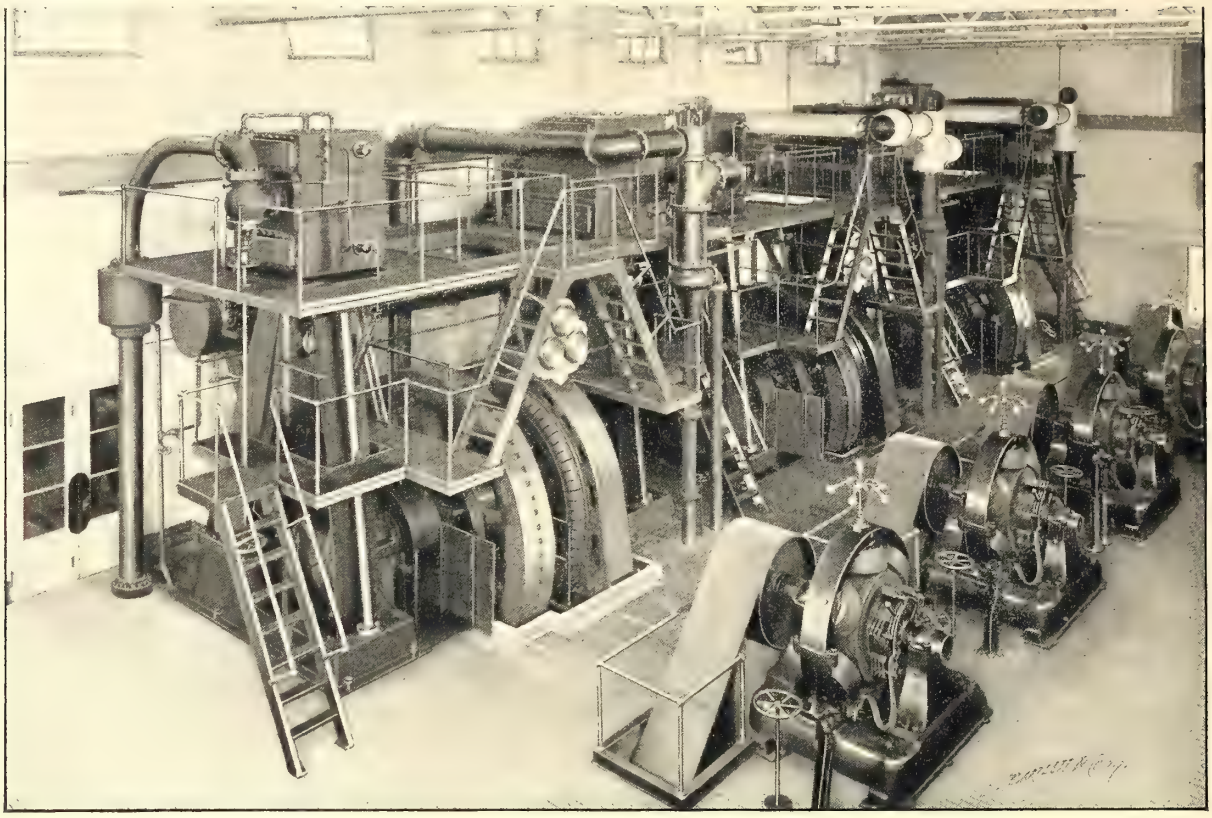
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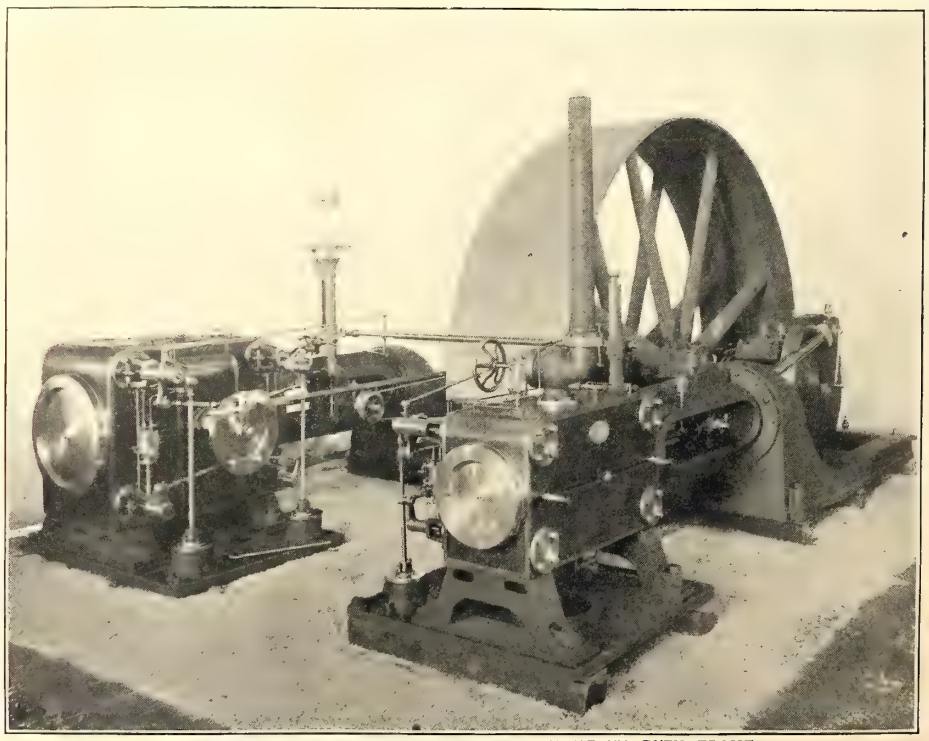
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ESPECIALLY ADAPTED FOR
Street Railway
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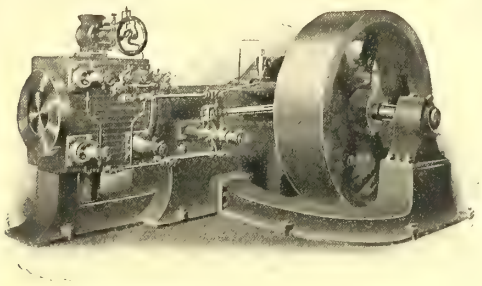


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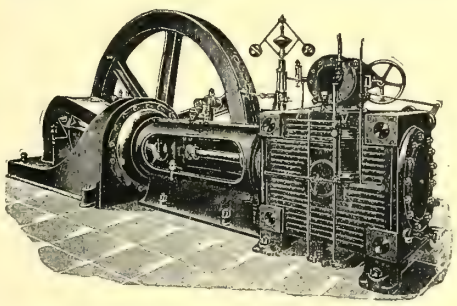


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A NEW and thoroughly developed type affording the highest economy and greatest simplicity ever attained in an Automatic Engine

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Special Heavy Duty Engines for Electric Railways, Rolling Mills, etc.

For Direct Connecting or Belting, Simple or Compound

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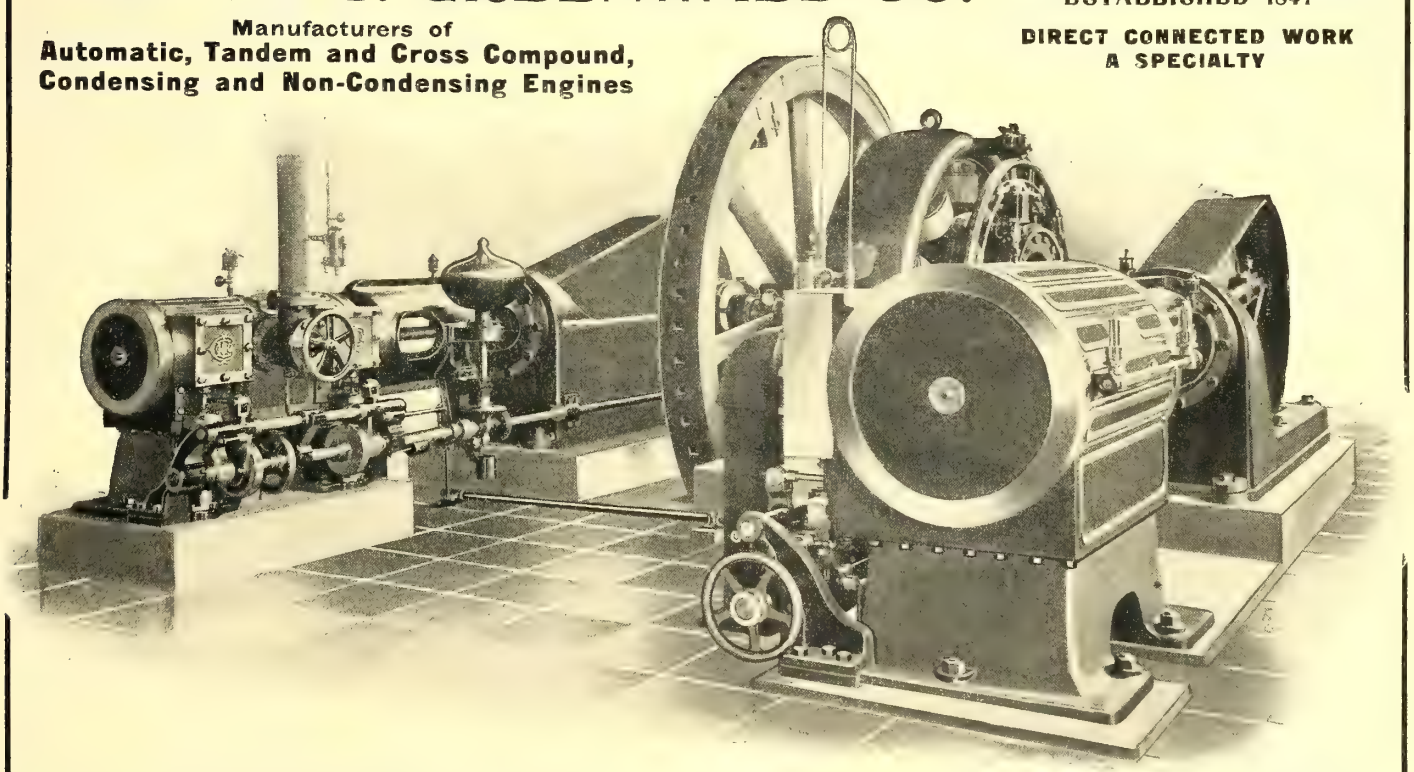
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ESTABLISHED 1847

Manufacturers of

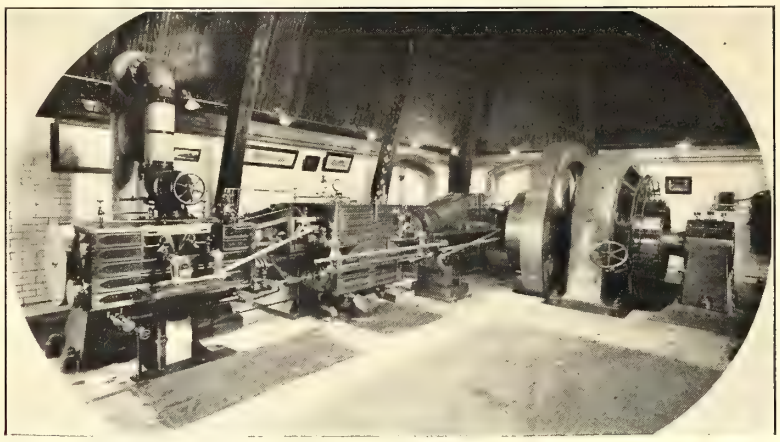
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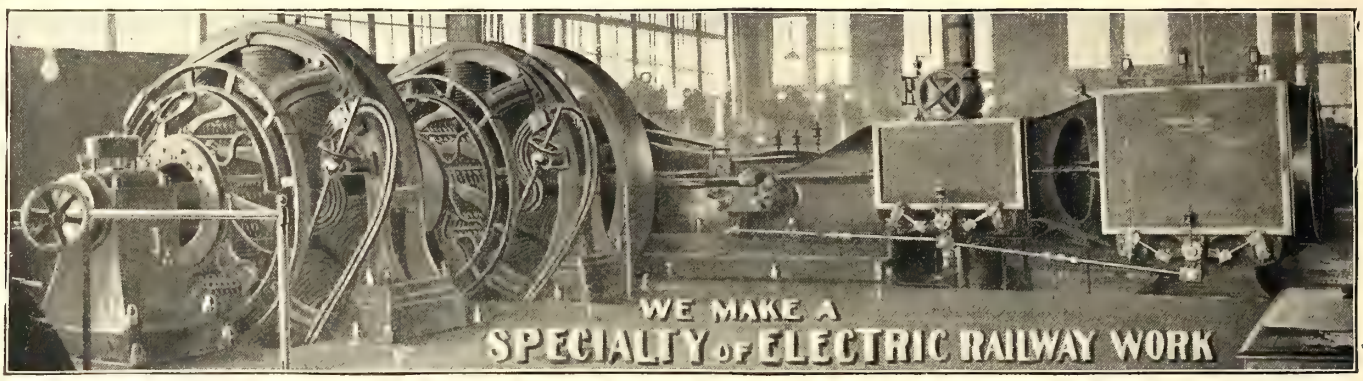
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Balanced expansible steam tight valves. Silent, positive and **reliable** valve gear. Best economy and regulation guaranteed.

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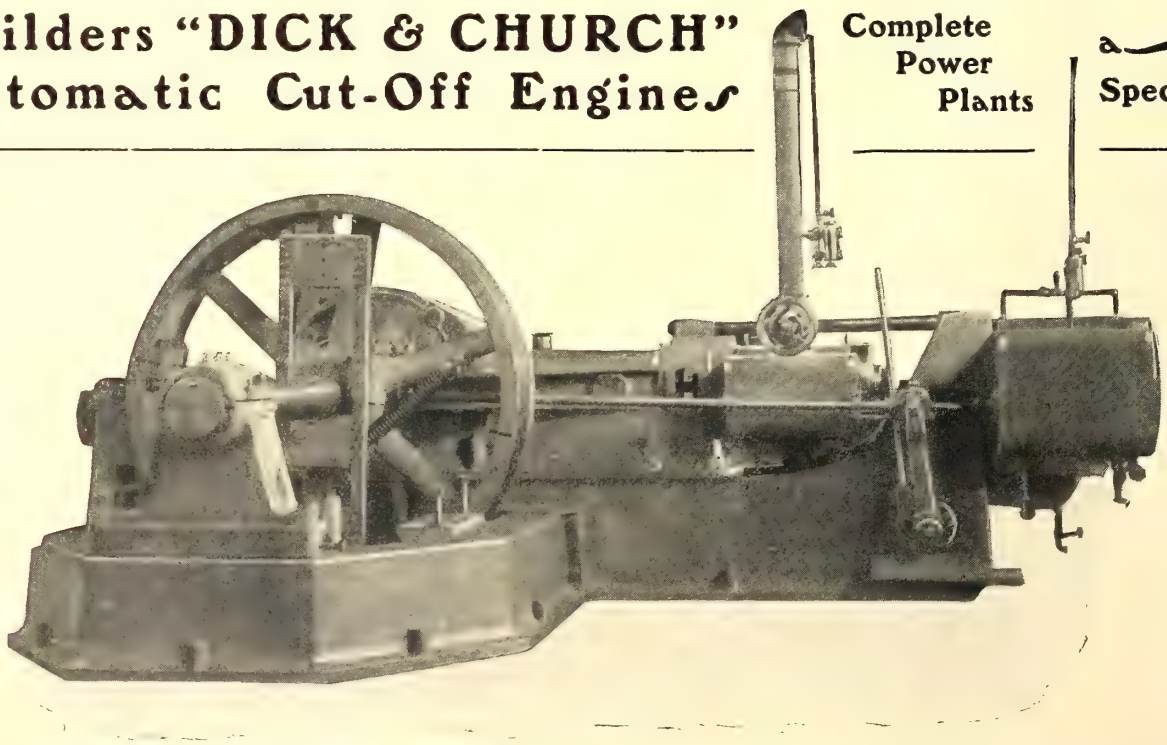


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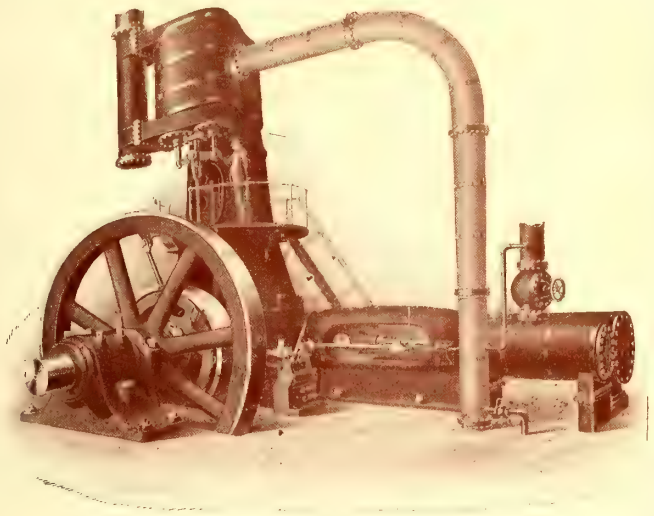


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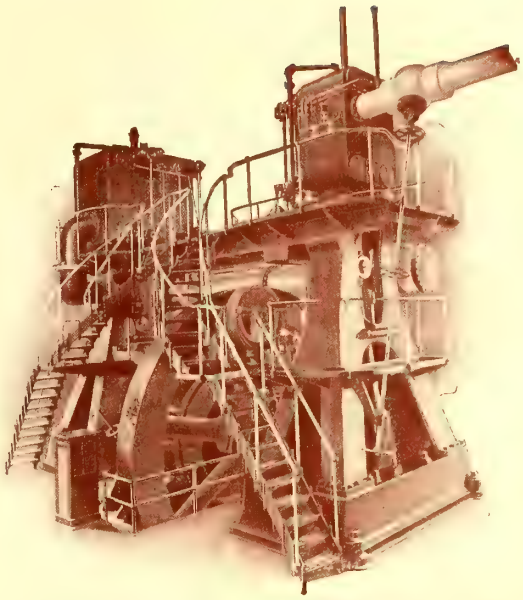


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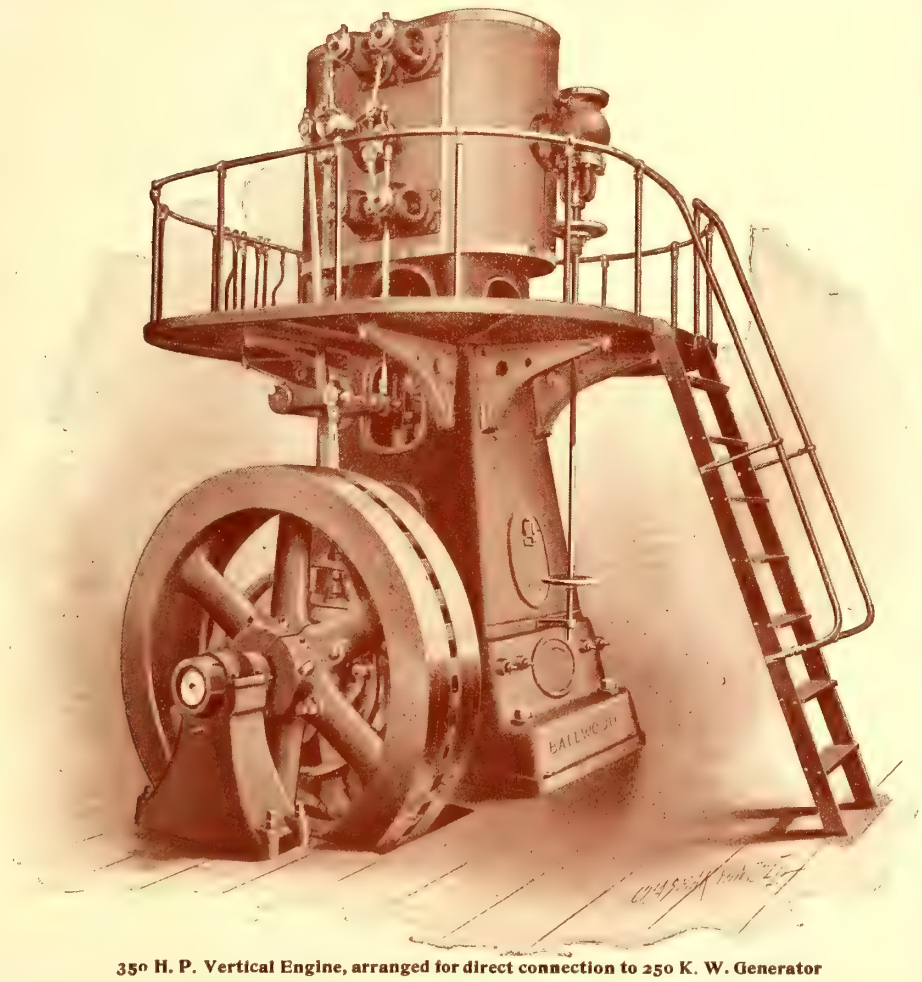
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All sizes and types. Especially designed for railway and lighting service.

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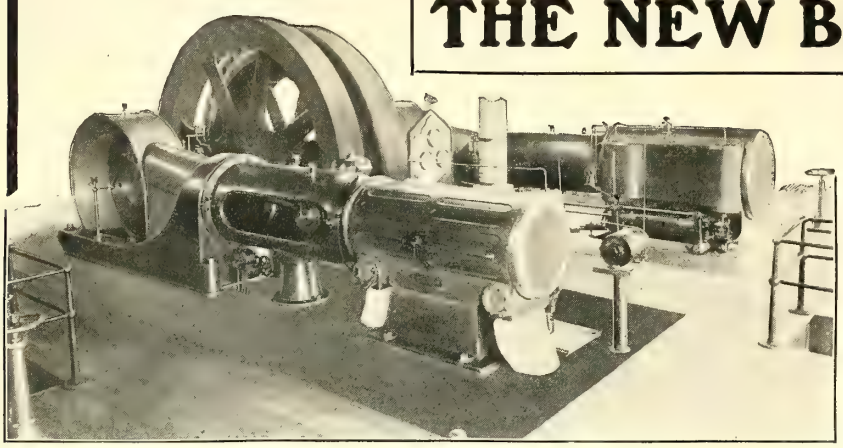
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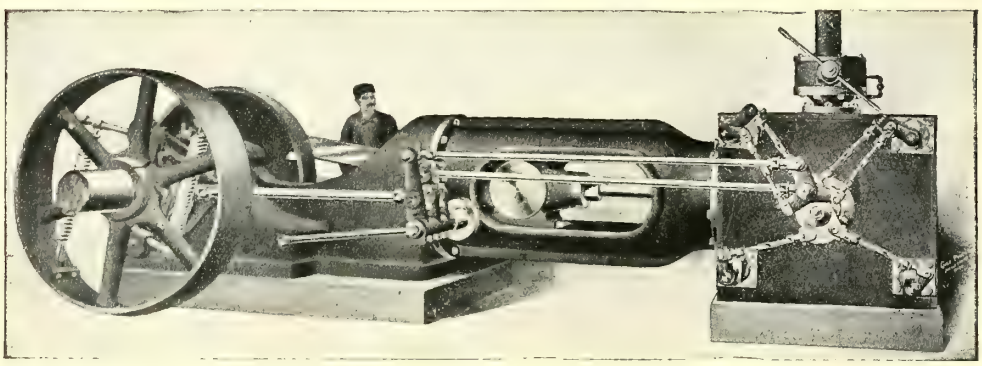
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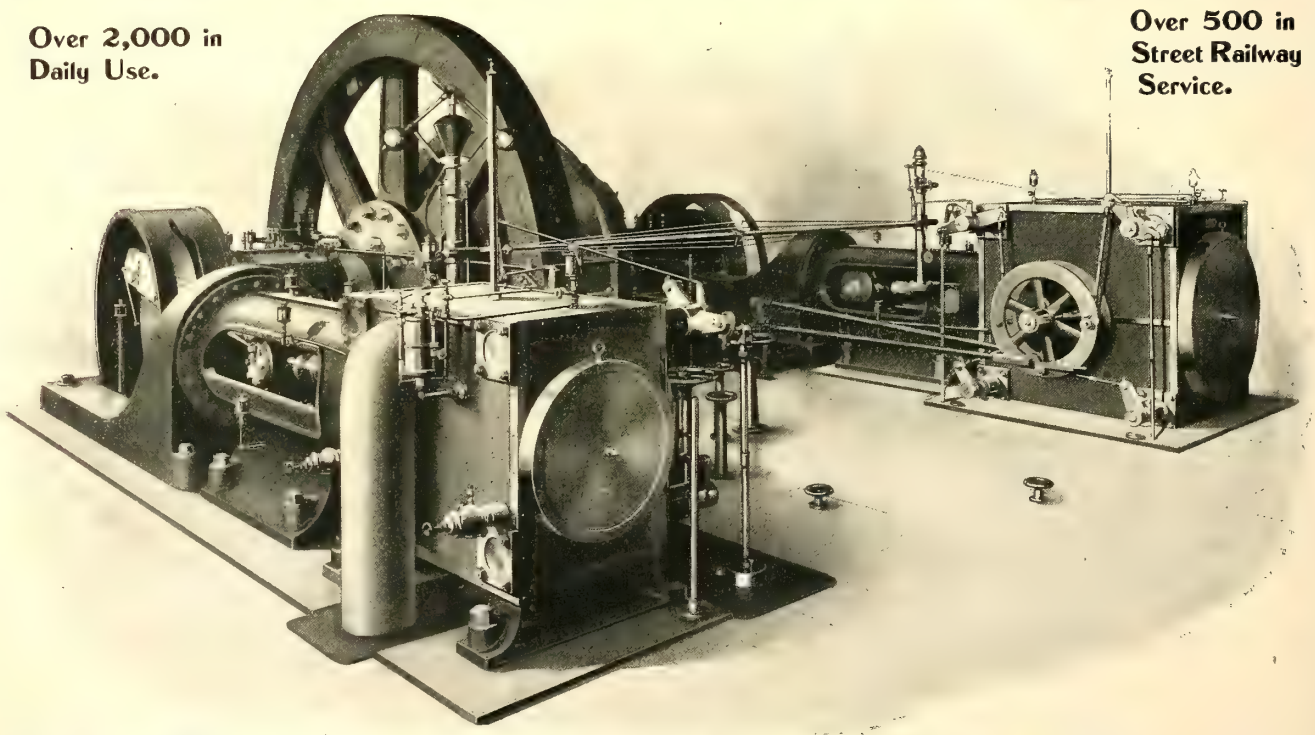
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Over 2,000 in Daily Use.

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ECONOMY OF FUEL

10 TO 20 PER CENT. SAVING

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We shall be glad to enter into fuller explanations if desired. Will also send our free booklet upon request.

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BOILER TUBE CLEANERS



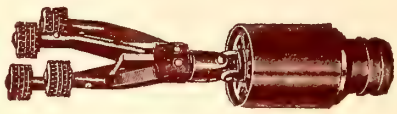
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THE TURBINE is the only successful machine for removing scale from

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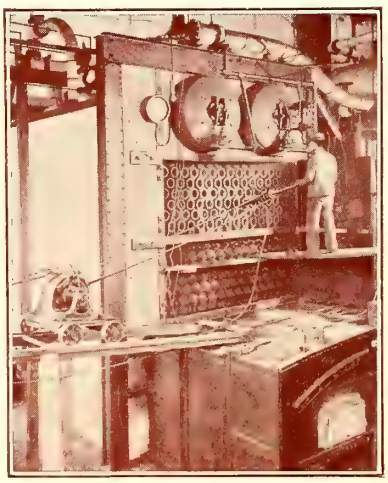
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DON'T CUT OUT BOILER TUBES

It's hard work and a dead loss; needless, too, as you can save them by cleaning with

Weinland Tube Cleaners

THE Vicksburg St. R'y Co. SAVED $1,500 WORTH OF TUBES WITH THIS CLEANER



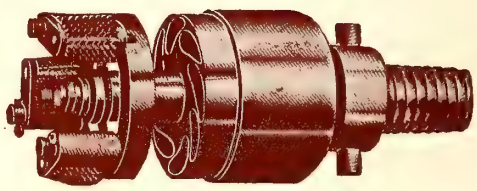
IT COSTS A WHOLE LOT LESS, EASILY OPERATED TOO

We make other styles of cleaners, notably **The Turbine.** Mr. Weinland, the patentee, is the pioneer who "blazed the way" in this line. Others have merely imitated without equaling his cleaner. Won't you try one? We send it on a strong guarantee. Write us about your "boiler cleaning troubles," we can help you. Had twenty years' experience and "know how."

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The LAGONDA MFG. CO.

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The Union Boiler Tube Cleaner and the Impulse Cleaner clean any and all Water Tube Boilers Mechanically and Successfully.

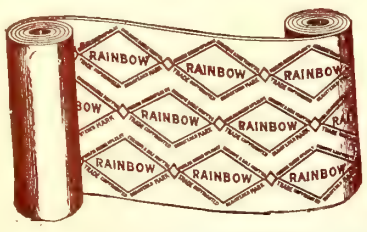
They have stood the test for years.
They are economical and efficient.
They save fuel and they save power.
They never fail to do the work.
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THE BEST FLANGE PACKING MADE



Rainbow Packing

MAKES A STEAM, FLANGE, AND HOT WATER JOINT INSTANTLY

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VEGETABLE FEED WATER TREATMENT

Removes old scale and prevents further formation. It will also correct all the bad effects of the water on the Boilers and Connections.

DEARBORN TREATMENT is used in the great majority of the largest Power Houses in America. Our large investment, immense facilities and long experience are behind the success of DEARBORN PREPARATIONS.

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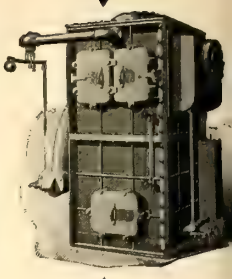
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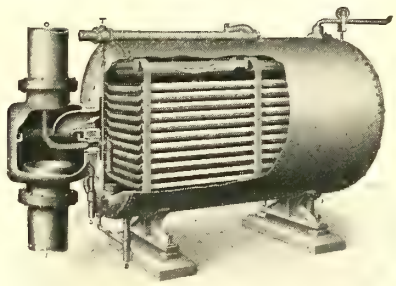


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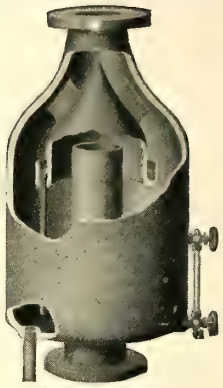
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Exhaust Steam Feed-Water HEATERS



Heater with Induction Chamber.

Our Purifiers are guaranteed to keep boilers clean, using any kind of water. The Heaters will heat feed-water to 210° and catch all solids liberated.

Hoppes Steam Separators and Oil Eliminators are the largest made, and separate without friction.



Vertical Separator

The Hoppes Mfg. Co.

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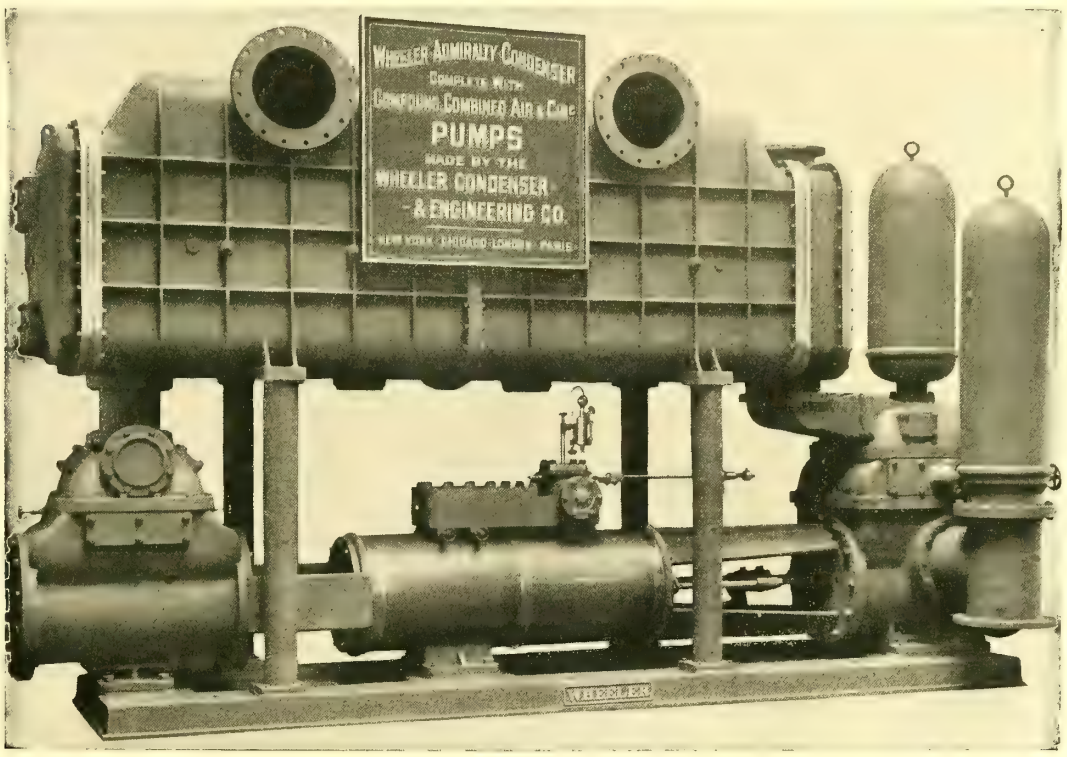
Wheeler Condenser & Engineering Company

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1642 Monadnock Block, Chicago 2 and 3 Norfolk St., Strand, London, W. C.

Barnard Water Cooling Towers ❧ Wheeler Surface Condensers ❧ Edwards' Air Pumps ❧ Wheeler Feed Water Heaters ❧ Steam and Electric Pumps

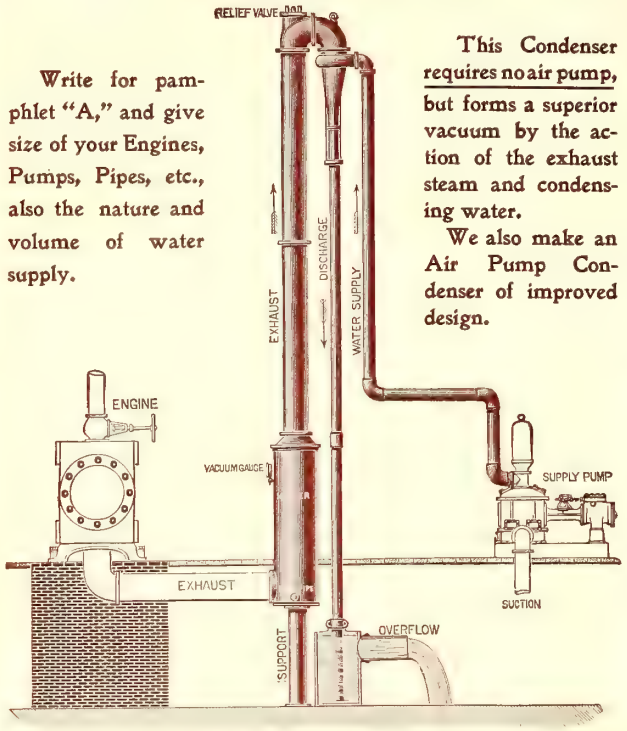
More than 90 per cent. of the **Surface Condensers** in use today are of the **Wheeler** make



Complete Cooling Tower and Condensing Plants for Electric Light, Railway and Power Plants, Mills, Mines, Etc.

For the benefit of those contemplating the installation or alteration of steam plants, we shall be pleased to give advice and prepare plans and specifications

The BULKLEY
"Injector"
CONDENSER



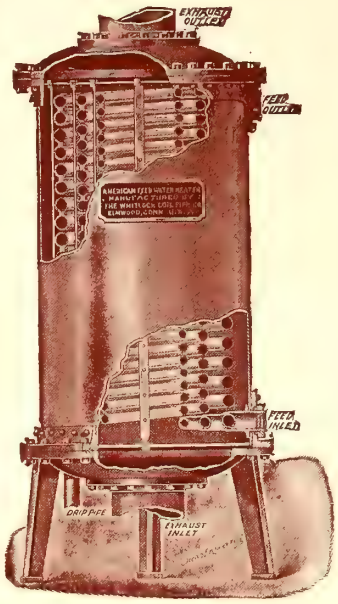
Write for pamphlet "A," and give size of your Engines, Pumps, Pipes, etc., also the nature and volume of water supply.

This Condenser requires no air pump, but forms a superior vacuum by the action of the exhaust steam and condensing water.

We also make an Air Pump Condenser of improved design.

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Feed Water Heater



Simplicity!
Strength!
Durability!
Efficiency!
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A Time Saver!
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Because it never gets out of order, never requires a bit of attention, has no movable or adjustable parts and will not wear out.
It is now used in some of the largest and best Street Railway Power Houses in the World.

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LOTS OF FUEL, LITTLE STEAM, MUCH WASTE AND DIRTY BOILERS
OR
LITTLE FUEL, LOTS OF STEAM, NO WASTE AND CLEAN BOILERS
ITS UP TO YOU. THE LATTER IS ATTAINED BY THE USE OF STILWELL'S FEED WATER HEATER.
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THE STILWELL-BIERCE & SMITH-VAILE CO.
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Good Words

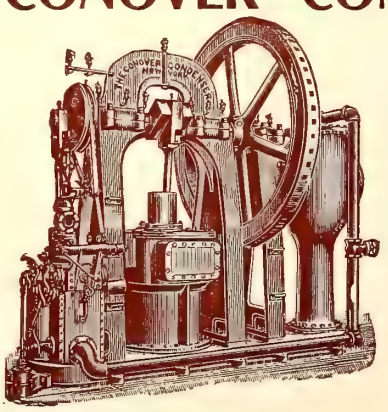
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Engineers must be cautious. Their reputations are easily injured. They cannot afford to recommend a heater unless it has been long and widely used, and thoroughly tested. A million and a quarter horse-power of Webster heaters in use.

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Driven by Compound Corliss Condensing Engine, twelve expansions of steam, vertical air pumps, all brass lined. Also Combined Air and Circulating Pumps for surface Condensers. Send for catalogue.

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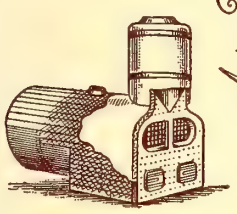
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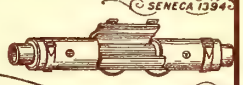
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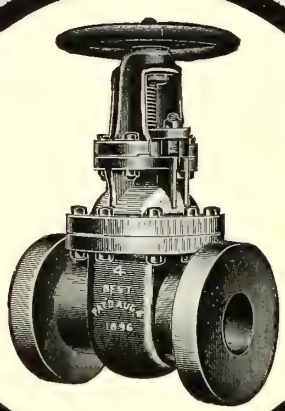
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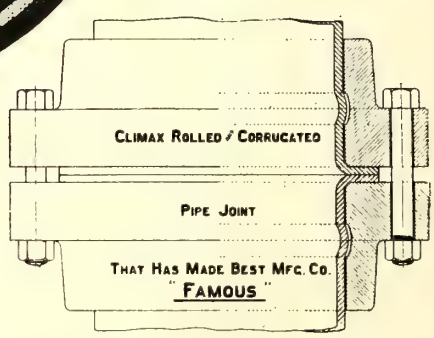
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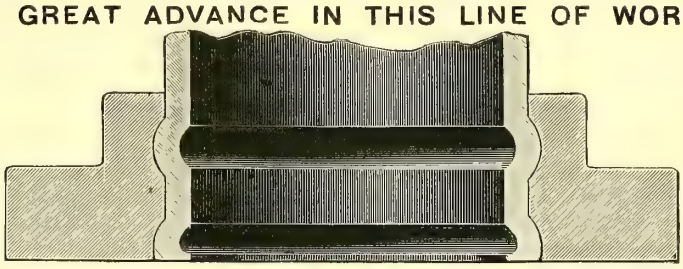
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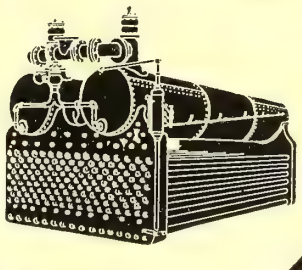
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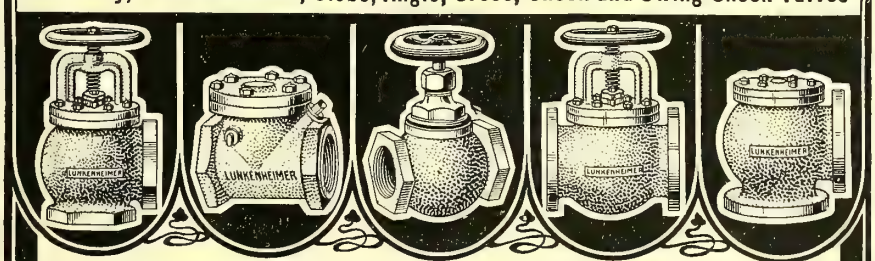
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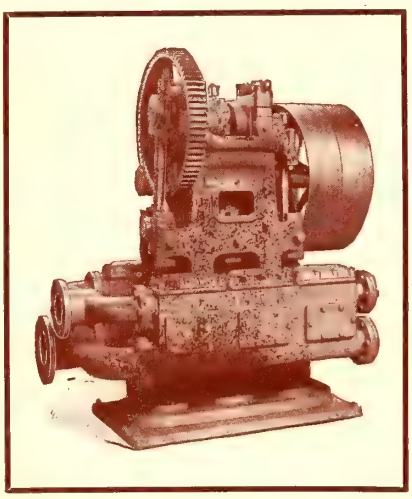
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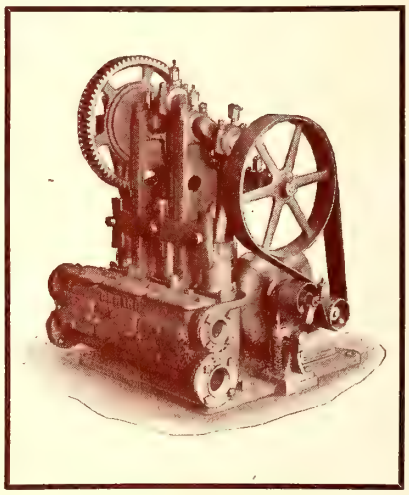
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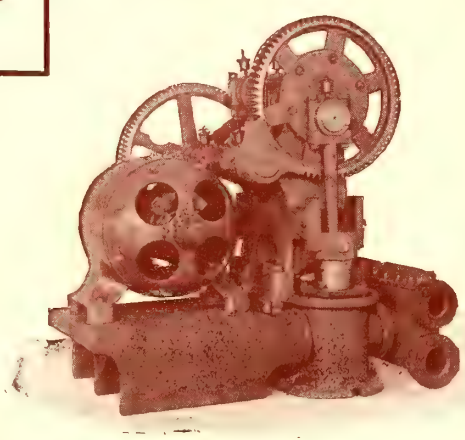
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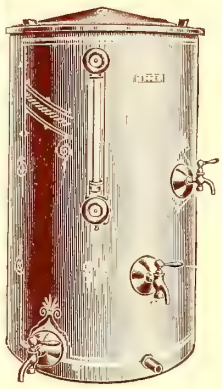
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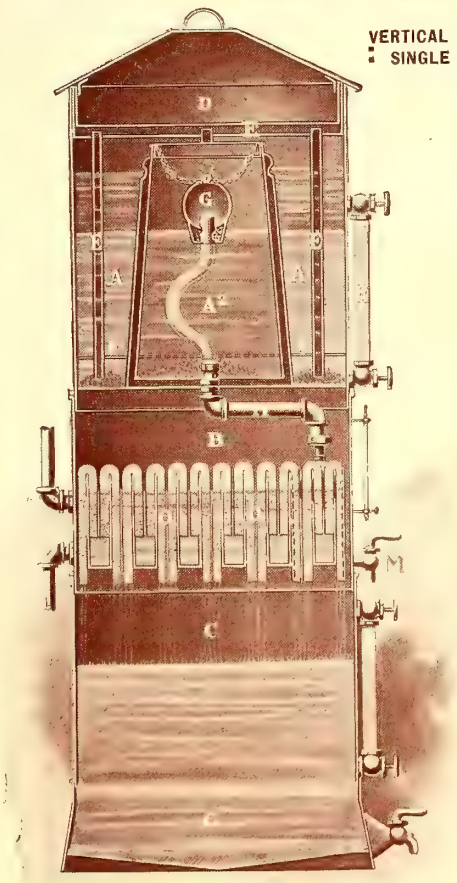
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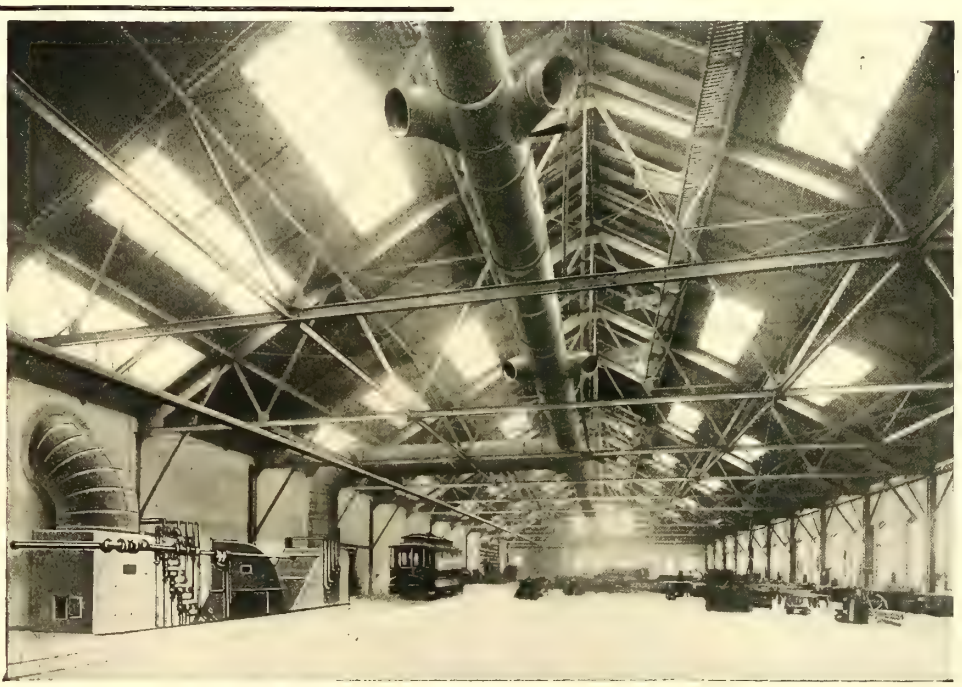
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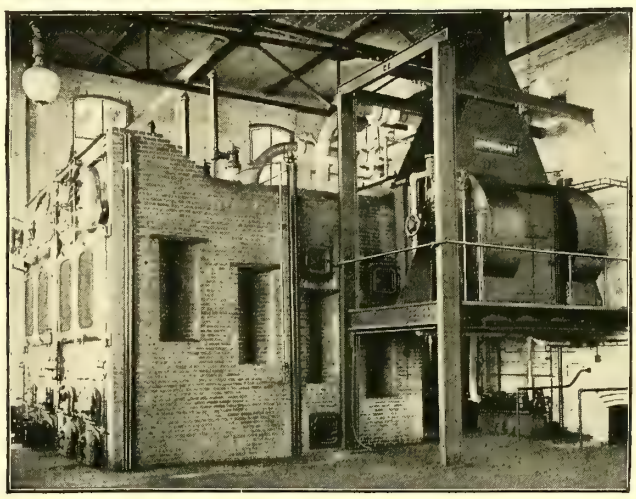
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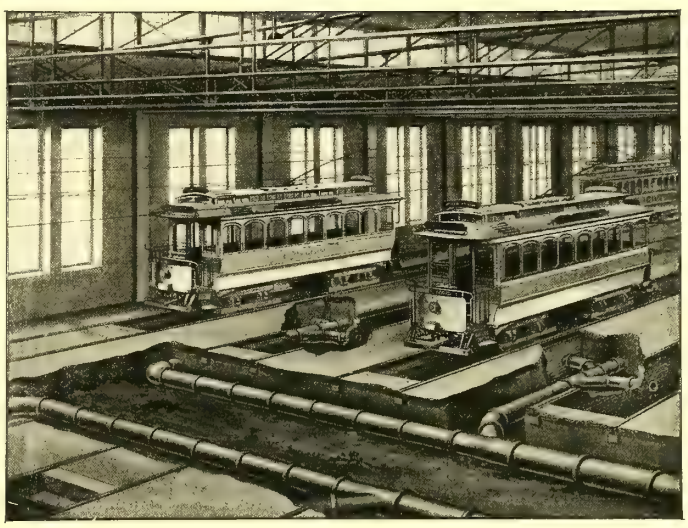
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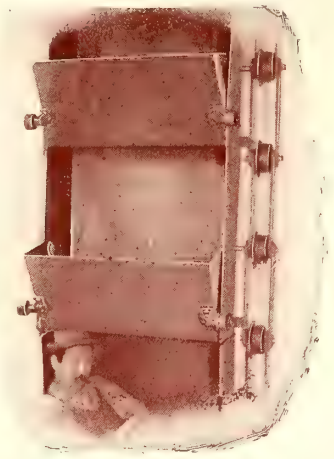


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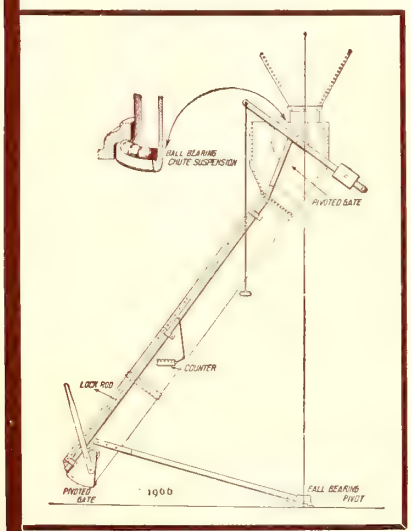


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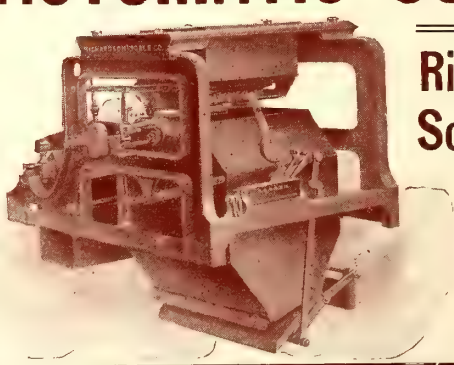
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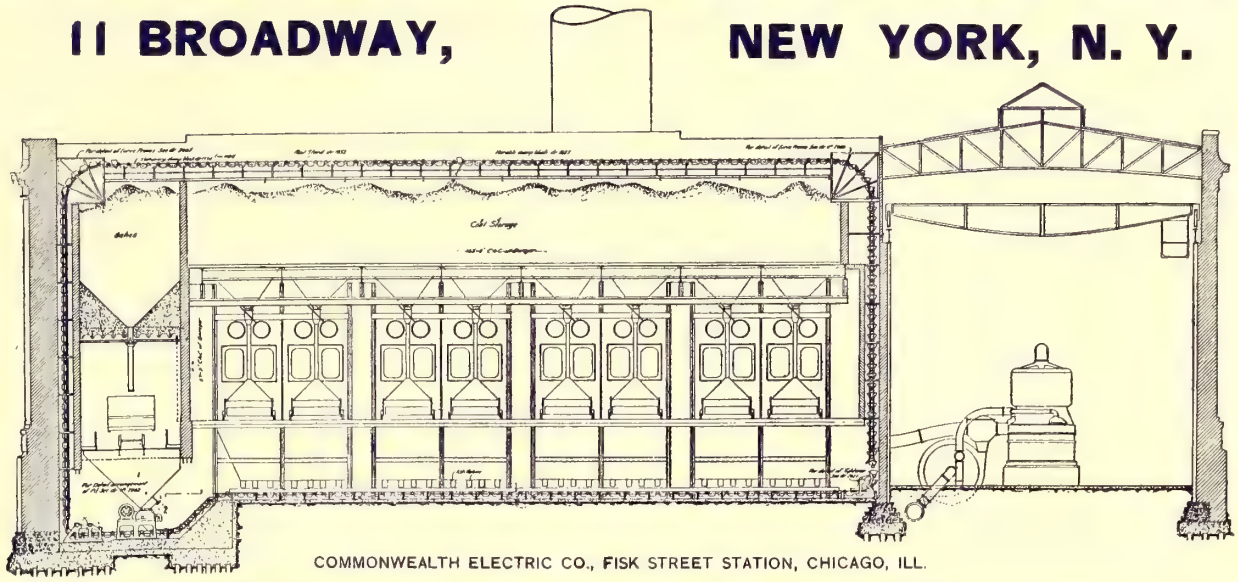


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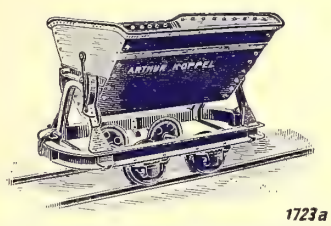
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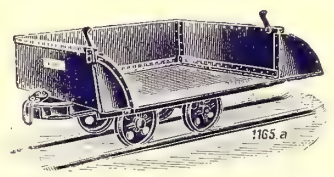


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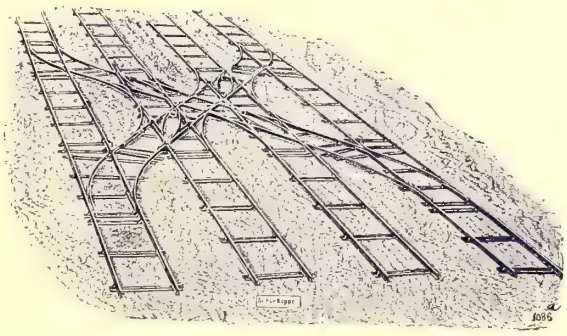
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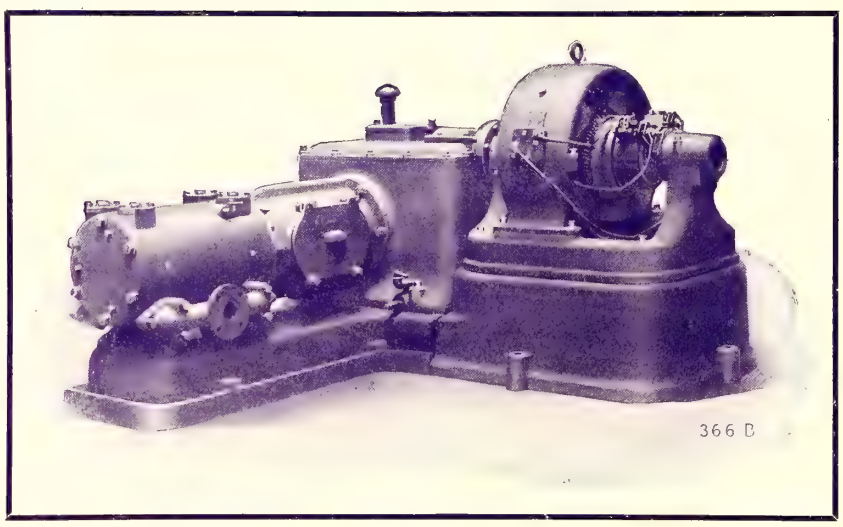


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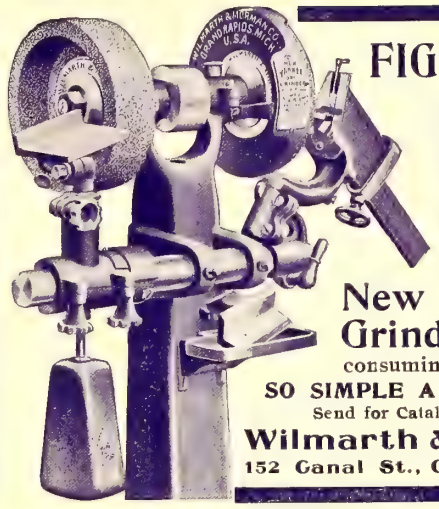


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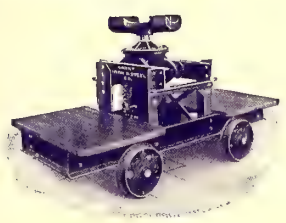
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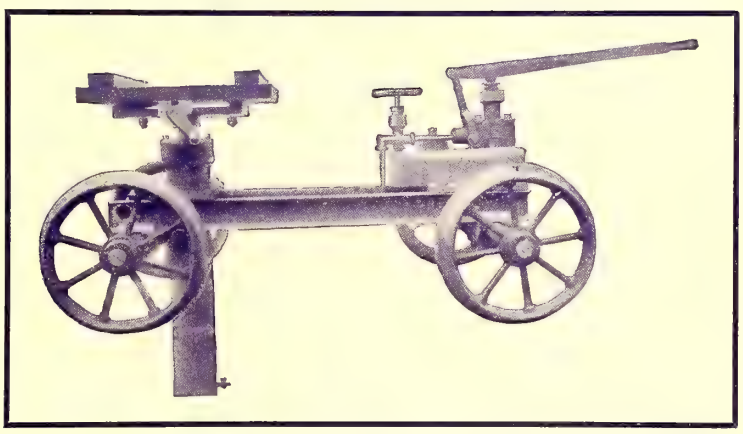
Toronto Street Railway

Rockford, Beloit and Janesville

Utica and Mohawk Valley

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And Many Others

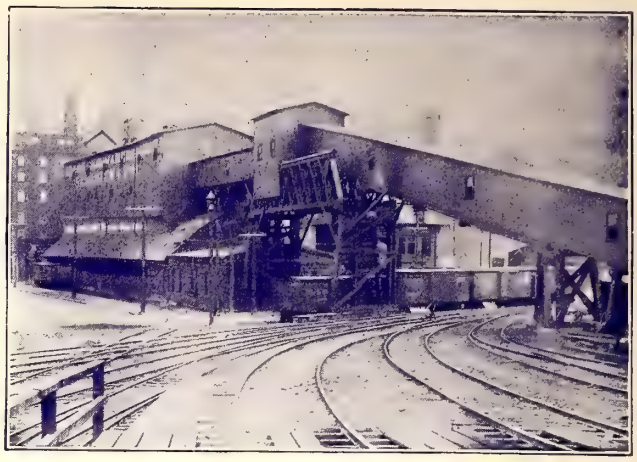


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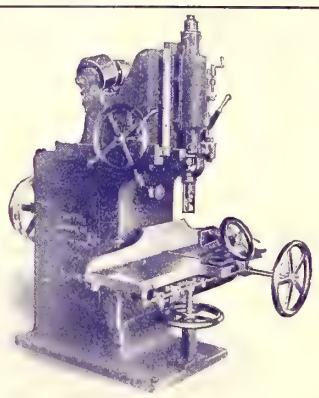
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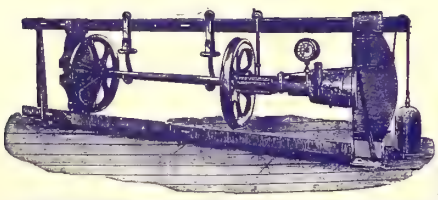
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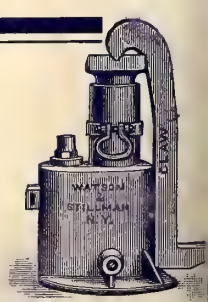
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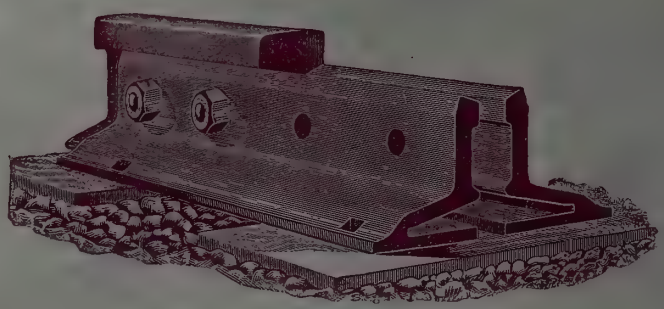
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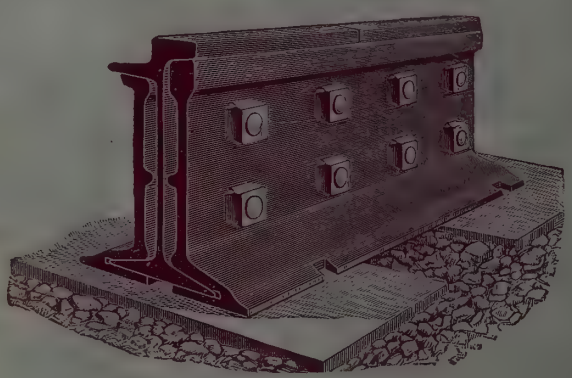
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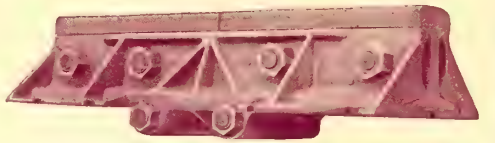
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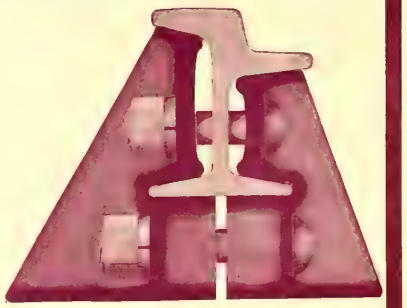


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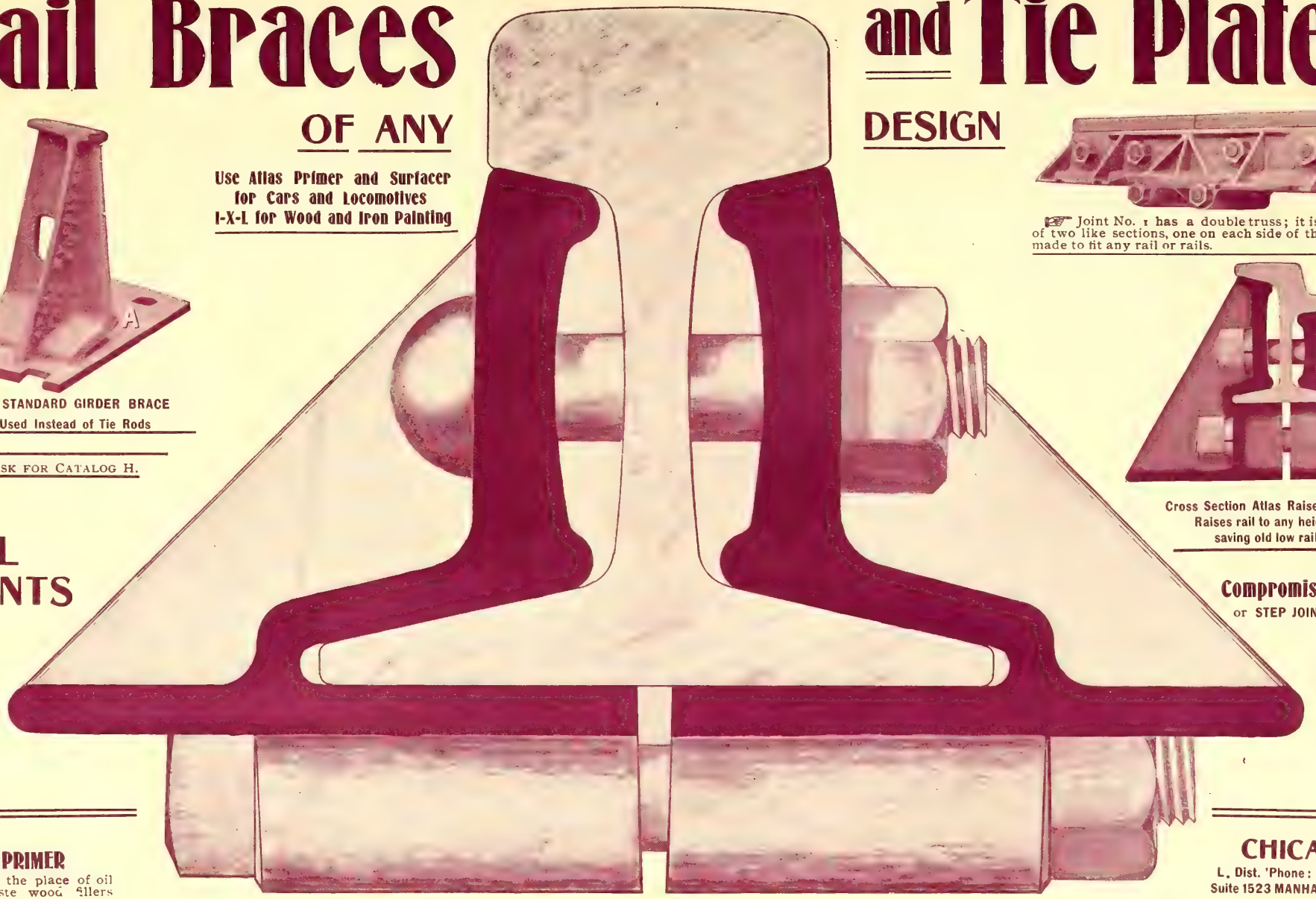
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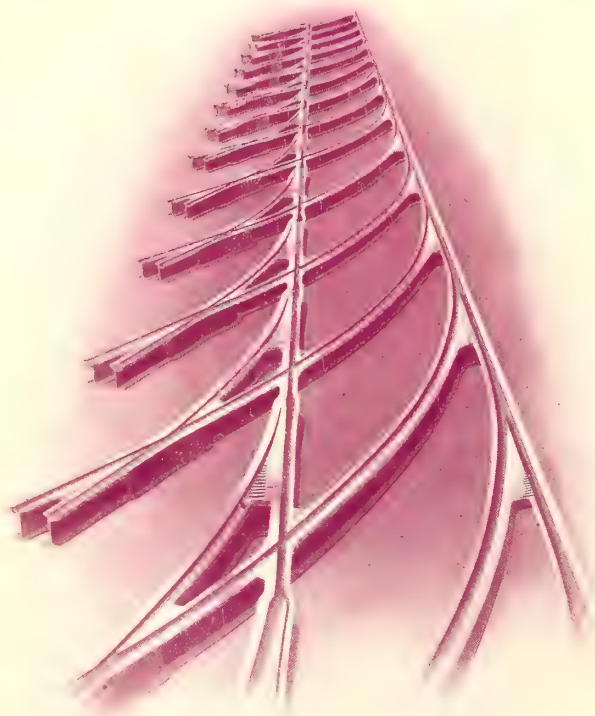




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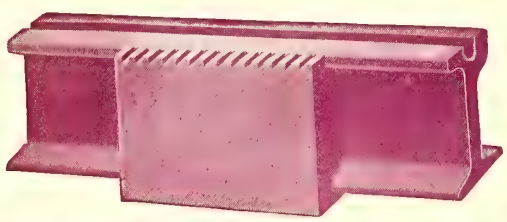
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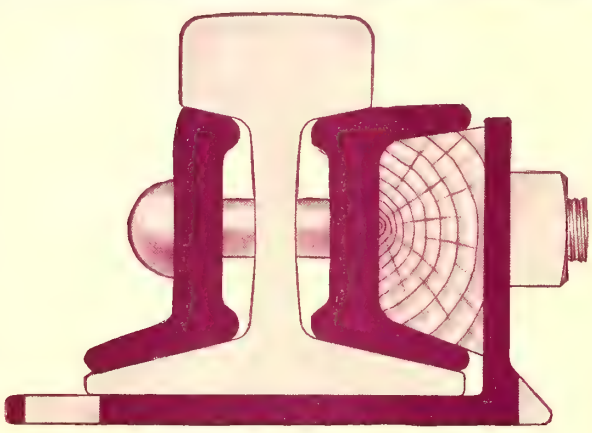
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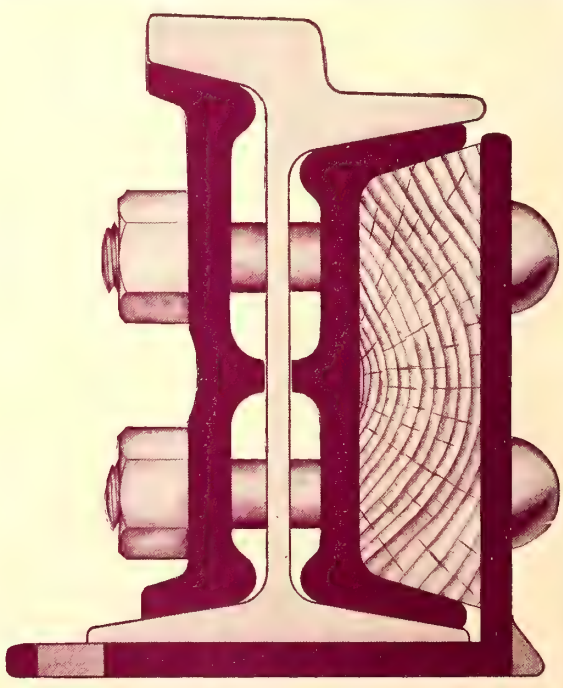
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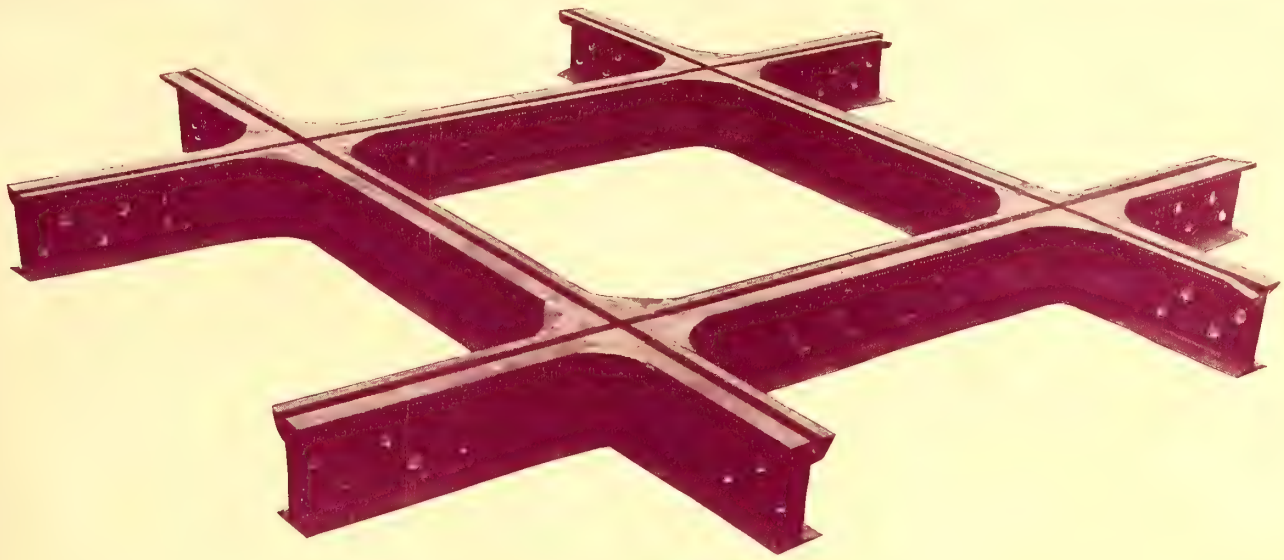
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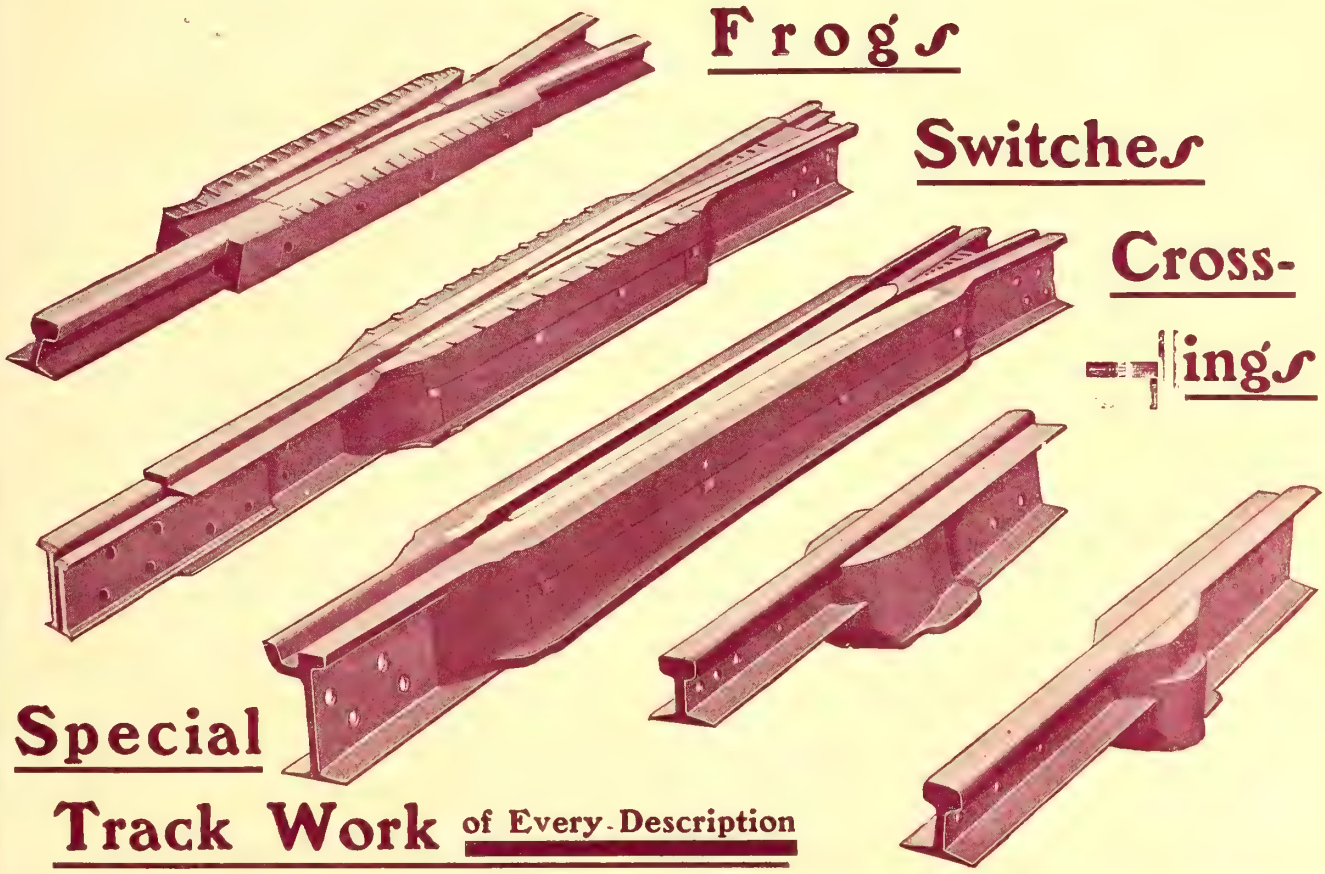
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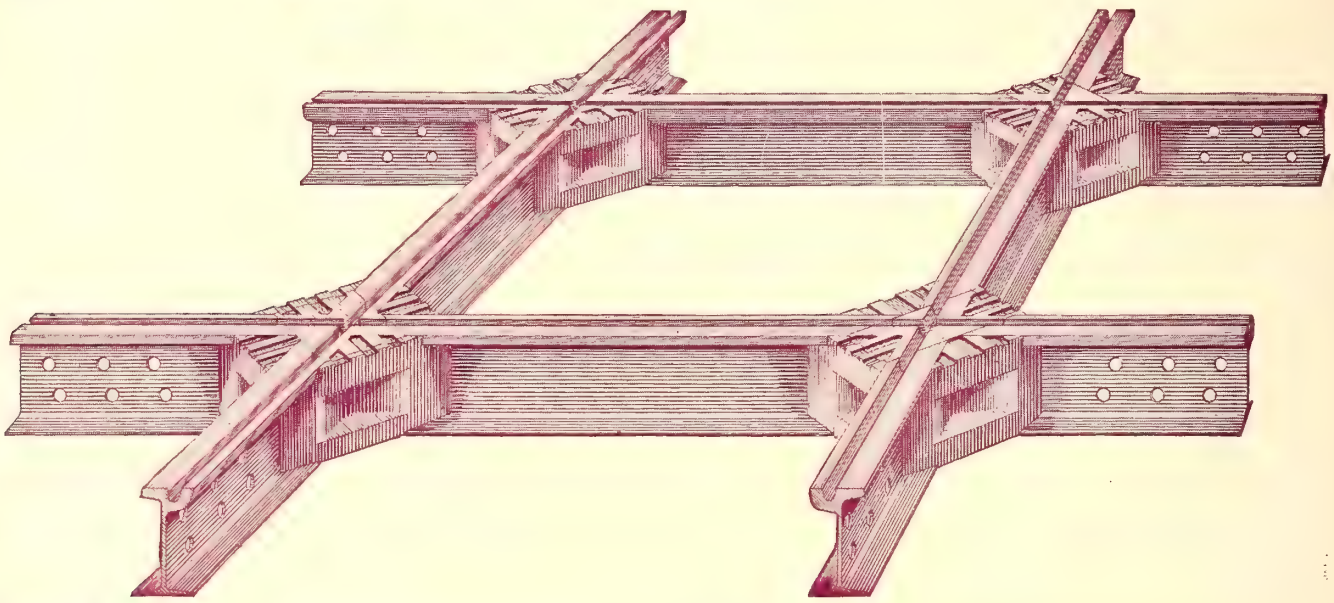
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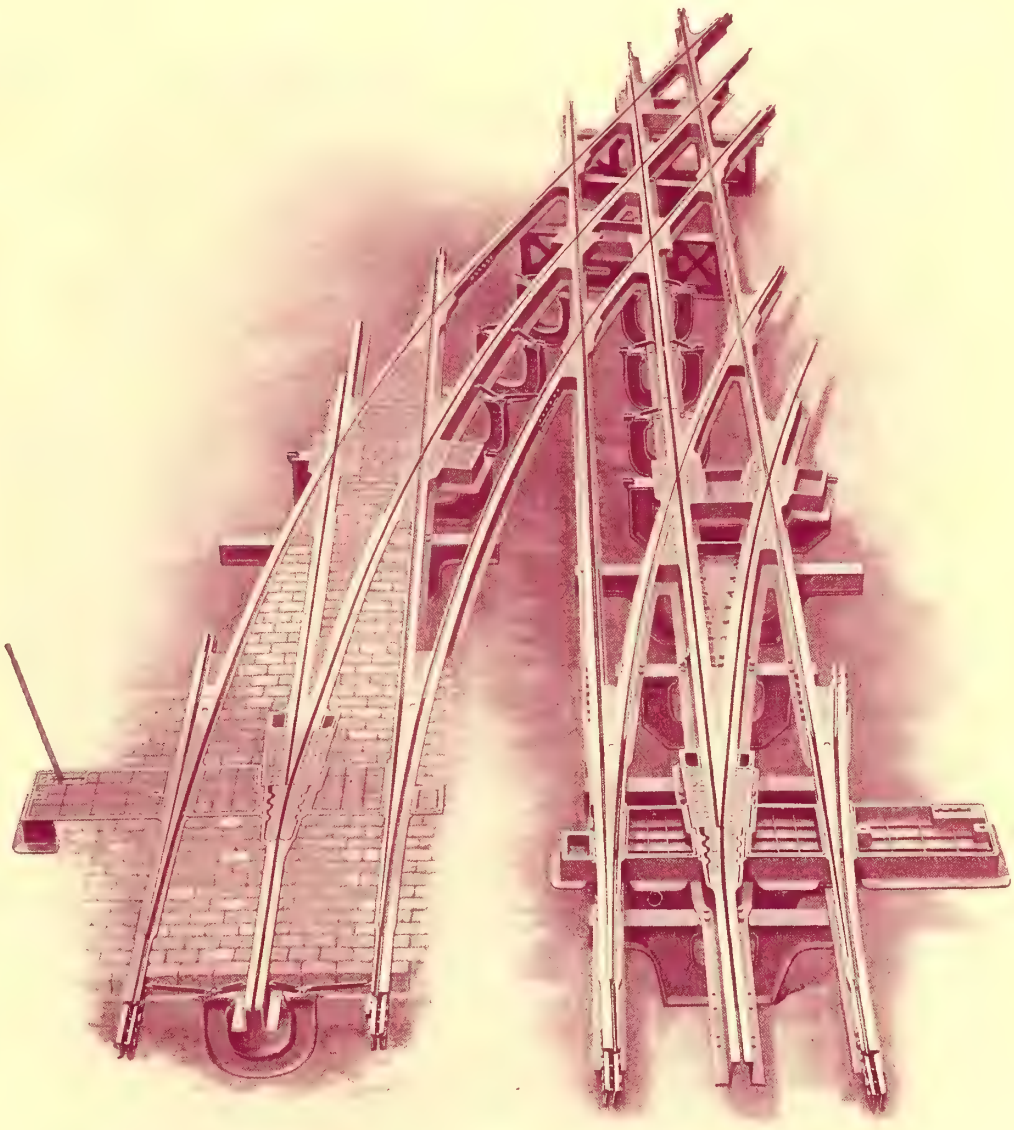
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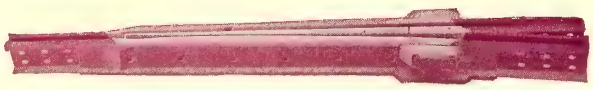
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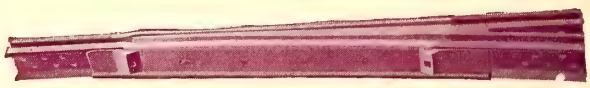
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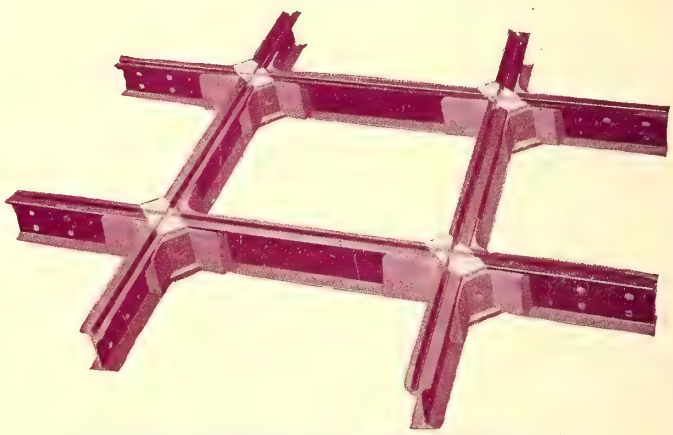
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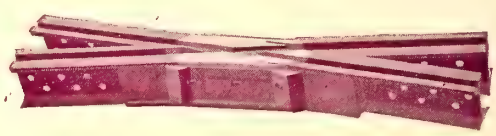
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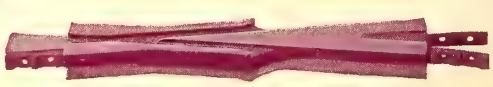
Manganese-Steel Girder Rail Crossing—Patented 5-16-93, 6-5-94, 9-3-95



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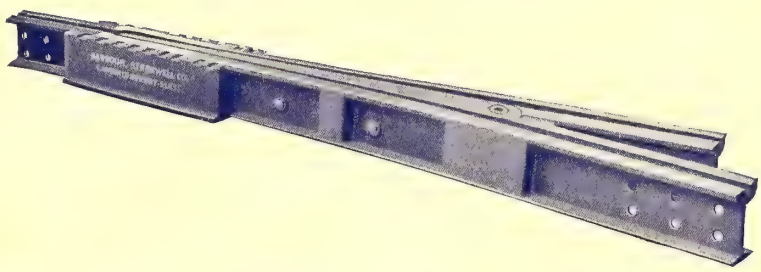
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For Street Railways

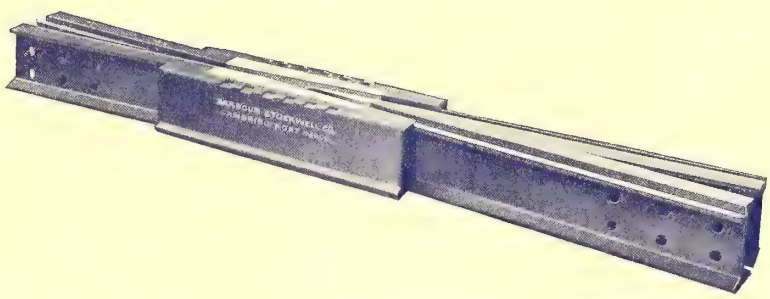
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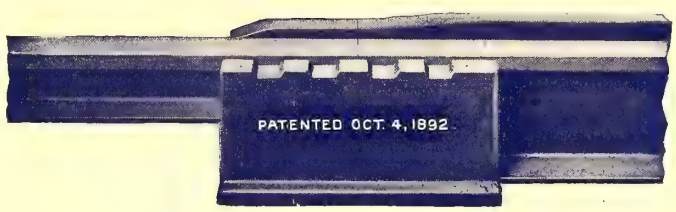
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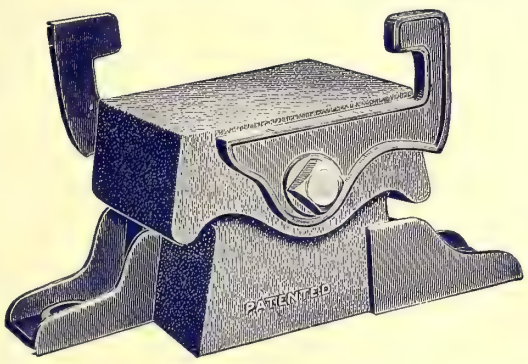
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The Street Railway Roadbed....
By MASON D. PRATT .....and C. A. ALDEN

An essential feature of a well-equipped street railway is a good track, and in this book are brought together and illustrated the various modern types of track material and methods of construction, with their good and bad features indicated. The authors are engineers of the Pennsylvania Steel Company, one of the largest manufacturers of rails and "special work" in America, and are therefore particularly well equipped to treat of the subjects of which they write. All the various features of street railway roadbed construction are carefully described, with illustrations where necessary, the latter including sections of rail, of roadbed, views of special joints, diagrams, etc. Rules and tables are also given for running curves, laying out crossings, turnouts, etc.

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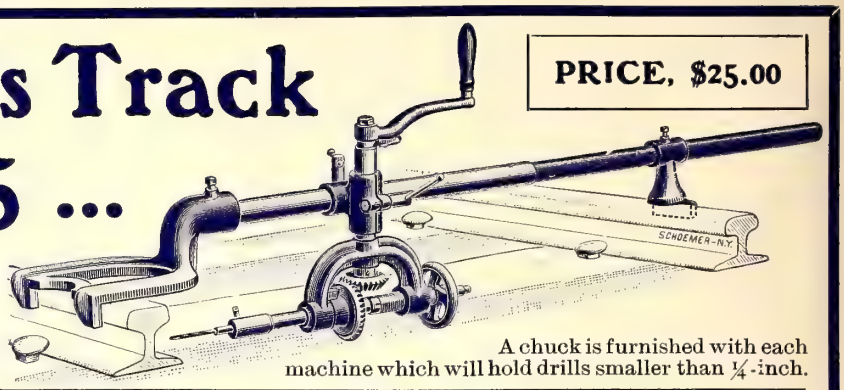
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NOW IN USE
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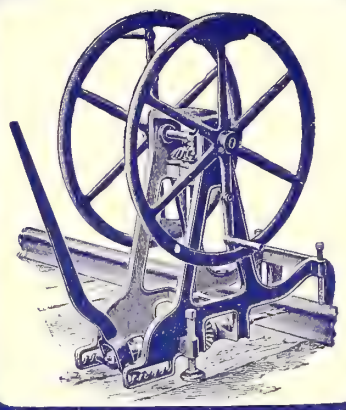
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A chuck is furnished with each machine which will hold drills smaller than ¼-inch.

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SWEETS' TRACK DRILL

"THE ONLY PERFECT DRILL."

SIMPLE. DURABLE. POWERFUL.

Works rapidly and positively, the feeding and withdrawing of drill being done by one lever.

Has a continuous and uniform motion for both light and heavy work, enabling 1¼ inch holes to be drilled easily. Drills either Girder Rails or Tee Rails.

The construction of spindle head decreases friction to minimum, and the fulcrumed lever furnishes a powerful and variable feed with a quick return.

Wheels will answer purpose of truck for moving drill about, doing away with carrying.

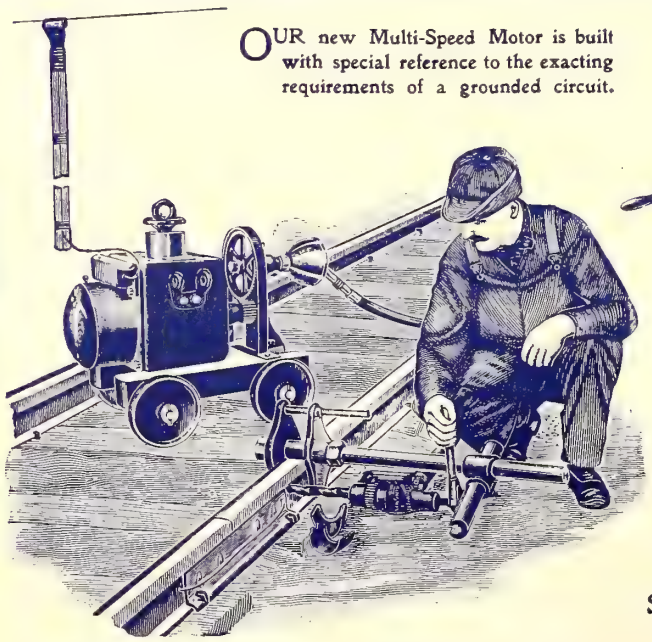
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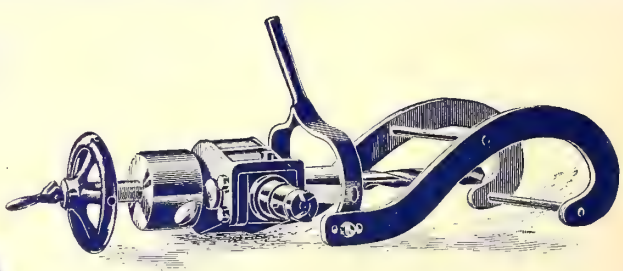
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Electric Street Railroad Track Drill

OUR new Multi-Speed Motor is built with special reference to the exacting requirements of a grounded circuit.



We can arrange this plant for grinding rails as well as drilling—or for rail grinding only. Write for descriptive matter.



THE AUTOMATIC TRACK DRILL (WITH CLAMP) is very convenient for quick adjustment.

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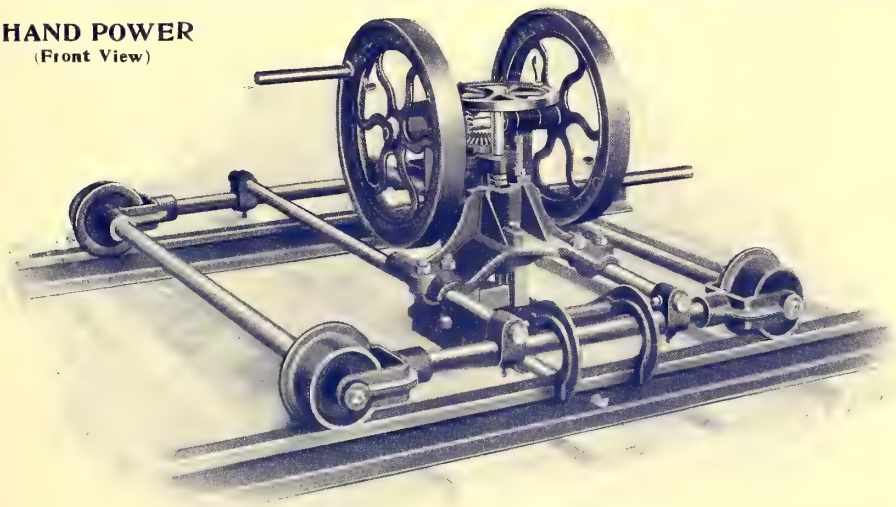
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(Front View)



The Speediest and Most Powerful Machine on the Market

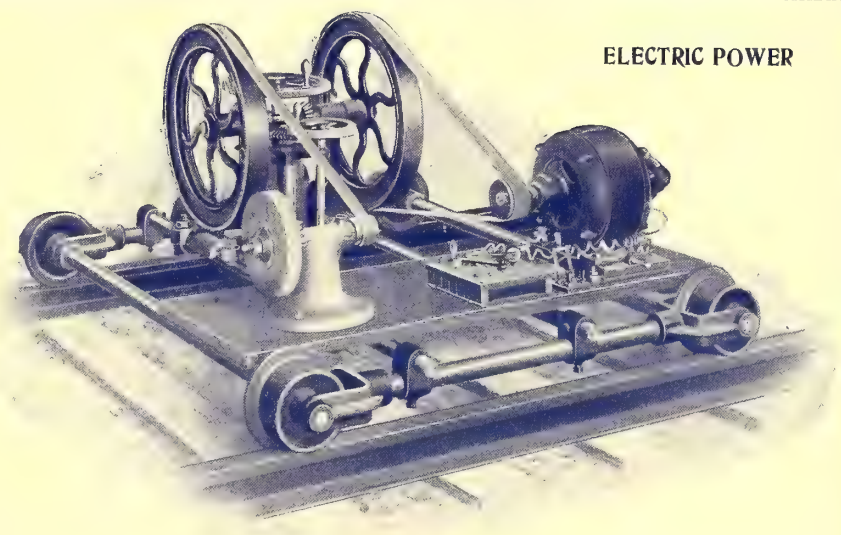
It will drill a 7/8 inch hole in a 70 pound T rail in less than a minute

Grinder for grinding drills is attached if required, same being operated by belt to fly-wheel

1 H. P.
Motor and Grinder attached, covered with boxes with locks and keys

With this equipment a 7/8 inch hole can be drilled in less than 40 seconds

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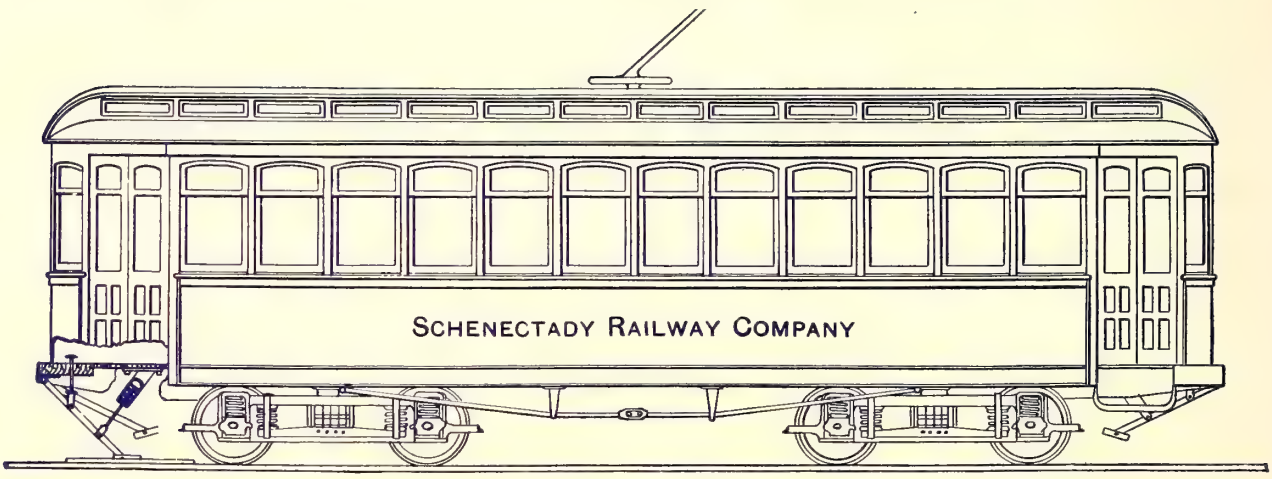
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THE KEEFER AUTOMATIC TRAMWAY SWITCH

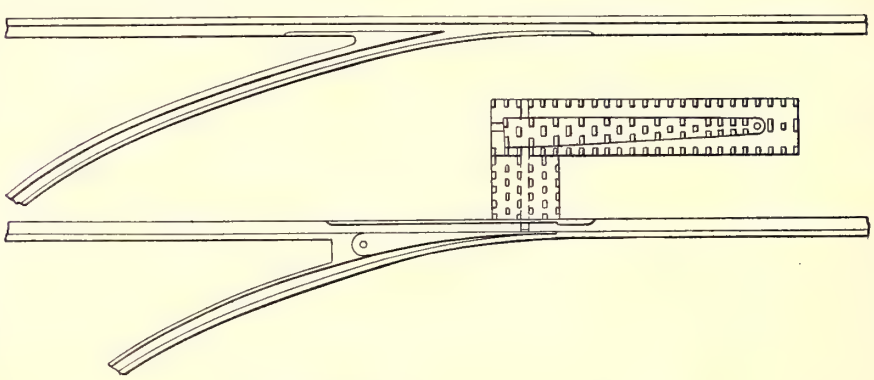
IS OPERATED FROM THE CAR WITHOUT STOPPING

DISPENSES WITH SWITCHMEN

It is simple, out of sight and out of the way, and requires only that the motorman shall put his foot on a pin or plunger when approaching a switch, to see the switch-point thrown in the desired direction



It has been thoroughly tested and has never failed to operate properly



It is simple reliable inexpensive and warranted to fulfill every requirement

NOT AFFECTED BY WEATHER

WRITE FOR CIRCULAR

KEEFER CAR SWITCH CO.

ALBANY, NEW YORK

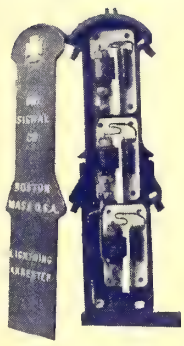
UNI SIGNAL CO.,

MANUFACTURER OF

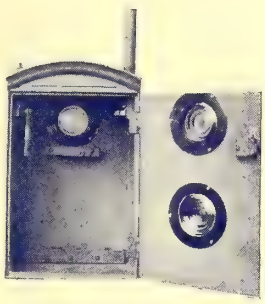
STREET RAILWAY SIGNALS

AND APPURTENANCES

42 OSBORNE STREET CAMBRIDGE, MASS., U. S. A.



Terminal Switch



Box with movement removed



Box Closed

The Uni Standard Automatic, Non-Interfering, Two Line Wire Block Signal System possesses the following advantages not possessed by any other Street Railway Signal System:

VISIBILITY of the green or SAFETY signal in BOTH DIRECTIONS, thereby allowing the conductor to see that the safety lamp is lighted, and thus protect against carelessness of the motorman.

PROVISION of a TERMINAL Box equipped with LIGHTNING ARRESTERS.

The ABILITY to REMOVE the ENTIRE SIGNAL MOVEMENT for inspection or test without the aid of any tools.

ABSENCE of all SPRINGS in the signal movement.

ABSENCE of any DETENT in the trolley switch, thus obviating shocks or liability of trolley being thrown off the wire.

The UNI SIGNAL COMPANY system also contains all the AUTOMATIC, NON-INTERFERING and INTERLOCKING features found in any other similarly operated system.

The Uni system excels all others in the ELECTRICAL and MECHANICAL PERFECTION of its details.

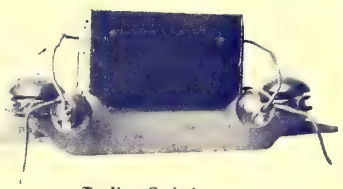
The Uni system excels in its thorough INSULATION and ISOLATION of its current carrying parts.

The Uni system contains FEWER PARTS and CONTACTS than any other signal system.

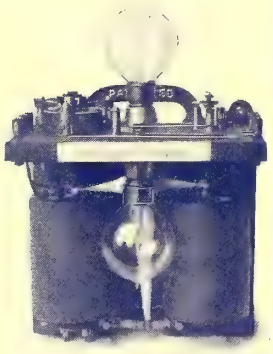
The Uni system uses CURRENT ONLY WHEN CAR IS IN A BLOCK and then only one-half an ampere.

The ADOPTION of the Uni signal system will ensue SAFETY and EXPEDITE TRAFFIC.

Write to the Company for their illustrated circular upon Electric Railway Signalling, which will be mailed upon request.



Trolley Switch



Signal Movement



Box Open

Inspect the Signal at the SARATOGA CONVENTION for yourselves

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What you have long looked for, found at last!

EUREKA AUTOMATIC ELECTRIC BLOCK SIGNALS

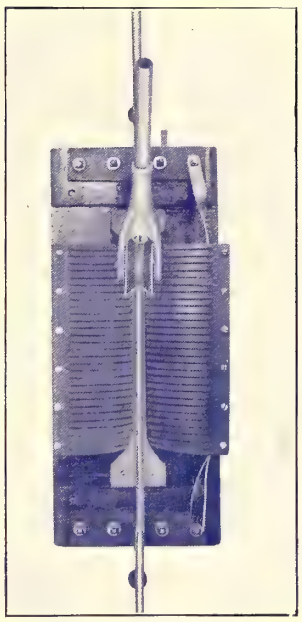
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DISTANT SEMAPHORE SET FIRST

SIMPLE PRACTICAL DURABLE

POSITIVE IN OPERATION
RELIABLE IN ALL KINDS *of* WEATHER
PROVEN LIGHTNING *and* FOOL PROOF

Regular cars need schedule and signals only—Extra cars can be sent out and called in without notice to other cars on line—Alert, active motormen force the lazy ones to hustle or lose their headway



CONTACT MAKER

POINTS TO BE NOTED

Any number of cars can follow each other into a block.
First car in sets signals to danger.
Last car out sets signals to safety.
Cars in a block can leave it at either end without deranging the signals.
Cars trying to take a block at opposite ends cannot set signals.

Motorman always has a signal ahead of him when setting system to danger or safety.
Signals show direction car is moving in a block and can be read as well by day as by night.
Burnt out lamps do not make system inoperative.
No magnets in series and none in circuit with lamps.
No magnets, no mechanism, in circuit with overhead wiring.
Magnets wound for certain operation with 65 per cent drop in voltage.
Contact-makers, certain of action with least sparking, avoid generation of counter electro-motor forces in magnet coils.
Though but 12 inches long will operate at speed of 60 miles per hour.



CAR IN THE BLOCK

FIVE PATENTS ALLOWED
THREE NEW APPLICATIONS PENDING

"Have our road, 20 miles, equipped with Eureka Signals—After a year's trial I pronounce them an unqualified success."—W. D. ZEHNER, Supt. and Eng., T. & L. St. Ry. Co.

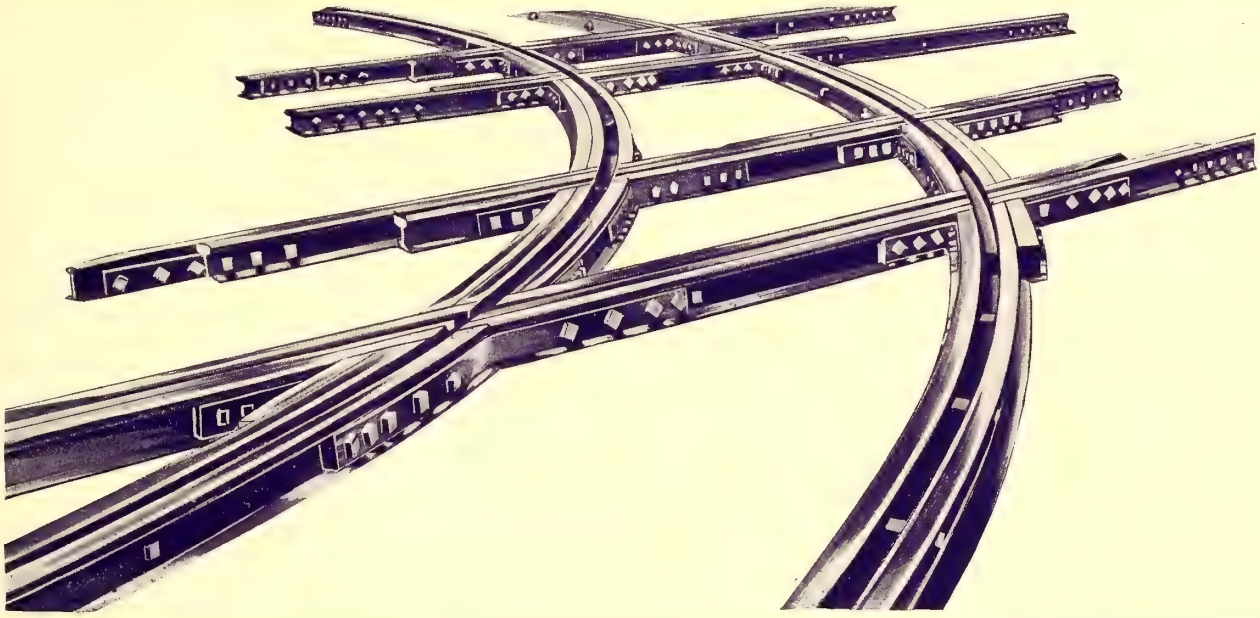
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HOW THEY ARE MADE TO DO IT . . . . . .

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LANSFORD, PA.

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FOR STREET RAILWAYS.



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We have been making them four years

HAVE BEEN TESTED AND PROVED SATISFACTORY

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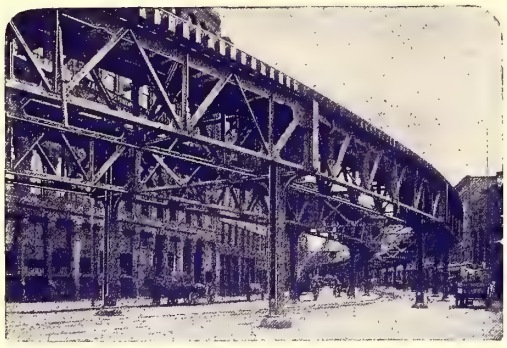
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Structural Steel
FOR EVERY PURPOSE

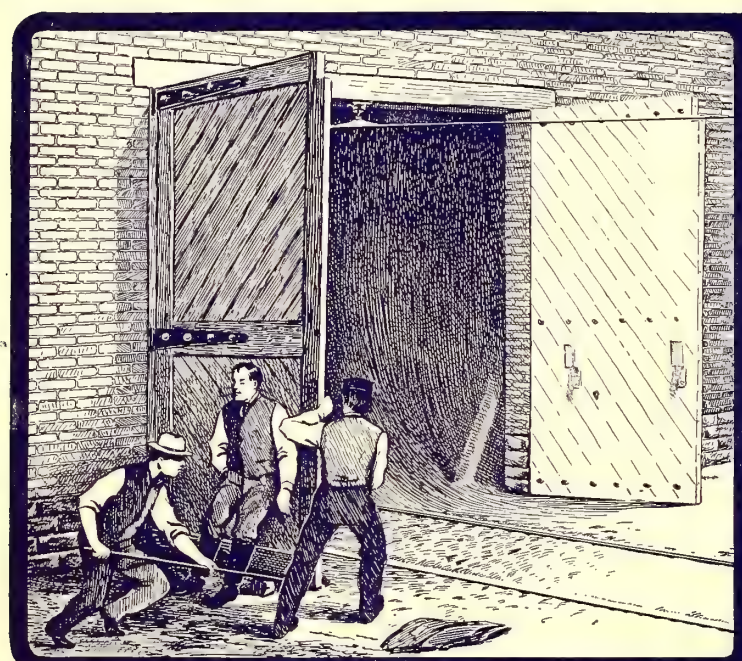
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Trusses

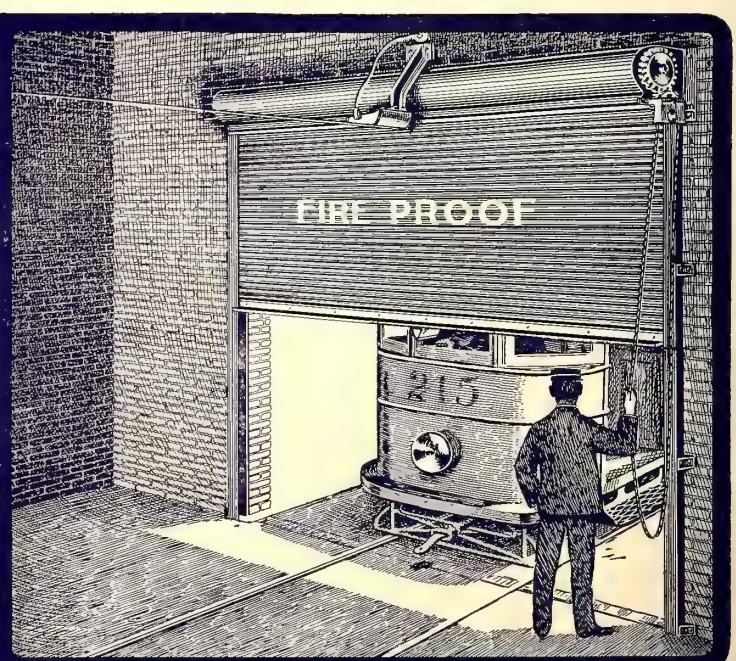


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By MASON D. PRATT
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An essential feature of a well-equipped street railway is a good track, and in this book are brought together and illustrated the various modern types of track material and methods of construction, with their good and bad features indicated. The authors are engineers of the Pennsylvania Steel Company, one of the largest manufacturers of rails and "special work" in America, and are therefore particularly well equipped to treat of the subjects of which they write. All the various features of street railway roadbed construction are carefully described, with illustrations where necessary, the latter including sections of rail, of roadbed, views of special joints, diagrams, etc. Rules and tables are also given for running curves, laying out crossings, turnouts, etc.

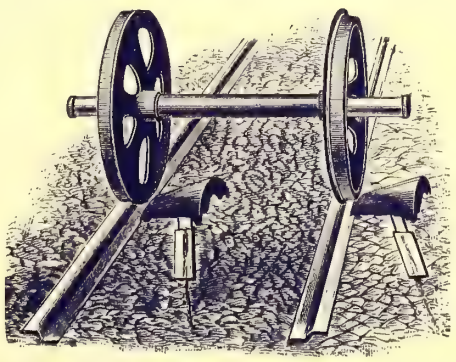
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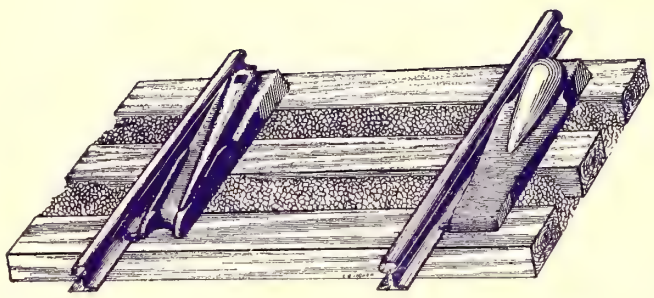
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meets perfectly the requirements of both steam and electric roads.

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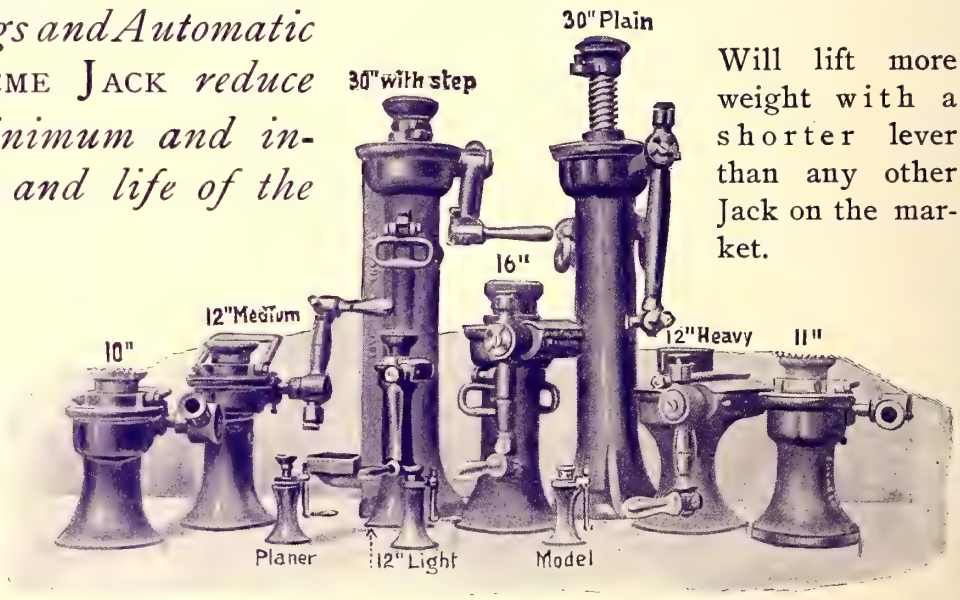
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The Gear in these Jacks is of Coe Bronze, which is almost frictionless.

The screw and worm are of cold rolled steel.

The weight rests entirely on the balls, and the direct application of the worm on gear gives the maximum of leverage.



Will lift more weight with a shorter lever than any other Jack on the market.

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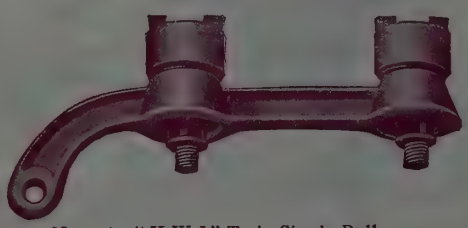
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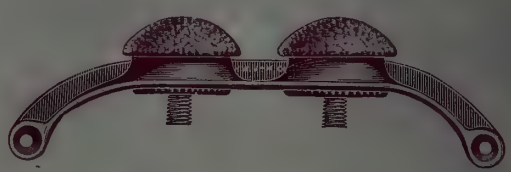
DOUBLE TROLLEY SUSPENSION



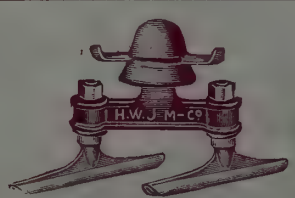
No. 240.—Double Suspension, complete with Insulators, 5/8-inch or 3/4-inch studs.



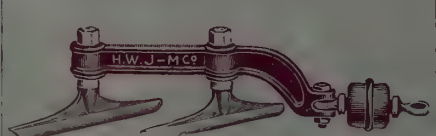
No. 242.—Double Suspension Single Pull Over, with Insulators, 5/8-inch or 3/4-inch studs.



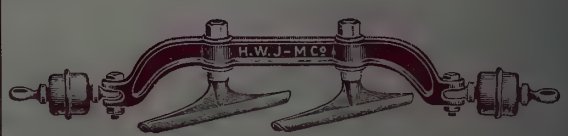
No. 244.—Double Suspension Double Pull Over, complete with Insulators, 5/8-inch or 3/4-inch studs.



No. 104.—Round Top, with straight wire Yoke. Malleable iron for hanger with 5/8-inch or 3/4-inch studs.



No 360.—Single Curve Double Suspension malleable iron Yoke, 5/8-inch or 3/4-inch studs, with No. 2 Giant Strain Insulator.



No. 364.—Double Curve Double Suspension malleable iron Yoke, 5/8-inch or 3/4-inch studs, with No. 2 Giant Strain Insulators.

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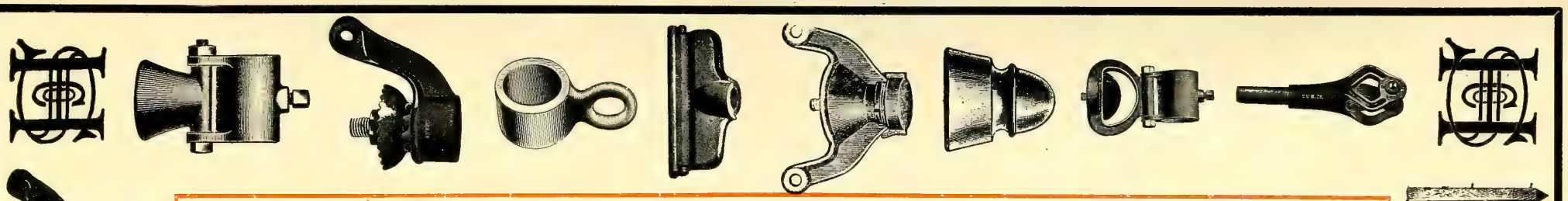
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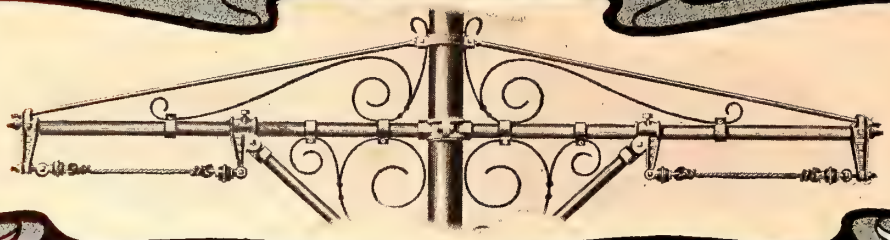
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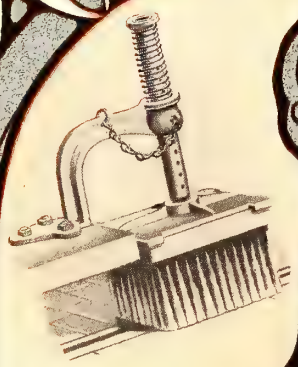
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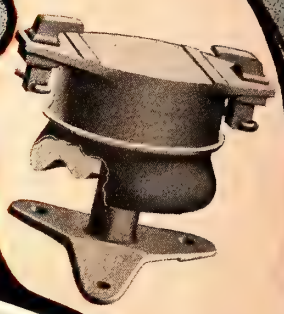
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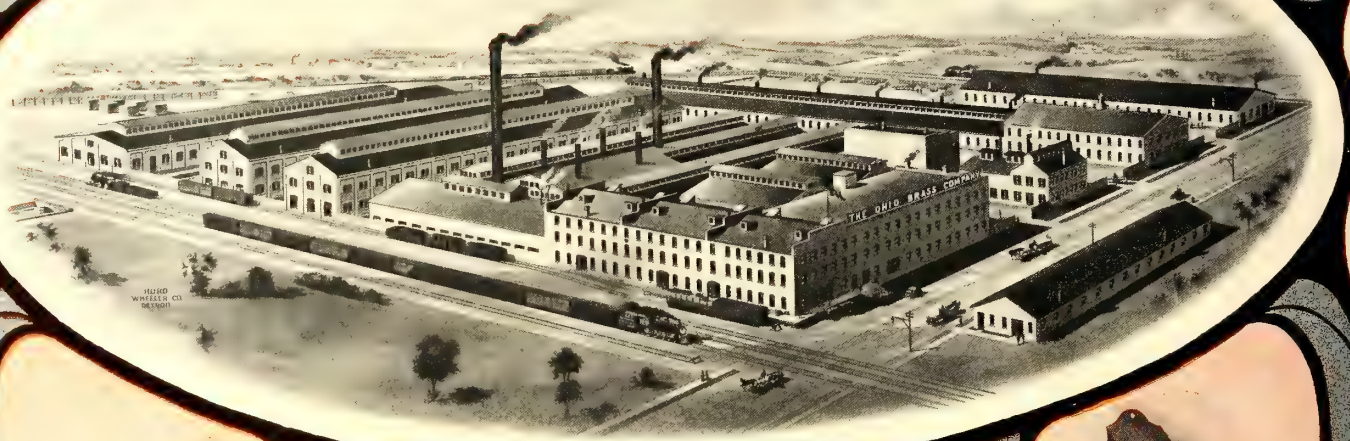




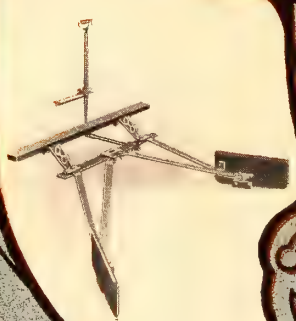
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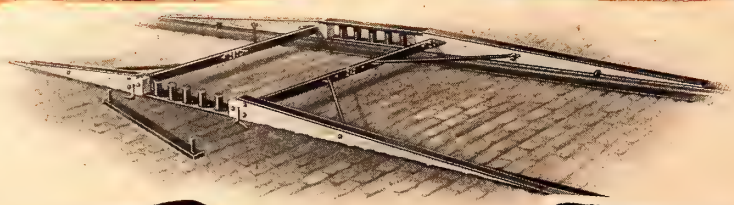


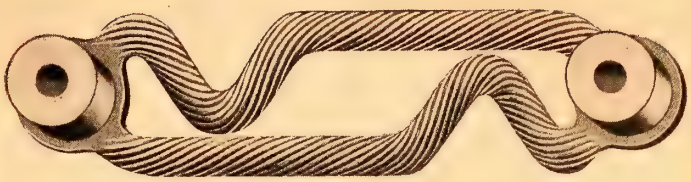


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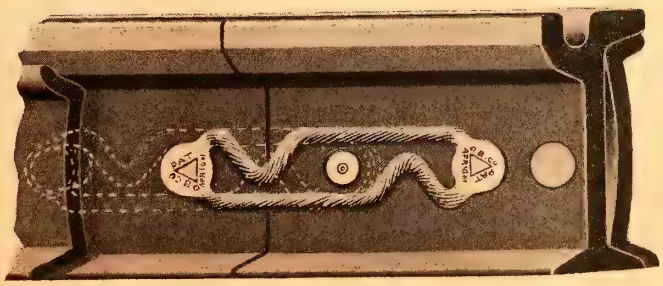
This Bond represents the perfect evolution of the "one-piece" idea in rail bond construction, as it is made entirely from a single piece of flexible copper cable. Although the word "one-piece" has been so indiscriminately used in connection with rail bonds as to be almost meaningless, a little consideration of the claims made by us for the "ALL WIRE" BOND will convince the most skeptical that this is the only type of flexible bond ever produced which is made in one piece.

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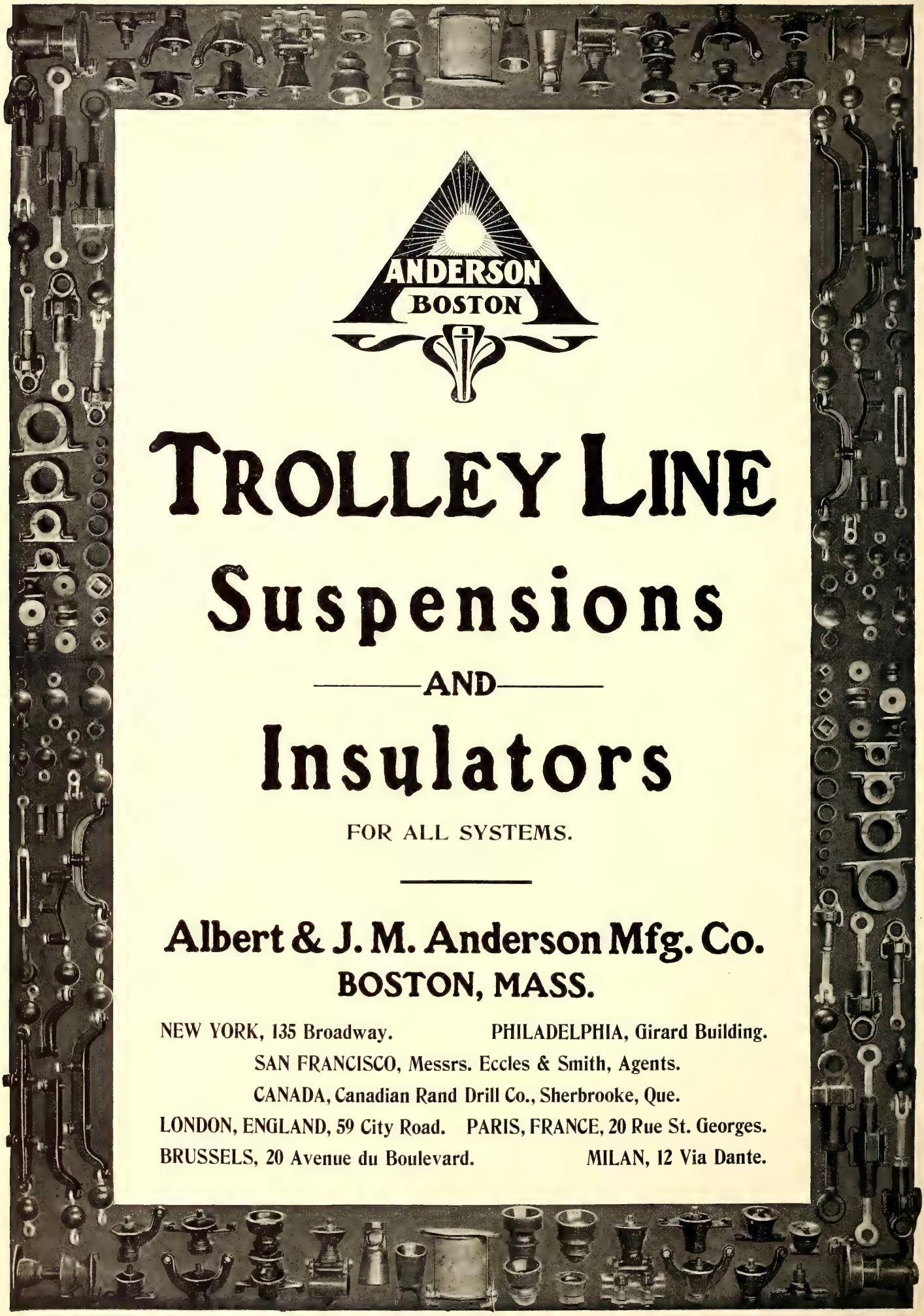
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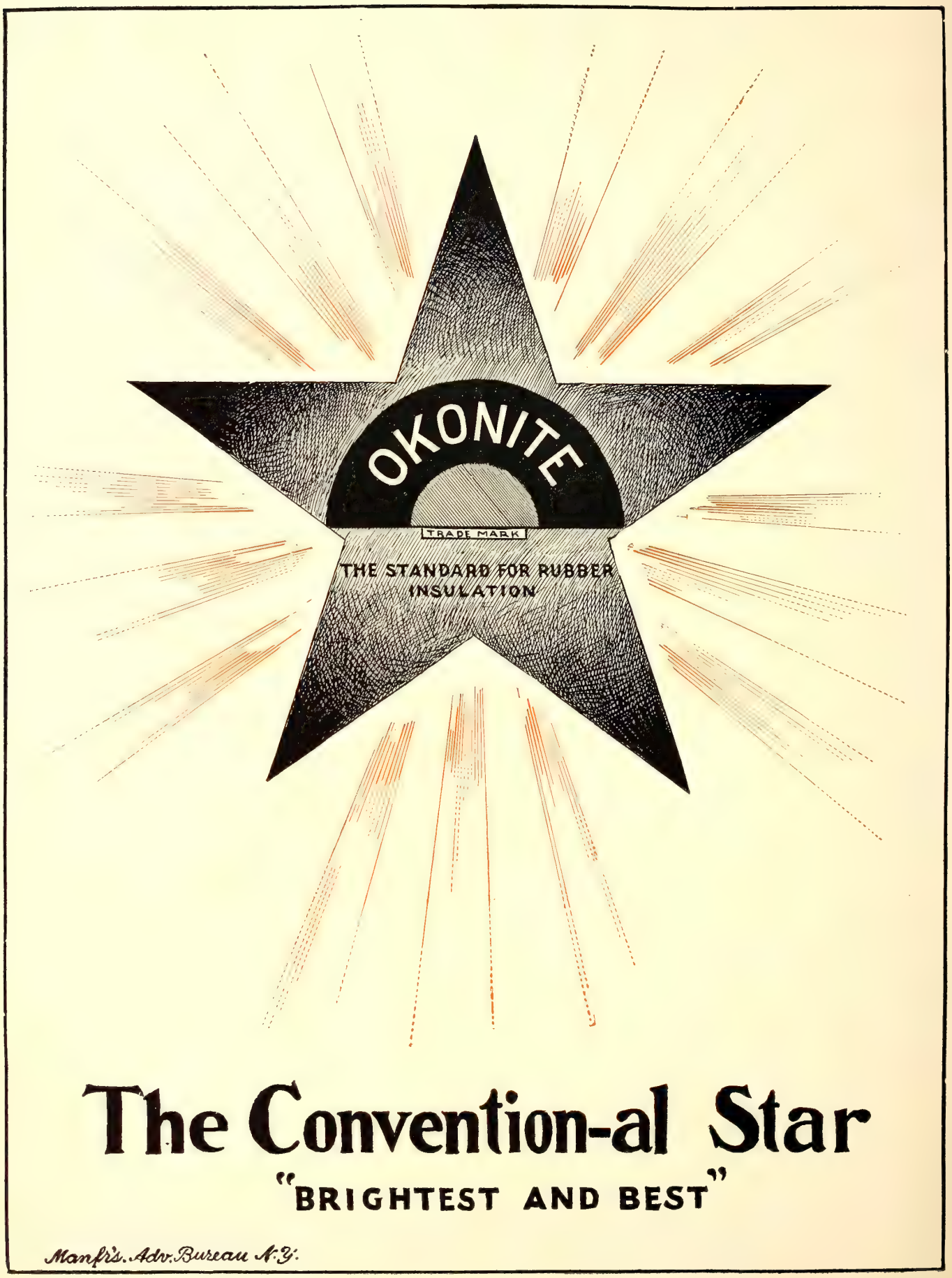
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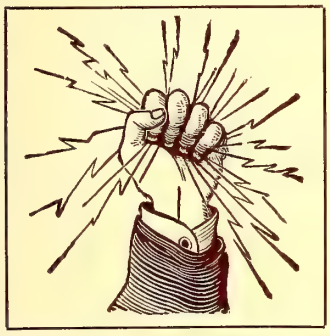
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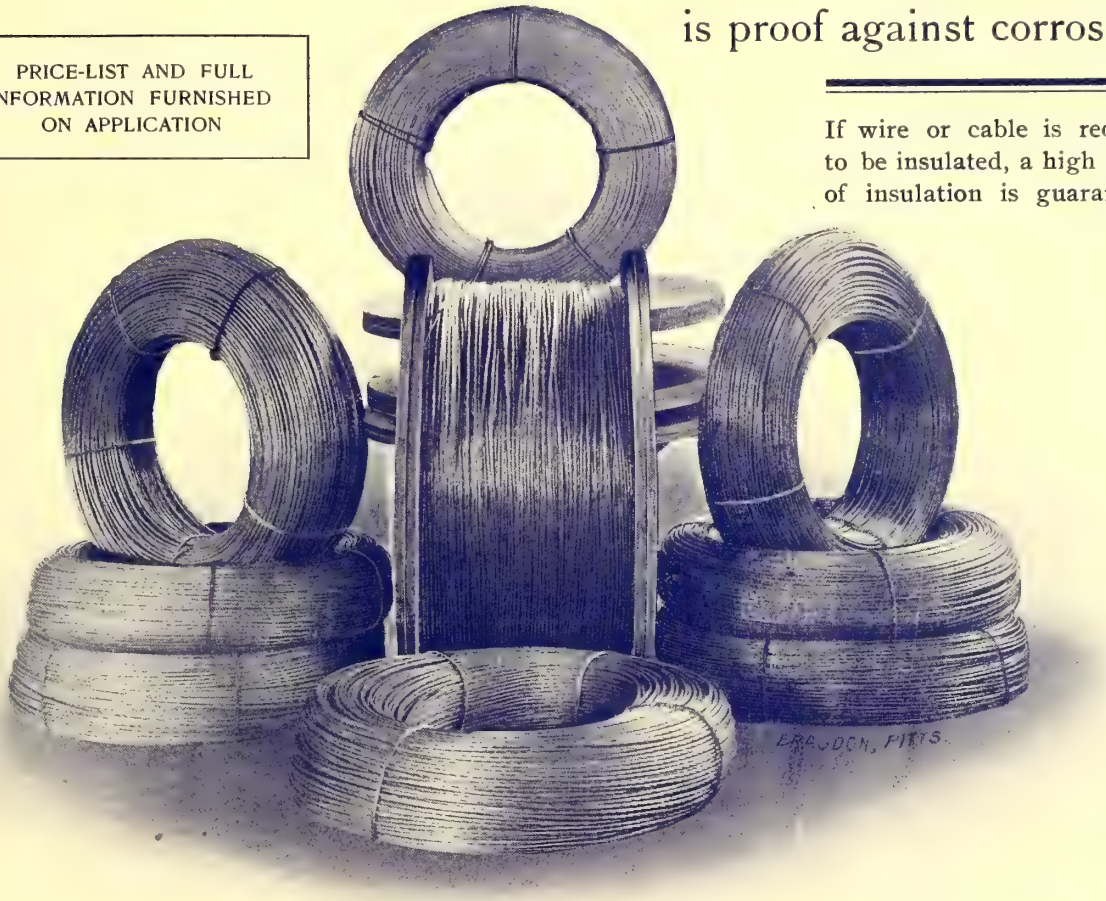
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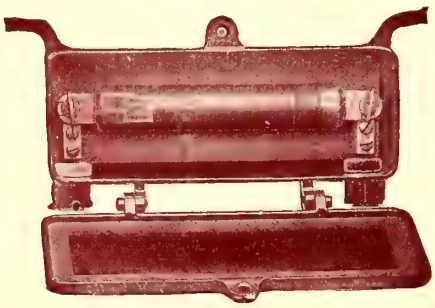
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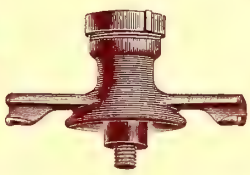
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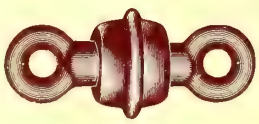
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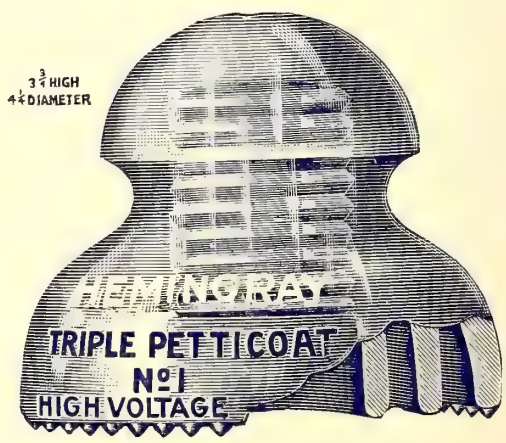


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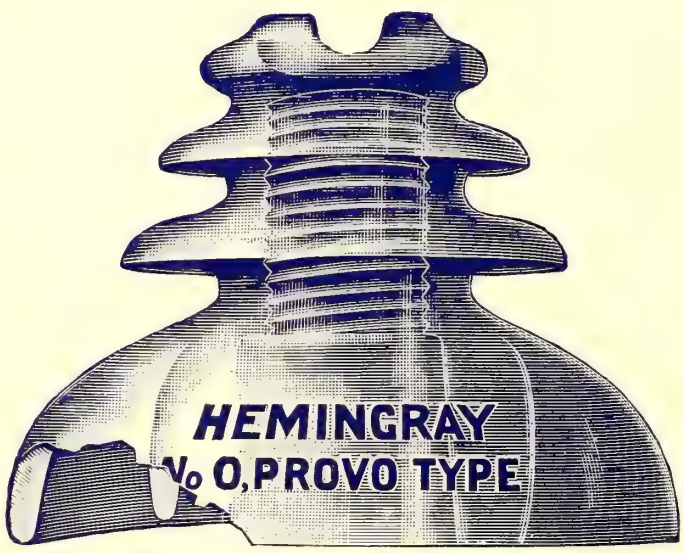


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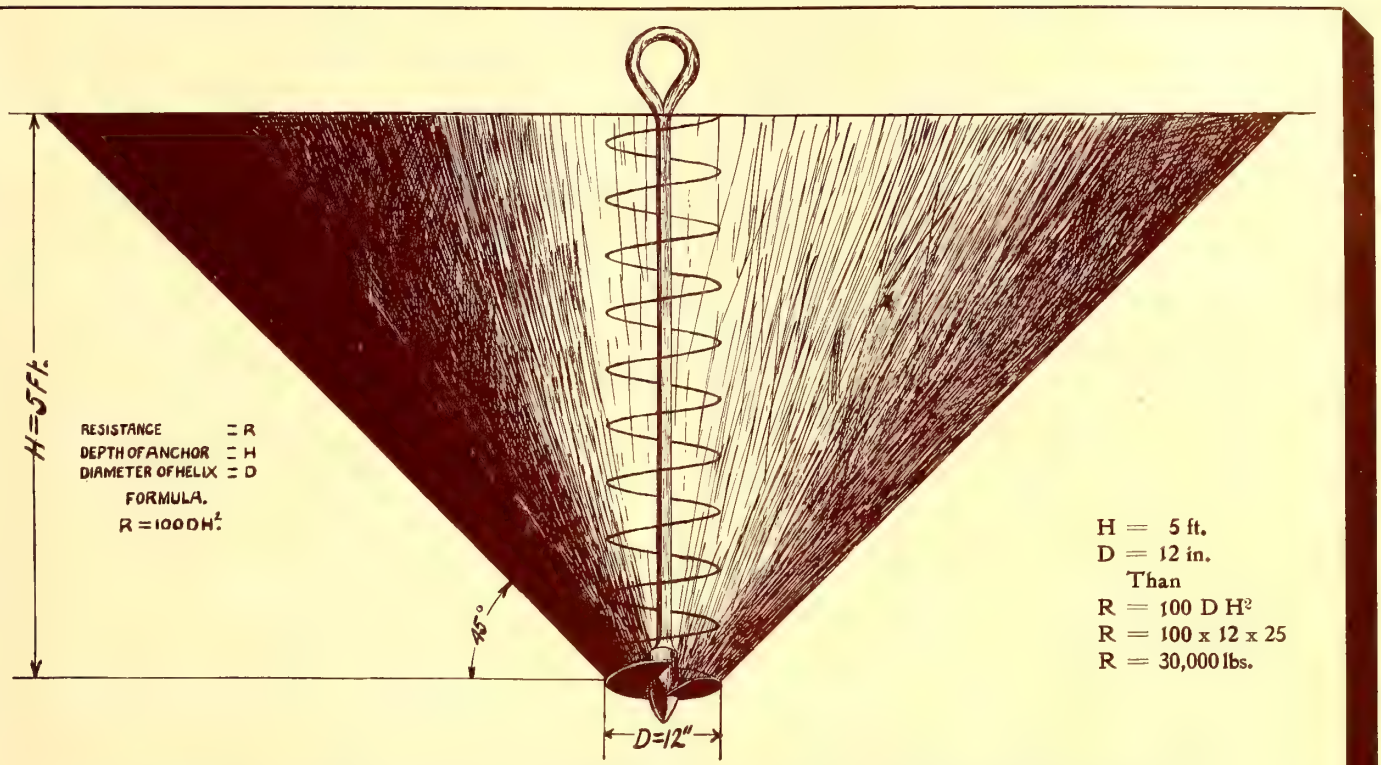
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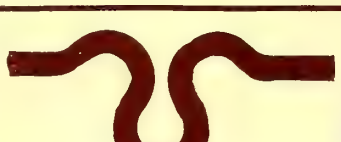
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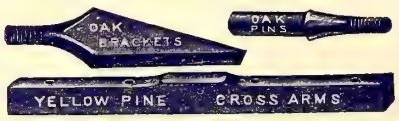
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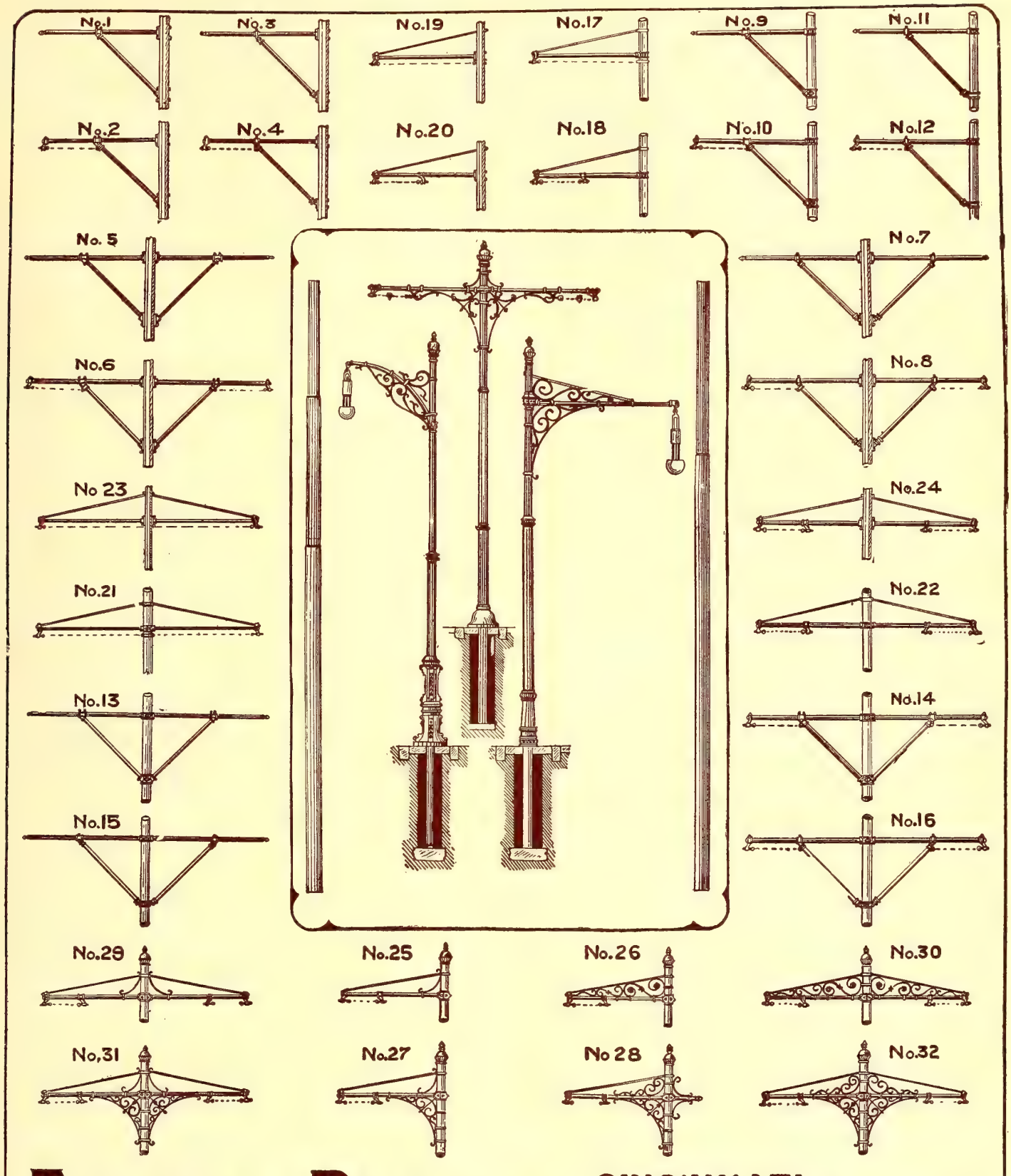
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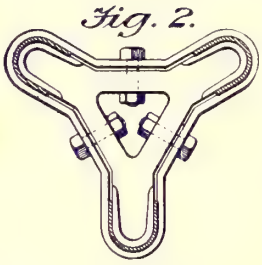
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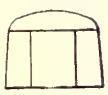




Fig. 6
CAP

Fig. 3.

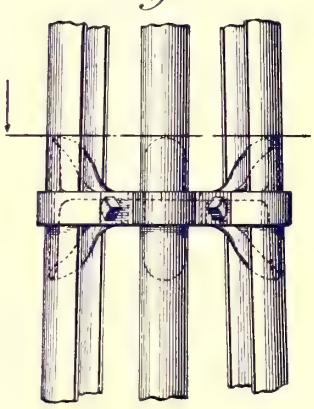




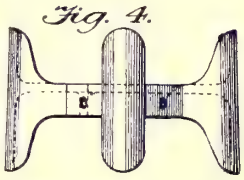
Fig. 5
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Fig. 7.
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Fig. 4.



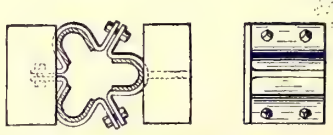


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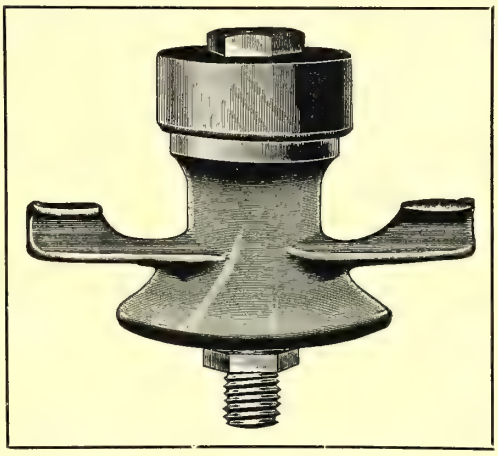
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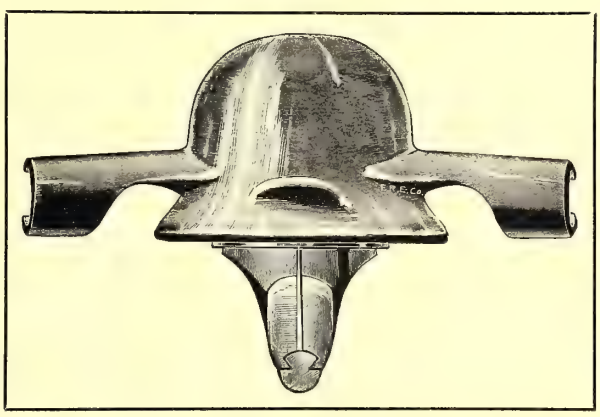
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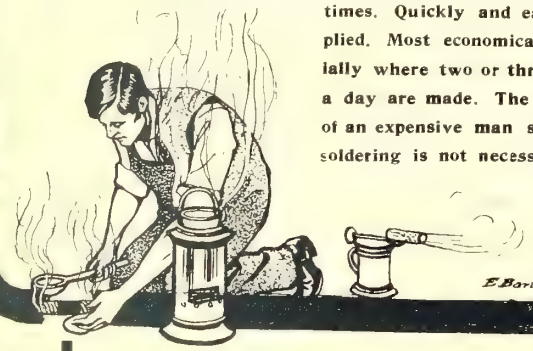
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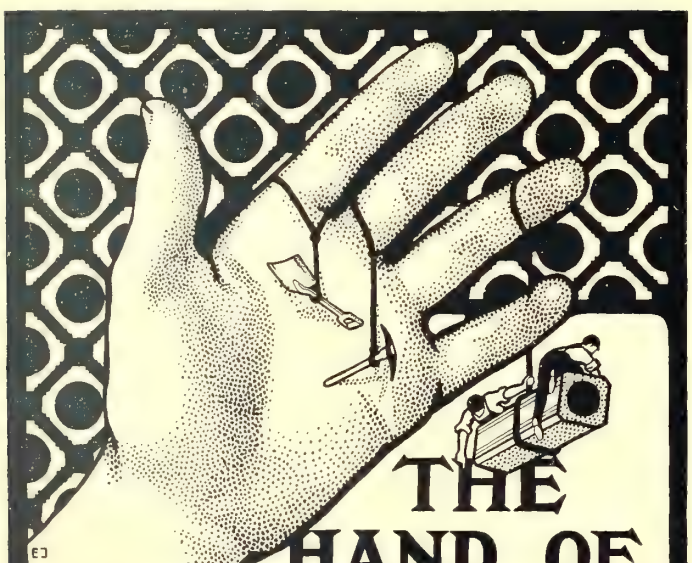
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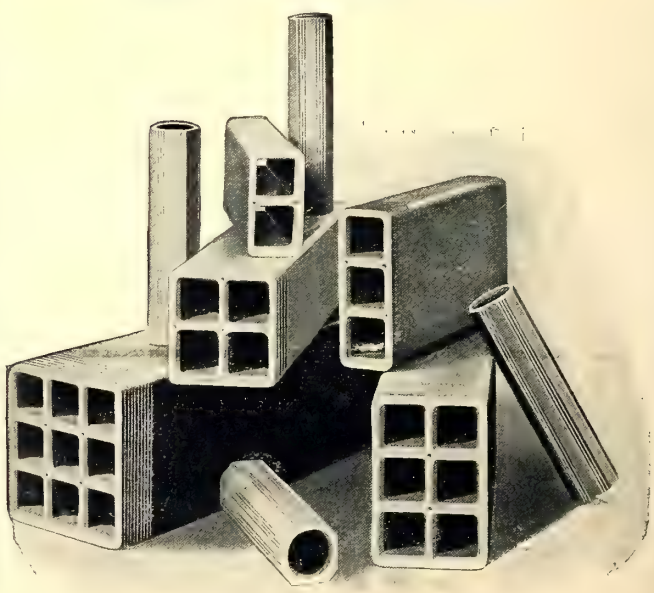
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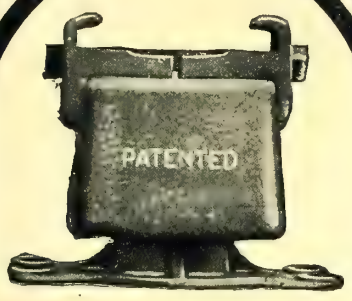
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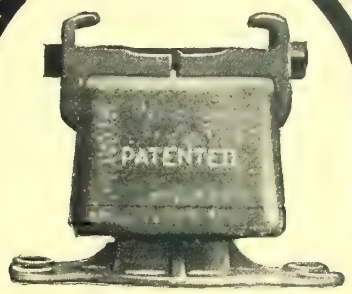
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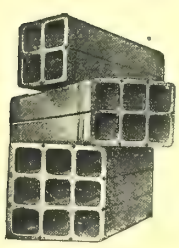
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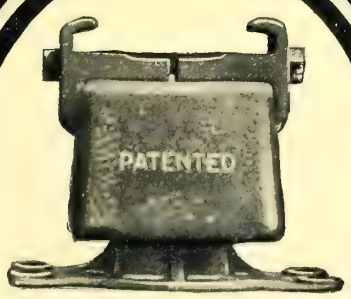
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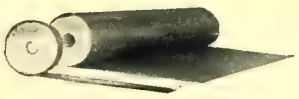
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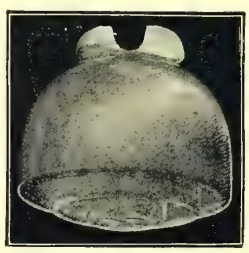
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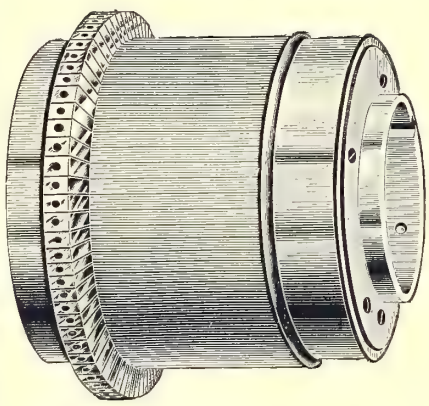
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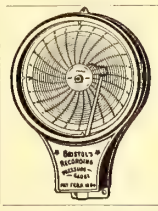
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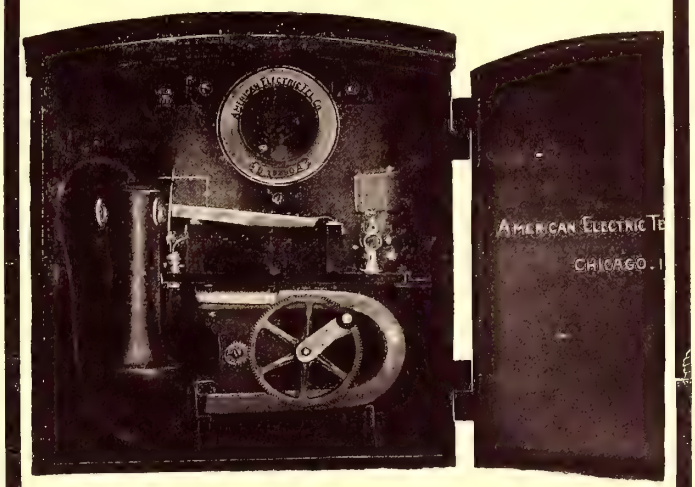
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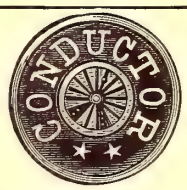
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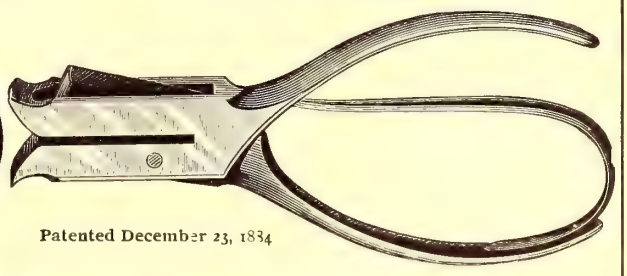
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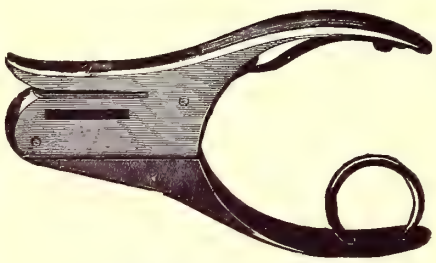
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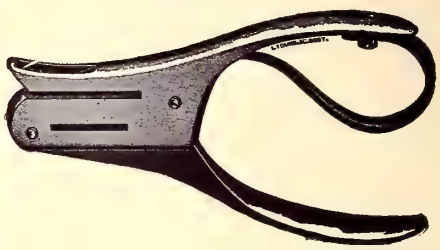
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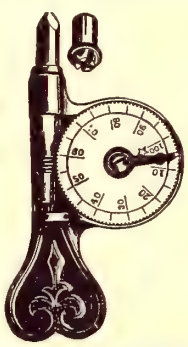
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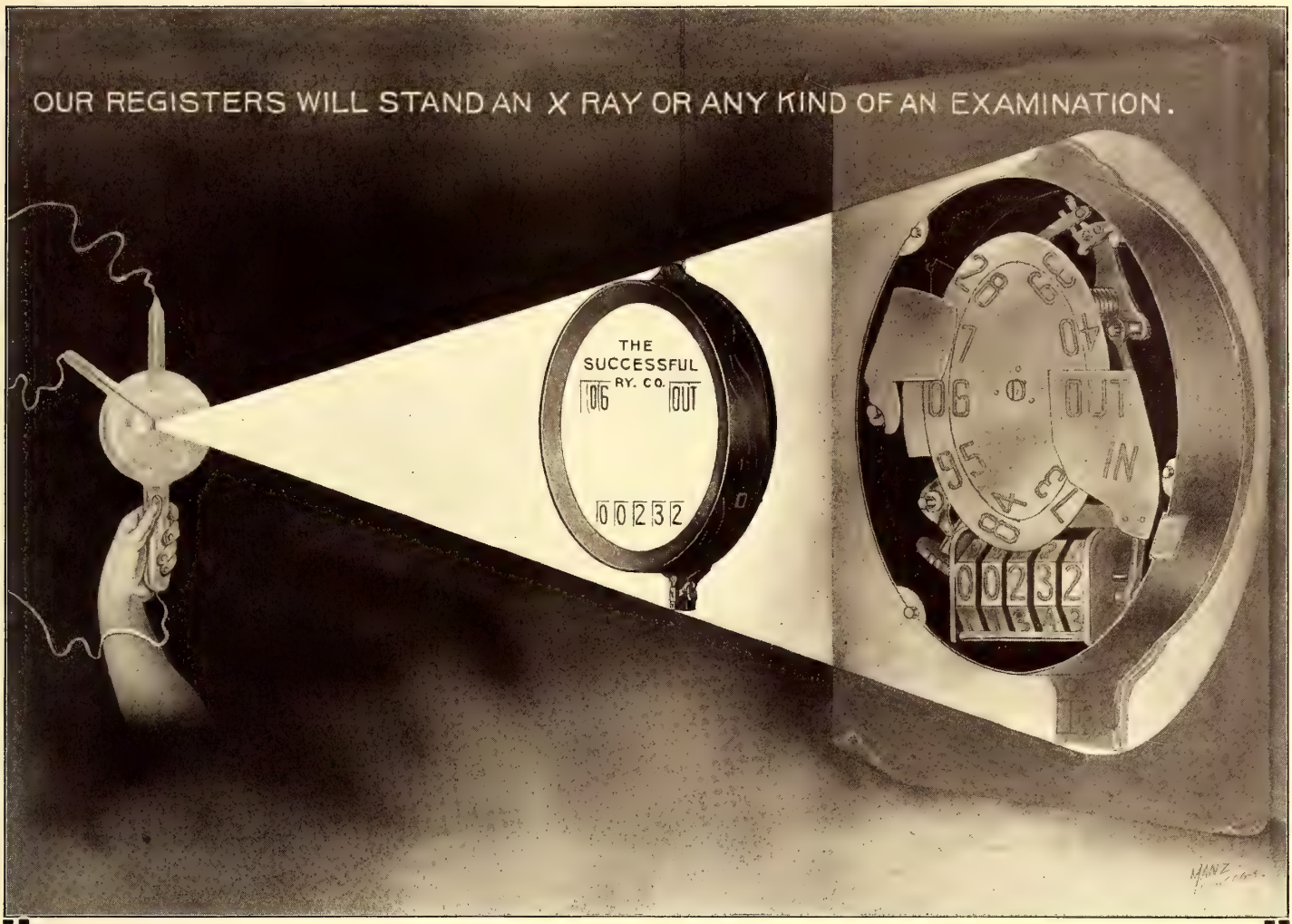
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The reason we call it

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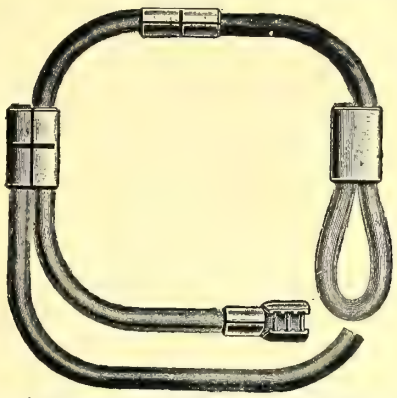


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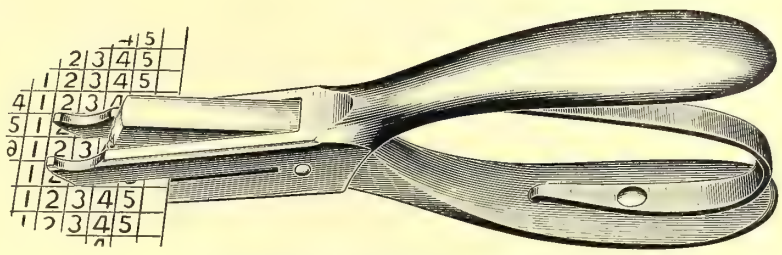
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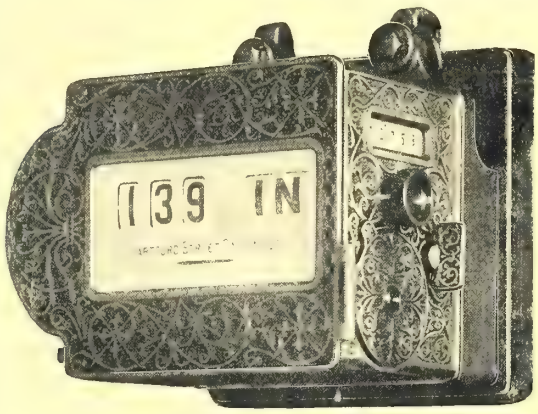


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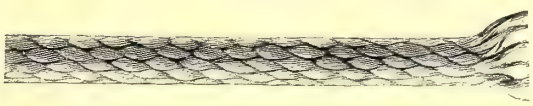
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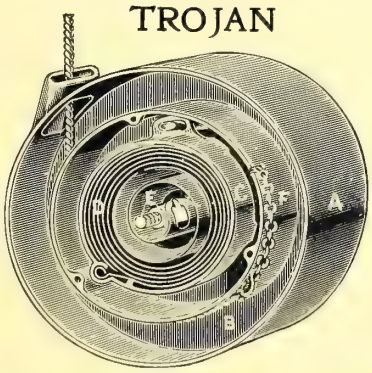
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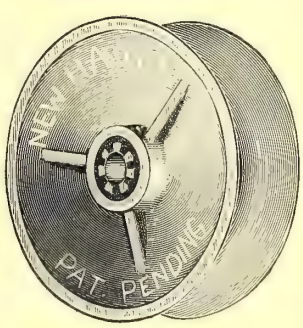
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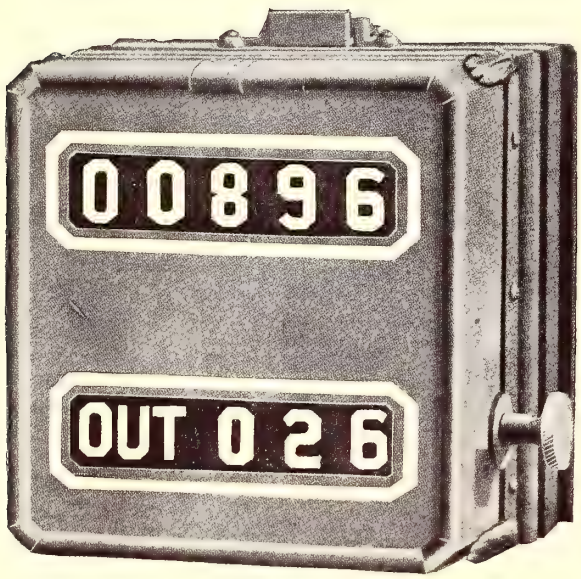


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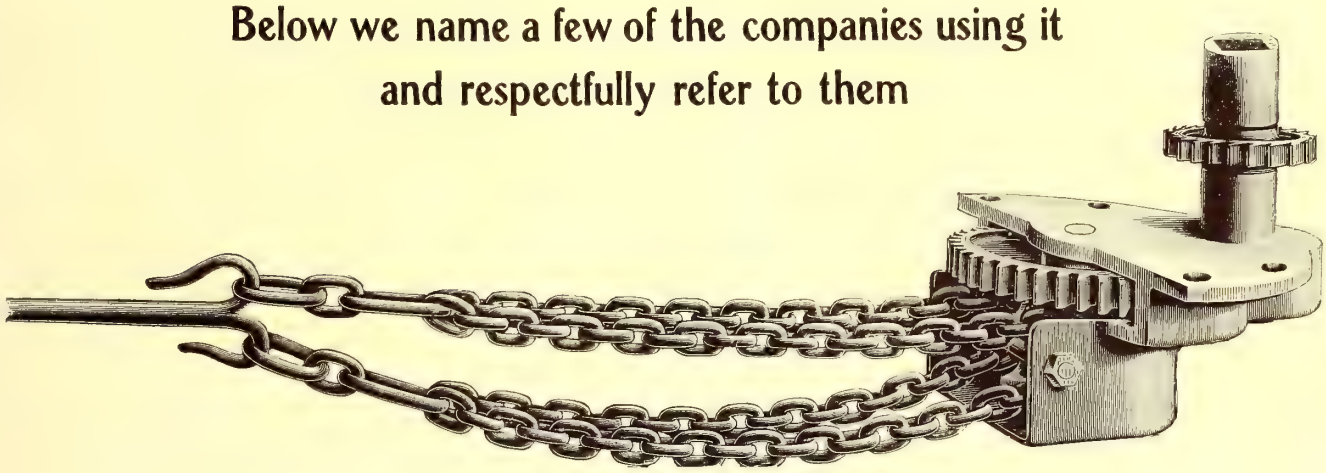
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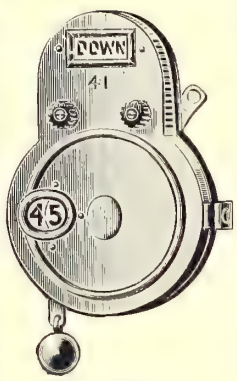
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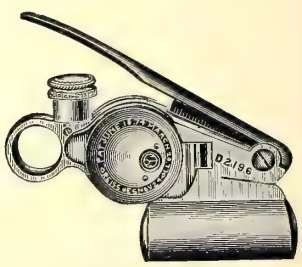
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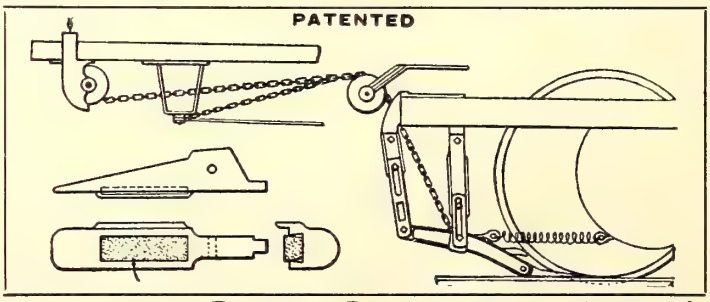
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Tell all your friends the good news and have them get some of the stock before it goes out of sight. It can be got now for $1.50 a share. Yours very truly,

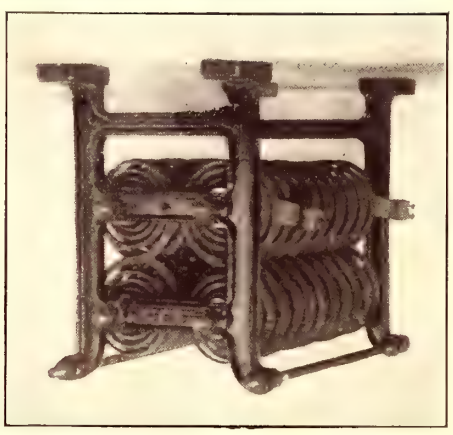
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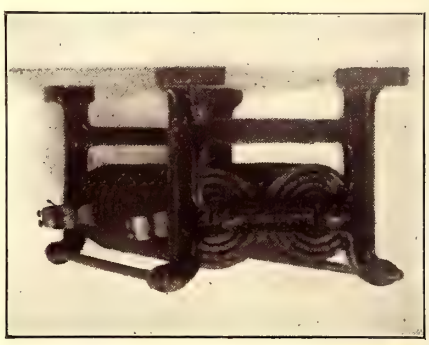
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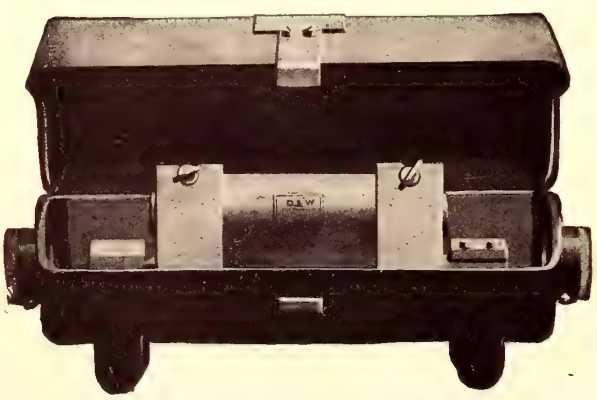


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M *echanism of pushover action, simplest in construction.*
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R *eferences affirm the merits of our production.*
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C *onstruction of full seat, strongest throughout.*
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N *o complicated and breakable racks and pinions used.*

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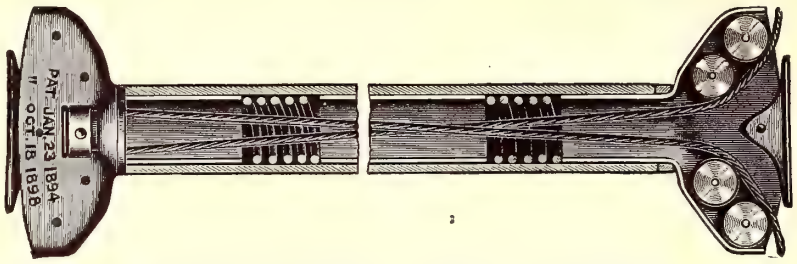
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Two inches more Sitting Space
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Unequalled Spring Construction

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No breaking or fraying of cables. Spring-pressed shoes hold curtain. Adapted for convertible or open cars. Can't bind or stick in grooves.

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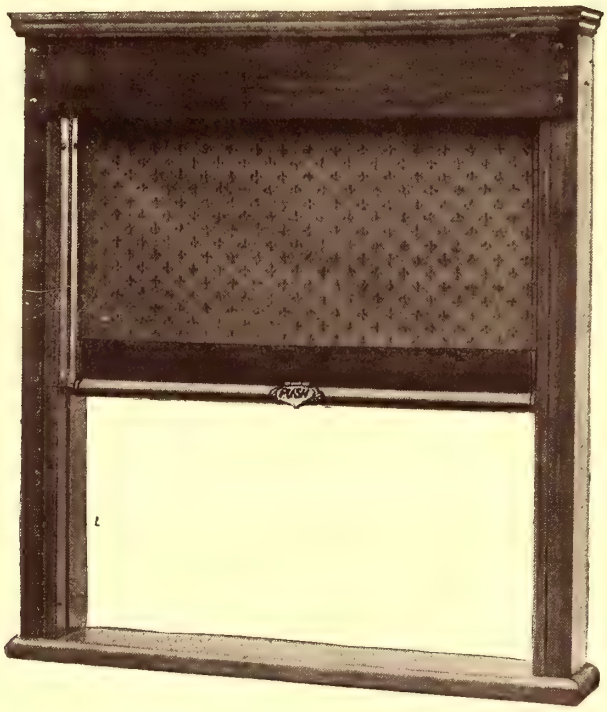
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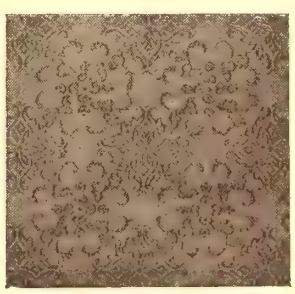




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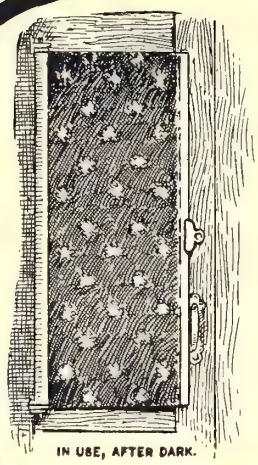
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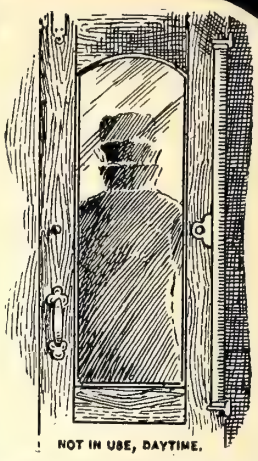
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By equipping your cars with our

AUTOMATIC VESTIBULE SHADES

you materially lessen the chances of accidents at night.

The motorman is enabled to see what is going on outside, instead of being blinded by the light from within the car.

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We have our own idea of a shade which is a vast improvement over any other. This shade is ornamental, is always out of the way, yet ever ready for use. It will stay on the roller.

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The Keeler "Eccentric" Fixture has no cables, adjusting or retaining devices. Its only bearing points are pivoted eccentric rolls.

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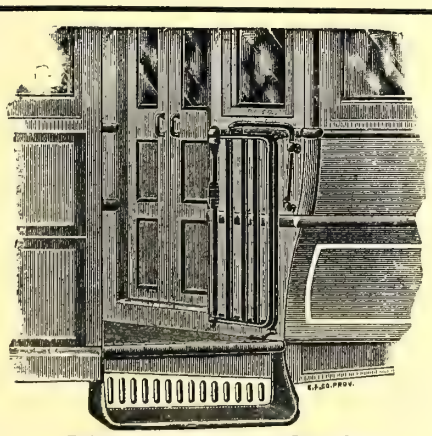
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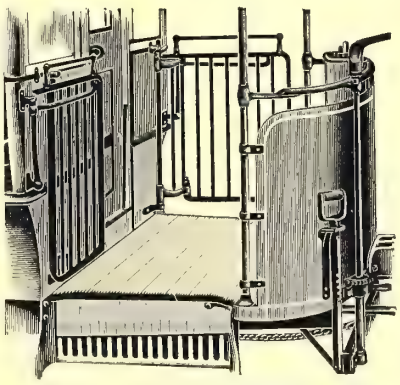
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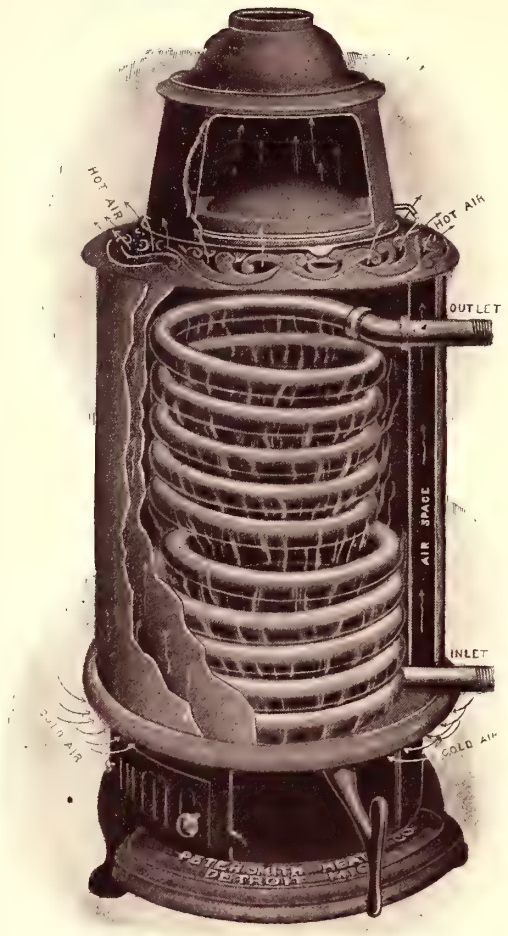
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SAVING OVER $2 In Cost of Operation per car daily

AND

OVER $7,000 In Cost Power House and Feeder Equipment per car

EXAMPLE

A 40 ft. Interurban Car equipped with twenty suspended electric heaters, operated on direct current proposition twenty miles long, with central power house; Voltage at power house 600, on line 500, at end of line 400 *vs.*, the same car equipped with a Peter Smith No. 2 Hot Water Heater Equipment.

Saving Daily Cost Operation:

Twenty Electric Heaters @ 1 Amp. each = 20 Amp. × 500 Volts = 10 K. W. × 16 hours service = 160 Kilo-Watt-hours, which on average Interurban road would cost about 1½ cts. (especially as this is usually an overload), making total cost per day $2.40 per car.

Peter Smith No. 2 Hot Water Heater Equipment is guaranteed to heat a car of this size uniformly and pleasantly on an average daily consumption not to exceed 100 lbs. of red ash nut coal, making total cost @ $5 per ton, 25 cts. per day.

Saving in Cost $2.15 per day per car.

Saving Cost Power & Feeder Equipment:

The above equipment will consume 20 Amp. of current × 500 Volts (= 10 K. W.) × cost of power house equipment @ $75–$100 per K. W. = $750.

Figuring covered feed wire required to carry current 10 miles (power house being central) to each car as follows:

Formula:

$$\frac{14.4 \times \text{Length Transmission in Ft.} \times \text{Amp.}}{\text{Drop at End of Line}}$$

Or,

$$\frac{14.4 \times 5228 \times 20}{100} =$$

150,000 Circular Mils @ 2300 lbs. copper per mile = 46,000 lbs. copper @ 15 cts. lb., say $6900.

Cost Power House.....	$750
Cost Feeder.....	6900
Total Saving per car.....	$7650

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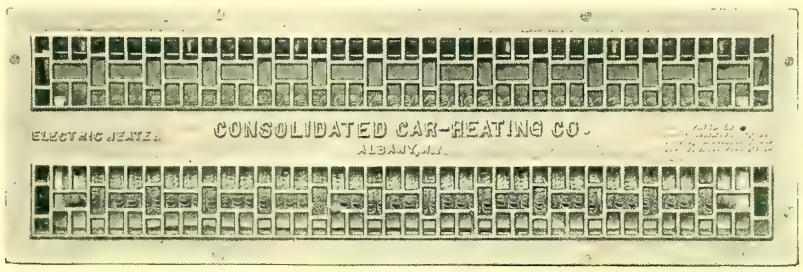
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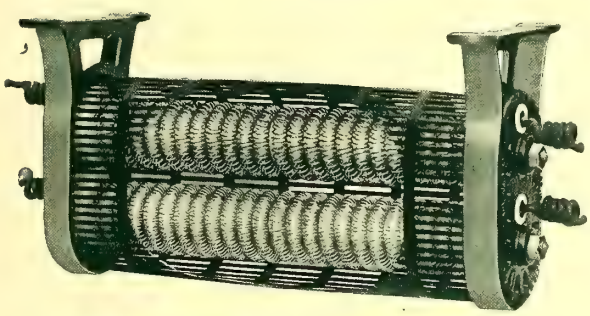


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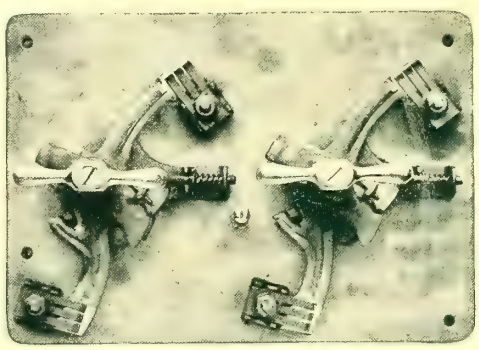
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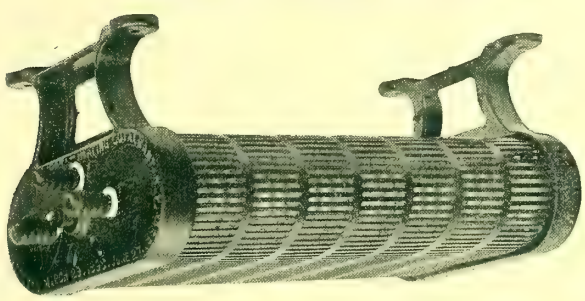
Record: Ten Years' Actual Service



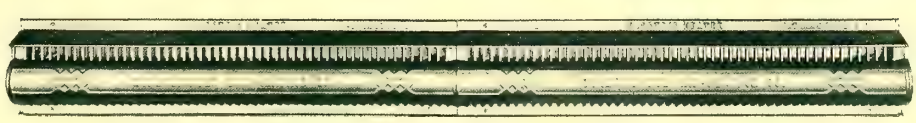
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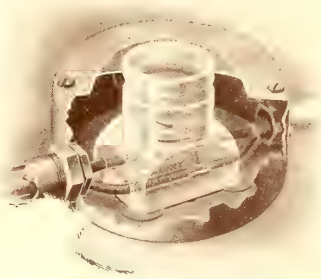
Scene showing the Norbitt Temporary Socket as used in a series of 500 volts, and the

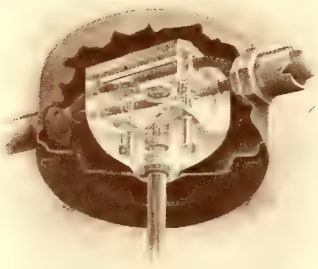
SYRACUSE CHANGEABLE ELECTRIC HEADLIGHT

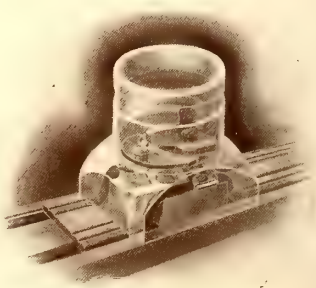
on the dash of trolley car.











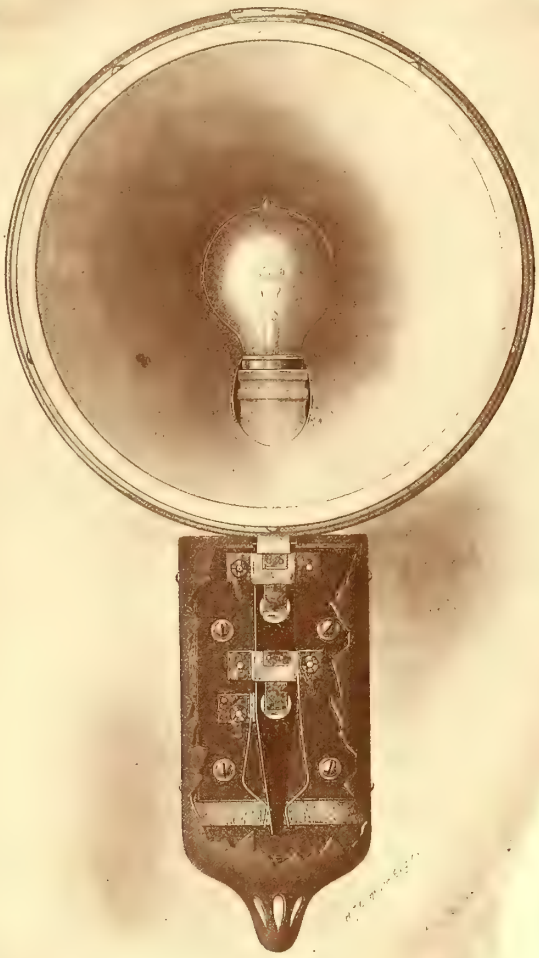
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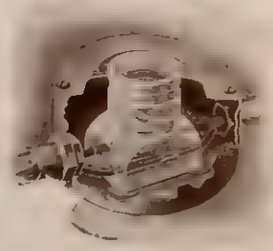
Scene showing the Norbitt Temporary Socket as used in a series of 500 volts, and the

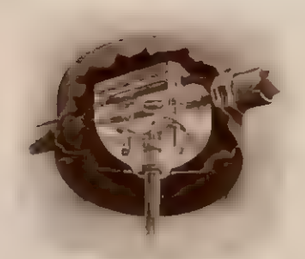
SYRACUSE CHANGEABLE ELECTRIC HEADLIGHT

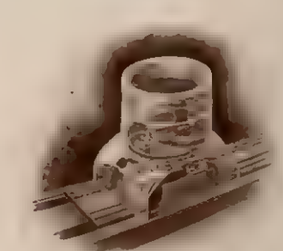
on the dash of trolley car.











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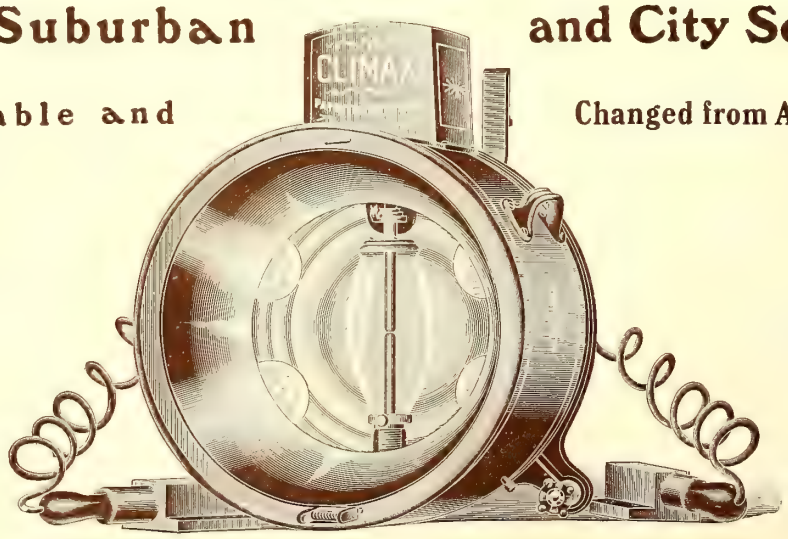
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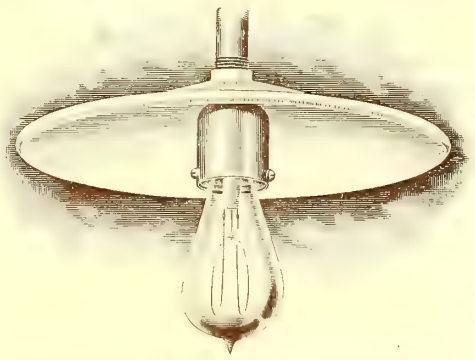
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Colorado Midland Ry. Co.
Wilkes-Barre & Hazleton Ry. Co.
Lake Street Elevated R. R. Co.
Sardis & Delta R. R. Co.
Detroit, Monroe & Toledo Short Line Ry.
Chicago City Ry.
New York & Ottawa R. R.
The Paducah City Ry.
Lynchburg Traction & Light Co.
Boyne City & Southeastern R. R.
Holyoke St. Ry. Co.
Seattle Electric Company.

This list will at least prove that Steel Wool Journal Packing is not in an experimental stage. To them it has demonstrated its superiority over any other packing; to prove it to your own satisfaction

Let us send you a trial sample.

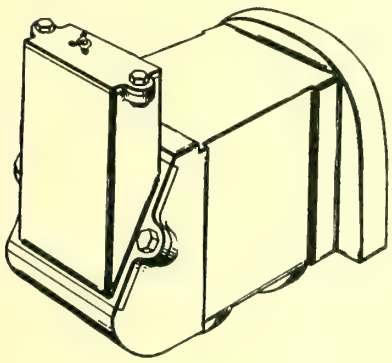
Federal Supply Co.

1209-1213 Stock Exchange Bldg., CHICAGO, ILL.

STANDARD AUTOMATIC LUBRICATOR CO.

810 Arcade Building

PHILADELPHIA, PA.

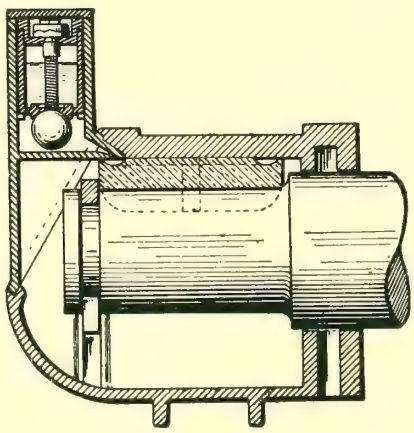


No Hot Journals

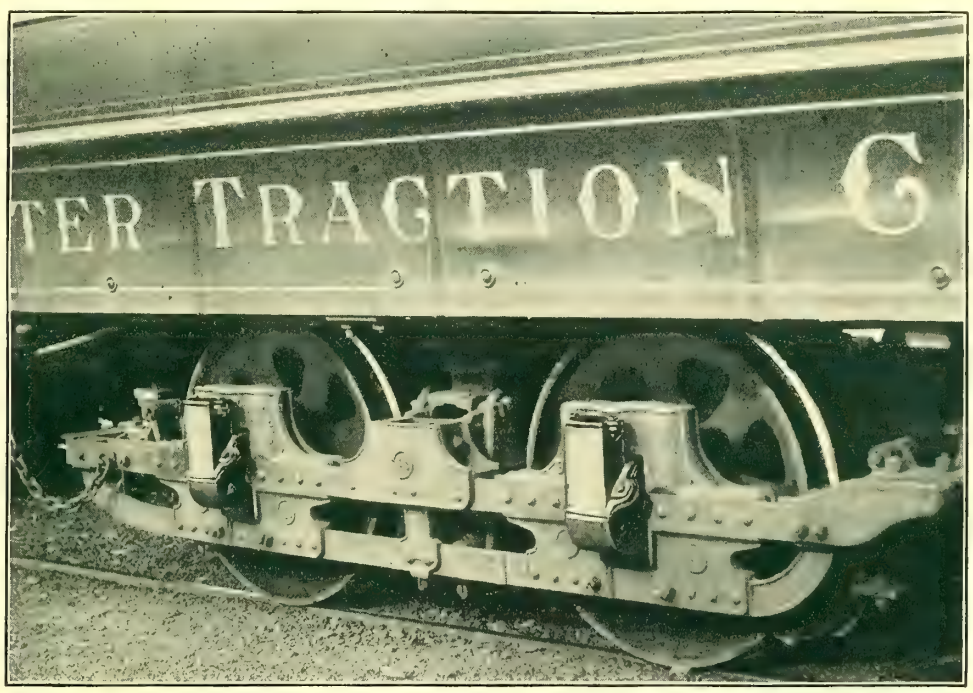
No Lateral Cut

No Oil Wasted

Oil Always Clean



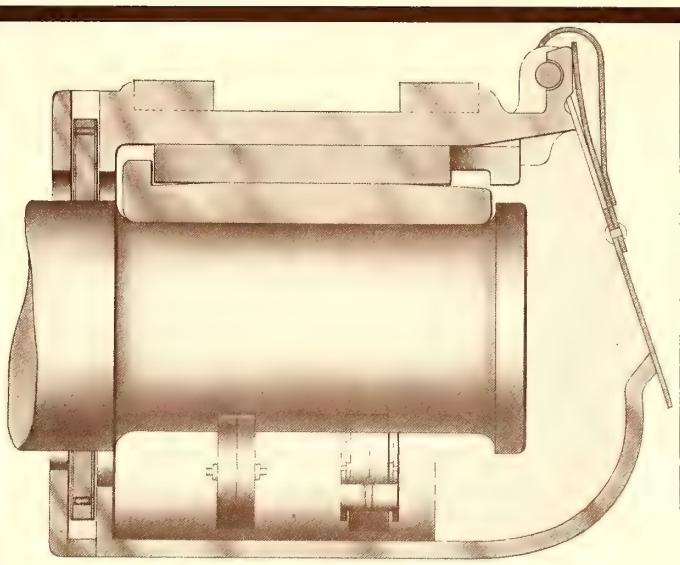
Lead Linings of Bearings will last two to three years; great saving in Oil, Waste, Bearings and Labor. Lubricators made to fit any Car box without change.



EQUIPPED WITH THE "STANDARD AUTOMATIC LUBRICATOR"

HAVE BEEN IN MOST SUCCESSFUL OPERATION OVER THREE YEARS

The cost of lubricating this car, making a mileage of 88,900 miles, was less than seven-tenths of a cent per 1000 miles, including bearings. The original lead linings of the bearings have continued in use two years and are still in service. No case of heating since car was first equipped. Boxes carry sufficient oil to lubricate 60 to 90 days. Box is dust-proof and only clean oil is fed. No waste required.



M. C. B. 5 in. x 9 in Journal, Sectional Side View

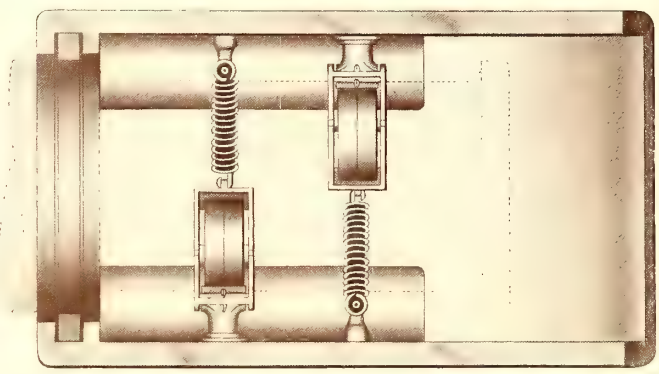
ECONOMY JOURNAL LUBRICATORS and DUST-GUARDS

Installed on Following Roads:

Aurora, Elgin and Chicago Railway
Chicago City Railway, Halsted St. and Wentworth Ave. Lines
Pennsylvania R. R., Passenger Locomotive Tenders
Wabash R. R., Passenger Locomotive Tenders

See Our Exhibit at the St. Railway Convention, it will interest you

Simple in its Construction makes it Durable. Can be applied to all Standard Journal Boxes

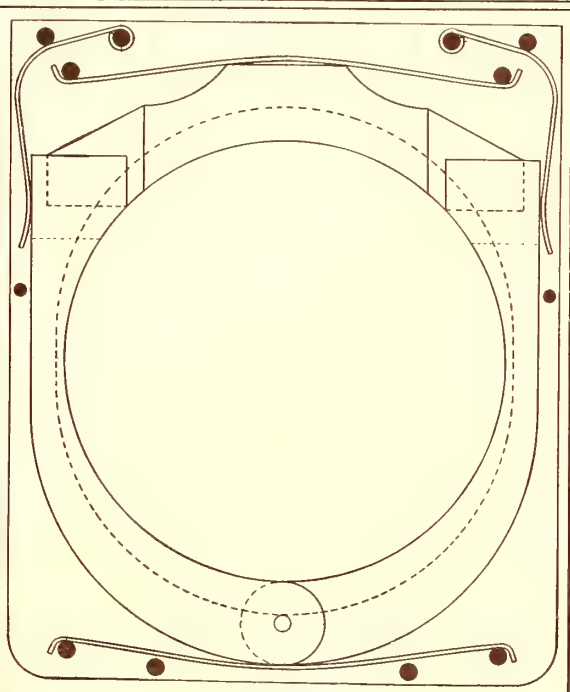


Looking down on Lubricators in position in Journal Box

Ball-Bearing Lubricating Wheels

Never "RUN HOT" or STICK

Dust and Sediment settles to the bottom of Journal Box, is not carried up to Journal.

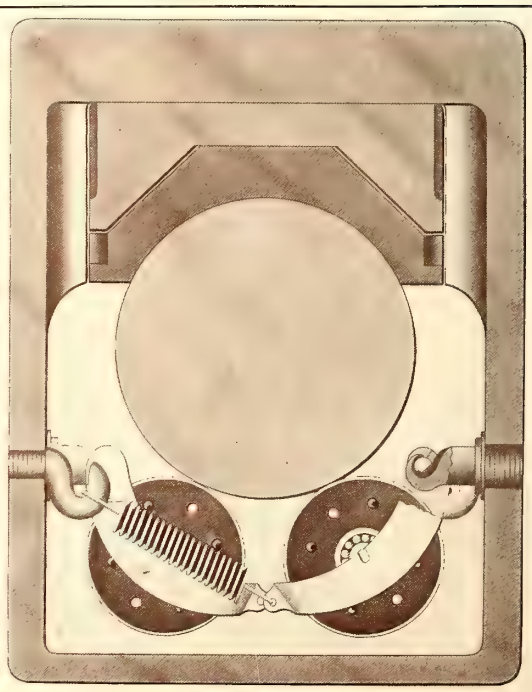


Dust-Guard

Vulcanized Fibre Self-Adjusting Dust-Guard keeps the oil in the box. Will wear for Years in the most severe service.

SAVES OIL 50 %

Adjoining cut shows method of applying Lubricator to Journal Box.



Sectional End View

RAILWAY JOURNAL-LUBRICATING CO.

MILWAUKEE
12th and St. Paul Sts.

CHICAGO
Monadnock Bldg.

BRUCK SOLIDIFIED OIL CO., 256 DOVER STREET, Boston, Mass.

Capital Stock, $500,000.00

OFFICERS:
Fred'k Kendall, Pres. — J. N. Bruck, Vice-Pres. and Mgr.
F. C. Dennis, Ass't Mgr. — J. T. Lennox, Treas. — Andrew A. Highlands, Sec'y

SOLIDIFIED OIL
FOR
MOTOR and JOURNAL BEARINGS
UNAFFECTED BY HEAT OR COLD

Our Solidified Oil is an absolutely pure mineral oil, containing no acids, alkalies or chemicals of any kind.

We Guarantee Solidified Oil

to last longer and give better lubrication than any other lubricant now on the market. We can afford to; we have journal bearings packed with Solidified Oil today which have run 60,000 miles without replenishing; also motor bearings that have run 20,000 miles without replenishing.

Heavy Solidified Oil for Motors, to use in Cups.
Heavy Solidified Oil for Journals, to use with Waste.
Soft Solidified Oil, the ONLY Lubricant known to Feed Through Felt Wicking during all seasons of the year, for Motors or Journals.

IT IS ABOUT TIME YOU DROPPED US A LINE FOR SAMPLES.

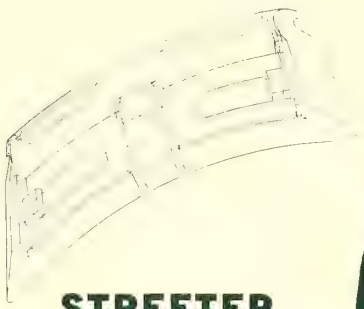
LUMEN BEARING CO.

MANUFACTURERS OF
LUMEN
TRUCK BEARINGS
ALPHA
CHECK PLATES
LOTUS
LINING METAL
IDEAL
TROLLEY WHEELS
LUMEN
MOTOR BEARINGS
WRITE US FOR PARTICULARS

BUFFALO NEW YORK

BRAKE SHOES

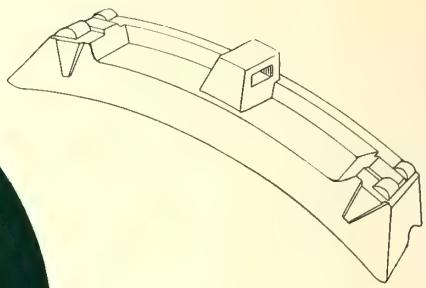
The Approved Standards of American Railway Practice for Steam and Electric Service



STREETER

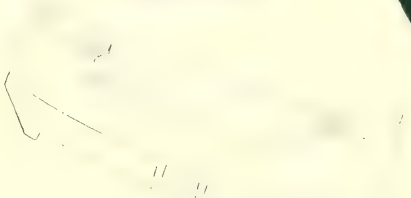
LAPPIN

THE AMERICAN BRAKE SHOE & FOUNDRY CO.
NEW YORK
170 BROADWAY
CHICAGO
WESTERN UNION BLDG.

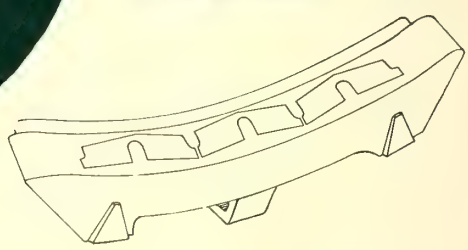


CORNING

DIAMOND "S"



and "U" TYPES



Elevated and High Speed Interurban Equipments require Steel Back Brake Shoes

MISCELLANEOUS IRON AND STEEL CASTINGS

Marginal Protecting Strip

AN ECONOMY IN THE MAINTENANCE OF ASPHALT PAVING



UNPROTECTED PAVING



Top View

MARGINAL PROTECTING STRIP



Bottom View



PROTECTED PAVING

"DETROIT" RE-INSULATING MACHINE

In Use Upon 35 Roads—Great Money Saver

BRAKE SHOES

With Re-Inforced or Strengthening Backs

Successfully used for several years, and proved to be the superior, dollar for dollar, over any other shoe.

Nearly 100% wear obtained when shoe constructed with our patented re-inforced back.

ALLEN & MORRISON

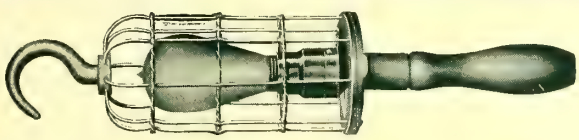
BRAKE SHOE AND MANUFACTURING CO.

721-722 Woman's Temple

CHICAGO, ILL.

ELECTRIC RAILWAY AND MINING SUPPLIES

LARGE STOCK PROMPT SHIPMENTS



WRITE FOR CIRCULAR ON OUR PORTABLE LAMP GUARD

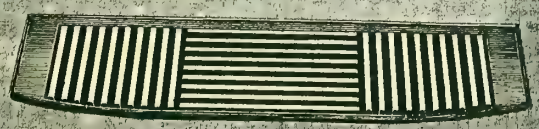
PORTER & BERG

309 DEARBORN ST., CHICAGO, ILL.

YOU NEED THE

Universal Safety Tread

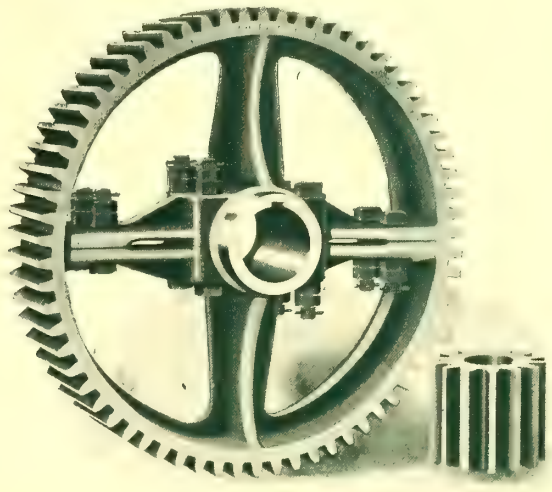
On Your Car Steps, Platforms and Floors.



Clean, Safe, Durable. Outwears all other forms of Tread.

Samples and Price List Furnished.

Universal Safety Tread Co., 45 BROADWAY, NEW YORK, N. Y.



You Must Admit

that it is good policy to purchase the very best grade of supplies obtainable

Our line of Electric Haulage supplies is complete in every respect and each and every item represents the best of its type on the market. High Grade and guaranteed material does not necessarily mean high prices. This we will convince you of if you will send an inquiry

We Sell and Ship Promptly

Protected Rail Bonds
Union Standard Trolleys
Wilson Trolley Catchers
Nuttall Gears and Pinions
M. & E. Line Material
International Fare Registers
New Haven Fare Registers
Garton & Wurts Arresters
Barrett Automatic Jacks

Send for our latest Catalogue

General Railway Supply Co.

PARK BUILDING

PITTSBURG, PA.

Why Use Antiquated Handles For Your Register Rods?

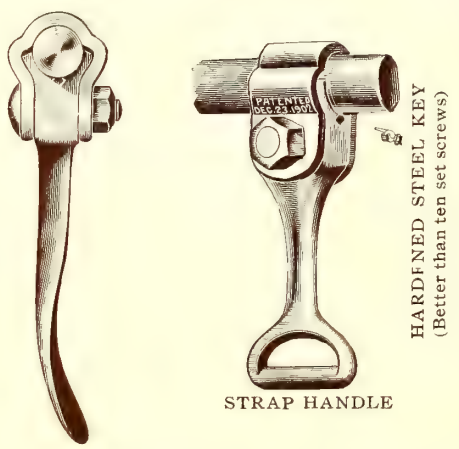
ARE there not two great objections to the handles you are now using—the ease with which they work loose, and the difficulty with which they are replaced?

If you want to avoid all this trouble and waste of money, specify the Oberg handles when ordering new cars, and keep them in stock to replace the set screw ones you are now using.

MADE IN
ANY DESIRED SHAPE.

COST ABOUT THE SAME AS THE OLD FASHIONED STYLE.

MUCH CHEAPER THAN THE SQUARE ROD HANDLES.



STRAP HANDLE

SEND
FOR SAMPLES OF THE
OBERG
HANDLES
AND YOU WILL BE
CONVINCED
OF THEIR SUPERIORITY

THE OBERG HANDLE is readily put on or removed without disconnecting the rod from the register, or from its bearings. None of the other handles has to be removed, and the operation of the register is not disturbed. The handle cannot possibly get loose even if worked both ways, on account of the powerful grip it has, and the hardened steel key which is set in the composition and which is pressed into the steel rod when the bolt is tightened up.

C. O. OBERG & COMPANY

100 Purchase Street, Boston, Mass.



The Padded Handle Gives Comfort to the Passenger who has to stand

Over 200,000 Ordered for Use in New York, Michigan and Ohio

Myers' Y-formed Safety Car Strap

Prevents accidents to passengers when a car is going around curves or when it is suddenly stopped or started

Straps of this type cannot accumulate, owing to the fact that they are placed between bar supporters and therefore cannot slide, thus preventing accident. On the ordinary strap the weight of a man is concentrated at one point. On our strap the weight is distributed over six inches, thus reducing the strain on the bar **One-sixth.**

WRITE FOR PRICES AND SAMPLES

Neatly and Strongly Made of the Best Leather

SAFETY CAR STRAP COMPANY

4 and 6 WHITE STREET, NEW YORK CITY

GEO. C. EWING
131 STATE STREET : : : BOSTON, MASS.

Electric Railway Material
Prepared to furnish complete construction, maintenance equipment and rolling stock for electric railways

---



Send for Samples.

SILVER LAKE WATERPROOFED CORD
FOR ARC LIGHT AND TROLLEY CORD.

SILVER LAKE CO., - Boston, Mass.

Q and C Stanwood Car Steps

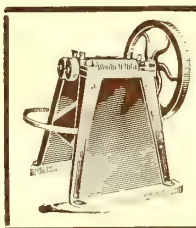
Combine perfect safety, cleanliness, appearance and minimum cost for repairs

RAILWAY APPLIANCES COMPANY
Gen'l Offices, Old Colony Bldg., Chicago
New York Office, 107 Liberty St

Shall we send you a copy of our

Classified Catalogue of Engineering Books?

McGRAW PUBLISHING COMPANY,
Book Department. 114 Liberty St, New York



PATTEN TICKET DESTROYER.

Don't burn your used tickets. Destroy them and avoid fraud. Remember, it is difficult to get a man to destroy anything of value to him.

Sell the old stock—it will soon pay for machine.

In use on the Boston & Northern R. R., Old Colony St. Ry. Co., Brockton St. Ry. Co., Waterbury El. Co., Bridgeport Traction Co., Buffalo Ry. and others.

Write for Circular.

PAUL B. PATTEN,
78 Lafayette Street, - Salem, Mass., U. S. A.

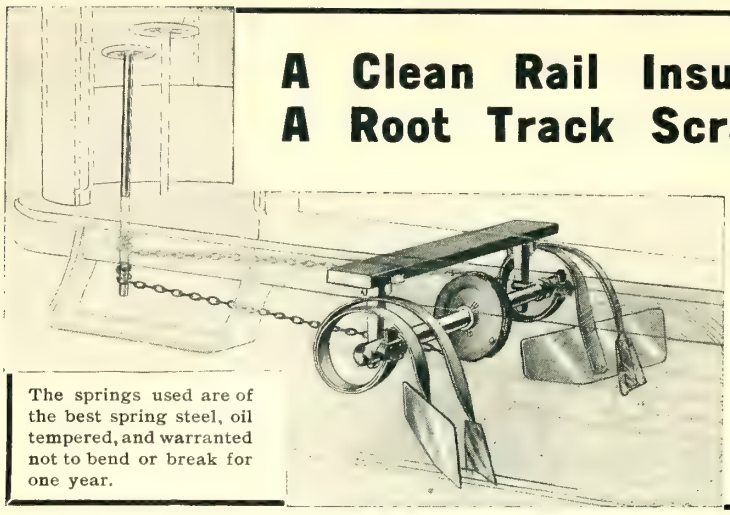
GEORGE KISSAM & CO.,
BRANCH OFFICES IN LEADING CITIES.

Largest Street Car Advertising Concern in the World.
We are prepared to negotiate for Long Time Leases with First Class Roads in any part of the United States.
GENERAL OFFICES, 253 BROADWAY, NEW YORK.

MOTOR BEARINGS
BRASS CASTINGS
JOURNAL BEARINGS
BABBITT METALS
TROLLEY WHEELS

BRADY BRASS COMPANY

Gen'l Office and Works
202-208 Tenth Street
Jersey City, N. J.
DANIEL M. BRADY
PRESIDENT



The springs used are of the best spring steel, oil tempered, and warranted not to bend or break for one year.

A Clean Rail Insures Perfect Contact — A Root Track Scraper Insures a Clean Rail

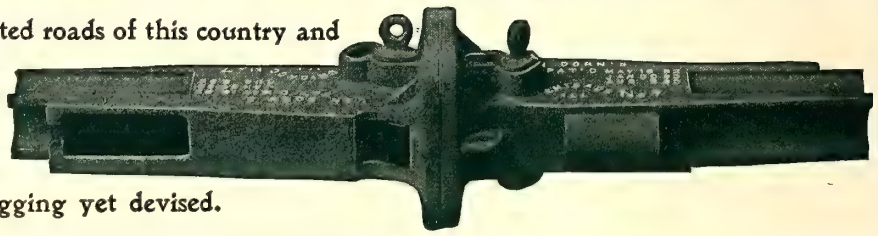
In adopting the principle of the spring harrow (which has been used for over thirty years) we have provided fully both for FROST and SPEED. The result is that the ROOT SCRAPERS will remove 50 per cent. more snow and do 50 per cent. better work than any other car scraper on the market.

Let us send you a list of companies using them or furnish you one for trial

Root Track Scraper Co.
KALAMAZOO, MICH.

VAN DORN AUTOMATIC COUPLERS

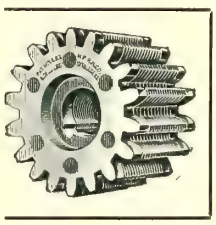
Are now a standard on all of the elevated roads of this country and are being made a standard on all the leading surface, street and interurban roads. All couplings are machine fitted and we make sixteen sizes to meet any requirements. We build the most complete draft rigging yet devised.



SEND FOR NEW CATALOGUE

W. T. VAN DORN COMPANY, Monadnock Block, **CHICAGO.**

Noiseless Pinions



Make quiet running cars. Let us tell you where it is to your advantage to use New Process Pinions. Others are using them. Why be behind the times?

The New Process Raw Hide Co.
SYRACUSE, N. Y.

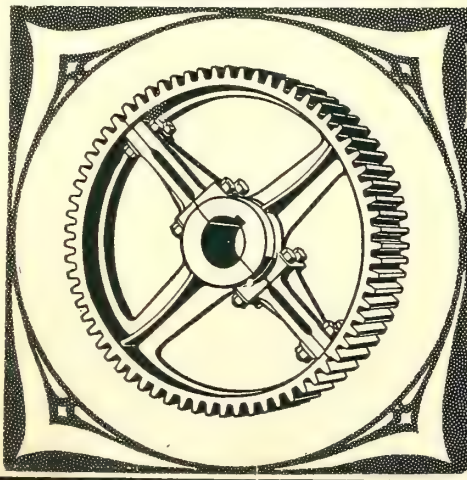
REG TRADE MARKS
"Phosphor-Bronze"
DELTA

THE PHOSPHOR BRONZE SMELTING CO. LIMITED,
2200 WASHINGTON AVE., PHILADELPHIA.
"ELEPHANT BRAND PHOSPHOR-BRONZE"
INGOTS, CASTINGS, WIRE RODS, SHEETS, ETC.
— DELTA METAL —
CASTINGS. STAMPINGS AND FORGINGS.
ORIGINAL AND SOLE MAKERS IN THE U.S.

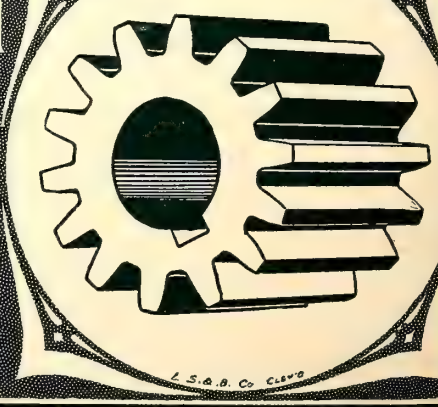
PITTSBURG WHITE METAL CO.
160 Leroy St., N. Y. 1739 Liberty St., Pittsburg, Pa.

BABBITT AND ANTI-FRICTION METALS

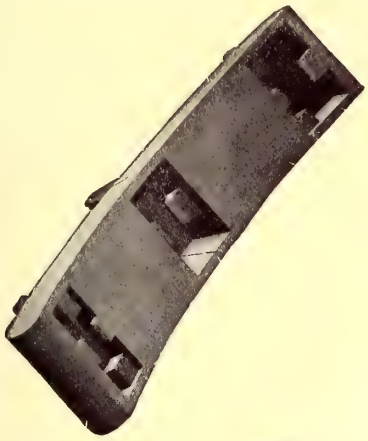
Linotype, Stereotype, Monotype and Electrotype
Prices consistent with quality and market
References — Westinghouse Interests



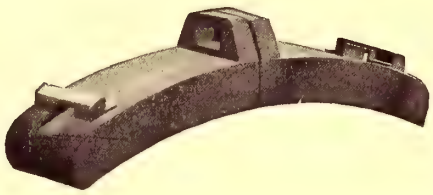
HORSBURGH & SCOTT
MANUFACTURERS OF
GEARS AND PINIONS
CLEVELAND, O.



THE INTERLOCKING BRAKE SHOE



Made to Fit Any Style of Brake Head





MANUFACTURED AND SOLD BY

Manufacturers' Railway Supply Co.

Fisher Building, Chicago

SPENCER-OTIS CO.
Chicago and Omaha

HUKILL-HUNTER CO.
Pittsburgh

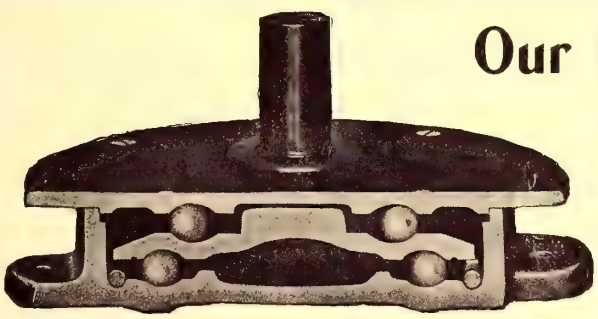
REPUBLIC RAILWAY APPLIANCE CO.
St. Louis



"THE SHOE THAT WEARS ALL OUT"



Our Ball Bearing Trolley Base



SOLVES THE PROBLEM OF OVERHEAD ECONOMY

The use of ball bearings reduces the friction on pole and trolley wire to the minimum, and the base is rendered extremely sensitive to every movement of the car, positively retaining the trolley wheel on the wire no matter what the speed of the car may be, nor how winding the track.

It will assure a greater saving in wear of overhead construction, saving on wear of trolley wheels, saving in poles. A pole used with our base will outwear four used with any other kind.

Let us demonstrate the saving features of our base in a trial order.

Detroit Trolley & Mfg. Co. Ltd., Detroit, Mich.

SHELBY TROLLEY POLES

Made from cold drawn seamless tubing. Each pole is tested by suspending, 12 feet from butt-end, a weight of 40 pounds which must not produce a deflection in pole greater than 12 inches. After removal of weight, if pole does not return to its original shape, it is rejected.

ALL STANDARD LENGTHS IN STOCK

GENERAL AGENTS FOR UNITED STATES AND CANADA
FEDERAL MANUFACTURING COMPANY—RAILWAY EQUIPMENT DEPT.
393 PERKINS AVENUE—CLEVELAND, OHIO

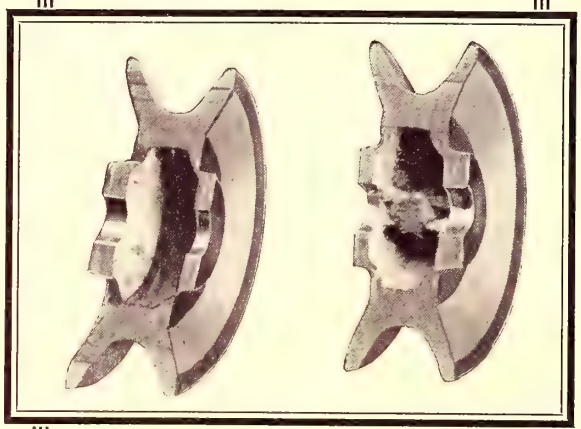
This wheel combines a graphite bushing with an automatic feeding oil chamber which can be filled quickly when necessary without removing the wheel from the fork.
There is no friction, no drip or other waste of oil, and no gumming of the pinion.

The **New**

C. B. & E. Trolley Wheel

(Patent Pending)

Is entirely self-lubricating, requires no attention except refilling the oil chamber, and will outwear three ordinary trolley wheels.



Has fully met all requirements in severe tests on long-distance suburban runs.

It is economical, clean and possesses perfect conductive power.
It is guaranteed to easily outclass in ease and efficiency any other trolley wheel on the market.
Can be quickly furnished in any quantities desired.

FOR FULL PARTICULARS, TESTIMONIALS, ETC., ADDRESS

COLLINS, BOUCHARD & EMERY

41 Main Street, Bradford, Pa., U. S. A.





NOT "THE HARP OF A THOUSAND STRINGS"

....BUT. ..

TROLLEY HARP of KALAMAZOO



THE KALAMAZOO TROLLEY HARP

is like the Kalamazoo Trolley Wheel—it is nearer perfection than any other device of the kind on the market.

The springs on the Harp are fully protected and cannot possibly be broken. As the friction of this wheel is borne entirely by the heavy washers or lugs, there is no wear on the springs, and they never have to be replaced during the life of the Harp.

The Kalamazoo Trolley Wheels combine extraordinary durability with the minimum of wear on the overhead wire. It is hard to find a road that is not using them.

THE KALAMAZOO TROLLEY WHEELS AND HARPS ARE MANUFACTURED ONLY BY

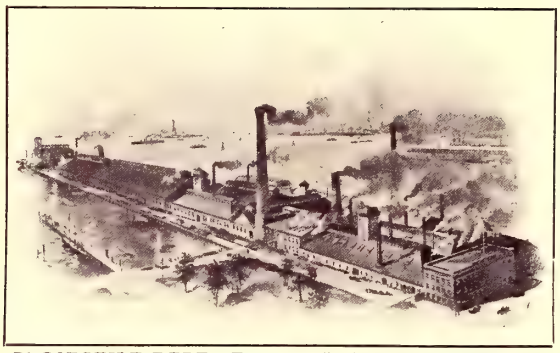
THE STAR BRASS WORKS

KALAMAZOO MICH.





ACCURACY TOUGHNESS and DURABILITY



PROJECTILE DEPT.—Formerly U. S. PROJECTILE CO.

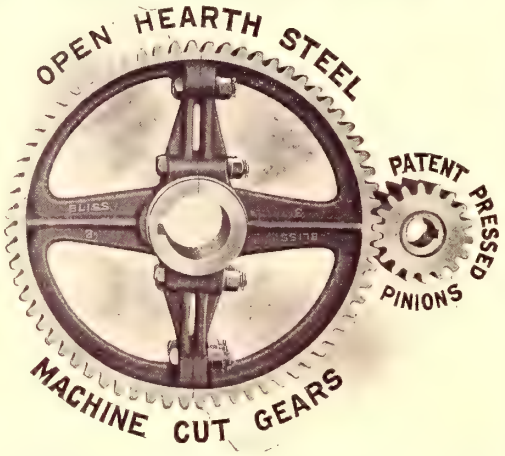
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R. D. NUTTALL COMPANY,

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President

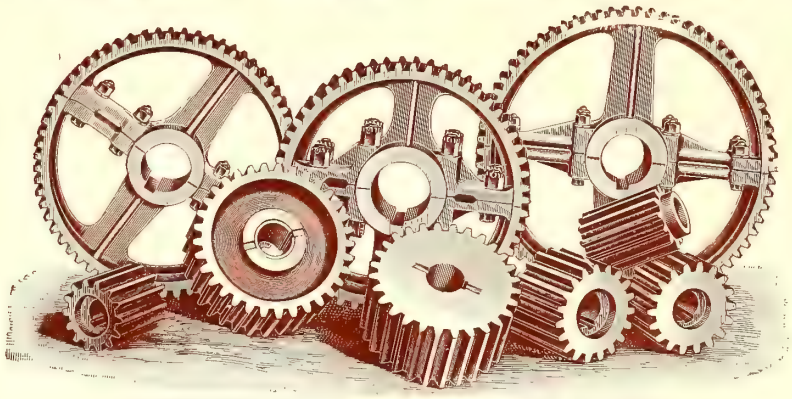
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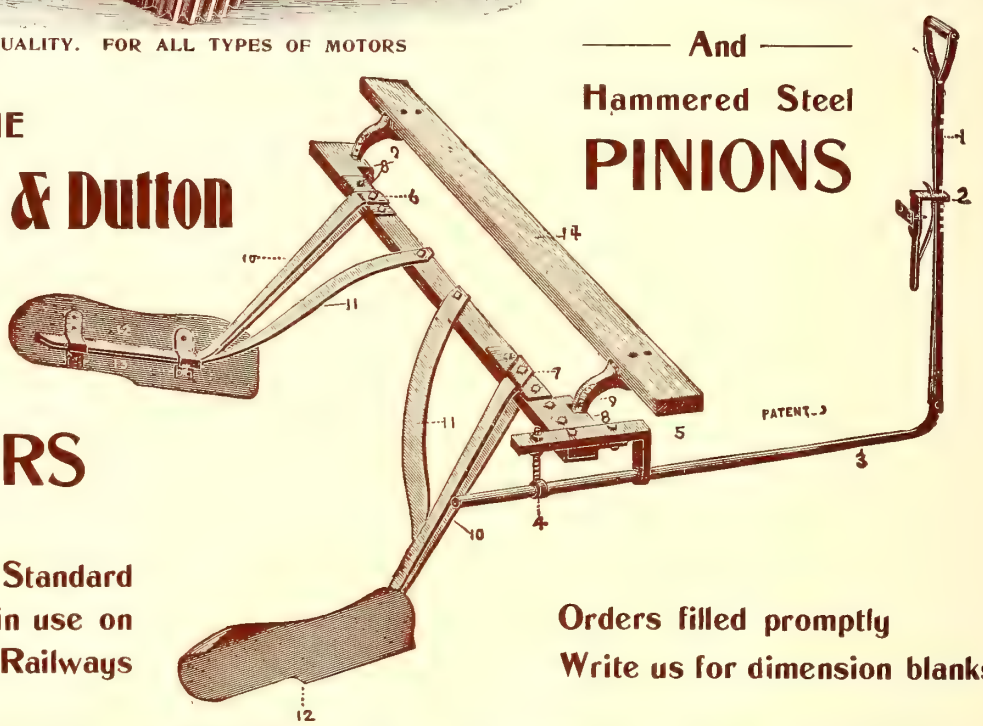
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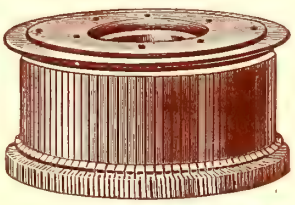
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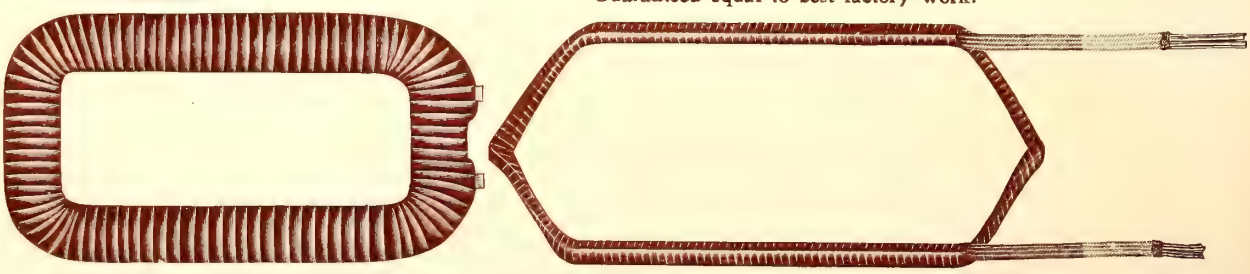
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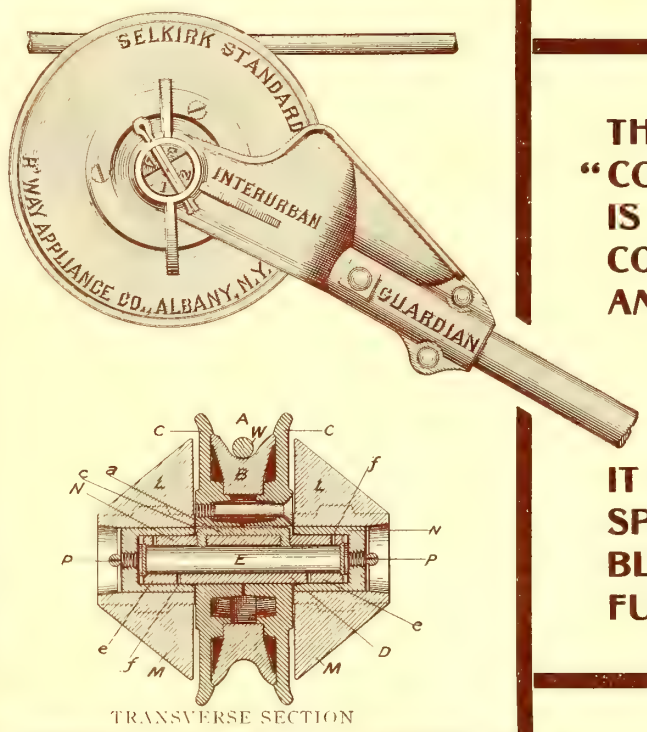
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The smoothest-running, longest-lived Trolley Wheel on the market

Visit our Exhibit. Our Representatives will give you full information

THE "BALANCE" OF THE WHEEL IS PERFECT

THE "RUNNING" IS SMOOTH AND EVEN



TRANSVERSE SECTION

THE "CONTACT" IS CONSTANT AND TRUE

IT WILL NOT SPARK OR BLOW OUT FUSES

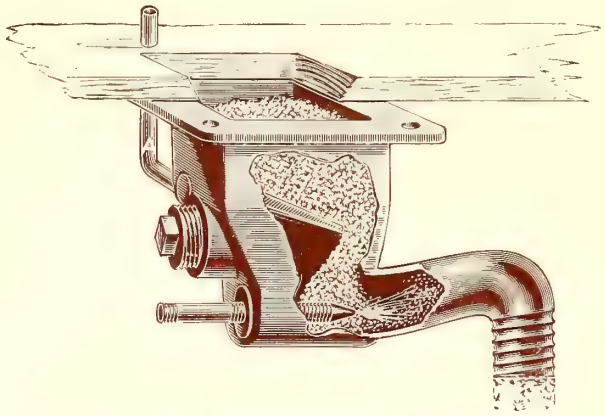
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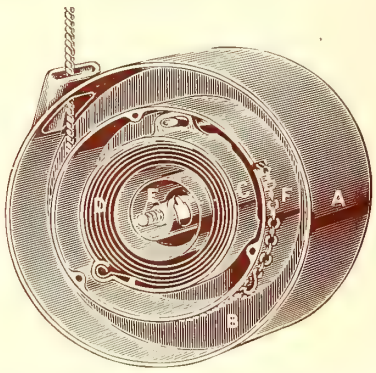
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Ham Sand Boxes are known and used universally. We make them to suit all conditions. Cut above illustrates our device for sanding rails with air or steam, and is the best air sander on the market for either electric or steam railways

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We claim for The Trojan Trolley Catcher that it is the most effective and the simplest in construction of any catcher on the market



Adjustable to suit any conditions and tensions at trolley base, and the cost of repairs is but 50 per cent. of other catchers. Especially adapted for interurban or high-speed cars.

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THE flying trolley is the cause of three sources of trouble. It may damage overhead construction. It may injure passengers or passers-by. It takes the attention of the conductor from his fares. All these three problems are met, and successfully met, by the Wilson Trolley Catcher, the only device which completely and satisfactorily takes care of the trolley rope.

The Catcher is made in malleable iron and in three sizes. No. 1 is for city service and takes a ¼ cord. No. 2 is for suburban and high-speed service and takes a 5-16 cord. No 3 is for extra high-speed service and takes a ⅜ cord. Let us quote you a price.

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replied a celebrated painter on being asked what he used to mix his paints with. This same element enters into every detail of the

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The design is on commonsense lines — each part strong and simple — the whole neat, compact, powerful and never failing. It is not cheapened at the sacrifice of efficiency and durability.

Brains enter into its working; it not only catches the pole when leaving the wire, but instantly pulls it down 3 or 4 feet out of harm's way. It enables the maintenance of a fast and accurate time schedule, without risking great damage to overhead equipment. It will increase your profits by cutting down by more than half the amount charged up for damage caused by unretrieved trolley poles.

We will send a sample equipment to be paid for if satisfactory.....

Trolley Supply Co. CANTON OHIO, U. S. A.

Guarantee For The Knutson Trolley Retrievers.

....WE GUARANTEE....

First..... That they will retrieve the trolley pole when it leaves the wire and hold it from four to six feet below wire.

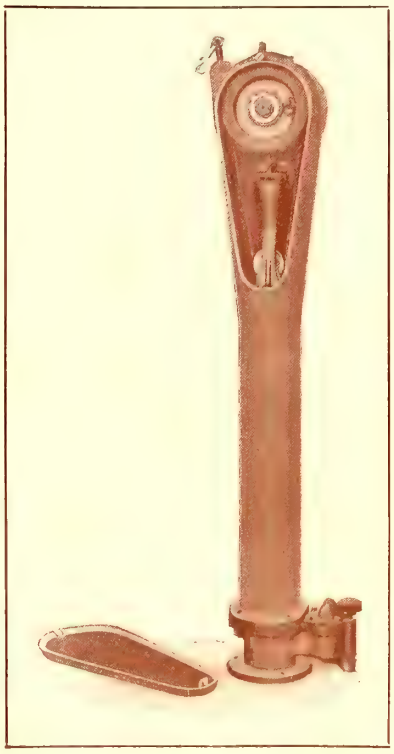
Second... That the action of the device for locking Retriever spring, and for throwing trip-latch, is positively automatic.

Third..... Freedom from mechanical defects and defective parts.

Fourth. . That, if the Retrievers sent out do not work as above guaranteed during the period of **ONE YEAR**, we will replace any part that may be defective, *Provided*, that it is because of a mechanical defect, or of defective parts, and not because of carelessness or ill-treatment on the part of operators, nor the result of accidents or other causes foreign to the legitimate work of the machine.

International Trolley

Buffalo, N. Y.



An Automatic Device That Can Be Relied On

Is the only sure means of preventing accidents

The International Trolley Controller is operated by compressed air, and can be used in connection with any make of air brake.

It automatically catches the trolley pole when accidently leaving the wire, instantly pulls it down two feet below the plane of contact, and automatically applies the air brake, making a service stop.

At the same time, the conductor is warned by a whistle, automatically blown in the vestibule, that the trolley has left the wire.

It is simple in construction and positive in its working under all manner of conditions. Reduces 97 per cent. the handling of ropes by conductor, prevents breaking trolley poles and damage to overhead construction.

Can be used with or without the brake connection.

Full Particulars, Printed Matter, or

DIVIDEND EARN

Will be Sent to any Trac

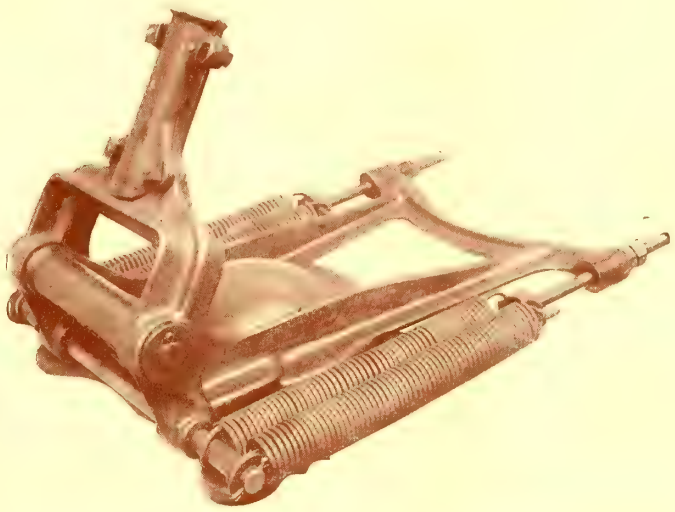
Controller Company

Buffalo, N. Y.

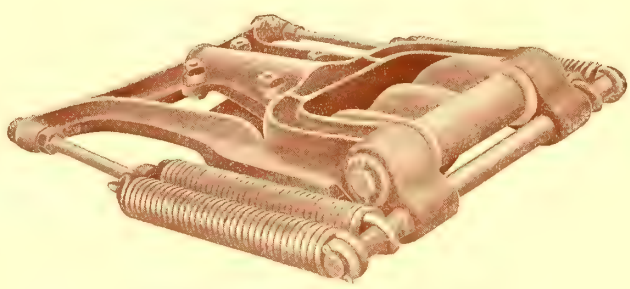
Why Waste Good Current by Poor Contact Between Trolley Wheel and Wire

The Milloy Roller Bearing Base follows the curves perfectly and thus produces a better contact than any other base ever made.

It prevents fulcrums
It has a uniform tension
It requires no oil
It accumulates no dust
It will pay for itself in a short time in the saving of current



THE MILLOY ROLLER BEARING TROLLEY BASE



OUR LOW TROLLEY BASE

Our low base has the same points of superiority as our standard base, with the additional advantage of being but four inches high, so that it will clear practically any low bridge or other overhead obstruction.

Sample Equipment of these two

ING SPECIALTIES

tion Company on Application

International Trolley

Buffalo, N. Y.



An Automatic Device That Can Be Relied On

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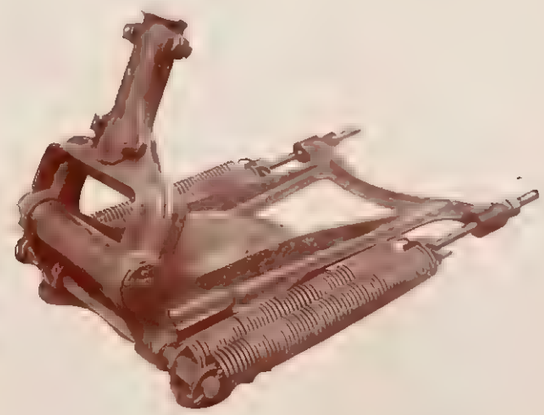
Controller Company

Buffalo, N. Y.

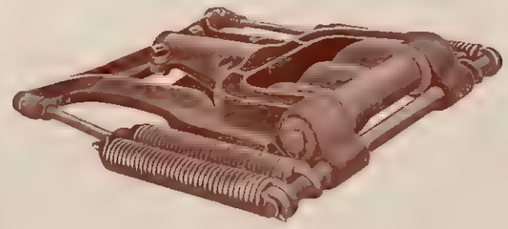
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Our low base has the same points of superiority as our standard base, with the additional advantage of being but four inches high, so that it will clear practically any low bridge or other overhead obstruction.

Sample Equipment of these two

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tion Company on Application

EASILY & QUICKLY OPERATED.

BARRETT JACKS

DURABLE, POWERFUL, EFFICIENT.

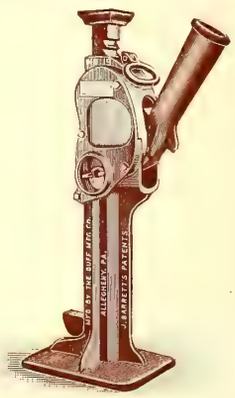
BARRETT JACKS are designed to meet every railway lifting requirement. They have been adopted as a **standard** by all leading Street Railways for car, car-barn and track construction work.



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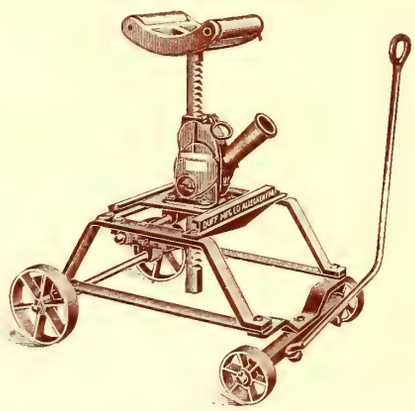


No. 8.—JOURNAL JACK.



No. 19.—FIFTEEN-TON CAR-BARN JACK.

The Barrett Motor Lift is a quick-acting lift, fully adapted to pit work, and is easily handled, powerful, and reasonable in price.



THE BARRETT MOTOR-ARMATURE LIFT.

Barrett Jacks are made in 25 sizes, with capacities from 5 to 20 tons.

BARRETT JACKS are manufactured only by **THE DUFF MANUFACTURING CO.,** whose name is a guarantee of high-grade material and workmanship, increased durability and a ready duplication of parts.

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THE "MILLEN" CAR STEP LIFTER

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Over 15,000 Cars on over 225 Electric and Cable Roads in the United States, South America and Europe are equipped with

THE PROVIDENCE CAR FENDER

READ THE FOLLOWING 15 PAGES

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NEW YORK OFFICE
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A CAR FENDER to do effective work and save life when placed in jeopardy, should be constructed to comply with the following conditions :—

FIRST: The device must be such that it will remove the endangered person from the track if the motorman should fail to stop the car in time.

SECOND: The removal should be effected by a projecting cradle on which the person may fall, and which at the instant of using it, touches the ground.

THIRD: It being impracticable to carry such a cradle, touching the ground all the time, it must be possible for the motorman to instantly drop it, while at the same time, his hands are free for other purposes.

FOURTH: The mechanism must be such that the motorman, after dropping the fender, can raise it again, without stopping the car or leaving the platform.

FIFTH: The front edge of the cradles should be furnished with such rolls, and the cradle itself be of such form that it may be dropped on any ordinary road surface, without risk of breaking.

SIXTH: The front edge of the cradle should be yielding so as to cushion the blow against the foot, or against the body, if the person has fallen.

SEVENTH: The front edge of the car must be furnished with a resilient shield, covering all the rigid projecting parts of the car, such as the bumper, the draw bar, and the fixtures by which the fender itself is attached to the car.

EIGHTH: The fender should be strong enough and elastic enough, to serve as a substantial buffer in colliding with other vehicles, so that, within a considerable limit, it may receive all the damage itself, and prevent injury to both colliding vehicles.

NINTH: It must be detachable from the car, so that in case of accident the conductor and motorman may readily remove it, without the use of tools.

TENTH: It must be foldable against the dash, so that if fenders are attached to both ends of the car, the rear fender, and in the car house, both fenders may be turned up.

ELEVENTH: It should have a breaking part inexpensive to repair.

TWELFTH: It must be easily transferrable from one end of the car to the other, so that if necessary, it may be quickly so transferred by the conductor and motorman at the end of each trip.

THIRTEENTH: It must be of simple construction, and easy to repair, and to that end all parts should be inter-changeable.

FOURTEENTH: All fenders for cars of the same Company should be inter-changeable.

The "PROVIDENCE" FENDER absolutely satisfies the above demands. It has been in service nearly ten (10) years during which time we have installed 15,000 cars. On its merits alone, the "PROVIDENCE" FENDER has practically covered the entire field, and 95 per cent. of all Car Fenders now in use, are "PROVIDENCE" fenders, except where the Railroads make cheap devices and attach them to their cars, to comply with local City ordinances.

The "PROVIDENCE" Car Fender is not automatic, in the sense of its dropping at the moment of striking the endangered person. That they are not automatic is a main point of safety. Automatic Fenders, by the very construction and in themselves, are theoretically and mechanically impracticable.

It is not enough for a Fender to drop when struck to be of value in saving life, the fender must drop before it comes in contact with the obstacle or body. By the natural law governing the velocity of falling bodies, the fender requires a sensible period of time in which to drop to the track. If the front of the fender be carried at a height of eight (8) inches, this time is about one-tenth of a second and in one-tenth of a second a car going eight (8) miles an hour, moves one and five-eights, or nearly two feet. Therefore, even for the moderate speed of eight miles an hour, an "automatic" fender must begin to drop more than one-tenth of a second before its services are required to be of any value. In other words, more than a tenth of a second before it strikes the person to be rescued.

THE CONSOLIDATED CAR FENDER CO.

NEW YORK OFFICE
39-41 Cortlandt Street

Paris Office, 6 Rue Boudreau

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Four different equipments of the "Providence" Fender are made in order to get a perfect adjustment on cars of different heights, widths and lengths



Model "A" Front View

THE PROVIDENCE CAR FENDER

will remove an endangered person from the track if the motorman fails to stop the car in time

THE CONSOLIDATED CAR FENDER CO.

NEW YORK OFFICE
39-41 Cortlandt Street

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Factory - Providence, R. I.

A Double Equipment consists of Two Fenders

two cushions, and two sets of attachments,

one each of which is attached to each end of a car



Model "A" Side View

The "Providence" Car Fender is thoroughly and mechanically constructed. Only the best material is used in its manufacture

THE CONSOLIDATED CAR FENDER CO.

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39-41 Cortlandt Street
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All fenders and parts are interchangeable, and the fenders can be transferred from one end of a car to the other, or from one car to another, in less than one minute



Model "A" Rear View

WHY?—95 per cent. of all the car fenders used in the world, other than those made by the electric roads themselves, are "Providence" Car Fenders

BECAUSE—The "Providence" Car Fender saves life.

THE CONSOLIDATED CAR FENDER CO.

NEW YORK OFFICE
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Factory - Providence, R. I.

Cut showing Model "B" Fender attached to the FRONT END of a car. Used on a low car, where the Upper Cross Bar can be adjusted to a position 15 to 18 inches above the track.



Model "B" Front View

The "Providence" Car Fender WILL pick up a person that has fallen on the track if the motorman fails to stop the car in time.

THE CONSOLIDATED CAR FENDER CO.

NEW YORK OFFICE
39-41 Cortlandt Street

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Cut showing car equipped at FRONT END, with Model "B" Fender, in position for use, and at REAR END, with fender turned up and fastened to the dash board out of the way



Model "B," Side View

THE "PROVIDENCE" FENDER has been saving lives for years

THE "PROVIDENCE" FENDER will continue to save lives

THE CONSOLIDATED CAR FENDER CO.

NEW YORK OFFICE
39-41 Cortlandt Street

Paris Office, 6 Rue Boudreau

Factory - Providence, R. I.

We not only say the "Providence" Car Fender will save lives, but the "Providence" Car Fender IS saving lives every day.



Model "B," Rear View

The "Providence" Car Fender is not an experiment, as you will see by referring to list of roads that are now using them. (Page 16)

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Paris Office, 6 Rue Boudreau
Factory · Providence, R. I.

A Single Car Fender Equipment consists of One Fender, One Cushion, and Two Sets of Attachments, one Set of Attachments being placed at each end of a car, and the fender and cushion transferred from one end of the car to the other, at the ends of the line.



Model "C," Front View

The "PROVIDENCE" CAR FENDER will pick up and carry an endangered person, whether standing or lying on the track, if the Motorman fails to stop the car in time.

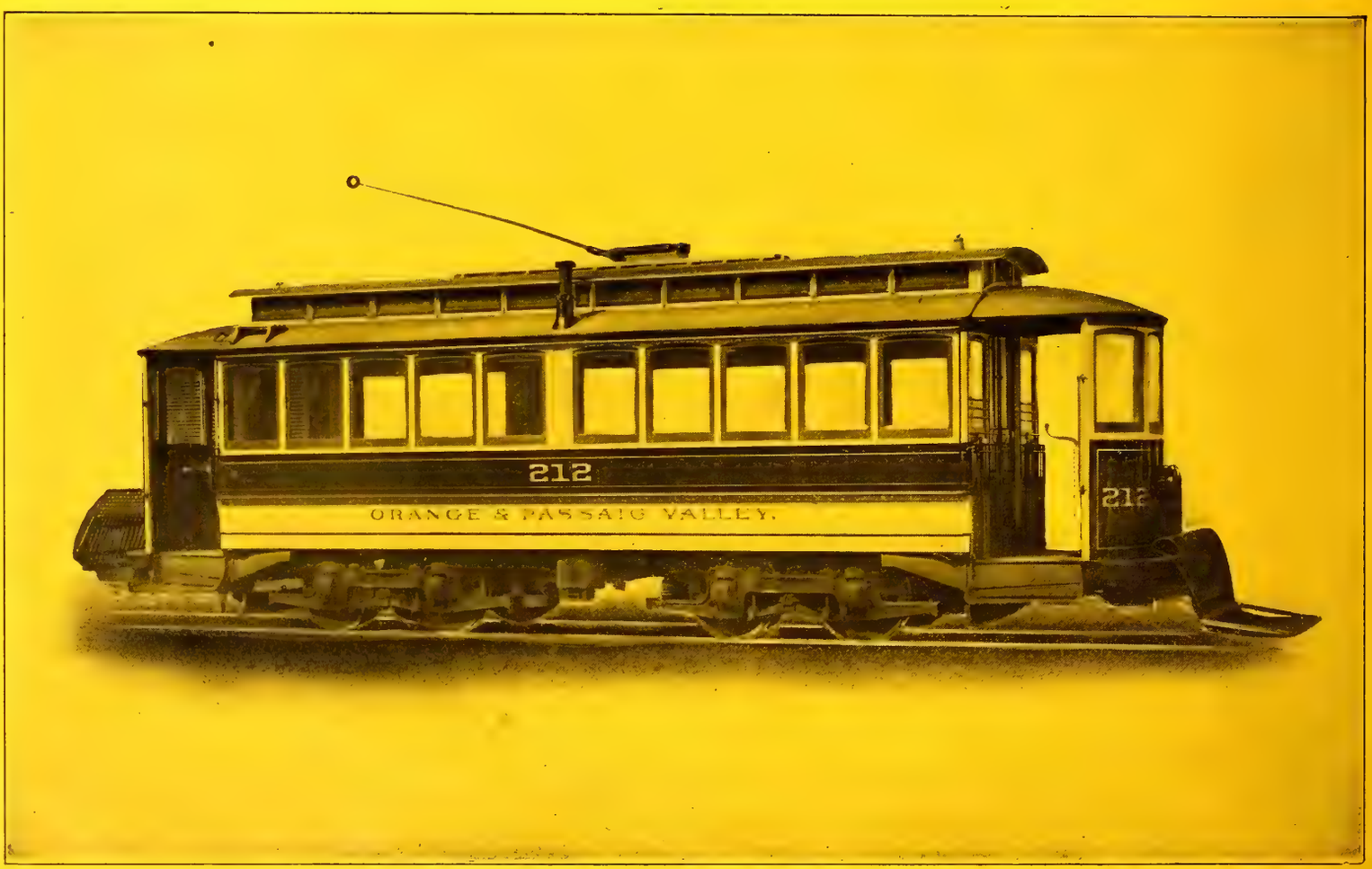
THE CONSOLIDATED CAR FENDER CO.

NEW YORK OFFICE
39-41 Cortlandt Street

Paris Office, 6 Rue Boudreau

Factory - Providence, R. I.

Our New Model "C" Fender is used on either a HIGH or LOW car, and is considered by competent Railroad Managers to be the best Life Saving Device ever attached to an Electric Car



Model "C," Side View

Cut showing Car installed with a full Double Equipment of Model "C" Fender. This Fender has a record of saving 100 per cent. of all lives placed in jeopardy from FRONT END accidents

THE CONSOLIDATED CAR FENDER CO.

NEW YORK OFFICE
39-41 Cortlandt Street
Paris Office, 6 Rue Boudreau
Factory - Providence, R. I.

FENDERS for { High / Low / Medium Height / Interurban / all kinds of } CARS



Model "C," Rear View

All of the

"PROVIDENCE" FENDERS

are made on the same lines, that is to say, Models "A," "B," "C" and "D" Fenders, are made of curved steel fingers, tempered to a point, where they will bend just before the breaking point is reached.

THE CONSOLIDATED CAR FENDER CO.

NEW YORK OFFICE
39-41 Cortlandt Street
Paris Office, 6 Rue Boudreau
Factory - Providence, R. I.

A One End Car Fender Equipment consists of One Fender, One Cushion, and One Set of Attachments, all of which are attached to one end of a car. This Equipment is used where THE SAME END OF THE CAR runs "head on" all the time



Model "D," Front View

Our Model "D" Car Fender is in use on several Interurban roads, and has many times prevented serious accidents by picking up and carrying the animal struck until the car could be stopped. Practically all danger of derailing of car is removed when the car is equipped with this fender.

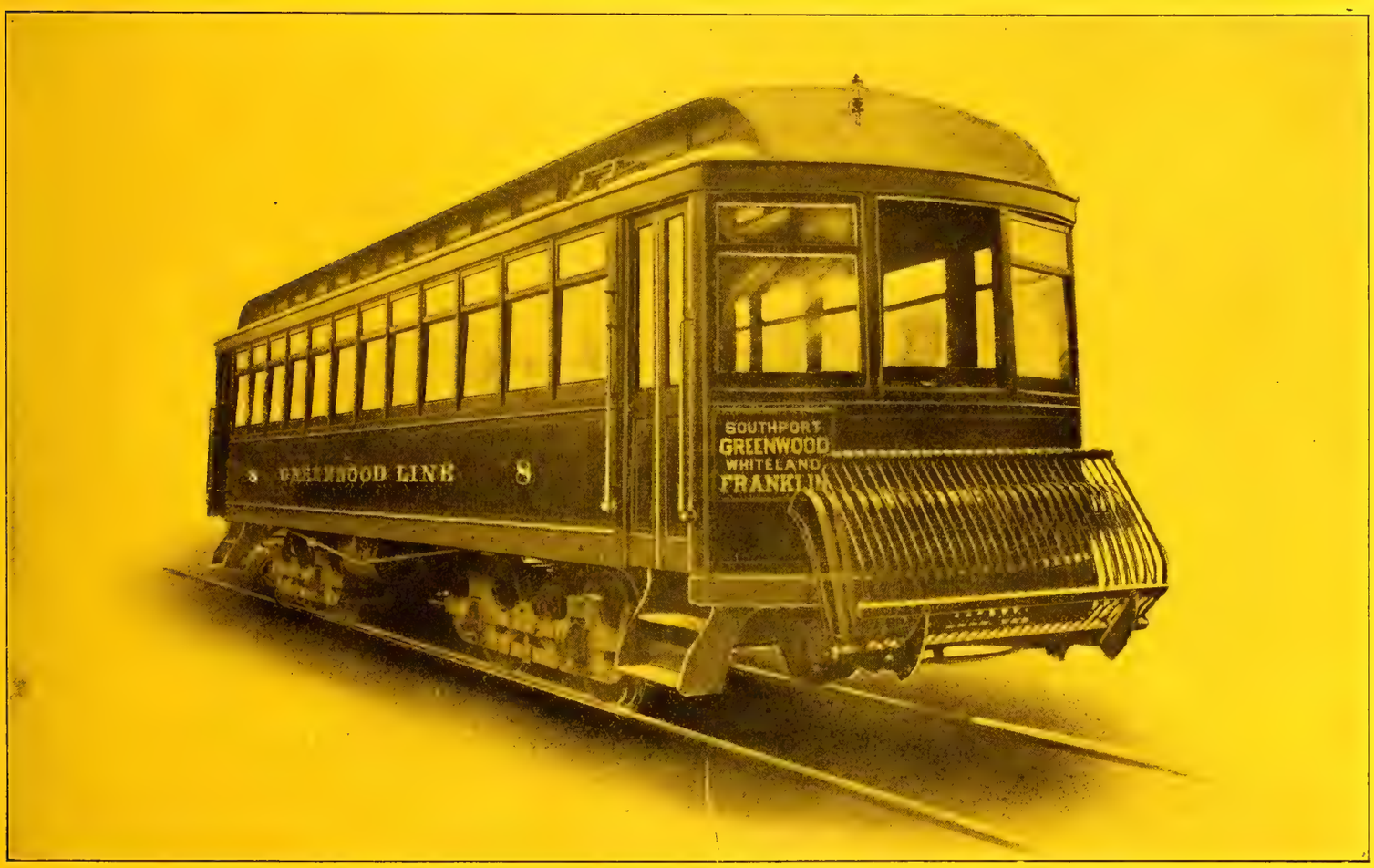
THE CONSOLIDATED CAR FENDER CO.

NEW YORK OFFICE
39-41 Cortlandt Street

Paris Office, 6 Rue Boudreau

Factory - Providence, R. I.

Our Model "D" or Interurban Car Fender is made especially for large Interurban or Suburban Cars. It is large and strong enough to pick up a horse and carry it until the car comes to a standstill. This is the only fender ever attached to a Suburban or Interurban Car, that will PICK UP the object struck when the car is running at a high rate of speed.



Model "D," Rear View

THE "PROVIDENCE" CAR FENDER IS APPLIABLE TO ALL SIZES AND STYLES OF CARS. THOUSANDS IN USE. (See list of Roads on page No. 16.)

THE CONSOLIDATED CAR FENDER CO.

NEW YORK OFFICE
39-41 Cortlandt Street
Paris Office, 6 Rue Boudreau
Factory - Providence, R. I.

The "Campbell" Rotary Snow Broom, owned and manufactured by the CONSOLIDATED CAR FENDER CO., has been thoroughly tested by some of the largest Electric Roads in the United States.

The "Broom Head" is made in sections of Malleable Iron, and will last for many years, in fact, not one has ever yet been broken, although subjected to the hardest possible usage.

The whole expense of keeping this Rotary Broom in repair is refitting the "Head" with rattan.



This cut shows a Three-Quarter View of the "Campbell" Rotary Snow Broom, all ready to be attached to the axle of a car.

The Malleable Iron sections are placed about four inches apart, and the length of the Broom is determined by the number of sections used.

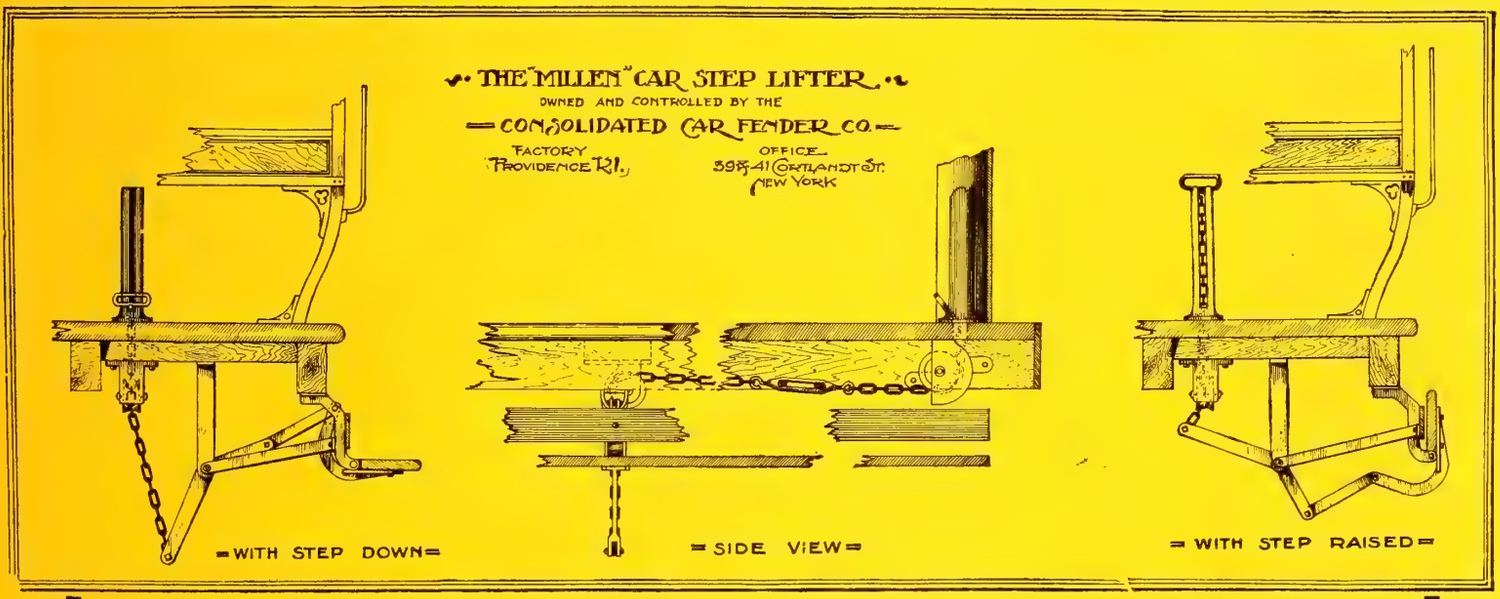
THE CONSOLIDATED CAR FENDER CO. will furnish, without cost, malleable iron sections to replace any that are broken when in actual service sweeping snow from the track.

THE CONSOLIDATED CAR FENDER CO.

NEW YORK OFFICE
39-41 Cortlandt Street
Paris Office, 6 Rue Boudreau
Factory - Providence, R. I.

This is a lifting device, attached to the under side of a car and connected with both platforms of the same, so that the motorman or conductor, by lifting up a handle, can turn up the long step of an open car and fasten it up, and also let it down again, without leaving the platform.

It has been the custom heretofore to fold up the steps by hand and fasten them with a hook or chain, it being necessary to have the step on the inside of the car, that is, the side which is next to opposite going car, folded up out of the way so as to give more space between two passing cars, and also to prevent passengers from entering or leaving the car from the "off side." It is also necessary at times, when passing trucks or wagons in crowded streets, to lift up the outside steps until the vehicle or obstacle is passed and then lower it down again. All of this may now be done without stopping the car or leaving the platform.



15

The "Millen" Car Step Lifter, owned and manufactured by the CONSOLIDATED CAR FENDER CO., was designed and perfected by the General Master Mechanic of the largest Electric Road in the World.

A large number of cars on said Road are equipped with this lifting device, and while not expensive to make, it saves valuable time, of both the motorman and conductor, in being able to operate it, at either end of the car, without leaving the platform.

List of Two Hundred and Twenty-Six Electric Roads Using The "Providence" Car Fender

Akron, Bedford & Cleveland R. R. Co., Cleveland, O.
Albany & Hudson Ry. & Power Co., Hudson, N. Y.
Albany Railway Co., Albany, N. Y.
Alton R. R. & Illuminating Co., Alton, Ill.
Altoona & Logan Valley St. Ry Co., Altoona, Pa.
Allentown & Lehigh Valley St. Ry. Co., Allentown, Pa.
Allentown & Bethlehem Rapid Transit Co., Allentown, Pa.
Allentown & Emaus St. Ry. Co., Allentown, Pa.
Allentown Passenger Ry., Allentown, Pa.
Allentown & Lehigh Valley Traction Co., Allentown, Pa.
Amsterdam Street Ry. Co., Amsterdam, N. Y.
Atlantic Highl'ds, Red Bank & L'g Branch St. Ry. Co., Red Bank, N. J.
Atlantic Coast Elec. R. R. Co., Asbury Park, N. J.
Auburn City Ry. Co., Auburn, N. Y.
Auburn Interurban Elec. R. R. Co., Syracuse, N. Y.
Auburn & Syracuse Elec. Ry. Co., Syracuse, N. Y.
Bridgeport Traction Co., Bridgeport, Conn.
Bennington & Hoosick Valley Ry., Hoosick Falls, N. Y.
Bergen Turnpike Company, Hoboken, N. J.
Berkshire St. Ry. Co., Pittsfield, Mass.
Bethlehem & South Bethlehem St. Ry. Co., Bethlehem, Pa.
Bethlehem & Hellertown St. Ry. Co., Bethlehem, Pa.
Bethlehem & Allentown St. Ry. Co., Bethlehem, Pa.
Binghamton R. R. Co., Binghamton, N. Y.
Blue Ridge Traction, Danielsville, Pa.
Bradford St. Ry. Co., Bradford, Pa.
Brantford St. Ry. Co., Brantford, Ont.
Bellows Falls & Sexton's River Ry. Co., Bellows Falls, Vt.
Cairo Electric R. R. Co., Cairo, Ill.
Carbon County Electric Ry. Co., Mauch Chunk, Pa.
Catasauqua & Northern St. Ry. Co., Allentown, Pa.
Central Market St. Ry. Co., Columbus, O.
Central Ry. & Elec. Co., New Britain, Conn.
Chicago & South Shore Ry. Co., La Porte, Ind.
Cincinnati & Hamilton Elec. Ry. Co., Cincinnati, O.
Cincinnati, Lawrenceburg & Aurora Ry., Cincinnati, O.
Citizens' St. Ry. Co., Fishkill, N. Y.
Citizens' Rapid Transit Co., Nashville, Tenn.
City Electric Ry. Co., Port Huron, Mich.
City Street Car Co., Staunton, Va.
City Passenger Ry. Co., Altoona, Pa.
Cincinnati, Dayton & Toledo Trac. Co., Hamilton, O.
Cleveland, Elyria & Western Ry. Co., Cleveland, O.
Cleveland, Berea, Elyria & Oberlin Ry. Co., Cleveland, O.
Cleveland & Chagrin Falls Elec. Ry. Co., Cleveland, O.
Cleveland, Painesville & Eastern R. R. Co., Cleveland, O.
Cleveland Electric Ry. Co., Cleveland, O.
Cleveland & Eastern R. R. Co., Cleveland, O.
Cleveland City Ry. Co., Cleveland, O.
Cleveland & Southwestern Traction Co., Cleveland, O.
Consolidated Traction Co., Jersey City, N. J.
Consolidated Street Ry. Co., Grand Rapids, Mich.
Connecticut Lighting & Power Co., Norwalk, Conn.
Connecticut Lighting & Power Co., Bridgeport, Conn.
Columbus, Buckeye Lake & Newark Ry., Columbus, O.
Columbus, London & Springfield Ry. Co., Columbus, O.
Columbus, Grove City & Southwestern Ry. Co., Columbus, O.
Columbus, New Albany & Johnstown R. R. Co., Columbus, O.
Columbus, Delaware & Marion Ry. Co., Columbus, O.
Dayton, Springfield & Urbana Elec. Ry. Co., Springfield, O.
Dayton & Western Traction Co., Dayton, O.
Derby Street Ry. Co., Derby, Conn.
Des Moines City Ry. Co., Des Moines, Ia.
Detroit, Monroe & Toledo Short Line Ry. Co., Detroit, Mich.
Durham Traction Co., Durham, N. C.
Eastern Ohio Traction Co., Columbus, O.
Easton Consolidated Elec. Co., Easton, Pa.
Easton Transit Company, Easton, Pa.
Easton, Palmer & Bethlehem St. Ry. Co., Easton, Pa.
Easton & South Easton Ry. Co., Easton, Pa.
Easton & Nazareth St. Ry. Co., Easton, Pa.
Elizabeth City Horse R. R. Co., Elizabethport, N. J.
Electric Construction Co., of Va., Richmond, Va.
Electric Construction Co., of Va., Portsmouth, Va.
Elyria, Grafton & Southern Ry. Co., West Park, O.
Elmira & Seneca Lake Ry. Co., Montour Falls, N. Y.
Elizabeth, Plainfield & Central Jersey R. R. Co., Westfield, N. J.
Elizabeth City R. R. Co., Elizabeth, N. J.
Fair Haven & Westville Ry. Co., New Haven, Conn.
Fall River Street Railway Co., Fall River, Mass.
Farmington St. Ry. Co., Hartford, Conn.
Fitchburg & Leominster St. Ry. Co., Fitchburg, Mass.
Fort Wayne Traction Co., Fort Wayne, Ind.
Fort Wayne & Southwestern Traction Co., Fort Wayne, Ind.
Fort Dodge Light & Power Co., Fort Dodge, Ia.
Fonda, Johnstown & Gloversville Ry. Gloversville, N. Y.
Fox River Electric Ry. Co., Green Bay, Wis.
Greenwich & Schuylerville Elec. Ry., Greenwich, N. Y.
Great Northern Construction Company, Springfield, O.
Galesburg Electric Motor & Power Co., Galesburg, Ill.
Hartford Street Ry. Co., Hartford, Conn.
Hartford & West Hartford H. R. R., Hartford, Conn.
Herkimer, Mohawk, Ilion & Frankfort Ry., Mohawk, N. Y.
Hornellsville Electric Ry. Co., Hornellsville, N. Y.
Hudson Valley Ry. Co., Glens Falls, N. Y.
Inland Traction Co., Easton, Pa.
Indianapolis, Greenwood & Franklin Ry. Co., Greenwood, Ind.
Indianapolis & Martinsville Rap. Tran. Ry. Co., Indianapolis, Ind.
Indianapolis & Eastern Ry. Co., Indianapolis, Ind.
International Transit Co., Sault Ste. Marie, Ont.
Interstate Consolidated St. Ry. Co., North Attleboro, Mass.
Interurban Construction Co., Alliance, O.
Interurban Railway Co., Des Moines, Ia.
Jackson Light & Power Company, Jackson, Mich.
Jersey City, Hoboken & Paterson St. Ry. Co., Hoboken, N. J.
Jackson Street Ry. Co., Jackson, Mich.
Kansas City-Leavenworth Elec. Ry. Co., Leavenworth, Kas.
Lake Ontario & Riverside Ry., Oswego, N. Y.
Lansing City Elec. Ry. Co., Lansing, Mich.
Lehigh Valley Traction Co., Allentown, Pa.
Linwood Street Ry. Co., Whitinsville, Mass.
Little Miami Traction Co., Springfield, O.
Lorain & Cleveland Ry. Co., Lorain, O.
Meriden Electric R. R. Co., Meriden, Conn.
Metropolitan Street Ry. Co., New York City.
Middletown-Goshen Traction Co., Middletown, N. Y.
Montreal Street Ry. Co., Montreal, Canada.
Meriden, Southington & Compounce Tram. Co., Meriden, Conn.
Montoursville Railway Co., Montoursville, Pa.
Middlesex & Somerset Trac. Co., New Brunswick, N. J.
Maple Avenue R. R. Co., Elmira, N. Y.
Miamisburg & Germantown Trac. Co., Miamisburg, O.
Mauch Chunk, Lehighton & Slatington Ry. Co., Mauch Chunk, Pa.
Montreal Terminal Ry. Co., Montreal, Canada.
Montoursville Passenger Ry. Co., Montoursville, Pa.
North Hudson County Ry. Co., Hoboken, N. J.
New Jersey Electric Ry. Co., Hoboken, N. J.
New Haven St. Ry. Co., New Haven, Conn.
New Haven & Centreville Ry., New Haven, Conn.
North Jersey St. Ry. Co., Jersey City, N. J.
Norwalk Tramway Co., So. Norwalk, Conn.
Newburgh Electric Ry. Co., Newburgh, N. Y.
Niagara, St. Catharines & Toronto Ry., St. Catharines, Ont.
Norfolk Ry. & Light Co., Norfolk, Va.
Northern Ohio Traction Co., Akron, O.
Northern Texas Traction Co., El Paso, Texas.
Niagara Falls, Wesley Park & Clifton Tram. Co., St. Catharines, Ont.
Northampton Southern St. Ry. Co., Easton, Pa.
Northampton Central St. Ry. Co., Easton, Pa.
Northampton Traction Co., Easton, Pa.
Orange County Traction Co., Newburgh, N. Y.
Philadelphia & Lehigh Valley Traction Co., Allentown, Pa.
Passaic & Newark Electric Traction Co., Passaic, N. J.
Plainfield St. Ry. Co., Plainfield, N. J.
Port Norfolk Elec. Ry. Co., Portsmouth, Va.
Paterson Ry. Co., Paterson, N. J.
Peekskill Traction Co., Peekskill, N. Y.
Perth Amboy R. R. Co., Perth Amboy, N. J.
Pennsylvania & Ohio Ry. Co., Conneaut, O.
People's Tramway Co., Putnam, Conn.
Peekskill Lighting & R. R. Co., Peekskill, N. Y.
Pennsylvania & Ohio Traction Co., Ashtabula, O.
Port Dalhousie, St. Catharines & Thorold Elec. St. Ry. Co., St. Catharines, Ont.
Richmond Ry. & Elec. Co., Richmond, Va.
Richmond Traction Company, Richmond, Va.
Rutland St. Ry. Co., Rutland, Vt.
Rochester Ry. Co., Rochester, N. Y.
Rochester & Sodus Bay Ry. Co., Rochester, N. Y.
Rochester & Suburban Ry. Co., Rochester, N. Y.
Richmond Passenger & Power Co., Richmond, Va.
Richmond & Petersburg R. R., Richmond, Va.
Raritan Traction Co., Perth Amboy, N. J.
Rockford, Beloit & Janesville R. R. Co., Beloit, Wis.
Springfield & Xenia Traction Co., Springfield, O.
Staten Island Elec. Ry. Co., New Brighton, N. Y.
Staten Island Midland Ry. Co., Stapleton, N. Y.
Suburban Traction Co., Orange, N. J.
Syracuse Rapid Transit Co., Syracuse, N. Y.
Syracuse & East Side St. Ry. Co., Syracuse, N. Y.
St. Louis & East St. Louis Ry. Co., East St. Louis, Ill.
Syracuse, Lakeside & Baldwinsville Ry., Syracuse, N. Y.
South Chicago City Ry. Co., South Chicago, Ill.
Superior Rapid Transit Co., West Superior, Wis.
Springfield Elec. Ry. Co., Springfield, Vt.
Sandusky & Interurban Ry. Co., Sandusky, O.
Southern Ohio Traction Co., Hamilton, O.
Schenectady Ry. Co., Schenectady, N. Y.
Springfield Consolidated Ry. Co., Springfield, Ill.
St. Louis Transit Co., St. Louis, Mo.
Springfield Ry. Co., Springfield, O.
Stark Electric R. R. Co., Alliance, Ohio.
Trans. St. Mary's Traction Co., Sault Ste. Marie, Ont.
Troy City Ry. Co., Troy, N. Y.
Tri-City Ry. Co., Davenport, Ia.
Toledo & Western Ry. Co., Toledo, O.
Toronto Suburban Ry., Toronto, Ont.
Toledo, Fostoria & Findlay R. R. Co., Toledo, O.
Toledo & Maumee Valley Ry. Co., Toledo, O.
Toledo Elec. Ry. & Light Co., Toledo, Ohio.
Toledo & Indiana Ry. Co., Toledo, O.
Toledo Rys. & Light Co., Toledo, O.
Union Depot Railroad Co., St. Louis, Mo.
Utica Belt Line St. Ry. Co., Utica, N. Y.
Utica & Mohawk Ry. Co., Utica, N. Y.
United Traction Co., Albany, N. Y.
Union Traction Co., of Indiana, Anderson, Ind.
Utica & Mohawk Valley Ry. Co., Utica, N. Y.
Van Brunt St. & Erie Basin Ry. Co., Brooklyn, N. Y.
Waterbury Traction Co., Waterbury, Conn.
Winchester Ave. St. Ry. Co., West Haven, Conn.
Westfield & Elizabeth St. Ry. Co., Plainfield, N. J.
Webster & Dudley St. Ry. Co., Webster, Mass.
West Side Railroad Co., Elmira, N. Y.
Wabash River Traction Co., Wabash, Ind.
Warren St. Ry. Co., Warren, Pa.
Western Ohio St. Ry. Co., Lima, O.
Wisconsin Construction Co., Beloit, Wis.
Westhampton Park Railroad Co., Richmond, Va.
Worcester & Connecticut Eastern Ry. Co., Putnam, Conn.
West Jersey & Seashore R. R. Co., Atlantic City, N. J.
Wheeling & Elm Grove R. R. Co., Wheeling, W. Va.
Yonkers Railroad Co., New York City, N. Y.
Compania de Ferrocarriles del Distrito Federal, City of Mexico, Mex.
Compania de Transvias de Lerdo, a Torreon Gomez Palacio, Durango, Mex.
Compania de Tranvias Ry. Co., Durango, Mex.
Colombo Tramway Co., Columbo, Ceylon.
Costa Rica Elec. Lt. Transportation Co., San Jose, Costa Rica.
Buenos Aires & Belgrano Tramway Co., Buenos Aires, Argentina.
Buenos Aires Electric Tramway Co., Buenos Aires, Argentina.
Durban Corporation Tramways, Durban, Natal, South Africa.
Federal District Ry. Co., City of Mexico, Mex.
Imperial Electric Supplies Co., Ltd., London, England.
Ferrocarril Electric de Lima & Callao, Callao, Peru.
La Capital Tramways Company, Buenos Aires, Argentina.
Lima & Chorillos Tramway, Chorillos, Callao, Peru.
Sao Paulo Ry., Lt. & Power Co., Sao Paulo, Brazil.
Tramvia Elec. de Buenos Aires Ry., Buenos Aires, Argentina.
West India Electric Co., Kingston, Jamaica.

16

ECLIPSE CAR FENDER COMPANY CLEVELAND OHIO

THE pictures on the following pages illustrate the fact that the Eclipse Life-guard picks people up, absolutely uninjured, who are unfortunate enough to be in the way of an electric car equipped with that guard. These snap shots were taken from a trial of this life-guard, made for the Brooklyn Rapid Transit Co. at Brooklyn, N. Y., May 22d, 1903, and car was running at a speed of 22 miles per hour when it struck the man (no dummy). The pictures were taken at the rate of 30 per second.

We do not knock the unfortunate down and crack his skull on the stone pavement or iron rail and then bump into him again in the hopes of scooping up his mangled remains on the fender, but pick him up and hold him in the guard absolutely uninjured until the motorman stops the car and allows him to get out and proceed on his way rejoicing and praising the Lord for the day of the invention of the Eclipse Life-guard.

Note the progress of car in pictures in order numbered.

ECLIPSE CAR FENDER COMPANY CLEVELAND OHIO



No doubt we have all, at one time or another in our life, been up against the problem as to what would happen if an irresistible force came in contact with an immovable body. The writer was reminded of this vexed problem on May 22, 1903, in Brooklyn, N. Y., at a trial of the Eclipse Lifeguard for the Brooklyn Rapid Transit Co. I suppose the reason for recalling it to mind was because the situation was so different. However, as Superintendent Smith's private car came thundering down Second Avenue at a speed of 22 miles per hour it certainly appeared like an irresistible



ECLIPSE CAR FENDER COMPANY CLEVELAND OHIO



force, rushing madly upon the defenceless man who apparently unconcerned walked out on the track in front of the swiftly moving car. He was calmly puffing away at his lighted cigar, which he held between his lips, and seemed as cool and indifferent as if he were out for a morning stroll on Broadway. It was not so, however, with the crowd on the sidewalk and curb, who with bated breath and pallid face observed the increasing speed of the on-coming car and realized that the daring inventor, Mr. Benjamin Lev, was coolly stepping in front of it where they were all



ECLIPSE CAR FENDER COMPANY CLEVELAND OHIO



morally certain that his brains must be dashed out and his body hurled thirty feet in front of the car and then possibly be mangled beneath the wheels before the car could be stopped.

It was a thrilling moment for the spectators, who thought it looked like deliberate suicide; but Mr. Lev, with full confidence in the merits of his life guard, was the coolest person present. It was a marvelous exhibition of the nerve of the inventor as well as the merits of his invention; for all who witnessed it realized unless there was a fender on that car that was radically



ECLIPSE CAR FENDER COMPANY CLEVELAND OHIO



different from the so-called fenders in use the man's body was bound to be hurled thirty feet or more away from the car. This, they thought, was inevitable and in accordance with all the laws of philosophy, but evidently the laws of philosophy don't count when the "Eclipse Car Fender" is on the business end of a moving electric car.

Did I say fender? Well, that's a misnomer; it is not a fender, it is a life-guard and more than a life-guard, as it not only saves life but picks up the person absolutely uninjured, suffering no further damage than the



ECLIPSE CAR FENDER COMPANY CLEVELAND OHIO













scare from the shock and fear incident to the accident. Hereafter we will call it a "life-guard" as fender means to parry, to ward off, to cast aside, etc. There are many "fenders" on the market, but only one life-guard:

The "Eclipse."

The head man of one of the leading fender companies when told of the trial of the "Eclipse" at Brooklyn, pooh-poohed the idea and declared it not so, saying there was no fender made that could hold a man struck by a car going at such speed, as the impact













ECLIPSE CAR FENDER COMPANY CLEVELAND OHIO













would knock him many feet to the side or in front of the car. To be frank, we will have to agree with him, for there is no fender made that will do it, but the Eclipse Life-guard did do it, as the officials of the Brooklyn Rapid Transit Company who were present, will testify.

We have no quarrel with fenders; they are good things to cast aside cattle, pigs and horses, but we protest against treating human beings as "beasts" when there is a life-guard made that will pick them up uninjured if they are so unfortunate













ECLIPSE CAR FENDER COMPANY CLEVELAND OHIO













as to be in the way of an electric car.

Demonstrations similar to the one in Brooklyn have been made in the past four months for fifteen different street railway companies in cities throughout the country and their testimony is the same everywhere: "It is the best device for the purpose they have seen." In every case the parties are picked up uninjured.

Twenty minutes after the twenty-two mile per hour trial at Brooklyn, Mr. Lev made a similar demonstration at twelve miles per hour and ten





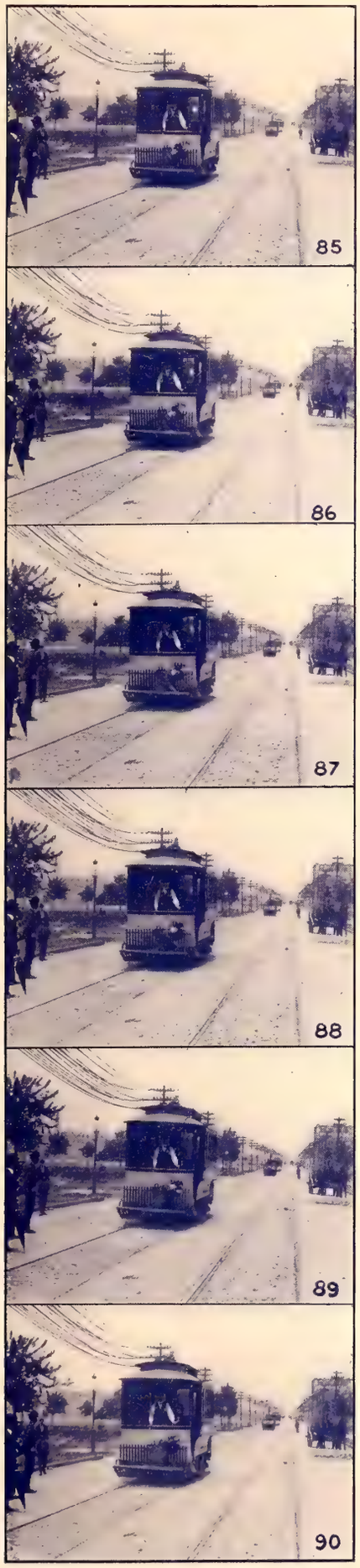






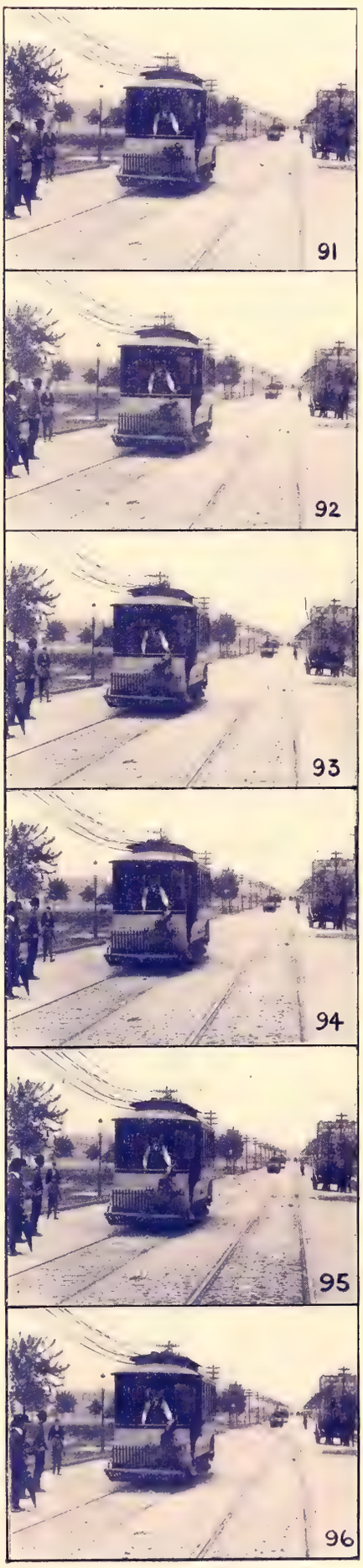


ECLIPSE CAR FENDER COMPANY CLEVELAND OHIO



minutes after that again at six miles per hour, and yet he did not have a bruise on his body or suffer any injury whatsoever.

I imagine, and it does not require much of a stretch of my imagination either, that I hear some of my readers say "O, well, he was the inventor and knew just how to fall into the life-guard". My dear reader, between the time of the first touch of that life-guard to his body and the time he lay at rest on the guard he had no more control over the movements of his body than



ECLIPSE CAR FENDER COMPANY CLEVELAND OHIO













an inanimate object would. To prevent just such comments, these trial demonstrations have been made by the employees of the roads for whom the life-guards have been tried, and the Eclipse Company is unique in that they guarantee any railway company trying their life-guard, that they will secure within twenty-four hours some of their own employees to volunteer without pay to stand in front of the car and allow the guard to pick them up with car going eight to twelve miles per hour. This should













ECLIPSE CAR FENDER COMPANY CLEVELAND OHIO













certainly do away with the idea that they have a trained corps of acrobats who perform these marvelous demonstrations for them.

The Eclipse Company, however, are not dependent upon these trial demonstrations for testimony as to the merits of their life-guard, as the record of the lives saved by their guards in use on the Cleveland City Railway will verify. They have there in a period of seven weeks saved no less than six lives, three of whom were small children.













ECLIPSE CAR FENDER COMPANY CLEVELAND OHIO













One instance was that of a farmer, with two boxes of berries in his hand, who was struck by the guard on a rapidly moving car. This accident was witnessed by an employee of the Big Consolidated Street Railway Co., in Cleveland, who turned his head as the man was about to be struck but turning again ran to the front end of the car, which in the meantime had stopped, and













ECLIPSE CAR FENDER COMPANY CLEVELAND OHIO













there beheld the man lying on the guard, holding his berries safe above his head. When asked if he was hurt he said: "No, nor I ain't spilt my berries, nuther." Another incident was that of a four-year-old child in the Bohemian district, who was evidently after beer for his parents. He darted out on the track and was bowled over into the life-guard, unhurt,

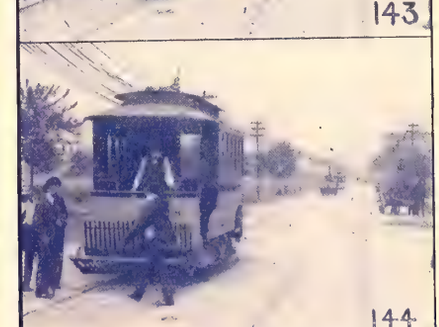












ECLIPSE CAR FENDER COMPANY CLEVELAND OHIO













and when the motorman unlocked the guard and let him out he ran away before they could get his name. He did not let go his hold on the beer pail, and I am told he didn't even spill the beer he was carrying, but I won't vouch for the truth of the latter statement; but you might write to the Cleveland City Railway Company and find out.













Similar Demonstrations

to that described on the preceding pages have been made for fifteen Street Railway Companies in the past four months, with car going full speed in every instance. Employees of the various lines in every case, demonstrating it as well as our own. (No dummies.)



...READ PROPOSITION ON NEXT PAGE...

ECLIPSE CAR FENDER COMPANY CLEVELAND OHIO

Read This Proposition

Place a trial life-guard on one of your cars at our expense, and within twenty-four hours we guarantee to so inspire the confidence of your own employees in its merits as a positive life saver, that one or more of them will volunteer, without pay, to stand in front of the car moving at a speed of eight to twelve miles per hour and allow the guard to pick them up.

Can you get your employees, at any price, to do this with any fender? Remember, it is your own employees, not ours.

It costs you nothing to satisfy yourself that it is the best life-guard on the market, and will more than save their cost to you in the first year, as in accidents with our fender the parties are picked up uninjured, and there is no opportunity for a claim for damages against you.

It is neat in appearance, is more durable and costs less for original equipment and much less for repairs than any so-called fender on the market.

No Company operating an Electric Railway for profit can afford to be without them.

Similar demonstrations to the one in Brooklyn will be made each day of the Convention. For time and place call at our Exhibit, Plot 89, Grand Union Hotel.

The Eclipse Car Fender Company

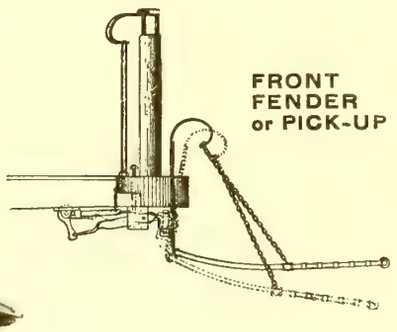
267-269 St. Clair Street, Cleveland, O.

The Life Saving Devices Which Have Never Been Known To Fail

PARMENTER

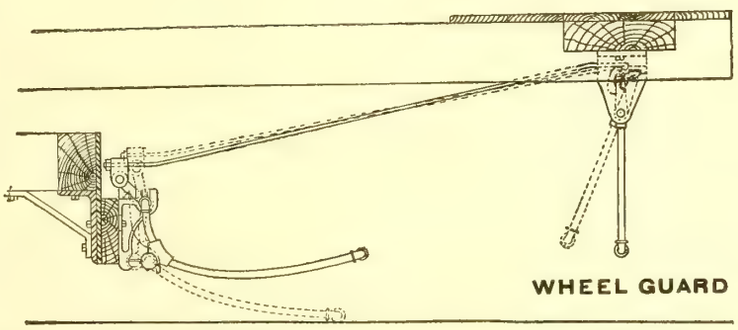
FENDERS AND WHEEL GUARDS

The Fender can be dropped to the roadbed at the will of the motorman either by foot or knee as desired; readily folded or transferred from one end of the car to the other; built of best material; light, effective and durable .....



FRONT FENDER or PICK-UP





WHEEL GUARD

The Wheel Guard is entirely automatic and can be used in connection with Fenders or independently; easily adjusted; built of best material .....

A full investigation of both Fender ana Wheel Guard solicited

PARMENTER FENDER & WHEEL GUARD COMPANY

Successors to GEO. A. PARMENTER

77-79 SUMMER ST.

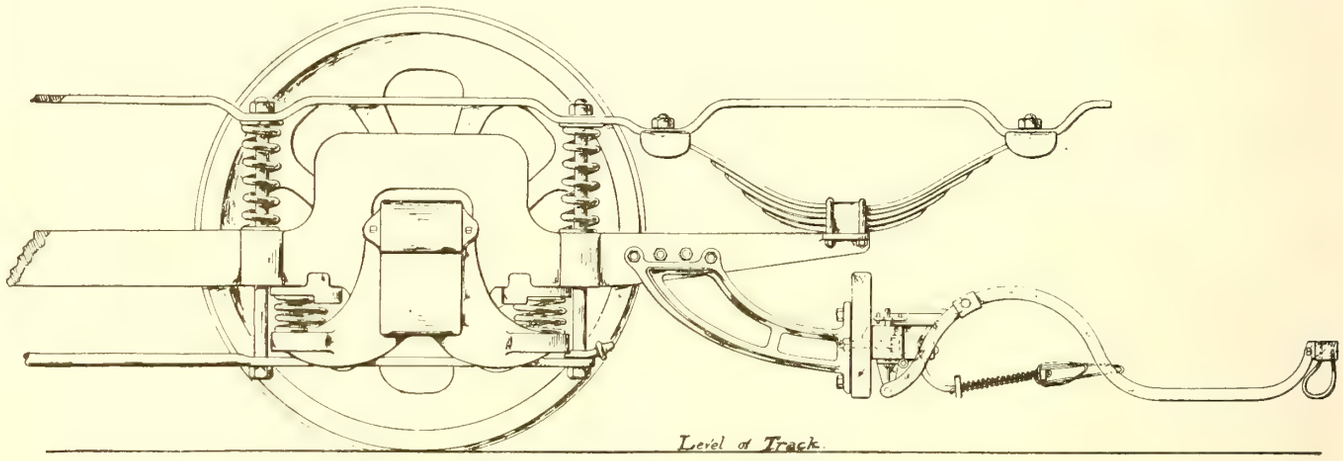
BOSTON, MASS.

The Watson Wheel Guard *is* Absolutely Automatic

It has no connection with any part of car body, and will therefore swing around curves with truck. *It runs at one height from rails and does not oscillate.*

It is *directly over rails* at all times.

The Trip Bar arms being attached to pilot board *act as a guard* to prevent any obstacle from rolling on to track at the sides. There is *no opening between Trip and Guard* as in the gate type.



The Watson Automatic Wheel Guard is easily attached to single or double trucks of any make, four bolts only being required to hold it in position. The wheel guard is provided with a special front or buffer to prevent it striking against any unevenness of road-bed.

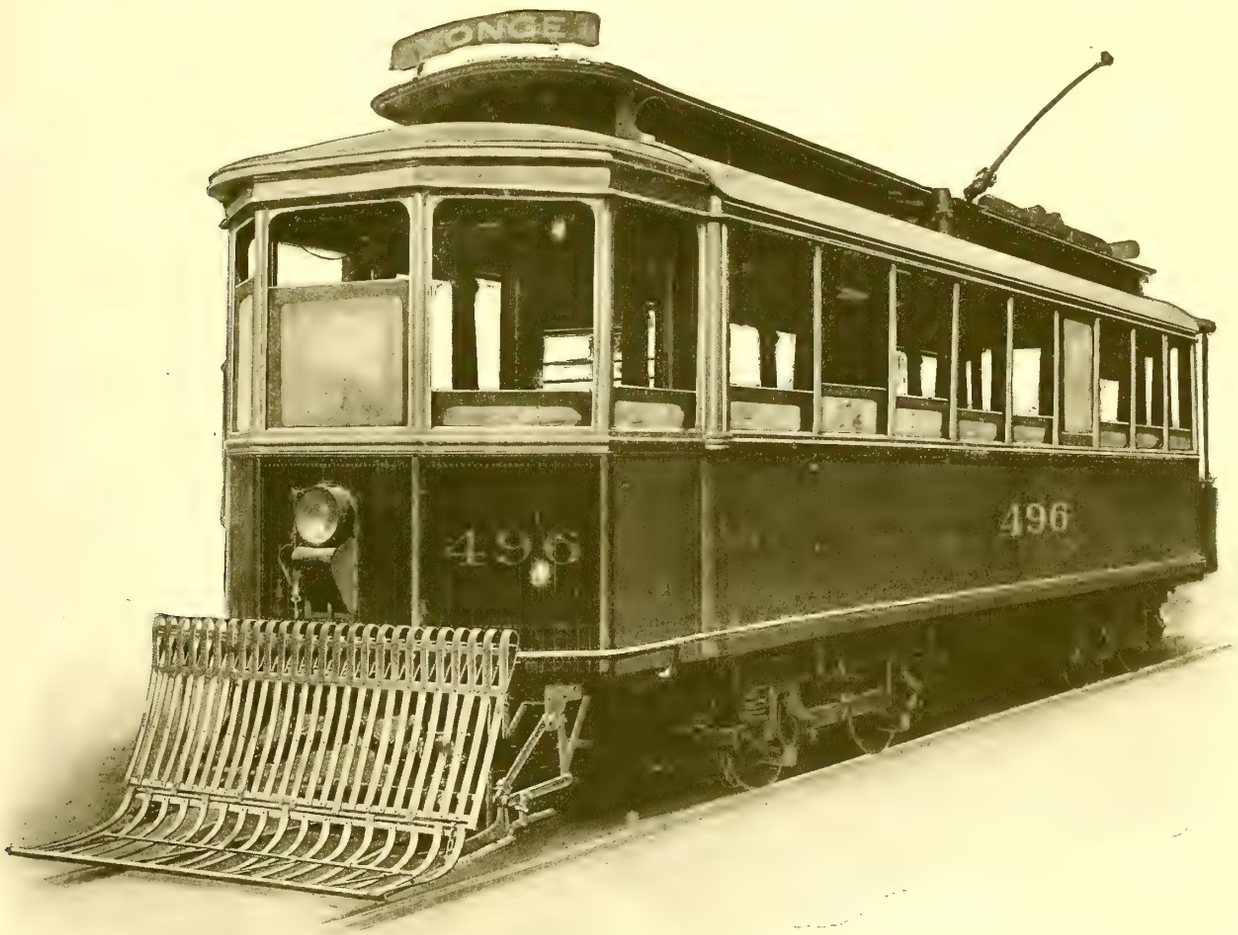
A sample Fender or Wheel Guard will be sent to any street railway company in the market for fender equipments, in the United States or Canada.

W. T. Watson, Newark, N. J.

No Amount *of* Talk will make *a* device better than it really is

The **Watson** Automatic Fender.... Speaks for Itself

It contains principles that make it absolutely the best life-saving device on the market.



This fender will be on exhibit at the SARATOGA CONVENTION, September 2–4.

THE FOLLOWING ARE SOME OF ITS SPECIAL FEATURES:

1. Fender is *self-acting*, but can also be dropped by motorman's foot.
2. *Is locked when dropped to road-bed.*
3. *Is easily detached* and *interchanged to any style of car, one size only* being required for any system.
4. *Can be folded up compactly*, with ease; *does not interfere* with headlight or when coupling.
5. *It has an independent Automatic Release* should the Automatic Trip Bar be turned up against back of cushion.
6. Is built entirely of metal, with interchangeable parts, and is inexpensive to repair.
7. Is most resilient in its action, being cushioned throughout. Frame is telescopic and very strong.

W. T. Watson, Newark, N. J.

ARCHIBALD M. McCREA, Pres. L. G. WOODS, Vice-Pres. A. PANCOAST, Sec'y and Treas

Union Spring and Manufacturing Company,

GENERAL SALES OFFICE
310 FRICK BUILDING, PITTSBURG, PENN.

....MANUFACTURERS OF....

Helical and Elliptical Springs

For Locomotives, Tenders, Coach, Freight Car And Street Car Service

CAPACITY OF PLANT, 60 TONS PER DAY

Branch Offices

D. L. Markle, Old Colony Building, Chicago, Ill.

Southern Railway Supply and Machinery Co., Savannah, Ga.

General Offices and Works, at New Kensington, Pa.

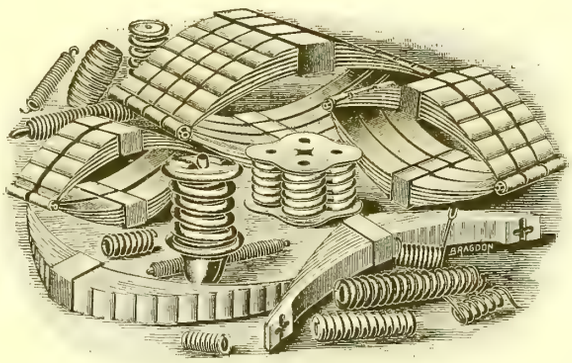
P.S.&S.Co

SPRINGS

P.S.&S.Co

ELLIPTIC COIL

Springs for Traction Cars especially adapted to High Speed Work; also for Locomotives, Freight, Coal and Dump Cars



Also Governor Machinery Agricultural Implements, Springs of the Highest Grade.



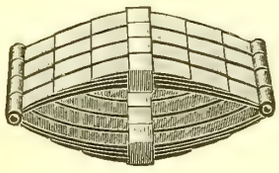
FOR EVERY PURPOSE

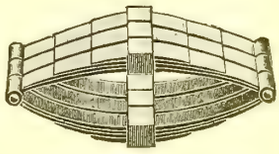


BEST MATERIAL USED.

ALL SPRINGS OIL TEMPERED







QUALITY AND WORKMANSHIP GUARANTEED



CORRESPONDENCE AND ORDERS SOLICITED

D. C. NOBLE, PRESIDENT

L. C. NOBLE, VICE PRESIDENT.

PITTSBURGH SPRING & STEEL CO.

INCORPORATED UNDER LAWS OF PENNSYLVANIA, 1902. CAPITAL, $500,000.00.

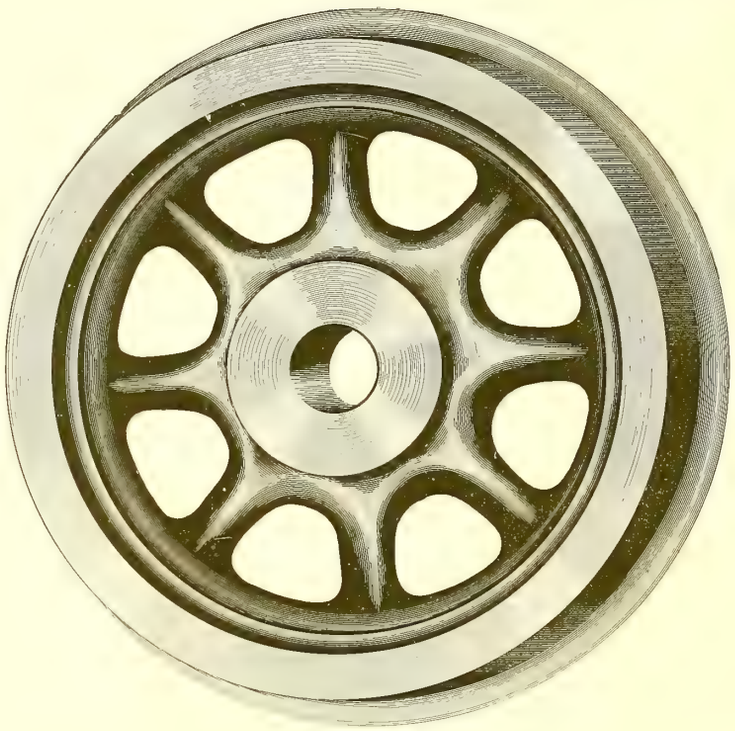
1416-16A-17 FARMERS BANK BLDG., PITTSBURGH, PA.

Farmers' Bank Building, PITTSBURGH, PA. | 12 John Street, NEW YORK, N. Y. | Fisher Building, CHICAGO, ILL. | Pioneer Press Building, ST. PAUL, MINN. | 516 North Third Street, ST. LOUIS, MO.

Railway Steel-Spring Co.

STEEL TIRED WHEELS

Adopted as Standard by Principal Electric and Interurban Roads



Safer, More Durable and More Economical Than Cast Iron Wheels

Blue Prints and Prices Furnished on Application

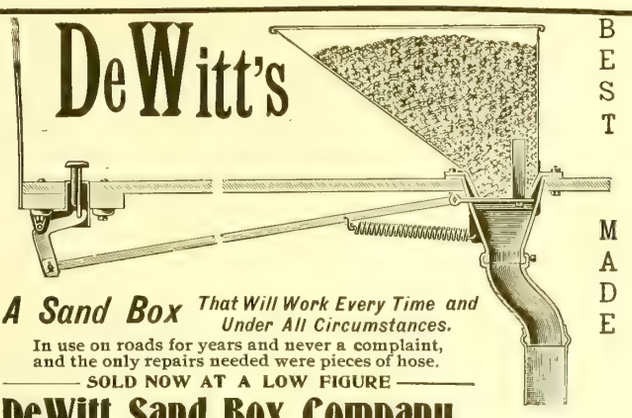
GENERAL OFFICE:

71 BROADWAY, = = = NEW YORK

BRANCH OFFICES:

CHICAGO, - = - - 1380 Old Colony Building
ST. LOUIS, - - - - Lincoln Trust Building
WASHINGTON, - - - - - 17 Sun Building
ST. PAUL, - - - - Pioneer Press Building

DeWitt's



BEST MADE

A Sand Box *That Will Work Every Time and Under All Circumstances.*

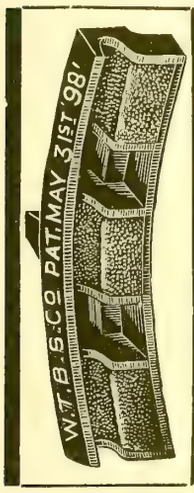
In use on roads for years and never a complaint, and the only repairs needed were pieces of hose.

SOLD NOW AT A LOW FIGURE

DeWitt Sand Box Company, 523-525 Fifth Ave., TROY, N. Y

New York Office, C. J. Harrington, 15 Cortlandt St., N. Y.

Western Agents, Standard Railway Materials Co., Chicago, Ill.



THE REMEDY FOR

FLAT WHEELS

THE WHEEL TRUING BRAKE SHOE

We can true your wheels perfectly while the car or engine is in service and do it cheaper and with less trouble than it can be done by any other method.

WHEEL TRUING BRAKE SHOE CO.

DETROIT, MICH.

Lobdell Car Wheel Co.

WILMINGTON, DEL., U. S. A.



MANUFACTURERS OF

CAR WHEELS

OF ALL SIZES AND DESCRIPTIONS

For Electric and Cable Cars, Snow Plows, Sprinklers, Horse Cars, Etc.

GRIFFIN WHEEL COMPANY

STREET RAILWAY DEPARTMENT
503 WESTERN UNION BUILDING
CHICAGO, ILL.

SPECIAL

CHANNEL SPOKE AND DOUBLE PLATE WHEELS

...FOR...

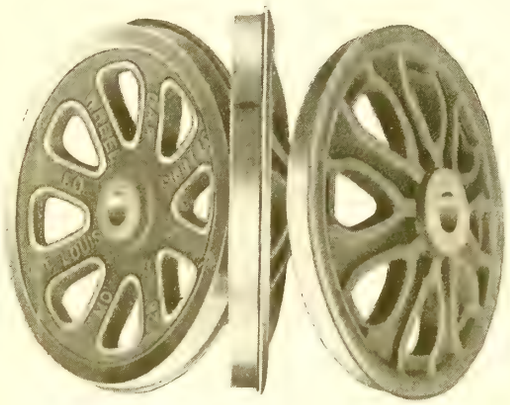
CITY AND INTERURBAN SERVICE

....FOUNDRIES....

CHICAGO DETROIT ⚜ DENVER ST. PAUL ⚜ TACOMA KANSAS CITY

Improved Car Wheels

FOR CITY AND INTERURBAN SERVICE



The only Spoke Wheel adapted for heavy, high-speed service

Stronger Spokes
Stronger Flange
Deep, Even Chill
Greater Mileage
Absolute Safety

Are Important Advantages of our

Re-Enforced Spoke Wheel

THIS Wheel is being substituted in place of the old style Plate Wheel because it does NOT rumble and roar when on paved city streets

A SAMPLE order will prove its superiority over the old style Spoke Wheel

WRITE FOR BOOKLET ON WHEELS

St. Louis Car Wheel Co.

ST. LOUIS, MO.

Section I

FINANCIAL AND ENGINEERING

Bankers, Brokers, Trust Companies, Engineers and Contractors

Section II

EUROPEAN MANUFACTURERS AND CONTRACTORS

Leading British, German and French Houses

Section III

ELECTRICAL MACHINERY, STORAGE BATTERIES, MOTIVE POWER SYSTEMS

Section IV

STEAM PLANT EQUIPMENT REPAIR SHOP APPLIANCES

CLASSIFIED CYCLOPÆDIA OF MANUFACTURERS, DEALERS, CONTRACTORS, ETC.

FOR ALPHABETICAL INDEX TO ADVERTISERS SEE PAGES 5-8

Section V

RAILS AND TRACK MATERIAL, SIGNAL SYSTEMS, STRUCTURAL IRON WORK

Section VI

POLES AND LINE MATERIAL, RAIL BONDS, WIRES AND CONDUITS, ELECTRICAL INSTRUMENTS AND SUPPLIES

Section VII

CAR and TRUCK EQUIPMENT

Brakes, Registers, Fenders, Wheels, Heaters, Headlights, Trolleys, Gears, etc.

Section VIII

ROLLING STOCK

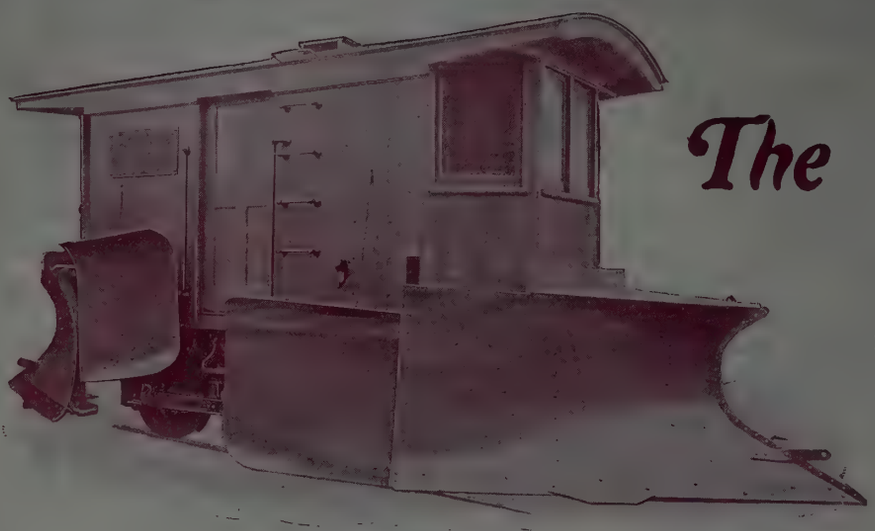
Cars, Trucks, Snow Plows, Sweepers and Sprinklers

SECTION VIII.

ROLLING STOCK

Cars, Trucks, Snow Plows, Sweepers and Sprinklers

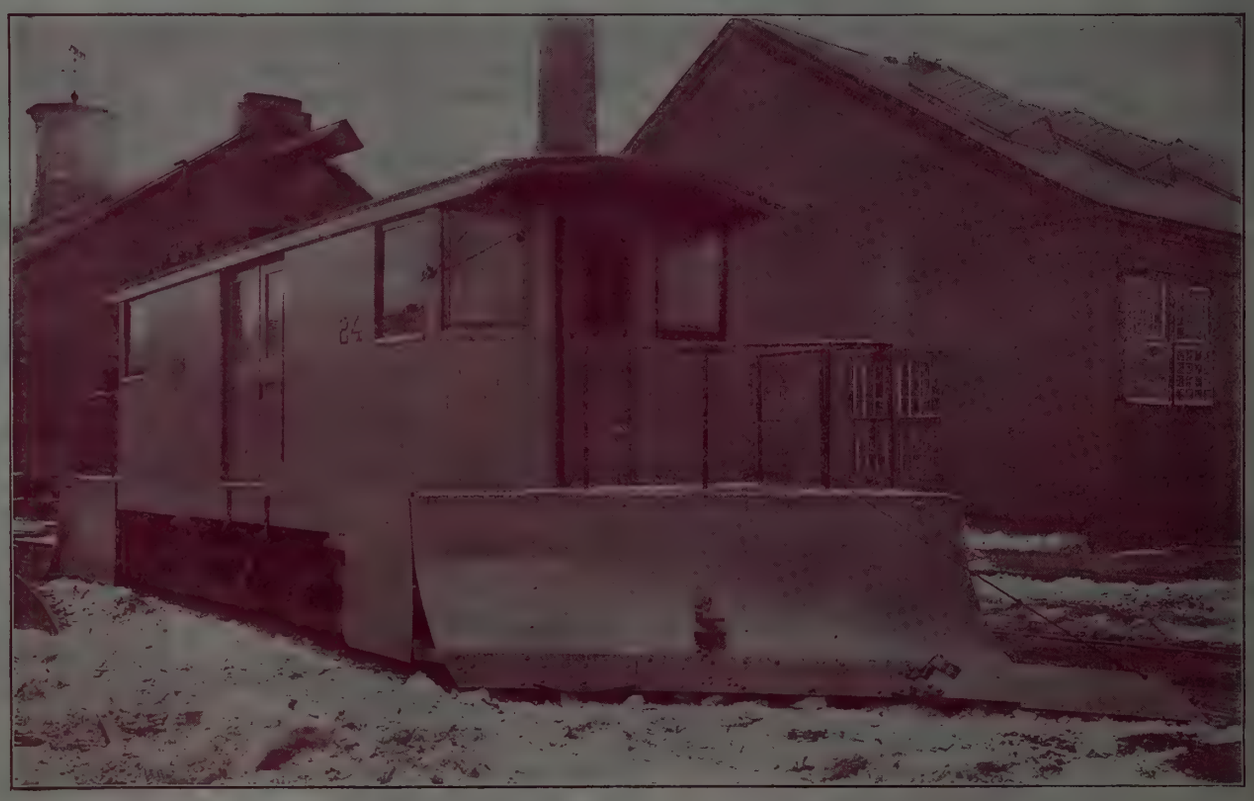
SNOW FIGHTERS



The Taunton Plows....

OUR CATALOGUE SHOWS THEM

THE FOUR-WHEEL HEAVY NOSE PLOW.



THE EIGHT-WHEEL DOUBLE TRACK SHARE PLOW.

The Taunton Locomotive Mfg. Co.

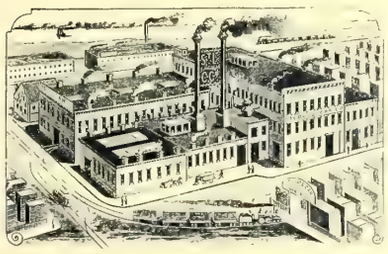
TAUNTON, MASS.

GEO. S. HASTINGS & CO.
CLEVELAND, OHIO

WENDELL & MacDUFFIE
NEW YORK, N. Y.

The Largest Individual Electric Car Plant in the World

A STUDY of the electric railway industry, is, at the same time, a study of the growth, development and expansion of the St. Louis Car Company. While the development of the former has been phenomenal, the latter has kept right abreast with the wonderful progress made by this industry, and to-day the St. Louis Car Company is the largest and leading plant of its kind in the world. This great establishment of the World's City fully represents the American idea of push, progress and advancement.



The company was organized in 1887 and its growth for the first ten years was sure and steady. During the last six years the progress made has been remarkable. There is a reason for all things—and that this company has grown so rapidly, is due to the systematic and up-to-date methods of manufacture and modern equipment, as well as a thorough knowledge and understanding of the requirements and wants of the electric railway industry.

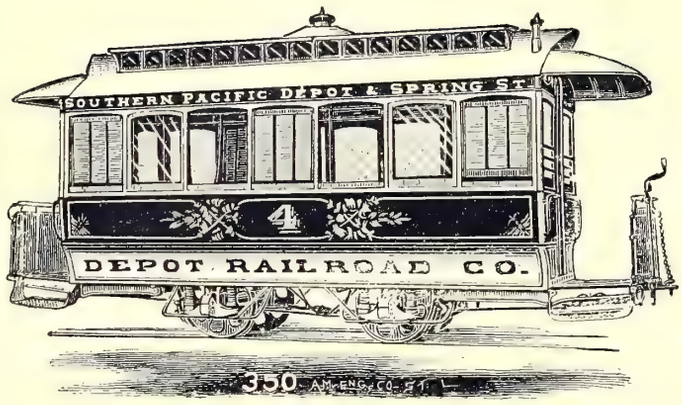
The original works of the company were located at 3000 North Broadway. In 1898 new works were erected at 8000 North Broadway. Its present manufacturing equipment is the most modern that can be found anywhere. A comparison of the original works and the shops of the present day, will illustrate the expansion of the company more than words possibly can. Several months ago the St. Louis Car Company

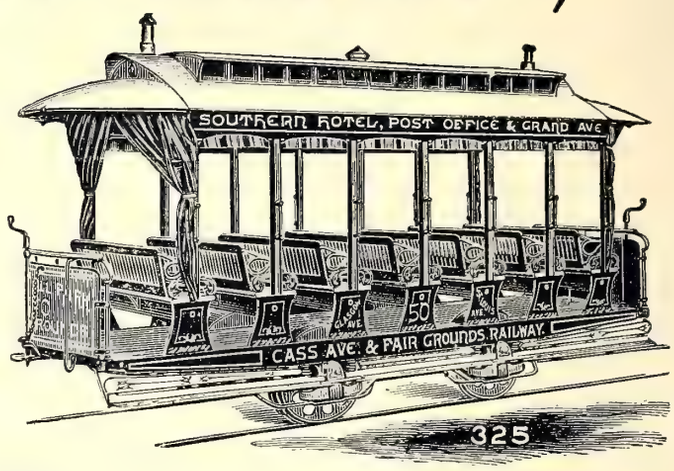


purchased the Laclede Car Company, of St. Louis. In 1887, the capacity of the parent plant was 600 cars per annum. At the two institutions are now employed close to 3000 men, and the capacity of the two plants is 3500 cars per annum. Besides this, there is a large output of trucks, the trucks of the company being noted for their easy riding qualities and strength. The St. Louis Car Company also makes its own seats, arc headlights and arc lamps for car interior illumination, and many other specialties and fixtures that are essential to a modern car. The company operates its own brass foundry, where all brass and bronze trimmings are turned out; and recently their malleable and gray iron foundry was completed and is now under full operation. Manufacturing these specialties and material themselves has proven quite a factor in the successful career of this company, as it permits them to take large orders for quick delivery.

REPRODUCTION OF ADVERTISEMENT IN STREET RAILWAY JOURNAL DURING 1888.

SAINT LOUIS CAR COMPANY,





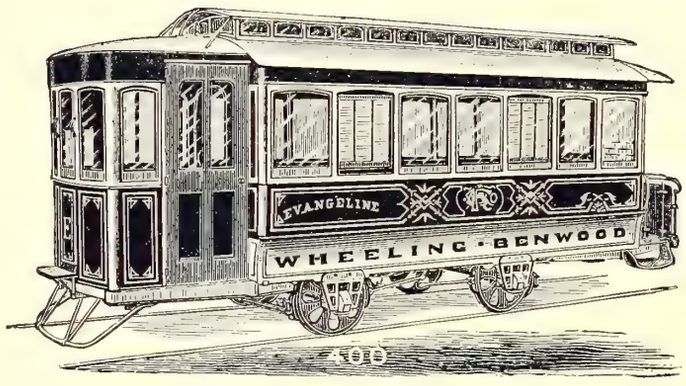
MANUFACTURERS OF

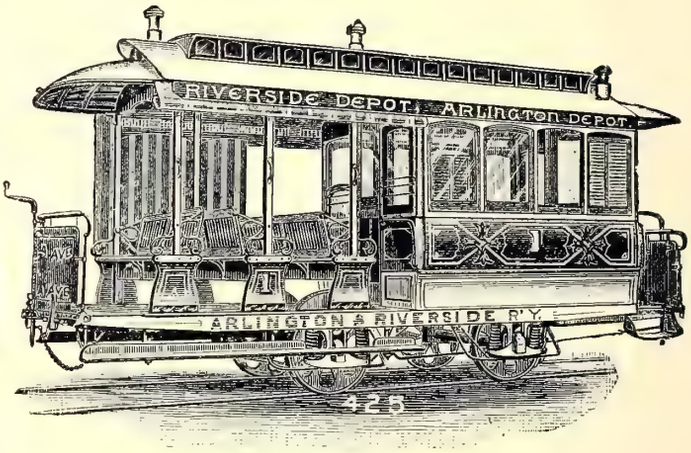
HORSE, CABLE, ELECTRIC

AND ALL OTHER

MOTOR CARS,

NARROW GAUGE COACHES, ETC.

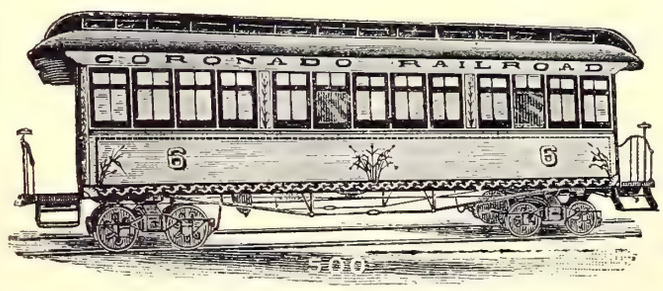


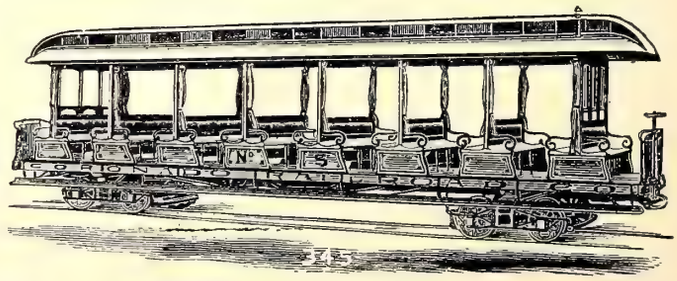


Works the Most Complete in the Union.

Patterns of the latest and most approved designs.

Best Materials and Workmanship Guaranteed.



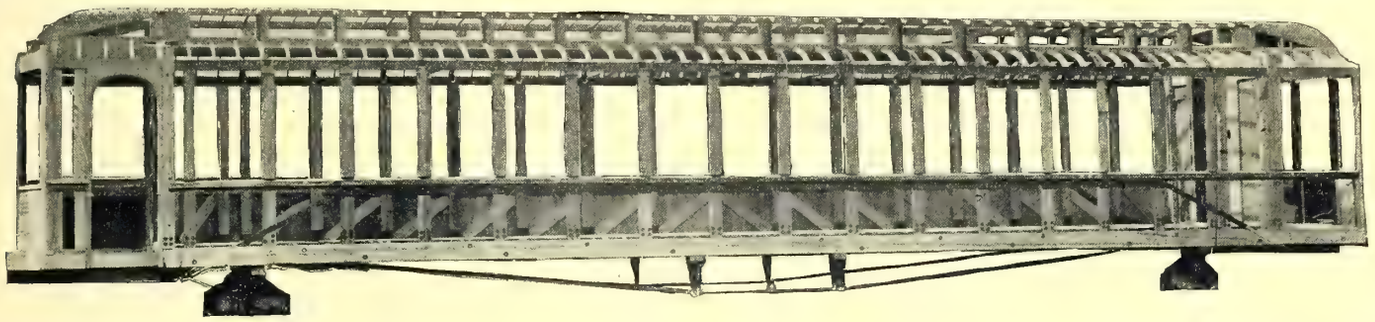


OFFICE: 3023 NORTH BROADWAY, ST. LOUIS, MO.

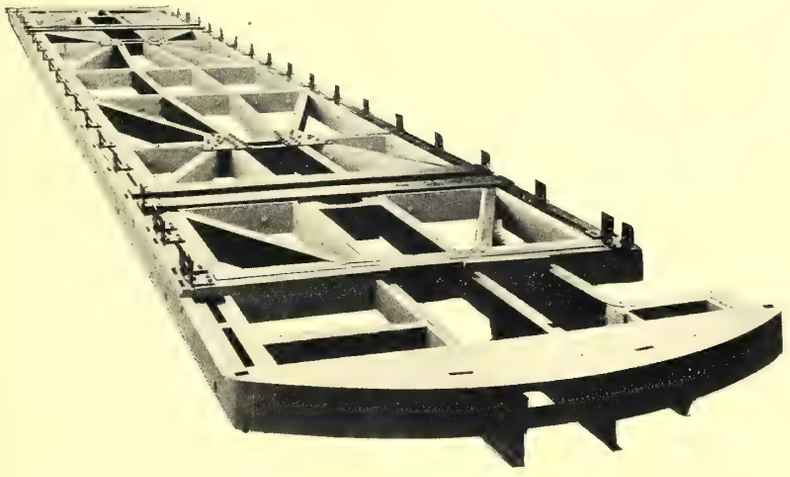
The Largest Individual Electric Car Plant in the World

The Old and The New

On the preceding page will be seen a reproduction of an advertisment published in the JOURNAL in 1888, showing style of cars used at that time and which were very popular in their day. Below we show illustrations of the Fonda, Johnstown & Gloversville car, which is the very latest in electric street car construction.



The bottom construction of these cars is all steel and was designed especially to minimize the effects of collision under all conditions. The steel in this bottom alone weighs 18,500 pounds. All connections on body framing are steel on steel, thus making a steel frame work, independent of any wood work. There are many novel features about these cars and more will be said about them in the next issue of the JOURNAL.



ST. LOUIS CAR COMPANY

ST. LOUIS, MO.

The Largest Individual Electric Car Plant in the World

Practical and Popular

When in the market again for cars look into our STEEL CHANNEL BOTTOM before signing contract. The feature of this bottom is the opportunity it gives for a very low car body without interfering with the strength of the car by cutting down the strength of the sills.



The longitudinal strength is obtained entirely by the two channel steel side-sills. This does away with the usual heavy longitudinal timbers under the middle, and allows more room for radiation of trucks. This form of bottom construction gives you a single low step from platform to ground, an advantage over other forms of car bottom framing that railway officials will readily see. These steel channel bottoms weigh no more than those of the combination wood and steel sill plates; are considerably stronger and better adapted for convertible cars.

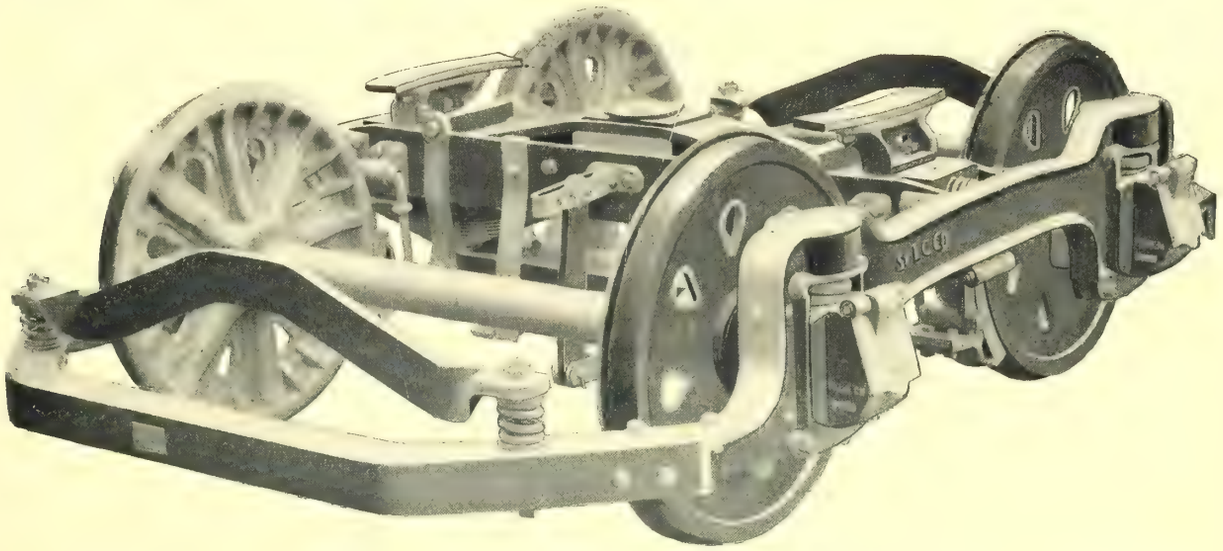
ST. LOUIS CAR COMPANY

ST. LOUIS, MO.

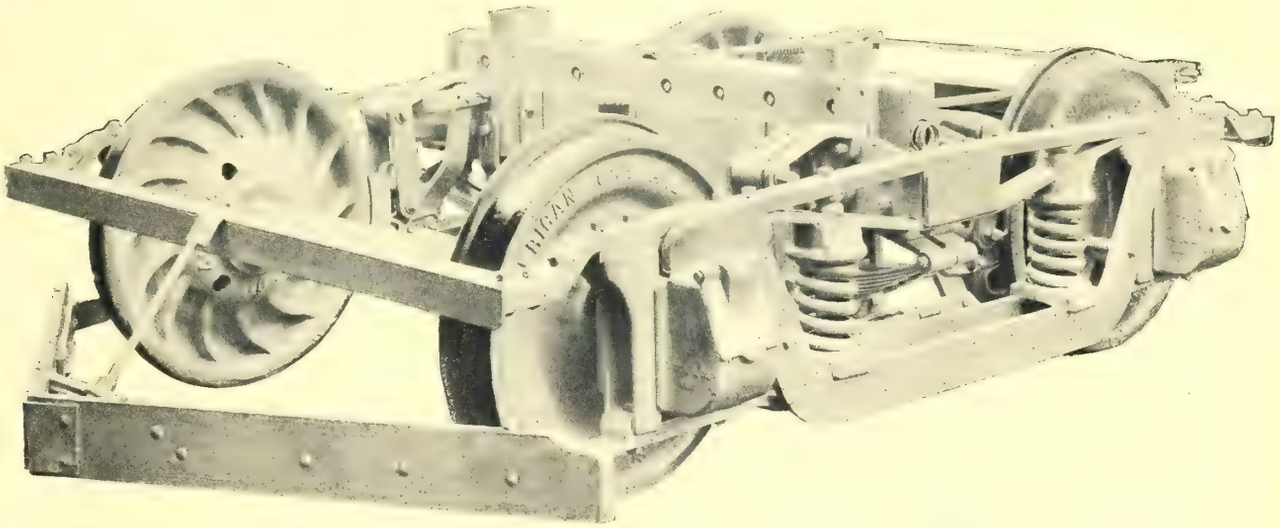
The Largest Individual Electric Car Plant in the World

The Two Essentials—Easy Riding Qualities and Strength

The trucks turned out by the St. Louis Car Company possess these two essentials that must necessarily be combined in a good truck.



Truck No. 47, a short wheel base truck for city service, proved an instantaneous success; and we have been turning out large numbers of this truck ever since we placed it on the market.



The many No. 23-B trucks now in use is the best evidence of its worth and popularity. This is *the* interurban truck, and it has made true the saying, "nothing succeeds like success". While we build these trucks to meet any and all requirements, we preserve the M. C. B. principles in the construction, which assures easy riding qualities and strength.

ST. LOUIS CAR COMPANY

ST. LOUIS, MO.

The Largest Individual Electric Car Plant in the World

Comfort, Ease and Durability

Are necessary to a good seat. The St. Louis Car Company seats—made at their shops—embrace all of these qualities. The importance of the seat is often underestimated, and in consequence, an inferior seat is obtained, entailing a big expenditure for repairs and maintenance. Get our seats and save this item. No repairs required—they last.



WRITE FOR CATALOG.

ST. LOUIS CAR COMPANY

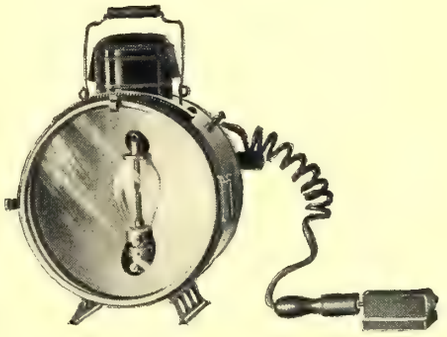
ST. LOUIS, MO.

The Largest Individual Electric Car Plant in the World

Bright Lights

An item that recommends itself to street railway officials in the purchasing of specialties and fixtures is ECONOMY. We recommend our arc lamps for interior car lighting for economy in current consumption and maintenance; for its steadiness of light, longer life and automatic clutch, which will not be jolted out of place.





The St. Louis Car Company's headlight is the result of practical experimenting. Defects have been weeded out as they came up in service, and to-day this headlight is *perfect*. *You cannot jar it out* and yet it is self-feeding.

WRITE FOR CATALOG.

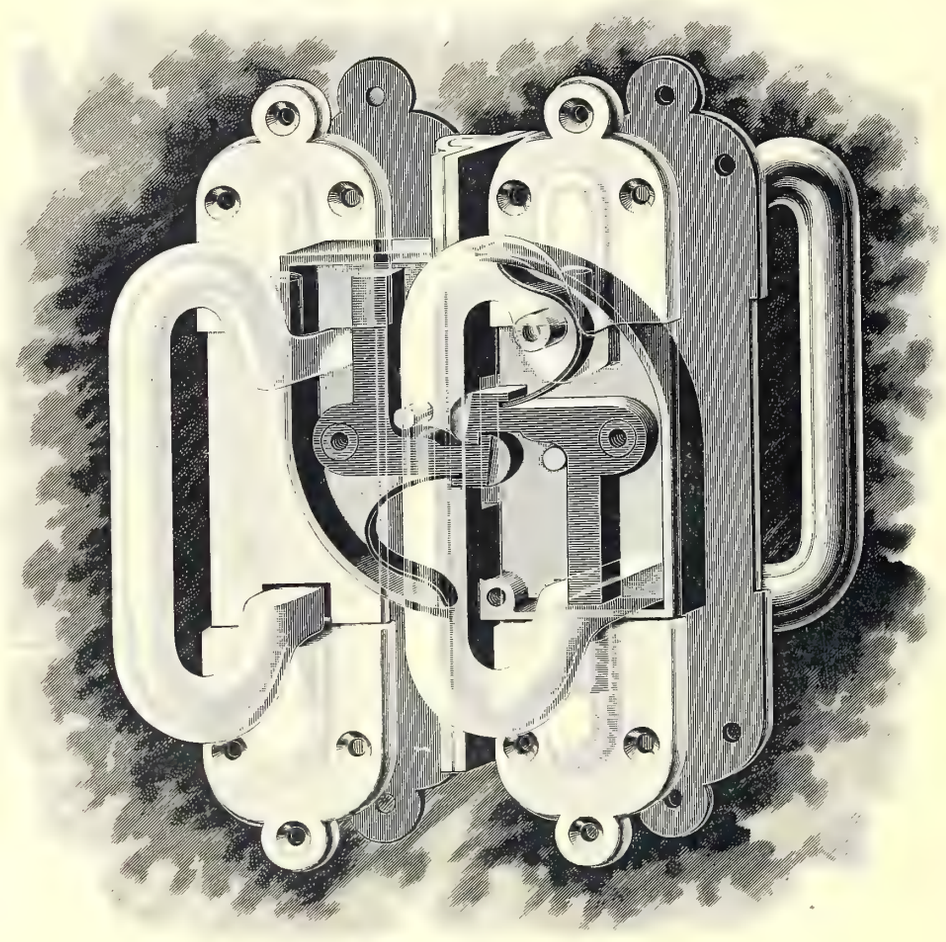
ST. LOUIS CAR COMPANY

ST. LOUIS, MO.

The Largest Individual Electric Car Plant in the World

Great in its Simplicity

Our automatic twin lock has many good and strong points. It's automatic; catch hold of grip and door opens; slamming two doors together locks them. It does away with hooks and loops.

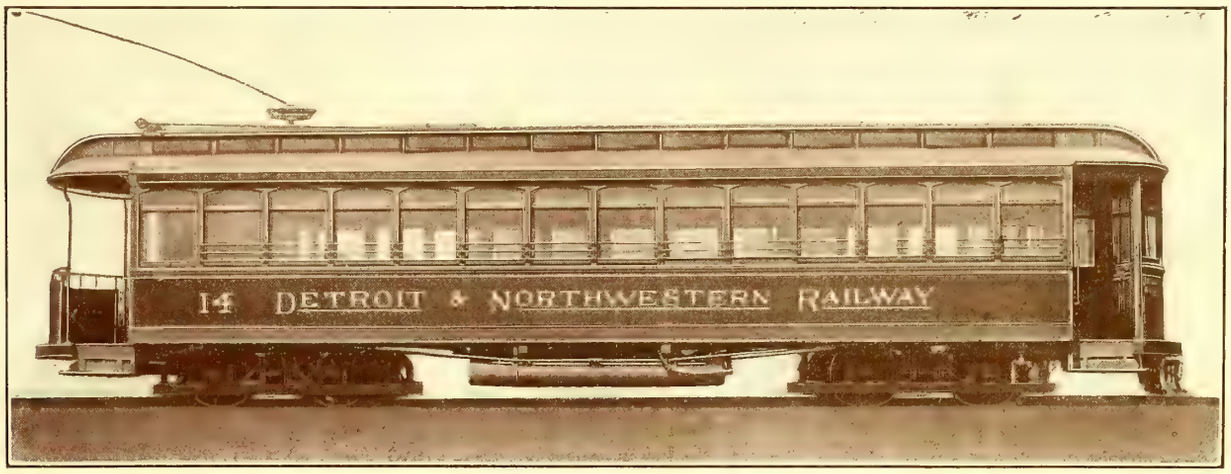


Motorman's attention is not diverted from his duty by continual opening of doors while car takes a curve. Passengers are not annoyed by "dust-baths," a common complaint everywhere. Doors once locked, stay locked, unless opened by taking hold of grip. It is a simple device, but it is successful, and works smoothly and satisfactorily. Try it, we are confident you will be pleased with the result.

ST. LOUIS CAR COMPANY

ST. LOUIS, MO.

Illustrating Durability



We have always claimed that our cars were built second to none in STRENGTH, DURABILITY and BEAUTY of design. We have illustrated in this journal photograph and report of a wreck, illustrating STRENGTH of our cars. We now wish to call attention to our claim of DURABILITY. The car shown in this page was built by the old G. C. KUHLMAN CO. over five years ago, and was pronounced by the railway men who visited the last convention in Detroit to be the best looking car and best PRESERVED car that came into Detroit.

The repairs on this car have been practically nothing, and it is good for years to come. WE HAVE ENTIRELY REBUILT CARS MADE BY OTHER COMPANIES THAT ARE NO OLDER THAN THIS ONE.

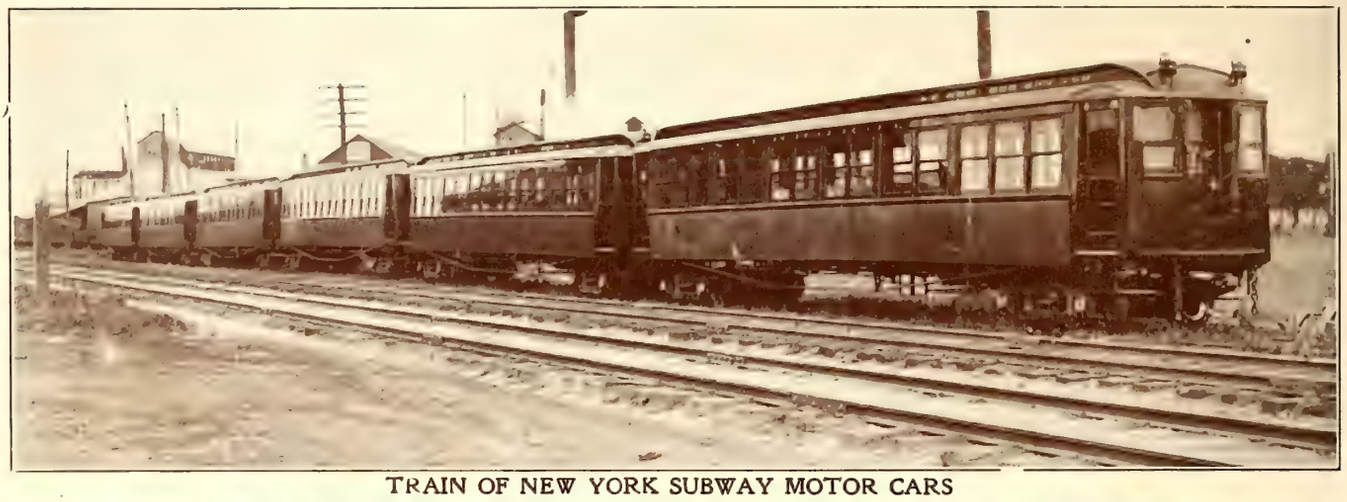
WATCH FOR OUR AD. ILLUSTRATING
BEAUTY OF DESIGN

THE G. C. KUHLMAN CAR CO.

CLEVELAND, OHIO

OFFICE AND FACTORY, COLLINWOOD, OHIO

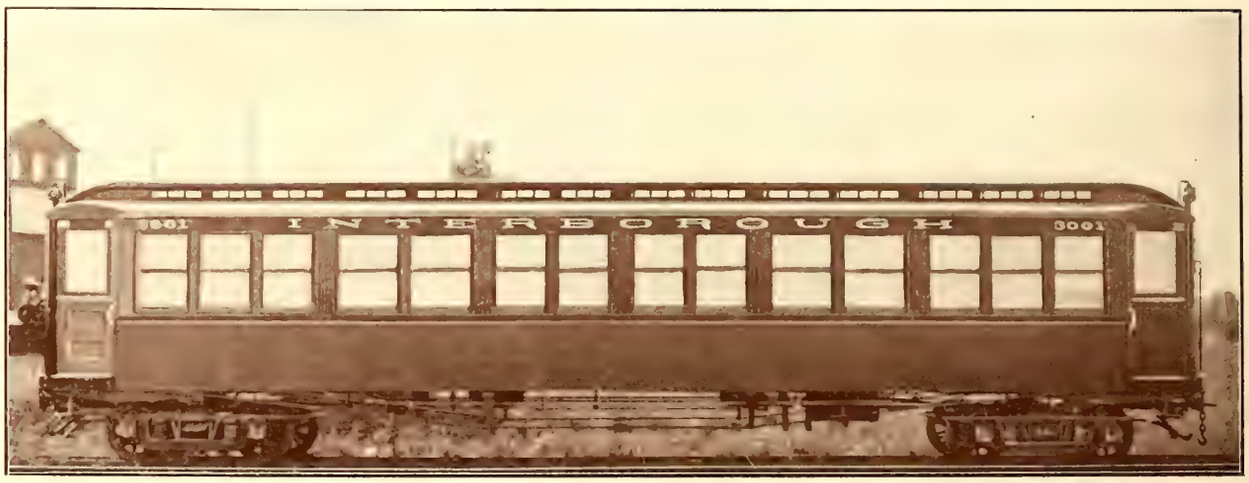
THE JEWETT



TRAIN OF NEW YORK SUBWAY MOTOR CARS



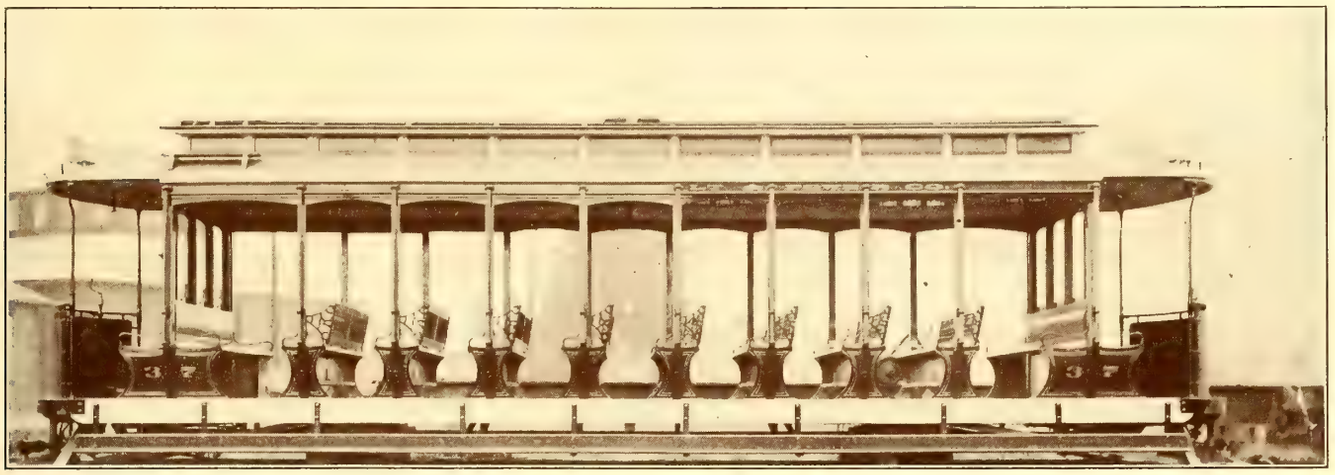
INTERIOR OF NEW YORK SUBWAY MOTOR CAR



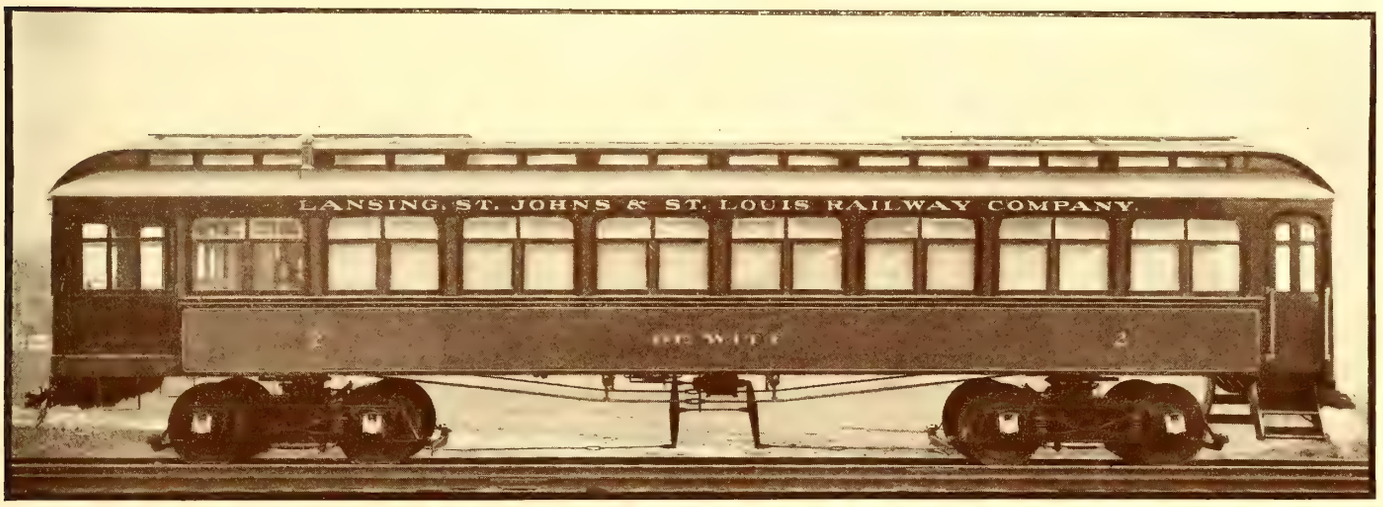
NEW YORK SUBWAY MOTOR CAR, ONE HUNDRED OF WHICH ARE NOW BEING BUILT AT OUR WORKS

NEWARK,

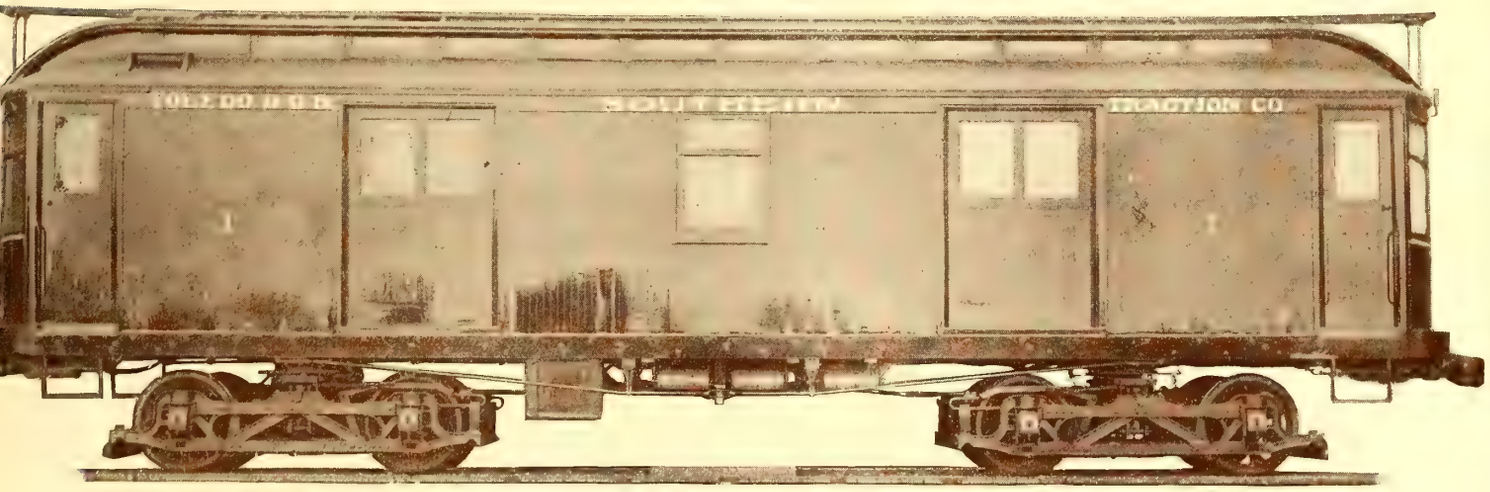
CAR COMPANY



STANDARD 12-BENCH OPEN CAR



56-FT. SPECIAL CAR BUILT FOR THE ARNOLD ELECTRIC POWER STATION OF CHICAGO, TO BE USED IN CONNECTION WITH B. J. ARNOLD'S SINGLE-PHASE MOTORS



STANDARD 45-FT. BAGGAGE AND EXPRESS CAR

OHIO, U. S. A.

THE JEWETT



TRAIN OF NEW YORK SUBWAY MOTOR CARS



INTERIOR OF NEW YORK SUBWAY MOTOR CAR



NEW YORK SUBWAY MOTOR CAR, ONE HUNDRED OF WHICH ARE NOW BEING BUILT AT OUR WORKS

NEWARK,

CAR COMPANY



STANDARD 12-BENCH OPEN CAR

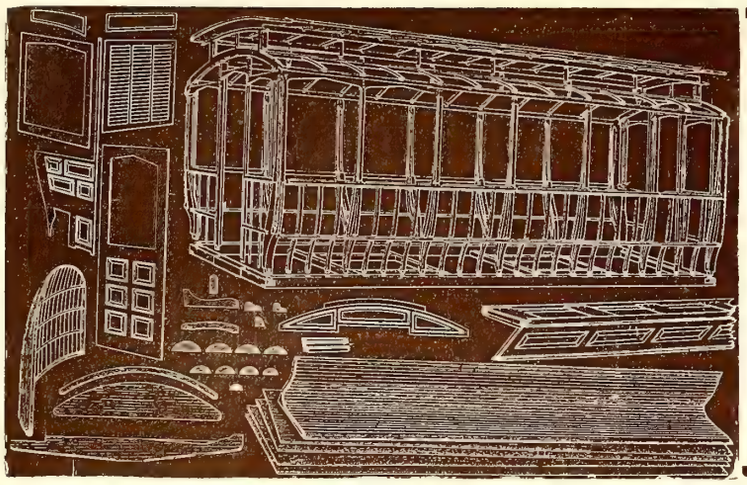


56-FT. SPECIAL CAR BUILT FOR THE ARNOLD ELECTRIC POWER STATION OF CHICAGO, TO BE USED IN CONNECTION WITH B. J. ARNOLD'S SINGLE-PHASE MOTORS



STANDARD 45-FT. BAGGAGE AND EXPRESS CAR

OHIO, U. S. A.



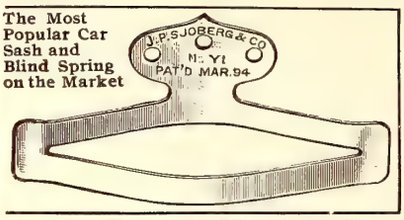
J. P. SJOBERG & CO.

533-539 West 32d Street, NEW YORK,

MANUFACTURERS OF

STREET CAR WOOD WORK

The Most Popular Car Sash and Blind Spring on the Market



For Repairs Rebuilding and Stationary Vestibules

Also Portable Vestibule Fronts Complete

THE NILES CAR & MFG. CO.

Manufacturers of

ELECTRIC and STEAM PASSENGER CARS

WORKMANSHIP AND MATERIAL THE BEST

Inquiries Solicited

NILES, OHIO = = U. S. A.

The Practical Electric Railway Hand Book

By ALBERT B. HERRICK

An exceedingly valuable compilation of engineering facts, figures and dimensions which are directly applicable in the construction, testing and operation of electric railway systems. Three Dollars per copy, postpaid.

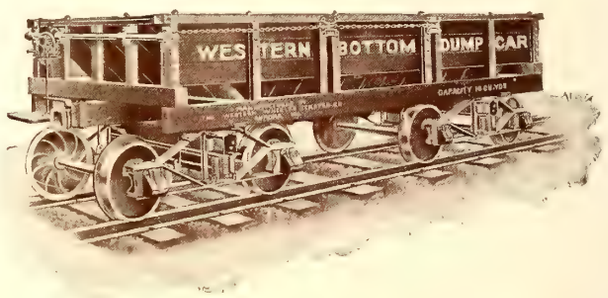
McGRAW PUB. CO., BOOK DEPT.
114 LIBERTY STREET, NEW YORK

WESTERN BALLAST CARS

CENTRE DUMP

OUR NEW CENTRE DUMP, DOUBLE TRUCK CAR
10 Yards' Capacity

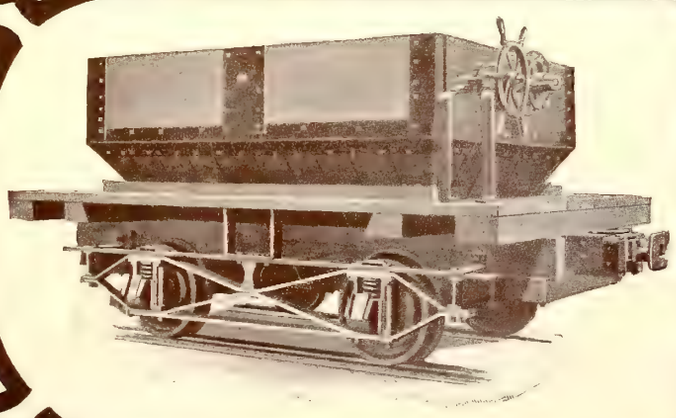
Strongly built, low construction, easily loaded, easily dumped, doors dropped instantly by moving a lever, equipped with simple but effective device for regulating opening to any desired size, from one inch to width of car.



These cars will stand up under any load; require few repairs, stick to the track, are easily handled, save labor, dump clean.
Also all sizes of Side and Bottom Dump Cars, Wheeled Scrapers, Dump Wagons, Grading Plows, Road Graders, Rock Crushers.

FOR FULL INFORMATION ADDRESS

WESTERN WHEELED SCRAPER COMPANY
AURORA, ILLINOIS, U. S. A.



BOTTOM AND SIDE DUMP

BALLAST CARS

FOR ELECTRIC RAILWAY LINES

Car discharges load between rails; has large opening so that it can be dumped instantly, the doors being dropped. If preferred, the tripping device can be made to distribute the load while car is in motion.

Made regularly in six yard sizes on standard gauge. Economical in operation. Invaluable for hauling cinders, gravel, etc.

WE ALSO MANUFACTURE
WHEELED SCRAPERS, DUMP CARTS, GRADING PLOWS, DRAG SCRAPERS, WHEELBARROWS.

THE KILBOURNE & JACOBS MFG. CO.
COLUMBUS, OHIO.

The "HART CONVERTIBLE" Construction, Ballast and Freight Car



AS A FLAT-BOTTOM GONDOLA CAR.

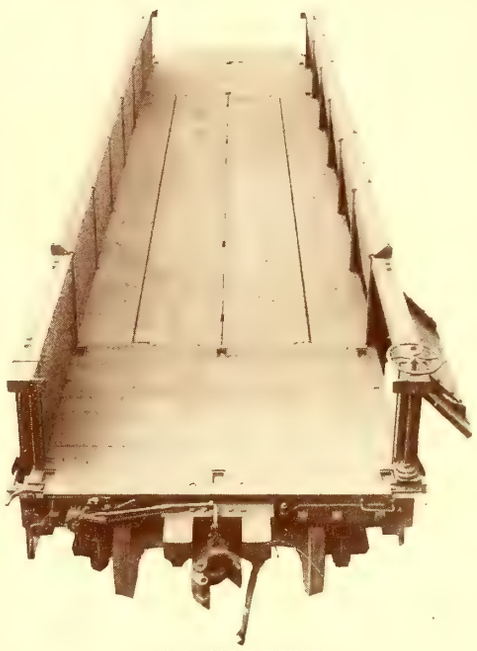
A GREAT COMBINATION—THREE CARS IN ONE.



AS A CENTER-DUMP.

Rodger Cars Used on 135,000 Miles of Track.

Save Cost First Season.



AS A SIDE-DUMP.

SOME OF MANY:

Detroit, Monroe & Toledo Short Line.
Indianapolis Northern Traction Co.
John R. Lee Contract Co.
Great Northern Construction Co.
Townsend, Reed & Co.
Oregon W. P. & Railway Co.
Union Traction Co. of Indiana.
Chicago & Joliet Electric Railway.

ONE OF MANY:

"The Rodger Cars, in connection with your Plow Car, have proved the MOST ECONOMICAL and QUICKEST way of handling ballast. I would not care to do any ballasting, either for CONSTRUCTION or MAINTENANCE, without having an equipment of your cars. Have tried both SMALL and large cars, and find that LARGE CARS are by far the BEST and MOST ECONOMICAL."

W. B. STRANG, Detroit & Toledo Short Line.

Rodger Ballast Car Co. FISHER BUILDING, CHICAGO, ILL.

McGUIRE MFG. CO.

Manufacturers of

Electric Trucks Single and Double for Every Condition of Service

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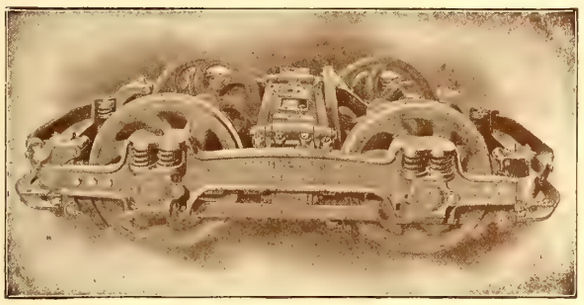
London Office:
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HIGH HOLBORN, LONDON, W. C.

SEND FOR CUTS AND BLUE PRINTS

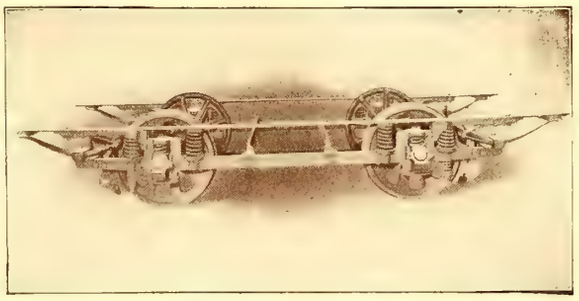
McGuire Manufacturing Co.



Pneumatic Sprinkler in Operation, Spraying Water 45 Feet on Each Side of Track



No. 39 Double Truck



Solid Steel Columbian

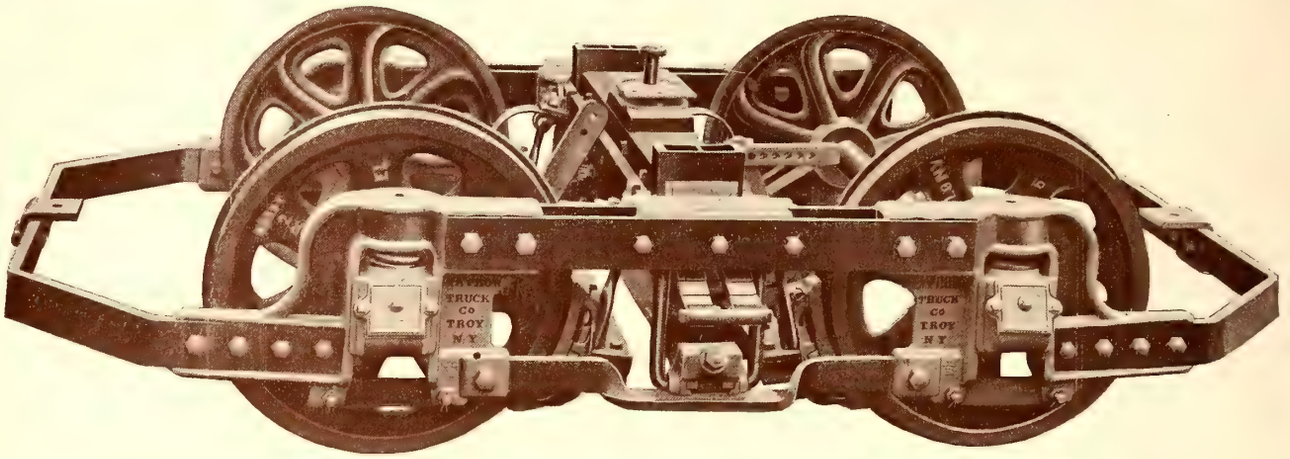


Snow Sweeper with Side Wing Plows

Illustrations, Blue Prints, Specifications and Other Data Cheerfully Furnished

McGuire Manufacturing Co., 122-132 N. SANGAMON ST. CHICAGO

For Carrying Long Cars Around Curves of Short Radii, the Taylor Swing Motion Double Truck is Superior to All Others



Constructed to mount a car low down, and to accommodate long cars that are FRAMED NARROW on the sills. The wheel base is 4′ 6″ with 33″ wheels, and 4′ 3″ with 30″ wheels. The only short wheel base Double Truck on the market with swing motion and elliptic springs for the riding of the car body. Constructed on the best principles of Master Car Builders' standard practice. The brakes are of the live and dead lever system, made extra strong, so that air-brakes can be used if desired.

TAYLOR ELECTRIC TRUCK CO., Troy, N. Y., U.S.A.

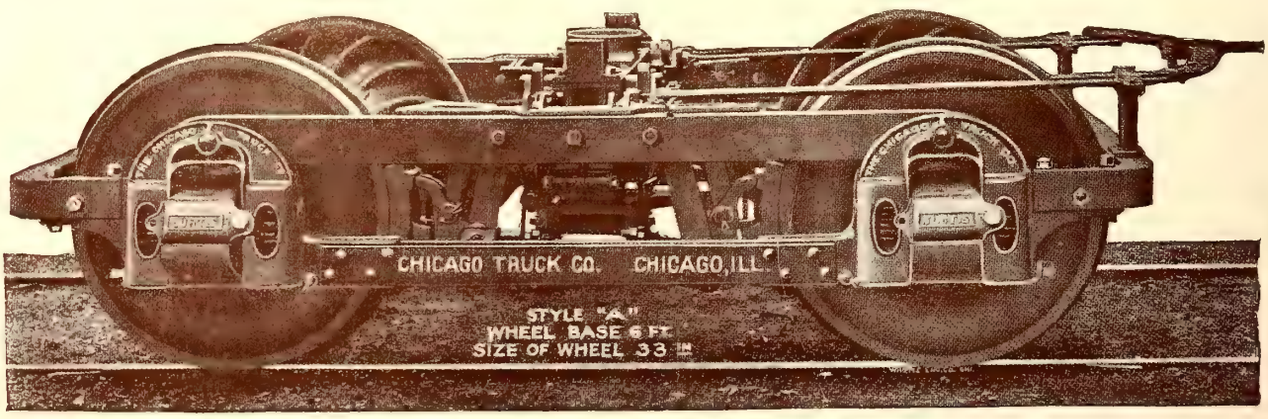
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Our Export Trade (outside of Great Britain) is Handled Exclusively by
DUTILH-SMITH, McMILLAN & CO., Broad-Exchange Bldg., New York

CURTIS TRUCKS

OUR TYPE "A" TRUCK

is designed expressly for severe high-speed service under heavy loads. It is a swing motion truck pure and simple. The frame is made of soft steel with the exception of the pedestals, which are of malleable iron with a tensile strength of 77,000 lbs. to the square inch. Full elliptic springs are used under the truck bolster, and coil springs on each side of the journal box in the pedestals.



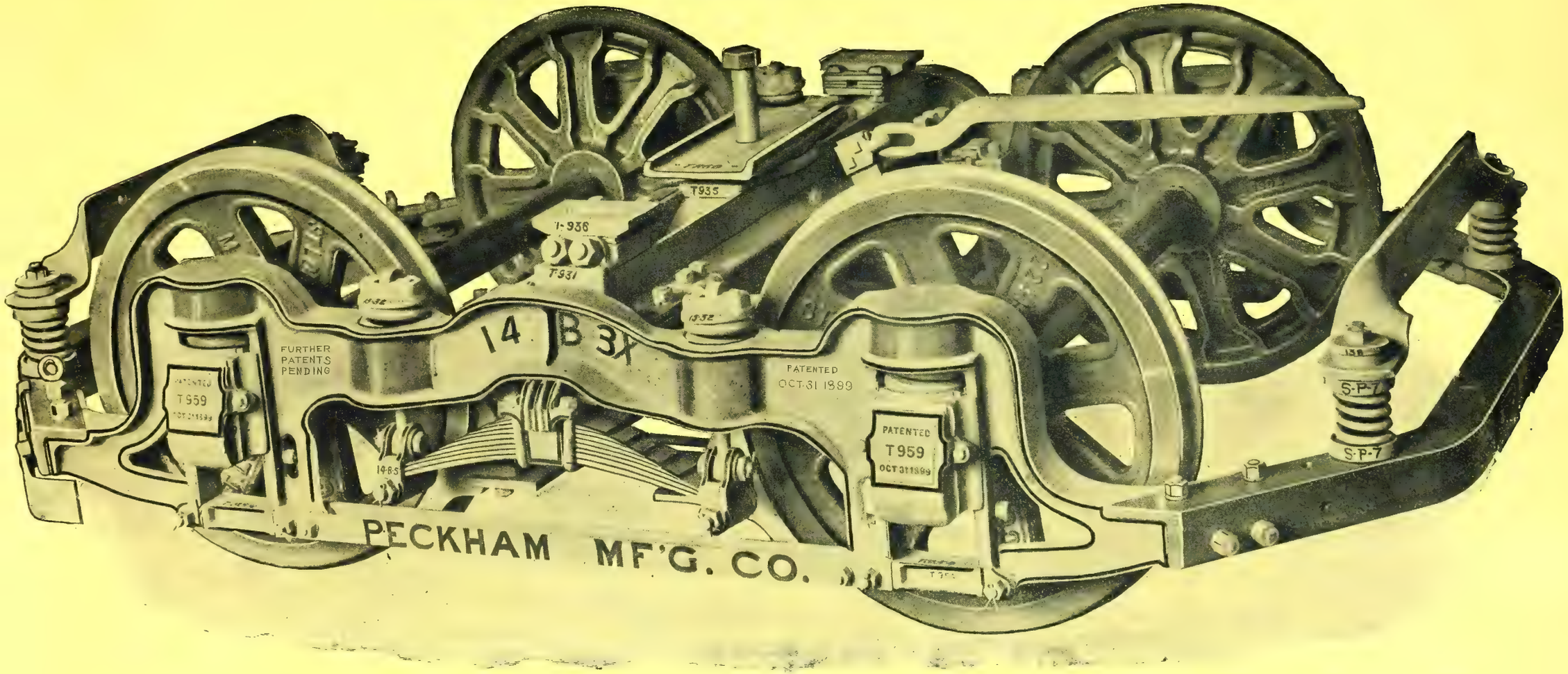
GUARANTEE—We guarantee perfect lateral, vertical and longitudinal ease; safety on curves at any rate of speed; a saving in wheel and tire wear and an increased life of roadbed. This truck will not get out of square, and will perform any work that is required of it. It is equipped with the Curtis patent inside hung brake without beams or cross-connections of any kind.

CHICAGO TRUCK CO

MONADNOCK BLOCK, CHICAGO, ILL.

PECKHAM'S "Extra Strong" Short Wheel Base Truck

DESIGNED EXPRESSLY FOR 40 TO 50 FEET SUBURBAN ELECTRIC CARS



"Short Wheel Base" allows wheels to radiate between the Car Sills, and reduces Heighth of Car body. Its "Centre Bearing" *Swing Bolster* is supported by three sets of springs and gives an easy riding car. SATISFACTION GUARANTEED.

FOR DESCRIPTIVE CATALOGUE, BLUE PRINTS AND PRICE LIST, APPLY TO

THE PECKHAM MANUFACTURING CO., KINGSTON, N. Y.

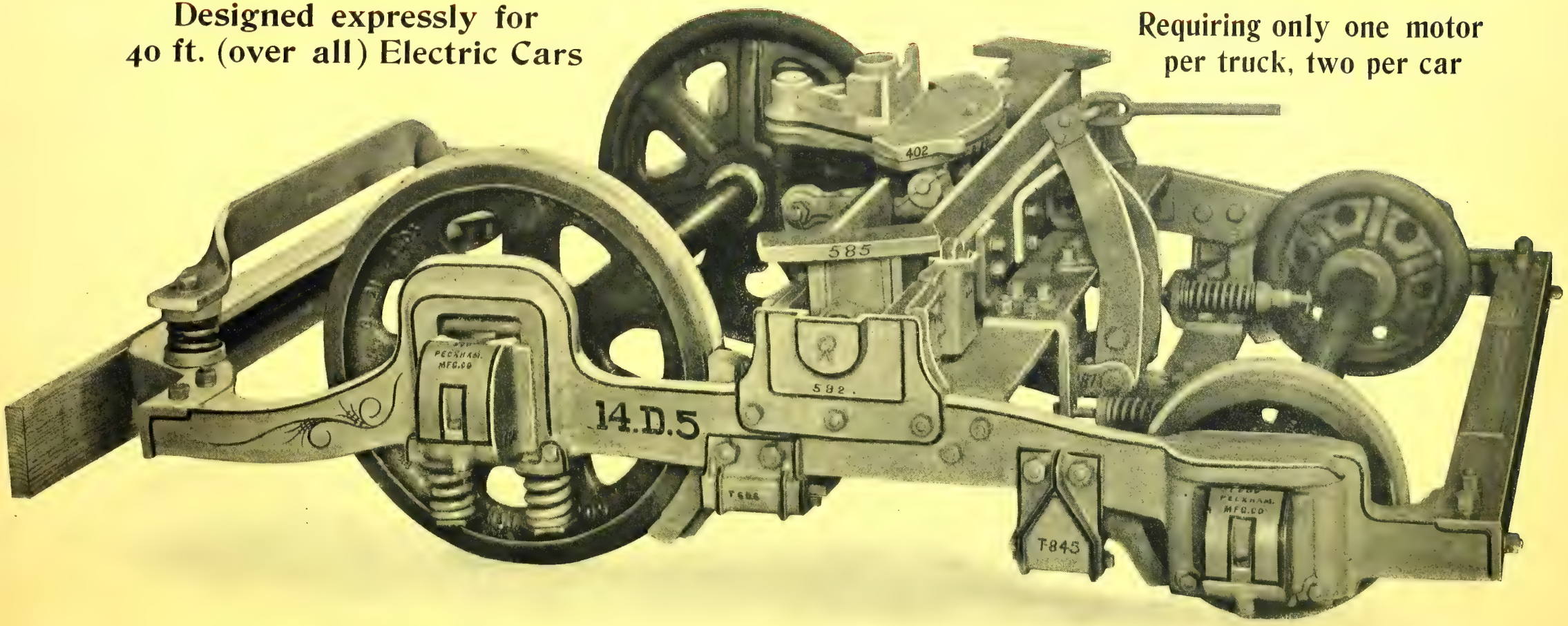
NEW YORK OFFICE	CLEVELAND OFFICE	CHICAGO OFFICE	BOSTON OFFICE	LONDON OFFICE
26 CORTLANDT STREET	312 ELECTRIC BUILDING	1232 MONADNOCK BUILDING	53 STATE STREET	59 CITY ROAD

PECKHAM'S (PATENT) Centre Bearing Swing Bolster Maximum Traction Truck

B

Designed expressly for 40 ft. (over all) Electric Cars

Requiring only one motor per truck, two per car



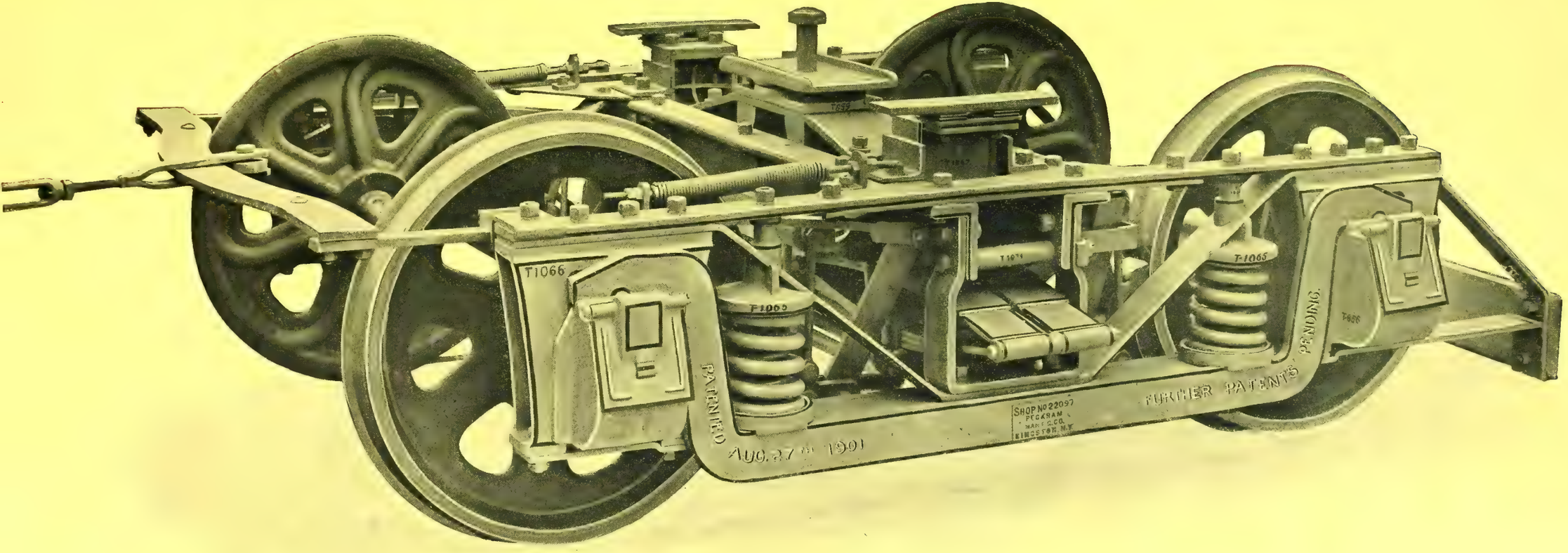
The only Maximum Traction Truck with a CENTRE BEARING "Swing Bolster." This Bolster relieves car body from side strains, prevents jumping the track, gives an easier riding car, and requires less power in rounding curves. This Truck is provided with an "all around" truck frame with angle bar end sections so braced that the truck can not get out of alignment. The brake mechanism is powerful and easily adjusted.

SATISFACTION GUARANTEED

THE PECKHAM MANUFACTURING CO., KINGSTON, N. Y.

PECKHAM'S "High Speed" M.C.B. Electric Truck 36=B

DESIGNED EXPRESSLY FOR "HIGH SPEED" ELECTRIC CARS



Equipped with Peckham's (Patent) Combination Side Frames. Peckham's (Patent) Flexible Motor Suspension. Taylor (Patent) Non-Chattering Brake Hanger and Double Elliptic Swing Bolster. Construction is such that Truck is "absolutely square" and cannot get out of alignment. This is important to prevent Hot Boxes. Wheel Base—diameter of Wheels and Axles to suit Motors. Weight of Truck, with Cast Iron Wheels, about 9,000 lbs.

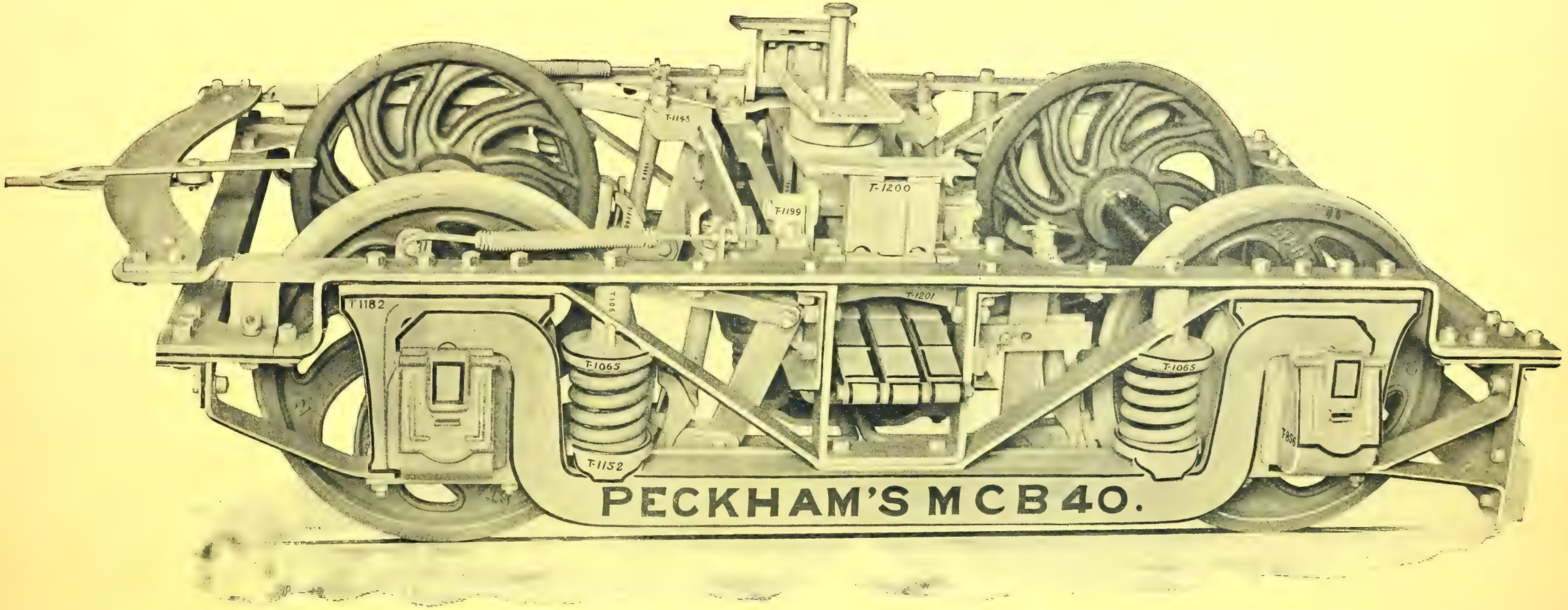
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PECKHAM'S "High Speed" M. C. B. Truck No. 40

DESIGNED EXPRESSLY FOR "HIGH SPEED" ELECTRIC RAILWAYS



Equipped with Peckham's (Patent) Combination Side Frames. Peckham's (Patent) Flexible Motor Suspension. The Taylor (Patent) Non-Chattering Brake Hanger and Triple Elliptic Swing Bolster. The Strongest and Easiest Riding and best Braking "M. C. B." High Speed in service. So constructed that it is "absolutely square" and impossible to get out of alignment. A Square Truck Frame is necessary to prevent Hot Boxes. Wheel Base, Diameter of Wheels and Axles to suit Motors. Weight of Truck, with Steel Tired Wheels, about 10,000 lbs.

FOR DESCRIPTIVE CATALOGUE, BLUE PRINTS AND PRICE LIST, APPLY TO

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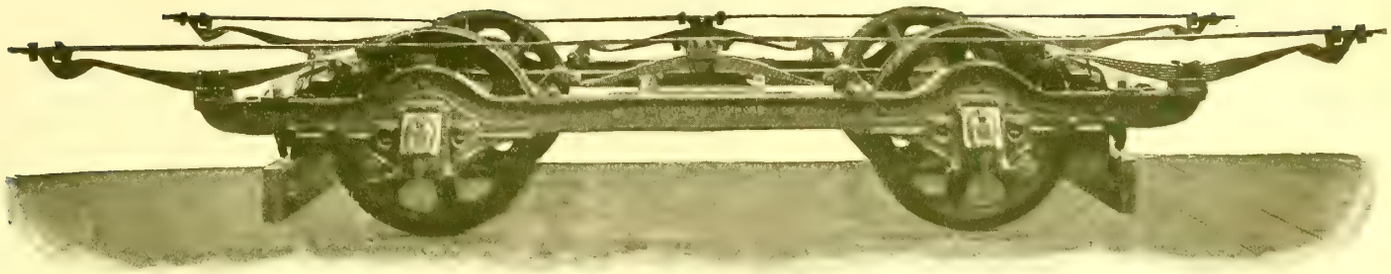
NEW YORK OFFICE
26 CORTLANDT STREET

CLEVELAND OFFICE
312 ELECTRIC BUILDING

CHICAGO OFFICE
1232 MONADNOCK BUILDING

BOSTON OFFICE
33 STATE STREET

LONDON OFFICE
59 CITY ROAD



THE BALTIMORE CAR WHEEL COMPANY

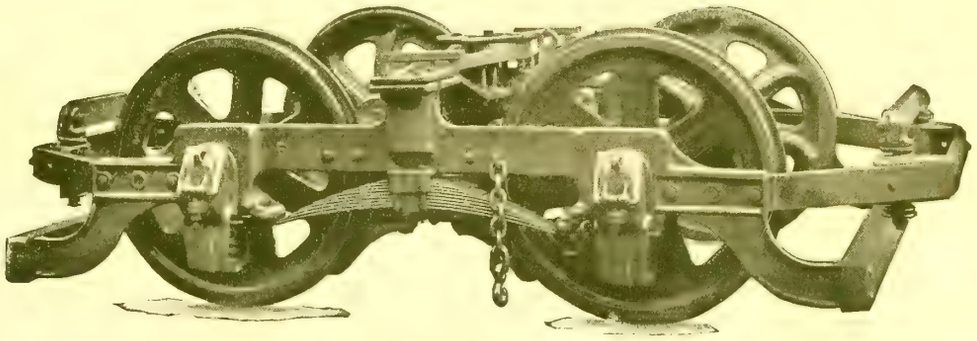
W. S. G. BAKER, *President and Treasurer* BALTIMORE, MD., U. S. A. J. PAUL BAKER, *Secretary*

MANUFACTURERS OF

THE LORD BALTIMORE

4-WHEEL BOGIE AND MAXIMUM TRACTION

ELECTRIC CAR TRUCKS



CHILLED WHEELS OF ALL PATTERNS AND SIZES FOR EVERY SERVICE, WITH OR WITHOUT AXLES

THE

AMERICAN CAR AND FOUNDRY CO.

Jackson & Sharp Plant, Wilmington, Del.



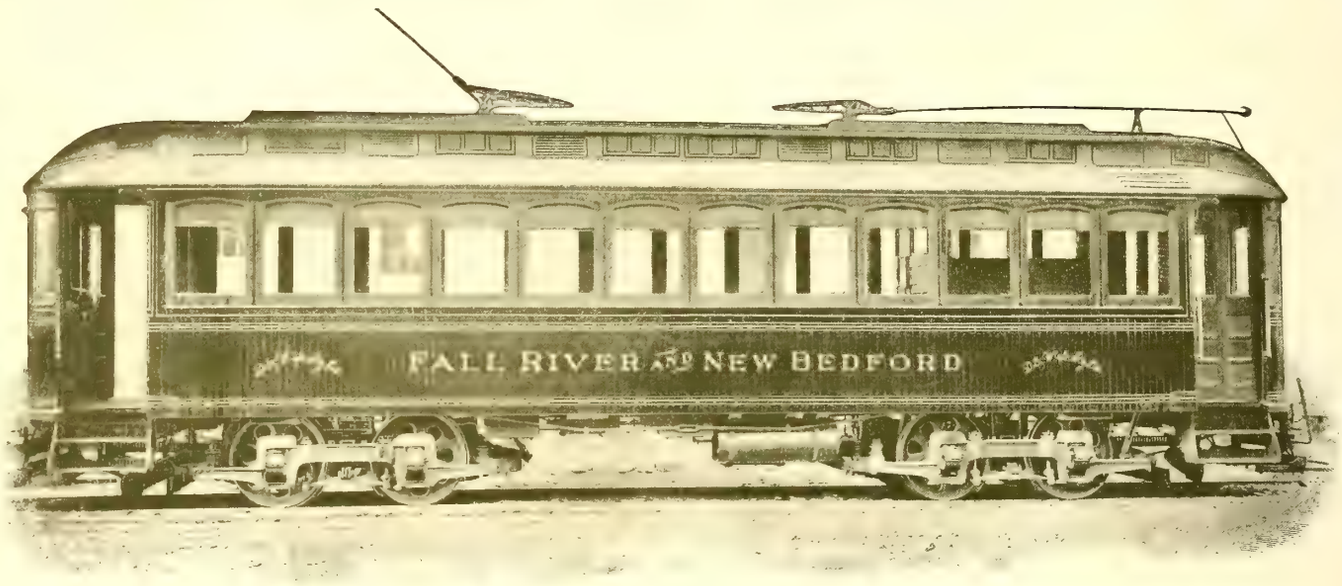
Builders of Any Type of Cars for Steam, Electric or Animal Traction for Either Domestic or Export Trade.

ESTABLISHED 1839

J. M. JONES' SONS

WATERVLIET, N. Y.

(FORMERLY WEST TROY)



STREET RAILWAY CAR BUILDERS



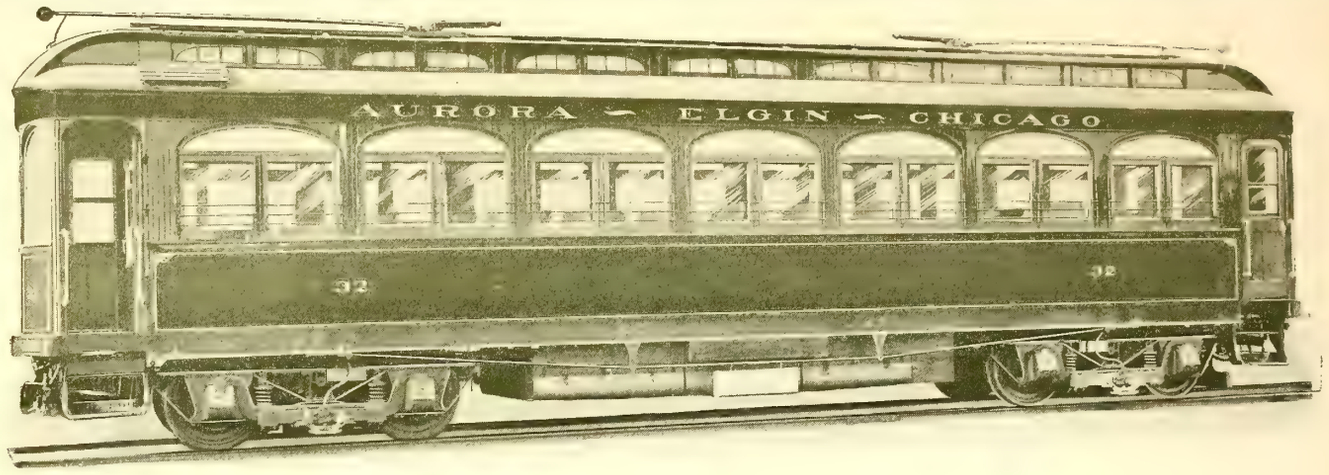
THE LACONIA CAR COMPANY WORKS

P. W. WHITTEMORE, Mgr. and Treas.

Board of Trade Building,
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MASS.

Works, Laconia, N. H.





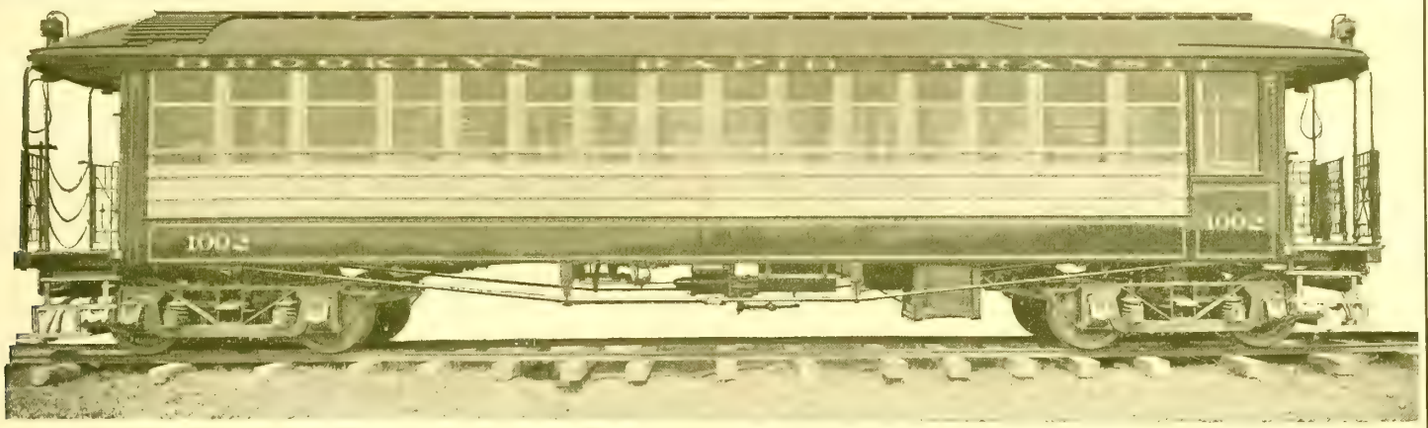
FIFTY YEARS BEFORE THE ORGANIZATION OF THE AMERICAN STREET RAILWAY ASSOCIATION

John Stephenson built the original tram car. That was in 1831.

The street railway industry has grown since those early days to proportions which the most enthusiastic prophet could never have predicted.

Many and important are the factors which have contributed to this wonderful development —and not the least of them has been the constant improvements made in the car builders' art.





Reduced to its final analysis the business of a street railway company is to carry passengers. The type of rolling stock that will attract the largest patronage to your lines, and will stand the strain of service for the greatest number of years, is the only kind you can afford to buy.

This is the kind that the John Stephenson Company has the reputation for building—and such a reputation extending over a period of 72 years must have a pretty strong foundation in fact.

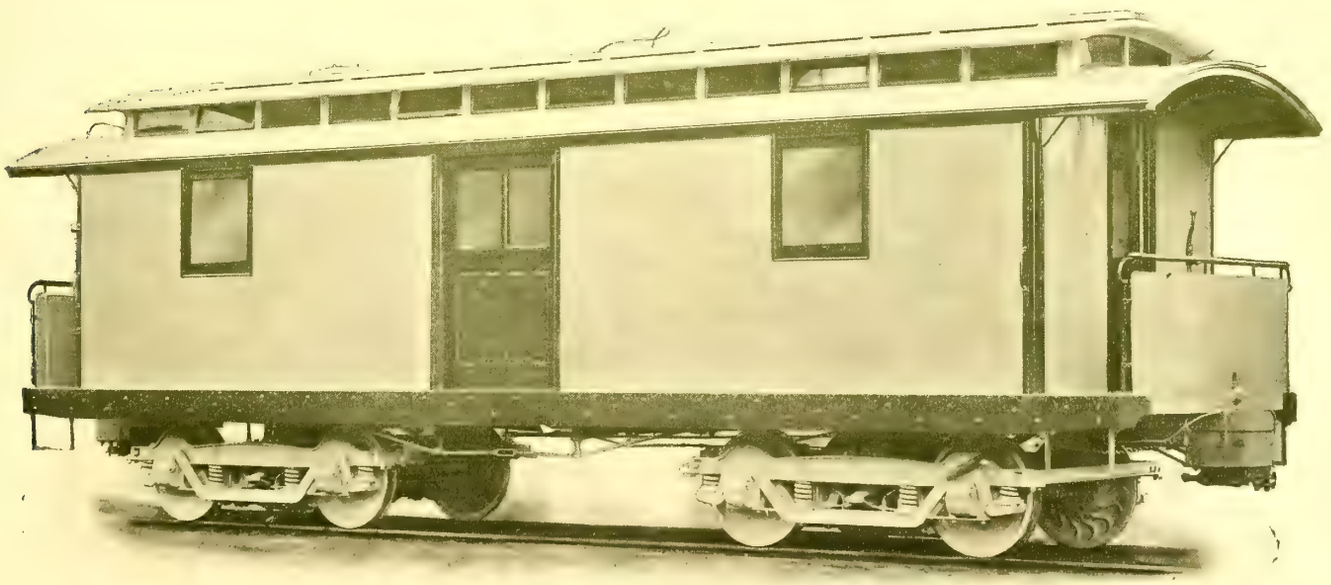
JOHN STEPHENSON COMPANY

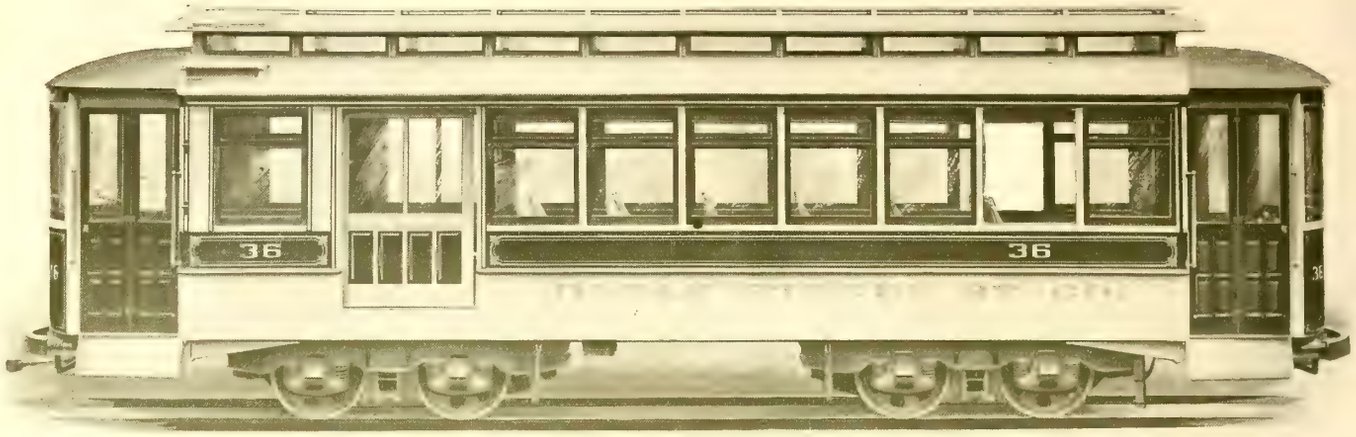
WORKS: ELIZABETH, NEW JERSEY

PETER M. KLING, General Manager E. J. LAWLESS, Agent

New York Office: 16 Exchange Pl.

JOSEPH C. WILLETTS, President
LEANDER M. DELAMATER, Sec.-Treas.

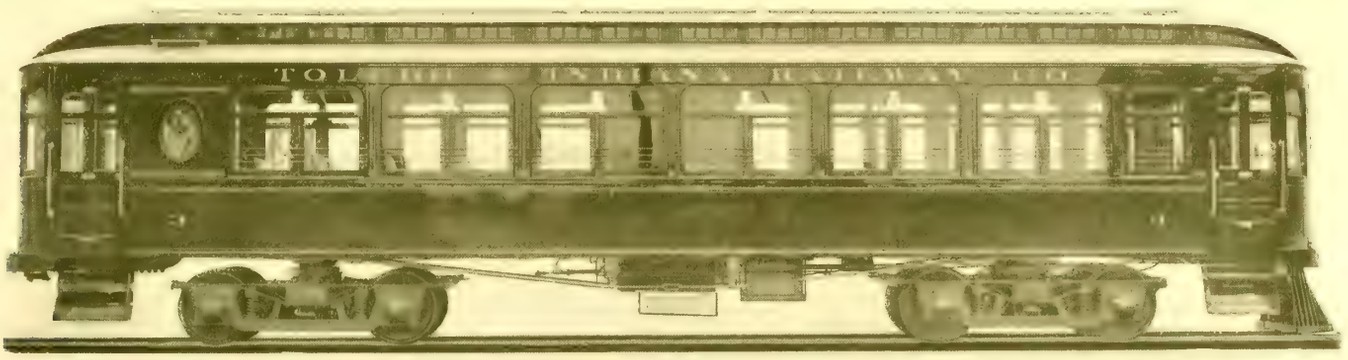




SOME OF OUR RECENT TYPES OF CARS FOR CITY AND INTERURBAN SERVICE

Are illustrated on these and the two preceding pages. They give but a very superficial view, however, of the kind of work we are turning out. We haven't any reason to be ashamed of the outward (and inward) appearance of these cars. In fact, they are such as to fulfil one of the two essential requirements—they attract patronage. As to the other essential—their durability—the test of time alone will tell.





We don't fear this test, however, nor do the companies for whom we built the cars. Why should they, when they know that for more than seventy years we have been building cars that have stood every possible kind of a test, from the leisurely trot of a single horse to the mile-a-minute run on the modern interurban.

When you need more cars, for either summer or winter service—or both—we would appreciate an opportunity of submitting plans and prices.

JOHN STEPHENSON COMPANY

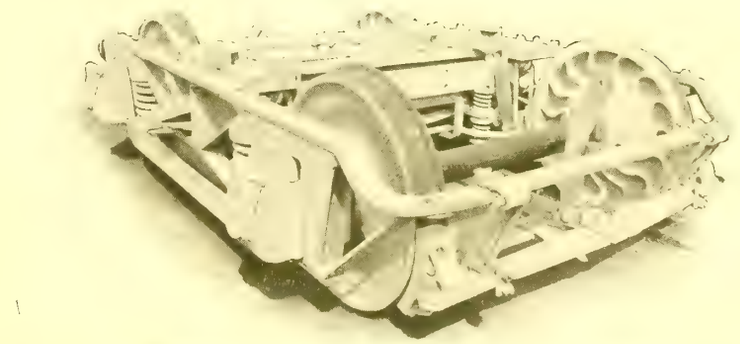
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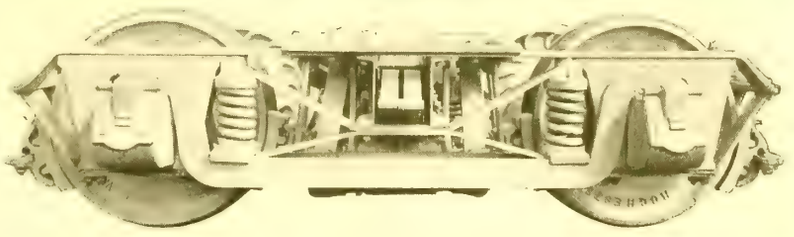
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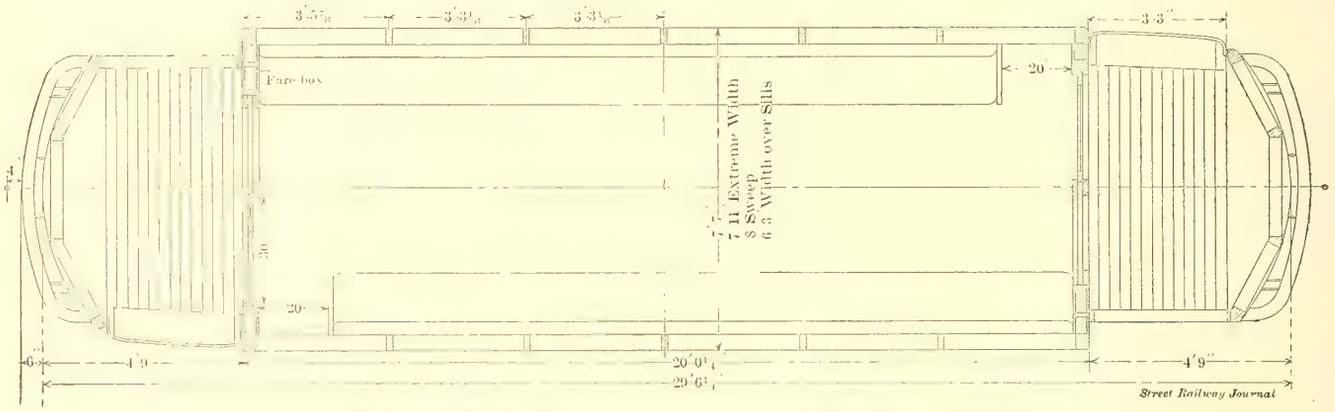
AND DON'T FORGET THAT WE BUILD TRUCKS ALSO--THE KIND THAT BELONG WITH GOOD CARS





Saving Seconds on City Systems

Two of the most valuable patents that we secured in the purchase of all the belongings of the Brownell Car Co., are the Accelerator and Semi-Accelerator types of cars. Below is shown a floor plan of the latter type which explains the off-set doors. The door being close to the step, passage in and out is rapid and unobstructed. On busy lines where the headway is short and the stops frequent, these cars help greatly to keep up the schedules. Two things are necessary to reduce the time of stops to a minimum—trucks that carry the car low and doors so placed that passengers will not stand in the way. These cars are more comfortable than those with ordinary double doors, for it takes less time to open and close them and there

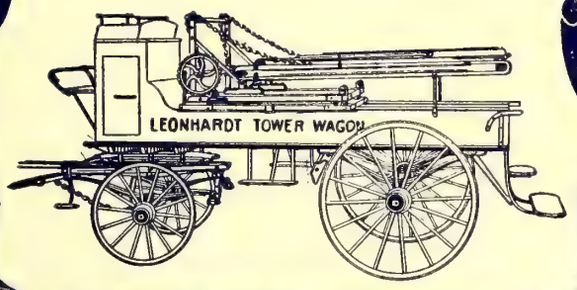


FLOOR PLAN OF SEMI-ACCELERATOR TYPE OF CAR

is less draft with the narrower opening. Passengers standing on the platform are not obliged to change their positions every time a passenger enters or leaves the car and the conductor is enabled to work more efficiently because more freely. Besides owning all the patents and patterns of the Brownell Car Co., we have everything that belonged to the old American Car Co., and have the use of all belonging to the J. G. Brill Co., putting us in the position to build every type of car that has proved best suited to all the conditions of city, suburban or inter-urban service. As we have said before, we are new in the business but not new at it, and our equipment and facilities are second to none in the country.

AMERICAN CAR COMPANY
ST. LOUIS, MO.

You Will Never Regret
BUYING A
LEONHARDT
REVOLVING TOWER WAGON,
IS THE MOST ECONOMICAL. RELIABLE. QUICKLY OPERATED
INSULATION ALWAYS PERFECT.
SEE TOOL COMPARTMENTS.



PATENTED AND BUILT BY
LEONHARDT WAGON MFG. CO.
BALTIMORE, - MD., - U.S.A.

THE TRENTON TROLLEY WAGON
AND THE
TRENTON AUTOMOBILE TOWER WAGON

For Lightness, Convenience, Ease of Operation, Safety, Durability, Low Cost of Maintenance, Simplicity and High-Grade Construction, they have no equal.

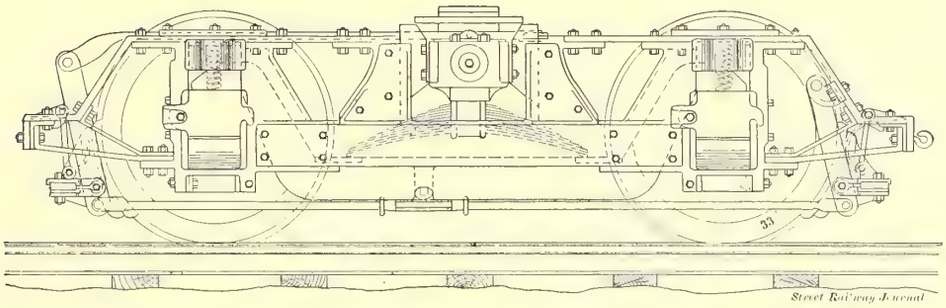
Circulars and prices on application.

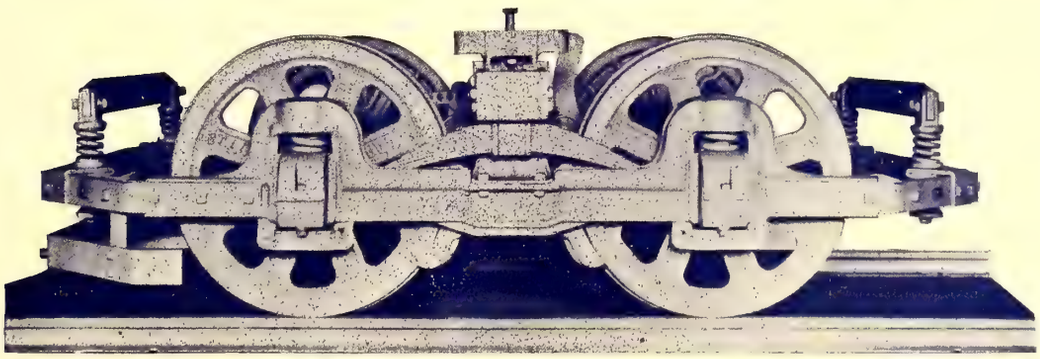


Derselbe Trolley-Wagon ist bereits auf allen Haupt-Strassenbahnsystemen Amerikas eingefuhrt.
Este Wagon ha sido adaptado por las principales lineas en America.

J. R. McCARDELL & CO.
Patentees and Sole Manufacturers
Trenton, N. J.

BEMIS CAR TRUCK CO.
Manufacturers of Horse, Cable, Electric Single and Double Trucks
Also Steam Passenger and Freight Car Trucks

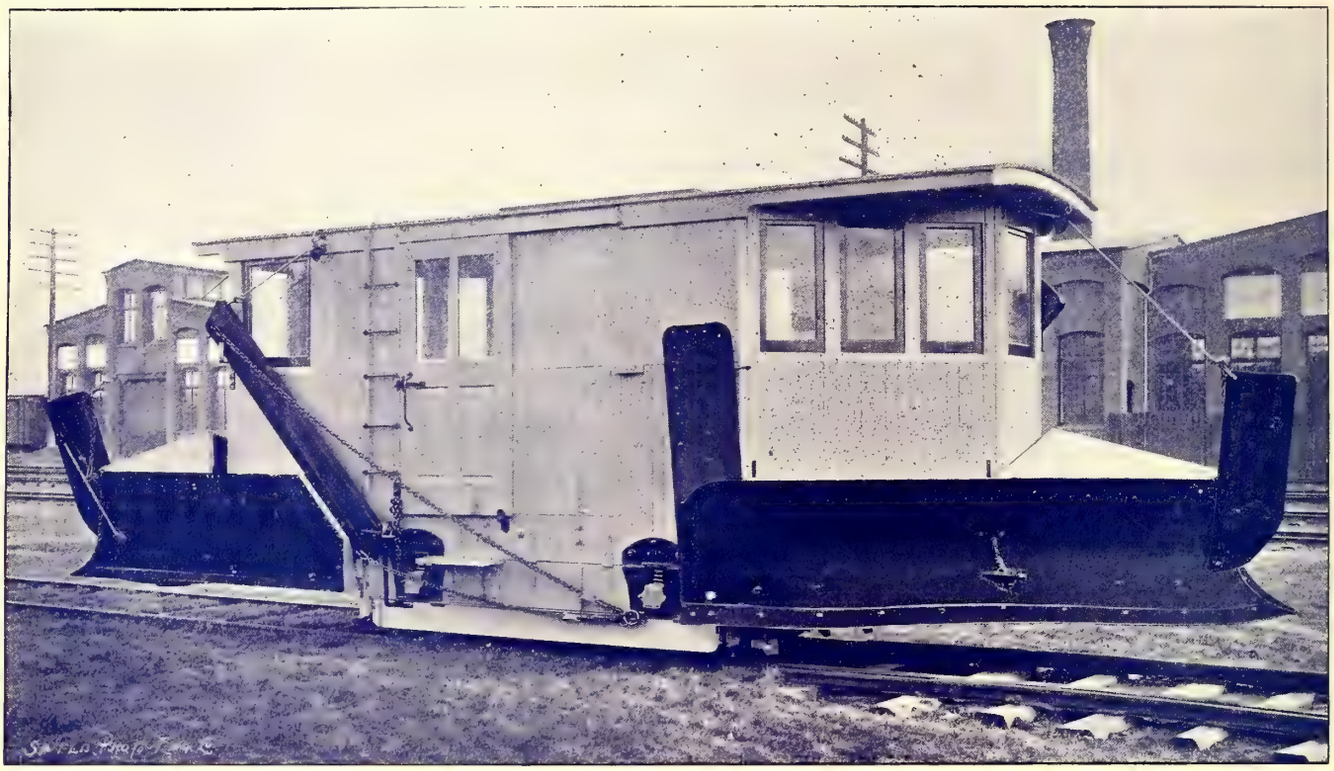




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THE SNOW PLOW SEASON IS COMING

WHY NOT BE READY FOR IT?



The Wason Plow is the type you should use. Let me tell you why and quote you prices.

A BARGAIN IN CARS

12 Bench
15 Bench
Open Cars
Equipped
and ready
for
immediate
shipment



SHALL I SEND YOU PRICES AND PARTICULARS?

THOMAS F. CAREY, 53 State Street BOSTON, MASS.

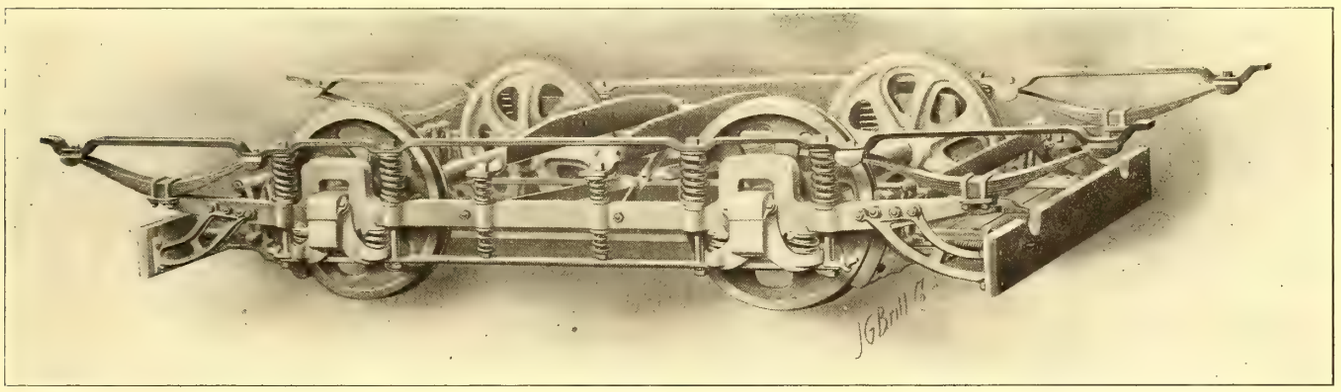
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A Tale of Two Cities

A traveler for our Supply Department said the other day that the Oswego Traction people told him that they had run our 21-E truck for nine years without the change of a single bearing. At Butler (Pa.) he heard much the same story, except that they have had the trucks a shorter time—four years. Nothing to do but oil the boxes every six months—the bearings and everything else are just the same as when the trucks were new. That is because the solid forged side frames, with their diagonal cross-braces, are always square, and keep every part exactly where it ought to be. The journal-boxes deserve part of the merit, as far as the bearings are concerned, for they are dust-proof—made so by a patented method that is won-



BRILL 21-E TRUCK (Patented)

derfully effective. With boxes that keep the dust out and frames that never get out of square and can't crystallize and break, there is no reason why the truck shouldn't run long, and always run smoothly. The arrangement of the springs gives an easy, steady movement to the car—quite different from the ordinary single truck, that bounces like a small boat in a gale and pounds the rail-joints apart. In Great Britain the 21-E is used almost universally, as they need a specially steady truck under their heavy and high double-deckers—one that has frames that won't sag at the ends. Our truck carries the car two inches lower than any other—a particularly good point, since single trucks are mostly used in city service, where cars should be carried as low as possible. Notice the four pairs of large diameter coil-springs at the sides of the journal-boxes. They furnish a low, easy support for the frame and keep the boxes upright and working freely in the jaws.

SPRINGS—We have one of the finest equipped spring shops in the country. Orders promptly filled.

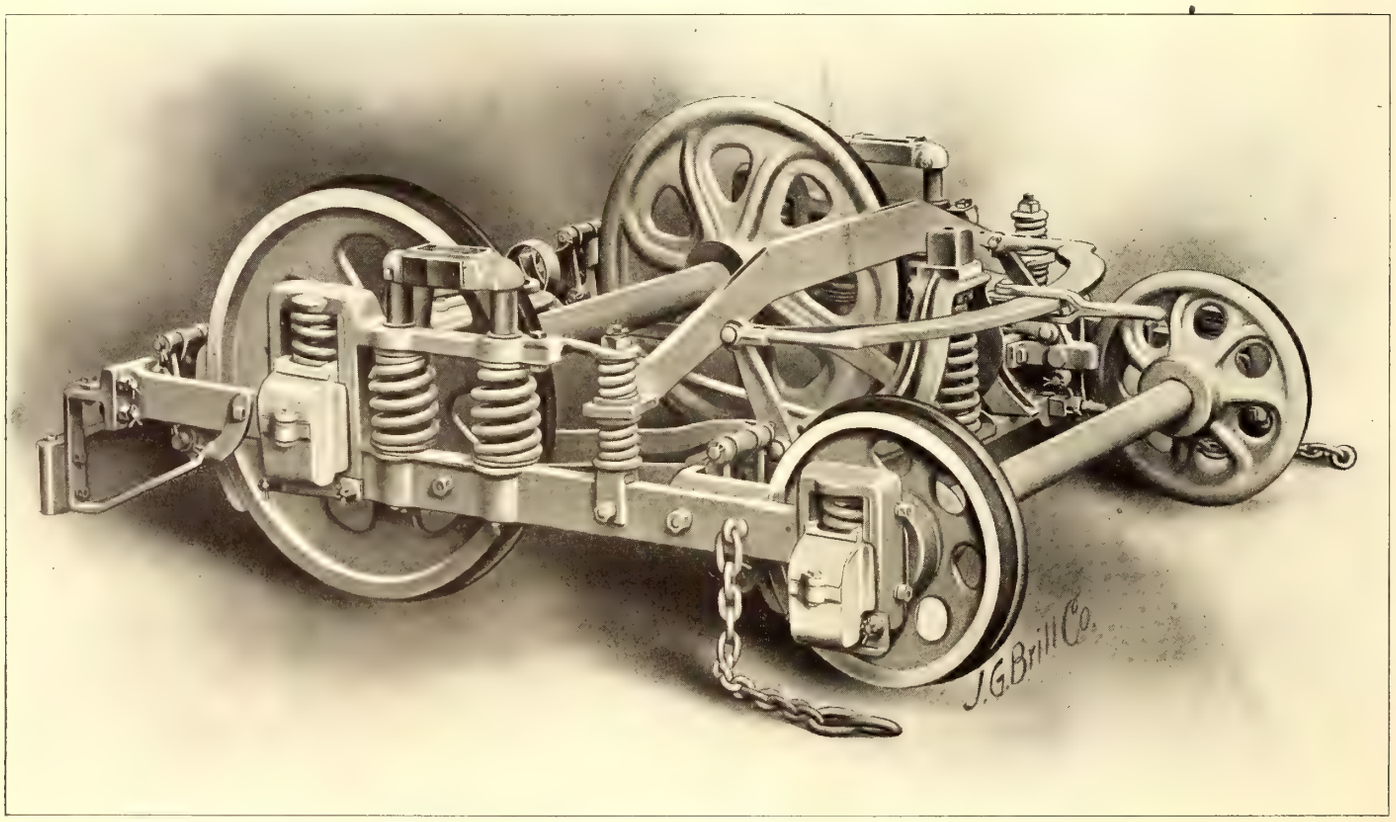
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A Remarkable Truck

In many respects the "Eureka" is the most remarkable truck that we build. It is remarkable on account of the number sold—for many years more have been built than any of our other types, and that means that there are more "Eurekas" in use in the world to-day than any other truck. It is remarkable because it won its place through a storm of opposition, and it won its place for good and all—no other truck can ever meet all the needs of city service as it does. Strange type that it is, it is a type that has been brought to perfection. The truck is remarkable in its operation. Crowded into a small space, under narrow and low cars, it still has room for the largest motor that it is practical to use. Having no bolster and



BRILL "EUREKA" MAXIMUM TRACTION TRUCK (Patented)

being open in the center, it is easy to get at the motor and its connections. The truck carries the car practically as low as a single truck. It rides steadily and smoothly, and takes curves easily. The compression device between the pony wheels transfers a certain amount of the load on these wheels while rounding curves. On tangents the load on the drivers is 75 per cent., giving a traction that enables the truck to start rapidly and climb heavy grades easily. The braking force is graduated to suit the load on the wheels. The wheels never skid. With the shocks and vibrations that a city truck has to stand, solid forged frames are necessary, and double its life. The "Eureka" is the standard truck on the Metropolitan Street Railway of New York, the Brooklyn Heights Railway and many large systems in this country and abroad.

SPRINGS—We manufacture high grade springs of every description.

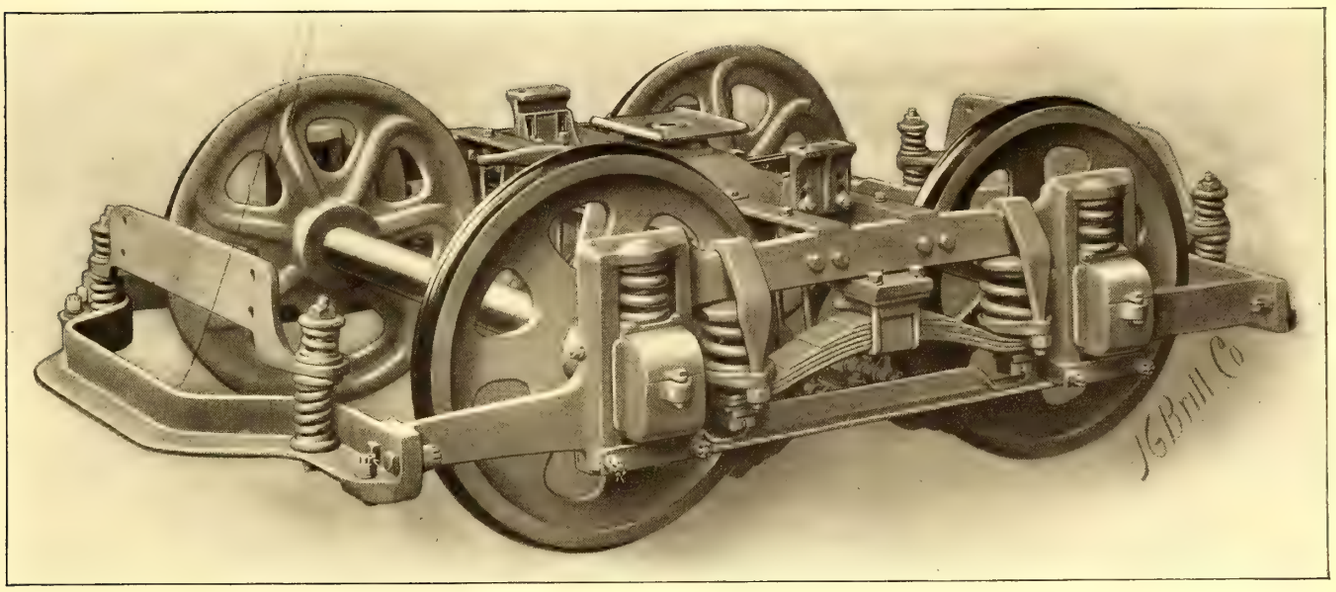
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A Friction Match

By the time this magazine is issued the world will probably have added something to its knowledge of speedy yachts. Just now it is the general hope that the race will not be a drifting match. Now if motor cars should be raced to see whose trucks run with the least friction it ought to be a drifting match. Cars of equal weight on trucks of same wheel-base (trucks to have had, say, three years' service without changing bearings, or any part), with same power motors, put at top speed on a level stretch, the power turned off at a given point and the cars allowed to drift —the smooth-running qualities to be proved by the distance they could drift. If such a match should be arranged for four-foot wheel base trucks, we should like to enter the 27-G, and would cheerfully accept a forty-yard handicap on account of the solid forged side frames, spring



BRILL 27-G TRUCK (Patented)

link suspended semi-elliptic equalizers, dust-proof boxes, and several other square-maintaining, smooth-riding, friction-reducing features. If the committee will put in a curve on that stretch of track we'll double our handicap, for if there is one thing better than another that the 27-G can do, it is taking curves. There is no jarring of the car and no grinding of the wheel flanges against the rail heads. The spring links swing the bolster, and then cushion the swing by the compression of the springs in the links. This truck is in use on city and suburban systems in Canada, Mexico, Porto Rico, Hawaiian Islands, Brazil, Great Britain, France, Germany, Africa, Australia and in nearly every State in the Union. In our own State of Pennsylvania thirty companies are operating with it, and in our own city of Philadelphia it is the standard truck.

SPRINGS—We are very particular about the springs that go with our trucks, and just as particular about the springs we make for other people.

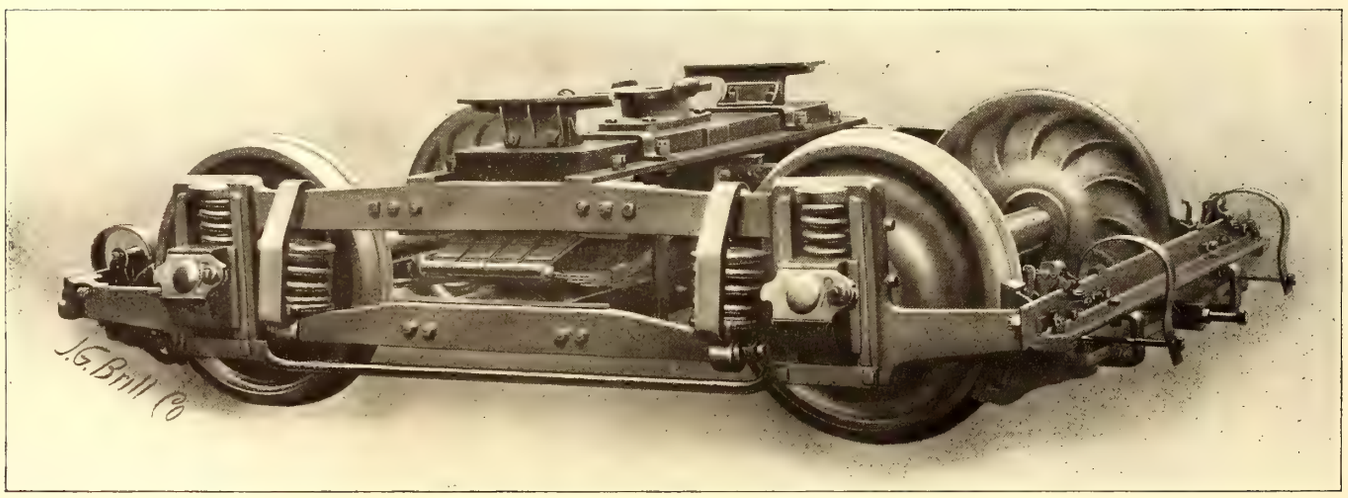
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Fast, but Sure

The frame of this truck carries the load close to where the frame itself is supported. That is the correct principle in all truck building, for it reduces the strain of the load on the frame to a minimum. The so-called "M. C. B." trucks (the Master Car Builders have never adopted a type) carry the load at the center of the frame, and by means of stiff hangers. Follow the load through the 27 truck from bolster to journal-boxes and you will find every part cushioned. The frame is not only supported on springs, but carries its load through springs—the spring links. These spring links have two other duties, they amplify the action of the elliptical springs and cushion the side swing. No other high-speed truck has the cushioned side swing



BRILL 27 TRUCK (Patented)

—all depend on stiff hangers to do the work. But when the hangers have swung as far as they can they stop with a jerk that wrenches the car and slams the wheel flanges with great force against the rail heads. When the links of the 27 truck have swung out the springs in the links prevent any jar or lurch, the car is brought steadily around the curve and without any "climbing" of the wheels. This is, of course, a very important thing on high-speed electric roads, as there are usually plenty of curves. It is absolutely impossible for the frame to tilt, and so with the cushioned side swing and non-crystallizing solid forged frames, the truck is safe and sure at the highest speeds. Last winter a car mounted on these trucks made ten miles of the run between Schenectady and Albany in five minutes.

SPRINGS—We use the grade of steel known as the Pennsylvania Railroad Standard analysis and test. Orders promptly filled.

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Salmagundi

Wherever you go, the world over, you will see Brill cars and trucks—the sun never sets on them. In the tropics you will find our open cars and double-deckers, with canopy tops and open sides; the "California" type still flourishes on the Pacific Coast—a couple of months ago we sent a lot to Dunedin, New Zealand. Thirteen open cars are in the packing shop now, being done up in neat bundles and marked "Lisbon, Portugal." It is something of a science to build cars for export—to build them so that an ordinary mechanic can put them together. There is no splicing—the cars are exactly as strong when set up as those that are shipped whole. ¶ Planning cars to meet peculiar and complex conditions is our forte. Undoubtedly the best examples of that are the



BRILL CARS AND TRUCKS STANDARD IN NEW YORK CITY

types of cars we build for New York city—the greatest system in the world, and with the most complex requirements. The cars must suit exactly, for the orders, year after year, call for the same as first planned. The cars for the City of Mexico probably face the worst climatic condit ons for cars of any on earth—intensely dry in summer and intensely wet in winter. We got around that difficulty by protecting the wood with thin steel. They use a modified form of our semi-convertible. ¶ In the shops at present are the two finest private cars ever built for use on electric roads. ¶ We build all kinds of electrical locomotives—heavy machines for hauling freight cars, combination affairs for hauling and carrying construction materials; standard and special types for manufacturing plants, mines and plantations. A very useful combination for general work around a manufacturing plant is a small but powerful locomotive, with a crane that is operated by the same motor that furnishes the propelling power.

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Setting a High Pace

For years to come there will doubtless be many fine examples of how not to build large interurban cars. Concerns that have been in the ordinary street car business will try their hand at it with full assurance that they know how, and two to one the outcome will be that the cars will be framed too heavy or too light, or the railway company will be told after the building has commenced that certain things can't be made to fit into the plan. Some builders are rushing into heavy metal bottom framing—presumably to save that part in case of a wreck. The steam roads are losing considerable money by dragging around a lot of totally unnecessary weight, and history will probably repeat itself in electric interurban railroading. Six cars like the one shown in the illus-



BRILL INTERURBAN CAR FOR THIRD-RAIL ROAD

tration are fair examples of our interurban car building, and so are those of the Seattle & Tacoma Railway, the Schenectady Railway, Chicago & Milwaukee, Rapid Railway of Detroit, Tamaqua & Lansford, Lake Shore Electric, Providence, Warren & Bristol, Ardmore & Llanerch, Camden Inter-State and many more. The Wilkesbarre & Hazelton cars are 43 feet over end panels, 51 feet over platforms and 9½ feet wide over side sheathing. The side sills are 5¼x8⅞ inches, reinforced for the overhang at the baggage compartment end of car by ½x8 inch plates; intermediate sills 4½x7½ inches. The center sills are double, with one-half inch plates sandwiched between; size over all 6x8¾ inches. The cars are mounted on Brill 27-E-2 trucks, which have no less than four braking appliances. The outside brakes are operated by automatic air and a vertical hand wheel; the inside brakes by magnetic power and a vertical hand wheel. The cars are arranged for running in both directions, are adapted for use either singly or in trains, and are equipped for head-end control.

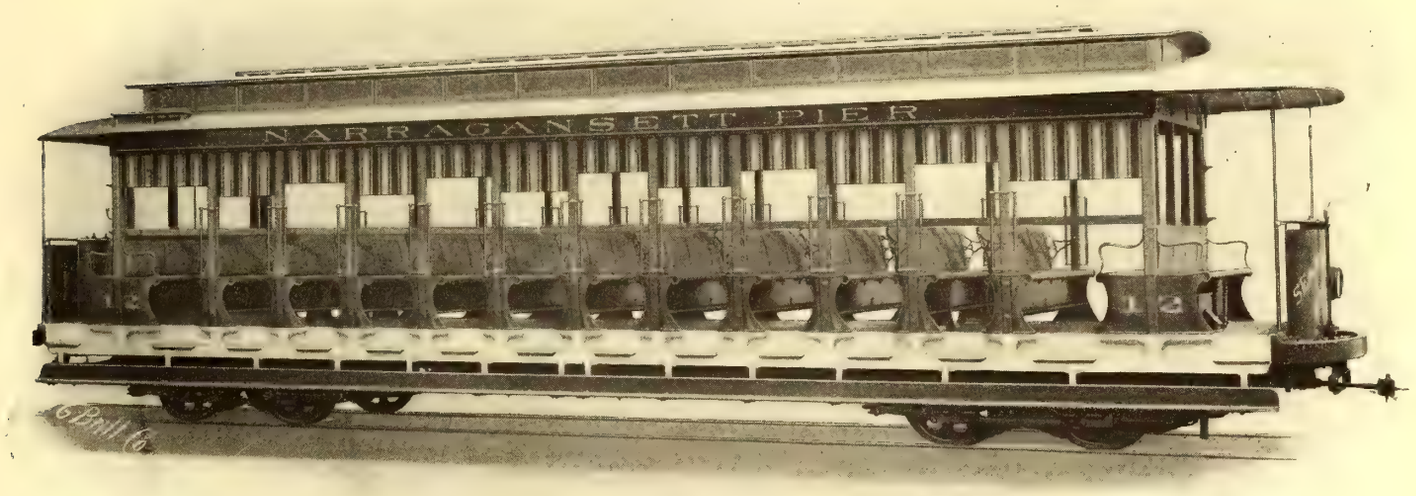
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An Easy Way Out of It

It is hardly likely that you would use closed cars with platforms flush with the floor for the usual conditions. What about open cars? The distance from the track to the floor is the same as a dropped-platform car, and yet it is customary to use but one step or running board. The Z-bar sills of the "Narragansett" do for the open car exactly what the dropped platforms do for the closed. The distance between the floor and the dropped platform is usually eight inches, practically the same as the distance between the floor and the Z-bar step of the "Narragansett," making an easy and safe step. The width over all of the "Narragansett" is no greater than the standard



BRILL "NARRAGANSETT" CAR (Patented)

single-step double-truck car, for the sill step merely uses the space occupied by the thick wooden sill of the ordinary car. This method doesn't lessen the length of the seats; in fact, they are six inches longer than standard. The posts are bracketed to the sills, and have an extra deep setting. For handling crowds of summer excursionists the car has no equal. Passengers don't have to be helped in and out, and that shortens the stops. Companies that operate with "Narragansetts" tell us that they have very few accidents. The cars may be safely and conveniently run on city streets. We have just finished fifteen 15-bench "Narragansetts" for the Pittsburg, McKeesport & Connellsville Co, eight for Atlantic City, three for Tamaqua & Lansford and one for Odessa & Middletown. Parkersburg & Marietta and the Sea View roads ordered more this summer.

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Weather-Wise or Otherwise

Whatever the weather has been elsewhere this summer, in this locality it certainly has shown the usefulness of the Convertible car to good advantage. Nearly every other week we have had overcoat weather—even the "dog days" were chilly. Convertible cars coax people out on chilly and wet days by promising and giving them protection and comfort. The cars are naturally very popular with the public, because they give those who ride the say whether the cars shall be open or not, and managers are generally glad enough to get rid of the "weather prophet" business. It takes less than five minutes to convert a car, and if the passengers help, which they invariably do,



BRILL CONVERTIBLE CAR (Patented) CLOSED

the change is almost instantaneous. There is no puzzling mechanism; the lower sash is raised in the ordinary fashion, and when half-way up the upper sash hooks itself on, and both are pushed up into the pocket. The panel is then raised, and takes a position in the pocket just behind the head-lining. The runways in the posts are entirely metal, and as the trunnions which guide the sashes are also metal, there is no chance of sticking. The panels are composed of two sheets of thin, flexible steel, which conform readily to the curvature of the posts. Air space between the metal sheets forms a non-conductor, keeping the warmth in and the cold out. The whole sliding arrangement is too simple to get out of order. The panels are perfectly waterproof, and the car is a perfect success throughout. We are now building Convertibles for Wellington, New Zealand; Lynchburg, Va.; Roanoke, Va.; Paden City, W. Va.; Austin, Tex., and Montgomery and Chester, Pa. Two of these lots are second orders.

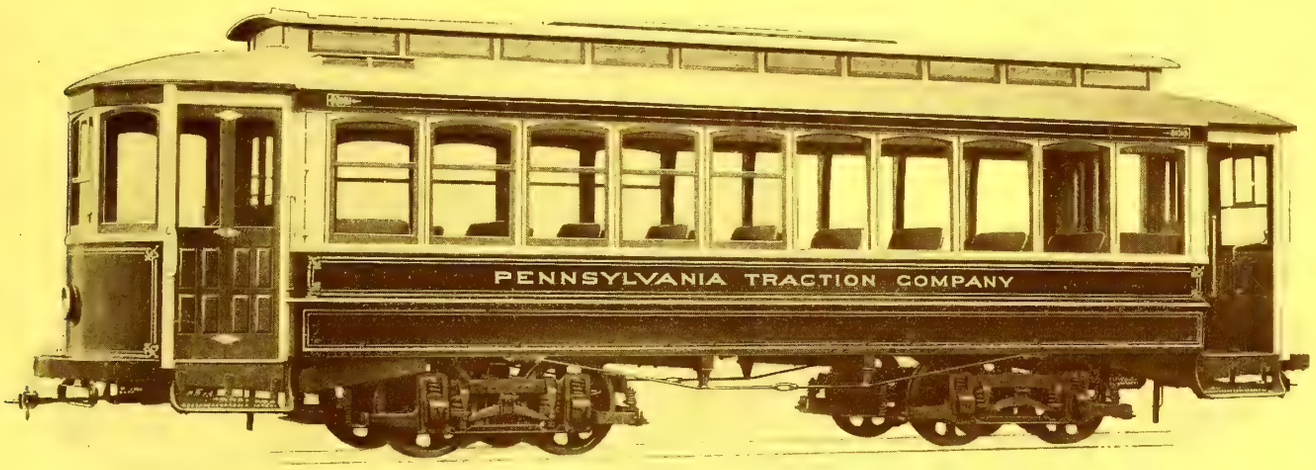
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Differentiation

The difference between our semi-convertible car and others is, first, that both window sashes are stored in the roof pockets when not in use; second, that one easy lift raises both sashes; and third, that there are no wall window pockets to take up valuable space and be used as rubbish receptacles. The side roofs are the proper places for window pockets, because in that position they don't occupy room that is needed for other purposes. A single movement in handling a pair of sashes, is of course better than two operations; it is quicker, and it is more easily understood. Go over in your mind the operation of dropping a pair of sashes into a wall pocket, or dropping one sash into a wall pocket and raising the other—think of how one has to change hands from bottom to top of a sash in lowering it into a pocket. Experienced passengers let the thing slam down,



BRILL SEMI-CONVERTIBLE CAR (Patented)

which is safer for their hands than for the glass and frames. In raising a pair of sashes of our semi-convertibles, large comfortable handles at the lower corners of the bottom sash, are grasped, and the sash is raised straight up into the pocket, the upper sash hooks itself on without stopping the operation and without giving one the feeling of much additional weight, for just at the point the connection is made, the sashes commence to incline in the pocket, which reduces the weight the farther in the pocket the sashes go. The trunnions at the corners of the lower sash, and the runways that guide them are all of metal, so there is no possibility of swelling and sticking, and as the whole upper structure is powerfully and firmly put together, there is never any binding. The car gains 6 to 7½ inches by not having wall window pockets, an important matter in a semi-convertible which is used chiefly in suburban and interurban service and has cross seats.

THE SPRAGUE-GENERAL ELECTRIC

SYSTEM OF

MULTIPLE UNIT CONTROL

FOR ELECTRIC TRAINS

Has been adopted exclusively by The New York Underground Railway (Interborough Rapid Transit Company), after exhaustive and impartial tests, on account of its

1—Safety to Passengers and Employees
2—Reliability of Service
3—Comfort to Passengers
4—Economy of Power
5—Low Cost of Maintenance
6—Simplicity

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Schenectady, N. Y.

New York Office: 44 Broad Street

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The British Thomson-Houston Co., Ltd.
Rugby and 83 Cannon St., London, E. C.

THE FOLLOWING ELECTRIC RAILWAY COMPANIES ARE OPERATING OR HAVE ORDERED THIS FORM OF EQUIPMENT:

Manhattan Railway Co., New York City.
Aurora, Elgin & Chicago Railway, Chicago, Ill.
Houghton County Railway Co., Houghton, Mich.
Boston & Maine Railway Co. (Concord & Manchester Div.)
Chicago, Burlington & Quincy R'y. (Deadwood and L.C.Div.)
Canton & Akron Railway, Canton, Ohio.
Columbus, Buckeye Lake & Newark Railway, Columbus, Ohio.
Columbus, London & Springfield Railway, Columbus, Ohio.
Columbus, Delaware & Marion Railway, Columbus, Ohio
Detroit & Chicago Railway, Detroit, Mich.
Denver & Northwestern Railway, Denver, Col.
International Railway, Buffalo, N. Y.
Central London Railway, London, England.
Great Northern & City Railway, London, England.
Chemen de Fer de L'Ouest, France.
Mediterranean Railway Co. (Gallarate Div.)
Lake Shore Electric Co., Toledo, Ohio.
Northwestern Elevated Railway, Chicago, Ill.
Seattle & Tacoma Interurban Railway, Seattle, Wash.
Fonda, Johnstown & Gloversville Railway, Gloversville, N. Y.
Schenectady Railway Co, Schenectady, N. Y.
Athens & Piræus Railway, Greece.
Prussian Government Railway. (Anhalt Suburban Div.)
Interborough Rapid Transit Co., New York, N. Y.
Boston & Worcester Electric Railway, Worcester, Mass.
Milwaukee Electric Railway Co., Milwaukee, Wis.
Baltimore & Ohio Railroad Co., Baltimore, Md.
South Side Elevated Railway Co., Chicago, Ill.
Boston Elevated Co., Boston, Mass.
Wilkesbarre & Hazelton Railway, Wilkesbarre, Pa.
Northeastern Railway, England.
Chemin de Fer de Paris-Orleans, Paris.
Kobu Railway, Kobu, Japan.
Brooklyn Rapid Transit Co., Brooklyn, N. Y.
New Albany Railway, Indiana.
Dayton, Lebanon & Cincinnati Railway, Dayton, Ohio.
Indianapolis & Northwestern Railway, Indiana.
Oakland Transit (Consolidated), Oakland, Cal.
Rochester & Eastern Railway, Rochester, N. Y.
North Shore Railway, San Salito, Cal.

This makes a total of Forty roads with 2,243 equipments up to June First, nineteen hundred and three.





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